



A Study on the Customers Approach towards the Services of Insurance Companies of Coimbatore District

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ABSTRACT

Protection is a help association and now-a-days it becomes purchaser situated. The mentality of the purchaser differs as indicated by their taste and prerequisites. So as to draw in the Customers' administration, the insurance agencies are giving compelling persuasiveness. All around, protection business is generally mainstream and very fulfilled by the Customers. So as to comprehend the mentality of the Customers and the concerned General Insurance Subsidiary Companies in Coimbatore District, an endeavor has been made to contemplate the instructive status of customers, nature of industry that they are overseeing, kinds of general protection strategies, consciousness of the arrangement and number of approaches taken to their endeavor. It is likewise dissected the advantages of strategy, methodology for the reestablishment of the arrangement, the administrations of the officials of General Insurance Subsidiary Companies and installment of premium. The specialist has likewise evoked assessment about the pace of premium, nature of property safeguarded, nature of harm and nature of fire mishaps. At last the scientist has made an investigation about settlement of cases, purposes behind the postponement in the settlement of cases and furthermore explanations behind the not educated by the operators. Along these lines, the controller should guarantee that the interests of the policyholders are ensured, and yet a great deal of opportunity should be given to insurance agencies to develop their own procedures to work together.

Keywords: General Insurance, customer approach, Premium, Policy, Actuaries, Claim, Insurers, Risk.



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INTRODUCTION

Protection is an assistance association and now-a-days it becomes shopper arranged. The mentality of the customer changes as indicated by their taste and prerequisites. So as to pull in the Customers administration, the insurance agencies are giving powerful charisma. Overall, protection business is generally mainstream and much fulfilled by the Customers. So as to comprehend the mentality of the Customers and the concerned General Insurance Subsidiary Companies in Coimbatore District. The protection by extricating cash in flexibly to the measure of premium gathered and by giving adequate assets to creation thin down the inflationary hole. The two fundamental driver of expansion, which is expanded cash in gracefully and diminished creation, are appropriately constrained by protection business. Protection is a venture. Protection is as method of decreasing vulnerability of event of an occasion. Since birth, it has accepted numerous capacities. The Government of India bought in to the capital of GIC. All the four organizations are government organizations enrolled under the Companies Act. This starts the overseer and trustee of the assets of a great many customers in India.

REVIEW OF LITERATURE

In order to fill the research gap the researcher has referred the following books, journals and relevant theses to make the present study more meaningful. To make the study more effective the researcher also has read the books on," Insurance and Risk Management by Dr. P.K. Gupta. In this book the author is focus on insurance in its earlier stages in India, Growth of insurance business in India and abroad.

Dr Velmurugan in 2016.,The protection division opened up and new players entered the space before 15 years. At present the business has 24 life coverage organizations, 28 general insurance agencies and 1 reinsurance organization. Fulfillment is a significant achievement in protection items, particularly when the business' notoriety has been ruined by mis-selling and ill-advised revelations of profits by operators. In that LIC holds larger part piece of the pie in disaster protection industry. The target of the examination is to comprehend the policyholder's fulfillment and the different components adding to the fulfillment level. The essential information was gathered by utilizing the organized poll and auxiliary information was gathered by utilizing diaries, papers and the web. The investigation region was restricted to Coimbatore District. The motivation to direct the examination in Coimbatore area is beforehand no analyst had done the fulfillment concentrate in extra security and IRDAI administrative body had demanded all the protection companied to unveil the causation of the approaches.

Prof.S.Chandrasekar, in his research work entitled," Customer service in United India Assurance Company Ltd". A study with Special reference to Madras City has examined the degree of customer satisfaction among the policyholders of United India Assurance Company Ltd. K. Elayaram in his doctoral thesis entitled," Marketing Scenario of General Insurance Corporation of India" Cuddalore District submitted to Annamalai University,(2005) studies the effectiveness of the promotional measures to market the General Insurance policies. Rm.Lakhsmanan in his P.hD thesis captioned Insurance marketing, "A Study with reference to The Oriental Insurance Company Limited (2004)", submitted to Alagappa University, ventures to study the marketing strategies of the Oriental Insurance Company and suggest measures for effectiveness of insurance marketing.

Statement of the Problem

The primary point of General Insurance Corporation of India is to secure the products by embraced the hazard and furthermore to advance sparing propensities among the individuals to guarantee their splendid future. At present the vast majority of the individuals especially in those towns don't know about the idea and advantages of the General Insurance Policies. Besides the General Insurance Corporation faces numerous issues in managing association just as with people in general. From the perspective the General Insurance Corporation, it is exceptionally hard to distinguish and persuade individuals to take a strategy. Simultaneously the strategy time frame will be one



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year. All things considered the installment of premium to the General Insurance Corporation is just a single portion which will be immense and now and again the little bungalow coordinate Industrialists can't pay the whole aggregate in single portion. At the point when the mishap happens, the customers face the issue is settlement of guarantee. The General Insurance Corporation is receives some bulky methodology to settle the cases. The General Insurance Companies can't escape from the above said issues. General Insurance Corporation likewise faces the trouble of the evaluating of the right estimation of the harmed products or things. It offers ascend to an absence of comprehension among customers and the insurance agencies. As of late General Insurance Corporation is dependent upon an open analysis, since it thinks that its hard to accomplish the goals for which it was fundamentally settled. The development of open analysis is for the most part because of logical innovations like fire quencher, gas chambers and control component. In addition, the businessperson abstains from keeping increasingly stock in the god down. There is a general inclination that, the administrations of the General Insurance Subsidiary Companies are not up as per the general inclination of the general population. Today General protection business has come to gain a status and steadiness that legitimize its case as one of the biggest nationalized general insurance agencies in the realm of majority rule government. Because of nationalization, the General protection business has procured a monopolistic hang on general protection business. In any case, taking into account the boisterous sob for privatization it is probably going to confront firm rivalry in the market.

Scope of the Study

The Researcher has endeavored to contemplate the demeanor about the administrations of General Insurance Subsidiary Companies of Coimbatore District. What the customer feels about the General Insurance Companies and what are their desires and how well the General Insurance Subsidiary Companies is satisfy their desires. A portion of the issues that go under the domain of the exploration. This investigation targets recognizing the elements which impact the policyholder for the choice strategies.

Objectives of the Study

- To study the history of the Insurance Companies in brief.
- To analyse the approach of the customers for value of the General Insurance Schemes.
- To suggest appropriate corrective measure to overcome the Problems of General Insurance.

Period of the Study

The present study covers a period of from 2018 to 2019.

Sampling Design

There are four Public division insurance agencies offering General Insurance administrations in the investigation territory. They are New India Assurance Company Limited, Oriental Insurance Company Limited, National Insurance Company Limited and United Insurance Company Limited. The analyst has chosen 200 example respondents who had taken any of protection strategies to be specific Fire protection, marine protection, engine protection and random protection plans. These hundred example respondents were picked dependent on Purposive Sampling technique. Further the specialist picked 50 respondents for every insurance agency to guarantee equivalent portrayals.

Limitations of the Study

The current investigation is restricted to the four auxiliaries of General Insurance Corporation of Coimbatore District. Further, it is constrained to the disposition of the customers towards the General Insurance Products inside a one year from 2018-2019. The examination doesn't cover investigation the business astute speculation example of General Insurance Subsidiaries in Coimbatore District.



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Certain policyholders, chose for the organization of meeting plan were hesitant to give reaction, expecting that giving reaction for the calendar examinations will land them into challenges in their accommodation of annual expense forms.

Data Analysis and Interpretation

It is observed from the above table 56 respondents (28 %) are in the age group of 20-30 years. 76 respondents (39%) are in the age group of 30-40 years. 68 respondents (34%) are in the age group of 40 and above years. Majority of the Customers are middle age group (30-40) taking in to the insurance policies(Table 1).

Sex of the Policyholders

It is identified from the above table 90% of the policyholders are being male respondents and the remaining 10% of the policyholders are female respondents (Table 2).

Marital Status Wise Classification

Table 3 explains that out of 200 respondents, 73% respondents are married customers and the remaining 27% respondents are unmarried customers. Therefore, the most of the customers are married.

Educational Qualification of the customers

From the above table it is known that most of the policyholders are Under Graduates (48%), followed by +2 level 20 %, Post Graduate 11 % (Table.4).

Types of General Insurance Policies

It is observed that the 47 per cent of the Customers preferred fire insurance, 17 per cent of the respondents like Motor insurance policy, 20 per cent of the Customers have personal Accident insurance policy, 10 per cent of the Customers preferred the Medical insurance policy, 3 per cent of the Customers' preferred Fidelity Guarantee insurance and the remaining 3 per cent of the respondents preferred House insurance policies. From the above analysis the Customers preferred more on Fire Insurance 'A' policies than the other policies. It is mainly because of giving more protection to the insured and hence this policy is more popular in the study area (Table 5).

Employment of the Customers

The above table explains that 42 per cent respondents are industrialists and 15 per cent respondents are business people and 12 per cent respondents are doing banking business, 27 per cent respondents are having service institutions remaining 4 per cent respondents are farmers. Therefore, the most of the Customers are industrialists in the study area (Table 6).

Awareness of the Policy

It is well known from the above table that, the majority 61 per cent of the respondents have taken policy from the agents. About 11 per cent of the respondents understood the fire policy from the bankers. The remaining 28 per cent of the respondents have received knowledge from friends and relatives (Table 7).

Services of the General Insurance Subsidiaries

The above table disclosed the fact that 65 per cent of the respondents highly satisfied with the service of the general insurance subsidiary companies in Coimbatore district. And the remaining 35 per cent of the respondents are not satisfied with the service of the GIC in Coimbatore district. It is inferred that the most of the respondents are impressed with the service of the general insurance subsidiary companies in Coimbatore district and which enable the customers to have an easy approach and contact with their problems (Table 8).





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Estimation About Rate of Premium

From the above table, it is clear that 46 per cent of the respondents felt that the premium amount is nominal, 40 per cent of the respondents opined that the rate of premium is high and the remaining 14 per cent of the respondents expressed that it is low. It is understood that the rate of premium is within the reach of the policyholders (Table 9).

Claim Settlement

It is observing from the above table it shows that most of the respondents (64.3%) not able to get their claim amount quickly. About 45.6% of the respondents have received the claim amount on time. It shows an unhealthy trend about the style of settlement of claims (Table 10).

Reasons for Delay in Settlement of Claims

It is evident from the above table shows that 69.2 % of the respondents said that there was an undue delay in sanctioning the claims. The remaining 30.7 % of the respondents are not satisfied with the settlement of claim due to the surveyors are taking more time to compute the losses (Table 11).

CONCLUSION

The GIC is taking the responsibility of selling the general insurance policies with an element of social conscience. The Indian insurance market has a vast potential with private insurance companies in general insurance space. General insurance market in India, promising one, is faced with many challenges and opportunities. The GIC major task in handling customer series and intermediary's relations. It is certain that the future of GIC business in India is bright and the fact that it will launch many insurance products for customers, in turn strengthen its scope further and insurance of all kinds will have bright scope for expansion and development.

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Table. 1 Respondent Age Classification

Sl. No	Age(in years)	Number of Respondents	Percentage
1.	20-30	56	27%
2.	30-40	76	39%
3.	40 & Above	68	34%
	Total	200	100

Source: primary data





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Table. 2 Sex of the Policyholders

S.No.	Sex of the policyholders	No. of Respondents	Percentage
1.	Male	180	90%
2.	Female	20	10%
	Total	200	100

Source: Primary data

Table. 3 Marital Status Wise Classification

S.No.	Category	No. of Respondents	Percentage
1.	Married	144	73%
2.	Un Married	56	27%
	Total	200	100

Source: Primary data

Table. 4 Educational Status

S.No.	Education	No. of Respondents	Percentage
1.	+2	40	20%
2.	UG	124	48%
3.	PG	22	11%
4.	Professional Degree	14	07%
	Total	200	100

Source: Primary data

Table.5 Types of General Insurance Policy Taken

SI.No.	Types	No. of Respondents	Percentage
1.	Fire Insurance	94	47%
2.	House Insurance	06	03%
3.	Personal Accident Insurance	40	20%
4.	Motor Insurance	34	17%
5.	Fidelity Guarantee Insurance	06	03%
6.	Medical Insurance	20	10%
	Total	200	100

Source: Primary Data

Table. 6 Employment of the Customers

S.No.	Employment status	No. of Respondents	Percentage
1.	Industrialists	84	42%
2.	Business men	30	15%
3.	Banking Companies	24	12%
4.	Service institutions	54	27%
5.	Farmers	08	04%
	Total	200	100

Source: Primary data





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Table. 7. Awareness of the Policies

S.No.	Category	No. of Respondents	Percentage
1.	Through Agents	122	61%
2.	Through banks	22	11%
3.	Through friends and relatives	56	28%
	Total	200	100.0

Source: Primary Data

Table. 8. Service of the General Insurance Subsidiaries

Sl. No.	Service	No. of respondents	Percentage
1.	Satisfied	130	65%
2.	Not satisfied	70	35%
	Total	200	100

Source: Primary data

Table. 9. Estimations about Rate of Premium

Sl. No.	Opinion	No. of respondents	Percentage
1.	High	80	40%
2.	Nominal	92	46%
3.	Low	28	14%
	Total	200	100

Source: Primary data

Table. 10. Settlement of Claim

Sl. No.	Situation	No. of respondents	Percentage
1.	punctual on time in settling the claim	62	46% (45.6)
2.	Delay in settling the claim	52	54% (54.3)
	Total	114	100.

Source: Primary data

Table. 11. Reasons for the Delay

Sl. No.	Reasons	No. of respondents	Percentage
1.	Delay in inspection	16	31% (30.7)
2.	Delay in sanctioning the amount	36	69% (69.2)
	Total	52	100.

Source: Primary data





Rizatriptan Benzoate for the Treatment of Migraine –A Review

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ABSTRACT

Migraine is a common neurological disease which occur in all age groups including males and females. The common migraine are also called the migraines without the aura. It is associated with throbbing or pulsatile headache, with moderate to severe pain that intensifies with movement or physical activity. The Rizatriptan benzoate is an antimigraine drug belonging to triptan class used for the treatment of migraine. It is a 5HT_{1B/1D} agonist. It causes vasoconstriction after the administration. The oral form of the drug undergoes the first pass metabolism. In order to enhance the bioavailability the different forms such as fast dissolving films, nasal spray, nasal gel, and oral disintegrating tablets are developing. The oral form of the Rizatriptan is available as the oral rapid disintegrating tablets. The aim of the article is to review the different available formulations of Rizatriptan , their advantages, disadvantages , method of preparations, patents on Rizatriptan , available formulation and their evaluation tests.

Key words: Rizatriptan, Nasal spray, Gel, Formulation, Migraine, oral dissolving film.

INTRODUCTION

Migraine is a neurological condition that cause multiple symptoms. It is characterized by the intense, debilitating headaches. A migraine is usually an intense pounding headache that can last for hours or days. The common types of migraine are classic migraine and common migraine. The classic migraine also called the complicated migraine which starts with the warning sign called aura. The common migraine are also called the migraines without the aura. It is associated with throbbing or pulsatile headache, with moderate to severe pain that intensifies with movement or physical activity. It occurs with unilateral and localized pain in the frontotemporal and ocular area, but the pain may be felt anywhere around the head or neck. The pain build up over a period of several hours which will progress to posteriorly and get diffused. The common migraine risk factors include the family history, sex and age. It occur in 3-6% of males and 13-18% of females [1].





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CAUSES OF MIGRAINE

- Stress
- Medications
- Hormonal changes
- Changes in weather

COMMON PROBLEMS OF MIGRAINE

- Nausea
- vomiting,
- anorexia
- food intolerance

Triptans are class of choice for migraine attacks and the Rizatriptan benzoate is 5HT_{1B/1D} agonist. Therapy using these selective 5HT_{1B/1D} agonists especially orally does not result in rapid, consistent and complete relief of migraine in all patients. Triptans work like brain chemical called serotonin. In addition side effects may occur in significant proportion of patients. The oral bioavailability of Rizatriptan is only 45% due to the first pass metabolism.

MECHANISM OF ACTION OF RIZATRIPTAN

The Rizatriptan is a 5-HT receptor agonist that has weak affinity for other 5-HT receptor subtypes and the 5-HT₂ receptor, but no significant activity at other 5-HT receptor subtypes or at alpha- or beta adrenergic, dopaminergic, histaminergic, muscarinic, or benzodiazepine receptors. The presumed mechanism of action of Rizatriptan is through activation of postsynaptic 5-HT_{1B/1D} receptors within cerebral and dural vessel walls, causing vasoconstriction and inhibition of trigeminal perivascular nerve terminal [2]. The Rizatriptan belongs to BCS class 3 which have high solubility and low permeability. The water in oil emulsion are preferred for the hydrophilic drugs. There are number of treatments are available for the treatment of migraine of which the Rizatriptan benzoate will provide the better results within few minutes by causing vasoconstriction [3].

FORMULATIONS OF RIZATRIPTAN BENZOATE

ORAL DISSOLVING FILMS

Oral pharmaceutical dosage forms like tablets and capsules are intended to be swallowed or chewed for exerting its action. The paediatrics and geriatrics patients suffer difficulty in consuming these dosage forms. In order to overcome these difficulties the novel drug delivery system like orally disintegrating tablets have introduced. The oral disintegrating tablets are the dosage forms containing active pharmaceutical ingredients which gets rapidly disintegrated within a minutes when kept under the tongue [4]. The Rizatriptan is more effective than the other triptans as it relieves pain and freedom from pain within 2 hours after administration than the tablets. Migraine is associated with a number of symptoms like nausea, vomiting, numbness, depression, irritability, sensitivity to light and sound. In order to overcome the symptoms and to enhance the pharmacological activity the fast dissolving films of Rizatriptan benzoate have emerged [5].

IDEAL CHARACTERISTICS FOR THE FAST DISSOLVING FILM

- The drug should have low dose
- The drug should have low molecular weight
- It should possess good solubility and stability in water and saliva
- Partial ionization at the pH of oral cavity
- It should have the capability to permeate the oral mucosal tissue [6]

ADVANTAGES OF FAST DISSOLVING FILM

- The dissolution and disintegration is enhanced with the larger surface area.
- Large ease for transportation as the fast dissolving films are flexible and less fragile





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- Enhanced patient compliance.
- Provide good mouth feel
- More comfortable to paediatrics, geriatrics and bed ridden patients
- No chances for the occurrence of choking
- Better acceptability because the formulation can be administered in the absence of water
- The formulation is self-administrable.
- Increased bioavailability due to avoidance of first pass metabolism
- It will disintegrate in the saliva [7].

DISADVANTAGES

- APIs with high dose cannot be incorporated
- Packaging is expensive
- Technical challenge is required for attaining the dose uniformity[8].

METHOD OF PREPARATION

SOLVENT CASTING METHOD

In this method the polymers which are water soluble are dissolved in the water and the excipients with the drug is dissolved in the suitable solvent. Finally both the solvent are mixed and poured into the petri plate, dried and cut into suitable dimensions.

HOT MELT EXTRUSION METHOD

The drug is mixed with the solid carriers. Extruders with heaters will melt the mixture. The melt is designed into films in the dies.

SOLID DISPERSION EXTRUSION METHOD

Immiscible components are extruded with the drug in this method and the solid dispersions are prepared. Films are prepared by the shaping of the dispersion.

ROLLING METHOD

In this method the suspension containing the drug is rolled on to the carrier. Commonly using solvent is water and sometimes mixture of water and alcohol. The films are prepared by initially drying with in the rollers and cutting into desired shapes [9].

SEMISOLID CASTING METHOD

Initially the water soluble film forming solution containing polymer is prepared. The remaining solution is added to acid insoluble polymeric solution prepared in the ammonium or sodium hydroxide solution. In order to attain the gel mass, suitable plasticizer is added. By using the heat controlled drums the gel mass is converted into the films. Commonly the ratio of 1:4 of the (acid insoluble polymer to film forming polymer) is used [10].

NASAL GEL

Conventional drug delivery systems like solutions, suspensions, ointments, and emulsions are no longer sufficient to fulfill the current requirements of providing a desired rate of delivery for a prolonged time. One of the major drawback for this is first pass metabolism of drug in the liver before reaching to systemic circulation which results into poor bioavailability. In order to overcome these problems nasal gel is the dosage form to improve the residence time and improving the bioavailability. Gels are considered as a substantially dilute cross-linked system, which exhibits no flow when in the steady-state problems nasal gel is the dosage form to improve the residence time and



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increased the bioavailability. Intranasal delivery increases brain accumulation of Rizatriptan benzoate and provide faster action [11].

ADVANTAGES

- Enhanced residence time of drug in the nasal cavity
- Less frequency of administration
- Rapid and onset of action
- Enhanced absorption
- By passes first pass metabolism
- Dose reduction

DISADVANTAGES

- Residence time of the drug is reduced by the mucociliary clearance.
- All drugs cannot be formulated in to the nasalgel formulation.
- Aqueous solubility is less
- Nasal irritation may occur
- High volume of dose is required.
- Not suitable for chronically administered drugs[12-13]

PREPARATION OF NASAL Gel

- Required quantities of both polymer and drug is mixed and dissolved in the purified water which is heated at about 80°C and then cooled for an hour to prepare the gel.
- The gel can be prepared by using the sonicator. The polymer and drug is mixed in the accurate amount and sonicated for minutes and thereafter it is magnetically stirred. To induce swelling the whole contents are placed in the refrigerator for overnight. Sonication is carried out for the removal of air bubbles [14].

EVALUATION OF THE NASAL GEL**ISOTONICITY ADJUSTMENT**

Its properly adjusted in the nasal drug delivery system.

P^H ADJUSTMENT

The p^H of the formulation should be equal to the p^H of the nasal cavity. Its measured by using the p^H meter

VISCOSITY DETERMINATION

The residence time of the gel is based on the viscosity of the formulation. The viscosity is determined by using the viscometer and it is measured at specific rpm for specific time.

GELLATION TEMPERATURE DETERMINATION

Modified millers and Donovan technique are commonly use for the estimation. 3 ml of gel is taken in the test tubes and placed in the water baths with the increment in the temperature.

DRUG CONTENT DETERMINATION

1 ml of the formulation is taken in the 100 ml of the volumetric flask and volume is made to 100 ml using suitable solvent. The drug content should be present within the limits.

MEASUREMENT OF GEL STRENGTH

It is determined by taking 100 g of the formulation in the cylinder which is then neutralized by using 0.5N NaOH and a weight is added to the gel. The gel strength is determined by the time required for the weight to enter into the gel[15].



**Maria John and Flowerlet Mathew****INTRANASAL SPRAY**

Intranasal drug delivery is considered as a useful and an alternative to oral and parenteral routes. The nasal route of drug delivery can be used for both local and systemic drug delivery. A diverse range of drugs including corticosteroids, anti-histamines, anti-cholinergic and vasoconstrictors can be administered locally. In recent years, achieving a systemic drug action using the nose as the entry portal into the body has received more attention [16]. Also, the nasal delivery seems to be a efficient way to circumvent the obstacles for bloodbrain barrier (BBB) allowing the direct drug delivery in the biophase of central nervous system (CNS)-active compounds. It has also been considered to the administration of vaccines. Intra nasal drug delivery is considered as the best formulation for exerting the therapeutic action.

ADVANTAGES

- Degradation of the drug is absent.
- Quick onset of action
- Bioavailability of the larger molecules can be enhanced by using the penetration enhancer.

DISADVANTAGES

- Low intrinsic permeability
- Large surface area is required for the enhanced therapeutic action
- Mucociliary clearance [17]

PREPARATION OF NASAL SPRAY

Nasal spray drug products contain drug substances is dissolved in solutions or mixtures of excipients (e.g., preservatives, viscosity modifiers, emulsifiers, buffering agents) in non pressurized dispensers which deliver a spray containing a metered dose of the active ingredient. The dose can be metered by using the spray pump. A nasal spray unit can be designed for unit dosing or can discharge up to several hundred metered sprays of formulation containing the drug substance. Nasal sprays are applied either to the nasal cavity for local nor systemic effects. Although similar in many features to other drug products, some aspects of nasal sprays may be unique. Metering and spray producing pump mechanisms and components are generally used for reproducible delivery of drug formulation, and these can be constructed of many parts of different design that are precisely controlled in terms of dimensions and composition. Energy is needed for dispersion of the formulation as a spray. This is typically done by forcing the formulation through the nasal actuator and its orifice. The formulation and the container closure system collectively form the drug product. The design of the container closure system will affect the dosing performance of the drug product. Both solution and suspension formulations can be formulated into nasal sprays formulation.

EVALUATION OF NASAL SPRAY**pH**

For both solution and suspension nasal sprays, the pH of the formulation is tested and is carried out by using pH meter and an appropriate acceptance criterion established.

OSMOLALITY

For formulations containing an agent to control the tonicity or for products having a label claim regarding tonicity, the osmolality of the formulation should be tested and controlled at release.

VISCOSITY

The viscosity is determined by using the viscometer and the required quantity of the formulation is kept at required rpm. The formulation which have higher viscosity will have good residence capacity.



**Maria John and Flowerlet Mathew****IMPURITIES AND DEGRADATION PRODUCTS**

The levels of impurities and degradation products can be determined by using validated analytical procedure or procedures. Acceptance criteria should be made for individual and total impurities and degradation products. All impurities appearing at levels of 0.1 percent or greater should be specified according to ICH guideline for impurities.

PRESERVATIVES AND STABILIZING EXCIPIENTS ASSAY

A number of preservatives, antioxidants, chelating agents, or other stabilizing excipients are used in the formulation, there will be a specific assay for these components with associated acceptance criteria. Acceptance criteria for the chemical content of preservatives at the time of product release and through the product shelf life should be included in the drug product specification.

PUMP DELIVERY

A test to assess pump-to-pump reproducibility is carried out in terms of drug product performance and to evaluate the delivery from the pump should be performed. In general, pump spray weight delivery acceptance criteria will maintain the weight of the individual sprays to within 15 percent of the target weight and their mean weight to within 10 percent of the target weight.

PARTICLE SIZE DISTRIBUTION

For suspension nasal sprays, the specification should contain tests and acceptance criteria for the particle size distribution of the drug substance particles in the formulation. The microscopic evaluation can be used and such an examination will provide information and data on the presence of large particles, changes in morphology of the drug substance particles, extent of agglomerates, and crystal growth [18].

ORAL DISINTEGRATING TABLET

Orally disintegrating tablets are designed in such a way that it will disintegrate fast in the mouth to provide dispersion before being swallowed where the active ingredient is allowed for gastrointestinal delivery and/or absorption. A solid dosage form containing active ingredients which disintegrates fast, usually within seconds, when put on the tongue. In addition to those definitions, FDA recommends that, orally disintegrating tablets can be considered as solid oral preparations that disintegrate fast in mouth, with an in-vitro disintegration time of approximately less than or equal to 30 second [19].

ADVANTAGES

- Tablet can be swallowed without the use of water
- No residue will remain in the mouth after administration
- It is highly suitable for children, bedridden and geriatrics
- The cost of production is less
- Oral disintegrating tablets are good for the delivery of the bitter taste drugs.
- Taste masking can be carried out

DISADVANTAGES

- It exhibits unpleasant taste when not prepared orally
- Proper handling is required if the tablet is having less mechanical strength.
- Difficulty in formulating high dose drugs [20].

**METHOD OF PREPARATION OF FAST DISSOLVING FILM
SPRAY DRYING**

Spray drying is most commonly used for the preparation of oral disintegrating tablets. It is economically efficient as it causes the loses of solvents and results in the formation of highly porous fine powders. The formulation make use



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of gelatin as supporting agents , maanitol being bulking agent and cross carmellose sodium as super disintegrating agents. The prepared tablets will disintegrate will in 20s of administration.

SUBLIMATION

The volatile materials present in the tablet can be removed by a process called sublimation which results in the formation of highly porous structures. The commonly used volatile materials include ammonium carbonate, urea, camphor and ammonium bicarbonate. In certain cases thymol, menthol and certain organic acids are used as volatile materials. The commonly used sublimation temperature ranges from 40° to 60°.

FREEZE DRYING

The freeze drying or lyophilisation includes the removal of solvents from the drug solution containing the structure forming excipients. The process can be carried out at low temperatures which avoids the thermal effects. It results in the formation of glassy amorphous structure.

MOULDING

The water soluble ingredients are the major component of moulded tablets. The powder mixture is sprayed with solvent and then compressed into tablets. The final product will be highly porous due to application of low pressure. The moulded tablets will increase the dissolution and disintegration rate. Due to the low mechanical strength of tablets it is prone to damage. Mechanical strength can be improved by making use of multistep process and by nonconventional equipment.

MASS EXTRUSION

In this technology the powder blend is moisturized with the solution of menthol and water soluble polyethylene glycol. The softened mass is either passed through the syringe to get cylindrical matter which is then converted into tablets by making use of heated blades [21-22].

RIZATRIPTAN ORAL DISINTEGRATING TABLET MANUFACTURERS IN INDIA

- Neuraxpharms APIs manufacturing plant
- Apotexpharmachem Inc.
- Cipla pharmaceuticals
- Emcure pharmaceuticals
- Glenmark pharmaceuticals
- Hetero drugs limited
- Natco pharma limited[23]

CONCLUSION

All the available formulations of Rizatriptan benzoate aims at enhancing the bioavailability and patient patient. The fast dissolving films, orally disintegrating tablets, nasal spray, nasal gel helps to overcome the first pass metabolism. Future challenges for many manufacturers include reducing costs by finding ways to manufacture with conventional equipment, varieties in packaging, enhanced mechanical strength and taste-masking potential. The Rizatriptan benzoate will be the drug of choice for the treatment of migraine with minimum side effects.

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Table 1: Patents on Rizatriptan Benzoate

Title	Patent Number	Publication Year
Fast disintegrating tablet	EP1058538B2	2012
Oral disintegrating tablet	EP2465539A1	2012
Fast dissolving solid	EP2493457A1	2012
Films and drug delivery systems for Rizatriptan	US20140275194	2014
Process for large scale production of Rizatriptan	US20090062550	2009
Transdermal methods and systems for the delivery of Rizatriptan	US20110087153	2011
Combination treatment for migraine	10688102	2013





Surya Namaskar: Its Techniques and Health Benefits

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ABSTRACT

Surya Namaskara also known in English as Sun Salutation (lit. "salute to the sun"), is a common sequence of Hatha yoga asanas. This sequence of movements and asanas can be practiced on varying levels of awareness, ranging from that of physical exercise in various styles, to a complete sadhana which incorporates asana, pranayama, mantra and chakra meditation. It is often the beginning vinyasa within a longer yoga series. Sūrya Namaskāra may also refer to other styles of "Salutations to the Sun". There are twelve poses in the Surya Namaskar series, and a full round consists of performing two sets of this series. During the second set, practitioners move the opposite leg from the one involved in movement during the first set. Whether you regularly practice yoga or not, you can enjoy the health benefits of Surya Namaskar. Performed correctly, it is a completely safe set of yoga poses that will not cause strain or injury.

Keywords: Surya Namaskar, Yoga, Health Benefits.

INTRODUCTION

It is said that the King of Aundh was the first one to introduce sun salutations. He stated that this sequence must be maintained on a regular basis and without fail under his reign in the Maharashtra region of India. Whether this story is true or not, the beginning of this tradition has its origins in that region, and the most popular form of exercise to begin each day is Surya Namaskar. Nowadays, many schools in India practice and teach yoga to all their students and start their days with the beautiful and poetic collection of exercises known as sun salutations. The literal translation of the word "Surya Namaskar" is *salutations to the Sun*. However, if one looks carefully into its etymological meaning, it has a deeper meaning. The word "Namaskar" means "I bow my head with complete gratitude and offer myself to you wholeheartedly without being biased and partial". The word "Surya" means "the





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one who expands and illuminates the world". You will experience health benefits by practicing the Sun Salutation just once daily, but you can also practice the series of poses as often as you like morning, noon or night. Surya Namaskar provides all of the key health benefits of yoga in a very succinct package. In addition to these physical benefits, Surya namaskar practice stimulates and conditions virtually every system in the body. Over time, Surya Namaskar will help you achieve a sense of well-being and purpose. It is a spiritually uplifting exercise and promotes a keen awareness of the interconnectedness of your body mind and breath. Muscle tone and Improve flexibility. All the asanas carried out in Surya Namaskar focus on different muscle groups and nerve centers called Chakras. This helps you tone almost all your body parts including arms, abs, thighs, and butt. It also gives you more flexibility and improves your body posture.

Great cardio training and hormonal balance

Surya Namaskar gives your body a quick and nice workout. If done in a fast manner, it acts as a cardio workout for your abs, thighs, and butt. Improved blood circulation results in low cholesterol levels and improved heart health. Another benefit of proper blood circulation is a good hormonal balance. Keep in mind that blood is the carrier of our hormones, so, if it is working properly, they'll reach all your organs without a problem.

Improves digestion and promotes weight loss

Proper exercise and proper rest along with a balanced diet result in improved insulin sensitivity. Sun salutations stimulate the digestive tract by producing the right kind of digestive juices. Thus, you improve your metabolism, which helps you get rid of all toxins and burn all the extra calories.

Increases energy and awareness levels

Along with asanas, the breathing pattern is also an important aspect of Surya Namaskar. This gives deep conscious relaxation to the body and mind. It helps to relax the mind and sharpen the senses. It increases your self-awareness, which increases your energy levels.

Enables Better Absorption of Nutrients

Proper blood circulation and digestion enables better absorption of nutrients, which in turn improves your overall health. Nutrient absorption helps to carry out vital functions in the body. In today's world, unhealthy lifestyles have led to many disorders like thyroid dysfunction, PCOD, PCOS, obesity, etc. Surya Namaskar can be part of a healthy routine which is proven to keep such diseases at bay.

Reduces moods swings and brings more emotional stability

Deep breathing techniques with specific asanas provide great relaxation to the nerve cells or chakras. It can positively impact brain functioning. Specifically, it helps you balance between the right and left sides of the brain. This brings you more emotional stability and increases your creativity and mental capacity.

Improves Your Skin's Glow

A nice-glowing skin is a result of good blood circulation, good digestion, relaxation and good sleep. You get all of this with sun salutations!

Benefits of Surya Namaskar

When practiced in the morning, Surya Namaskar relieves stiffness, energizes the body and refreshes the mind. During the day, it is a rejuvenating alternative to caffeine, and at night, Surya Namaskar can help you relax and get a good night's sleep. SuryaNamaskar provides all of the key health benefits of yoga in a very succinct package. It is a holistic exercise that provides physical health benefits, but also mental or emotional as well as spiritual benefits. The obvious advantage of Surya Namaskar is the workout it provides for the muscles, but it also benefits joints, ligaments and the skeletal system by improving posture, flexibility and balance. In addition to these physical benefits, suryanamaskar practice stimulates and conditions virtually every system in the body. It is good for the heart and





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stimulates the cardiovascular system. It oxygenates the blood and helps strengthen the heart. Surya Namaskar is good for the digestive system and the nervous system. It stimulates the lymphatic system and supports respiratory system health, as well. Practicing Surya Namaskar also benefits the Endocrine system and enables the various endocrinal glands to function properly. These include the thyroid, parathyroid and pituitary glands as well as the adrenal gland, testes and ovaries. Like most forms of exercise, Surya Namaskar provides mental benefits to regular practitioners. You will feel wonderful after performing the Sun Salutation. It is relaxing and rejuvenating, and tension, stress and anxiety melt away as you perform Surya Namaskar. Surya Namaskar is an excellent alternative to caffeine and other stimulants. If you suffer from insomnia or sleep disturbances, you will find practicing Surya Namaskar aids in helping you fall asleep without the need for depressants. With regular practice, Surya Namaskar is an excellent way to manage stress and alleviate depression. You will expend a tremendous amount of energy as you move through the two sets of poses. Surya Namaskar teaches you to concentrate, and learning to achieve the poses is incredibly gratifying.

Benefits of Poses

Each of the SuryaNamaskar, poses in the series provides specific health benefits:

- Pose 1 (and 12): Promotes balance, stimulates the respiratory system, exercises shoulder, back and neck muscles
- Pose 2 (and 11): Promotes balance, promotes digestion, exercises arms and shoulder muscles, tones the spine, promotes flexibility in back and hips
- Pose 3 (and 10): Promotes blood circulation, tones abdominal tracts, stretches back and leg muscles, stimulates spinal nerves, stimulates lymphatic system
- Pose 4 (and 9): Exercises spine, strengthens hand and wrist muscles
- Pose 5 (and 8): Stimulates blood circulation, strengthens the heart, strengthens wrist and arm muscles, relieves neck and shoulder tension
- Pose 6: Strengthens leg and arm muscles, increases flexibility in neck and shoulders, stretches arms, shoulder, neck and back muscles, exercises back muscles, releases tension in neck and shoulder
- Pose 7: Stimulates circulation to abdominal organs, tones digestive tract, stretches upper and lower body, promotes flexibility in the back, stimulates nerves in spine
- Poses 8 through 12 are essentially repetitions of poses 5 through 1, respectively. The health benefits of each are similar to their corresponding poses.

The 12 mantras for Surya Namaskar

12 mantras for Surya Namaskar are the auspicious mantras (chants). One should recite one mantra after completing one round of Surya Namaskar. Some people prefer to recite Gayantri Mantra after doing sun salutations. Following are the 12 mantras to recite while performing sun salutation.

- | | | | |
|----------------------|---------------------|----------------------------|------------------------|
| 1. Aummitrayanamah | 2. Aumravayenamah | 3. Aumsuryayanamah, | 4. Aumbhanavenamah |
| 5. Aumkhagayanamah | 6. Aumpushnenamah, | 7. Aumhiranyagarbhayanamah | 8. Aummarichayenamah |
| 9. Aumadityayanamah, | 10. Aumsavitrenamah | 11. Aumarkayanamah | 12. Aumbhaskarayanamah |

CONCLUSION

Sūrya Namaskāra may also refer to other styles of "Salutations to the Sun". Surya Namaskar is an exercise in itself, but it is also sometimes used as a warm up for other, more strenuous workouts. Regular practice of *Surya Namaskar* is the way towards good health. Surya Namaskar provides all of the key health benefits of yoga in a very succinct package. It is a holistic exercise that provides physical health benefits, but also mental or emotional as well as spiritual benefits. The obvious advantage of Surya Namaskar is the workout it provides for the muscles, but it also benefits joints, ligaments and the skeletal system by improving posture, flexibility and balance. In addition to these





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physical benefits,. Surya namaskar practice stimulates and conditions virtually every system in the body. Over time, Surya Namaskar will help you achieve a sense of well-being and purpose. It is a spiritually uplifting exercise and promotes a keen awareness of the interconnectedness of your body, mind and breath.

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Variability of Morphological and Botanical Characters of Seeds of Some Species of Fabaceae (Leguminosae) in the Region of Sétifian High Plains, Algeria

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ABSTRACT

In this study, morphological and botanical characters of seeds of nine species belonging to Fabaceae were analyzed. These species were the following: *Vicia monantha* Retz., *Vicia sativa* L., *Vicia hirsuta* (L.) S.F. Gray., *Medicago orbicularis* (L.) Bartal., *Medicago hispida* Gaertn., *Scorpiurus muricatus* L., *Melilotus segetalis* (Brot.) Ser., *Lathyrus ochrus* L., *Coronilla scorpioides* Koch.. The analyzed characters in which the study was based on are: shape, color, size (length, breadth), solidity, brightness, surface, weight per 100 seeds, Appendages, the average number of seeds per plant. As a result of the study, the shape of seeds is showed a large variation among the investigated species. Most of seeds have spherical shape (*Vicia sativa* L., *Vicia monantha* Retz., *Vicia hirsuta* (L.) Gray, *Lathyrus ochrus* L.) and others are reniform (*Medicago hispida* Gaertn., *Scorpiurus muricatus* L.) or linear in shape (*Coronilla scorpioides* Koch.). Color varies from black to brown, brown to dark brown, greenish straw to reddish straw, yellow-brown-black, yellow dark to brown, yellowish, light brown with waxy layer, yellow dark to brown, red-brown to black, yellow dark to brown. Seed dimensions vary greatly among the examined species, the largest seeds in *Lathyrus ochrus* L. have a diameter of 5.58 ± 1.80 mm, and the smallest seeds measure 0.94 ± 1.37 mm, 0.55 ± 1.80 mm in *Medicago orbicularis* (L.) Bartal and *Melilotus indica* (L.) ALL. Highest weight was observed with seeds of *Lathyrus ochrus* L. (9.94 ± 2.04 mg), while lowest weight was found in seeds of *Melilotus segetalis* (Brot.) Ser. (0.84 ± 0.54 mg). Number of seeds product per plant varies greatly among the examined species, the high number of seeds is 2000 ± 480 seeds in *Medicago hispida* Gaertn. and the low number is 120 ± 27 in

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Melilotus segetalis while the number of seeds in the rest of the studied species are ranged from 150±26 to 1800±249 seeds. This work constitutes a contribution for a better knowledge of the seeds of Fabaceae. Seed morphological characteristics proved to be useful taxonomic features, helpful in identification of large number of species and genera.

Keywords: Morphological characters, Botanical characters, Seeds, Fabaceae, Setifian high plains, *Vicia monantha* Retz.

INTRODUCTION

The Fabaceae (Leguminosae) is a family of flowering plants comprising about 269 genera and 5100 species [1] and it is one of the largest plant families in Algeria and in the world. The Fabaceae is the third largest family of flowering plants with 650 genera including about 18 thousand species [2]. Many of these species are important as food, fodder, wood, ornamentals, and raw materials for industry. A characteristic feature of Fabaceae is capacity to fix the atmospheric nitrogen (N₂) by means of symbiosis with the nitrogen fixing bacteria [3]. Therefore, these plants play an important ecological role. Woody legume seeds often poses impermeable seed coats which require treatment before germination can take place, as it prevents water uptake, gaseous exchange and radicle emergence [4].

Seed is a vital genetic source and dispersal unit between successive generation of plants, and it possesses very reliable and constant characters in various groups of seed plants. Seed morphological studies have great value and these characters can be individually used as a beneficial tool for the identification of plant species at various levels [5, 6]. A well trained seed analyst will usually be able to identify seed to generic level but not always to the species level [7]. Seed Identification can be both a science and an art. Some seed scientists use "seed keys" to identify seeds, others visualization, and most use both depending upon what experience they have in the field and what they are trying to identify [8]. Seed morphology and the structure and morphology of the seed coat has been found to be a useful taxonomic feature. Seed characters are very helpful for identification of a large number of species or genera [9]. In many cases, morphological characteristics, such as seed shape and testa ornamentation, can be used to distinguish species and varieties [10]. Fruits and seeds tend to show less phenotypic plasticity, in comparison with other organs [11]. Seed characters are less affected by environmental conditions, and often reflect genetic differences. Remarkable variability in seed morphology exists in Angiosperm taxa, with relative constancy of seed structure in narrow taxonomic units [12].

knowledge on biology of seeds and seedlings comes essential to conduct ecological restoration programs, both in knowledge of the germination process to obtain seedlings and in knowledge of the morphological character of propagation material located in the seed bank and seedlings. Morphological studies and production on seeds have been developed with the aim to provide information to be used in botanical identification of native species, also facilitating individuation of the species in field and in the seed bank [13]. They may also be useful in characterization of seed dormancy related to morphology, to interpretation of germination tests and determine storage methods [14]. Studies on seed morphology in some genera of Fabaceae and the other families have been proved to be useful for distinguishing taxa [15,16,17]. Zoric *et al.*, [10] examined 38 *Trifolium* species from five sections concluding that seed characters do not provide reliable information and do not support infrageneric classification. Taia [18] examined seeds of *Ononis*, *Melilotus*, *Trigonella*, *Medicago* and *Trifolium*, in order to assess the relationship between them.

Preliminary studies of the seed coat surface of 24 *Trifolium* species were made by Slattery *et al.*, [19]. They found that the surface of the seed was smooth, roughened, tuberculate, wrinkled or pitted and described five types of seed coat patterns. The seeds of this genus vary in their dimensions, weight and shape. Algan and Büyükkartal [20] described ultrastructure of the seed-coat of *Trifolium pratense*. According to their findings, the outer layer of the seed coat is composed of elongated macrosclereids.



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Several species of this family are cultivated as economically important fodder crops. Seeds of such plants are often used and transported with no collateral plant parts to aid in their identification, so it is particularly important to obtain better knowledge of their morphological characteristics, which could help in determination of species. The purpose of this study was to describe and identify external seed morphological characteristics of nine species belonging to fabaceae, and to evaluate their possible use for taxonomic considerations.

MATERIALS AND METHODS

Plant Material

The present study includes seeds of nine species of Fabaceae (Table 1) collected from different localities in the region of Setifi an high plateau which situated in the north east of Algeria between the two longitude 5° and 6° and between the two latitudes 35°. 40 and 36°.35. After maturation of the seed we collect as many as possible, we put the seed in paper bags to keep it dry and to avoid humidity and climatic factors which lead to germinating these seeds; they were kept in normal condition of laboratory.

Seed morphology

Seeds morphological discrimination is related to external description of all the characteristics of seed. The study requires taking 30 seeds randomly of each species [21]. Apparent substantial information helps researchers to identify or describe seeds. The seeds were principally observed by a light microscope to make sure that they were of normal size and maturity. The observations were made on thirty randomly selected seeds of each species. The detailed structure of the seed coat was observed far from the hilum. Weight was obtained for 100 seeds, in five replicates, using an electronic balance. The morphological characteristics in which the study was based on were used by different researchers for example the characteristics like size, weight, color and shape were used as suggested by various workers such as Imbert *et al.*, [22], Irieet *al.*, [23], Jana and Mukherjee [24]. As well as other some researchers who bear on other characteristics such as solidity, brightness, surface [25, 26]. Generally the characteristics were used in this study are the result of the most important characteristics which were used in the different researches of seeds identification.

Average number of seeds per plant

Five mature plants per species were randomly collected in an area of about 50 x 50m. Each plant was placed in a paper bag. The plants were subsequently sanded and the mature seed are cleaned manually and counted.

RESULTS AND DISCUSSION

Morphological characteristics

In order to identify the different morphological characteristics of seeds species of Fabaceae, we found that the single character is not enough to distinguish the species because the seeds of more than one species possess same mean value however their standard deviations vary. But the consideration of these characteristics collectively was found unique in this study. The identifying characters described and used in this publication are found only on the external surface of the seeds. Their usefulness for identification varies. Characters of major importance are color, size and shape of the seed [27, 28]. Other characters used in conjunction with these features have limited use. So these characteristics may serve as a convenient method for identification and classification of species on the basis of their seed bank available in the soil [29]. Seeds of Fabaceae species included in this study are represented in photos (Photo1 to Photo 09).

Each species shows morphological characteristics different from the plant or other species, these morphological characteristics are not restricted to the external form of the plant only but it can be on level of different other parts of plant like fruit and seed [14]. The shape of seeds is showed a large variation among the investigated species. Most of seeds have spherical shape (*Vicia sativa* L. subsp. *Sativa*, *Vicia monantha* Retz., *Vicia hirsute* (L.) Gray, *Lathyrus ochrus*





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L.) and others are reni form (*Medicago hispida* Gaertn., *Scorpiurus murcatus* L.) or linear in shape (*Coronilla scorpioides* Koch.) (Table1). The seed shape as observed in the present study seems to be diagnostic at the generic level. The data of seed shape is compatible with that mentioned before by Gunes [16]. The color of seeds is of high diagnostic and systematic interest among species. The color varies from black to brown, brown to dark brown, greenish straw to reddish straw, yellow-brown-black, yellow dark to brown, yellowish, light brown with waxy layer, yellow dark to brown, red-brown to black ,yellow dark to brown. The seeds color is black to brown in *Vicia sativa* L. subsp.*sativa* and yellow dark to brown in *Medicago orbicularis* (L.) Bartal , *Scorpiuru smurcatus* L. and *Melilotus indica* (L.) ALL. In *Medicago hispida* Gaertn. And *Coronillas corpioides* Koch. Seed color greatly varies in same specie between yellow-brown-black and red. The seed color is diagnostic at the generic and specific level for some extent. The data of seed color is compatible with that mentioned before by Mirzaei et al.,[3].

Seeds dimensions vary greatly among the examined species, the largest seeds in *Lathyrus ochrus* L. have a diameter of 5.58 ± 1.80 mm, and the smallest seeds measure 0.94 ± 1.37 mm, 0.55 ± 1.80 mm in *Medicago orbicularis* (L.) Bartal and *Melilotus indica* (L.) ALL., while the rest of the studied species have seeds their dimensions from 3.98 ± 1.66 mm, 2.01 ± 0.32 mm to 5.50 ± 0.71 mm. The seed size was found useful to separate species of *Melilotus indica* (L.) ALL., and *Medicago orbicularis* (L.) Bartal from the other species (see Table 1). The character of Seeds surface texture can be of considerable diagnostic and systematic value. The surface shape is smooth in the most of species as *Vicia sativa* L. subsp. *Sativa*, *Vicia monantha* Retz., *Vicia hirsuta* (L.) Gray, *Medicago hispida* Gaertn., *Medicago orbicularis* (L.) Bartal, *Lathyrus ochrus* L., *Melilotus indica* (L.) ALL., *Coronillas corpioides* Koch., *Scorpiurus murcatus* L. and rough in *Melilotus segetalis* (Brot.) Ser. The seed shape was found useful to separate specie of *Melilotus segetalis* (Brot.) Ser. from the other species (see Table 1). This is in accordance with the work of Ozbekel al.,[4].

Table 2 showed that seeds of Fabaceae are solid in the most of species such as *Vicia sativa* L. subsp. *sativa*, *Vicia monantha* Retz., *Vicia hirsuta* (L.) Gray, *Medicago hispida* Gaertn., *Medicago orbicularis* (L.) Bartal, *Melilotus segetalis* (Brot.) Ser. While in *Melilotus indica* (L.) ALL. seeds are fragile. Seeds vary between bright in *Vicia sativa* L. subsp. *sativa*, *Medicago hispida* Gaertn., *Medicago orbicularis* (L.) Bartal, *Coronillas corpioides* Koch., and *Scorpiurus murcatus* L., and Pale in *Vicia monantha* Retz., *Vicia hirsuta* (L.) Gray, *Melilotus segetalis* (Brot.) Ser., *Lathyrus ochrus* L. and *Melilotus indica* (L.) ALL. Seeds can have a short beak in *Melilotus indica* (L.) ALL. Average weight of 100 seeds of species was taken, results are given in table2. Highest weight was observed with seeds of *Lathyrus ochrus* L. (9.94 ± 2.04 mg), while lowest weight was found in seeds of *Melilotus indica* (L.) ALL. (0.84 ± 0.54 mg).

Average number of seeds per plant

Seeds production that is to say the number of seeds produced per plant. Knowledge of this number is essential firstly in understanding the dynamics of plants populations[30]. Number of seeds product per plant varies greatly among the examined species, the high number of seeds is 2000 ± 480 seeds in *Medicago hispida* Gaertn. and the low number is 120 ± 27 in *Melilotus segetalis* while the number of seeds in the rest of the studied species are ranged from 150 ± 26 to 1800 ± 249 seeds. The seed number was found useful to separate species of *Medicago hispida* Gaertn., *Melilotus segetalis* from the other species (see Table 3).

Most species are prolific seed manufacturers, in some cases producing a more than 2000 seeds/plant. These seeds produced are eventually deposited either onto the soil adjacent to the parent plant or transported to another area where they wait for the adequate conditions to germinate and grow[21]. Annual plants depend on seed production as the sole means of propagation and survival. Production of abundant small seeds is a common adaptation that ensures a high probability of dispersal and infestation[13]. Due to high seed production potential combined with dormancy, seed longevity possesses higher advantage as there is a chance of at least for some of them to germinate and grow into new plant, a single plant of an annual plant can produce enough seeds in one season to cover an area of one acre[31].





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CONCLUSION

Seed characters are very important to separate among species in the Fabaceae family. Previous studies on seed morphology indicate that seed characters are important for the taxonomy of the species. Our study also confirms their importance; it shows that seed features, such as ornamentations of the seed surface, seed shape and color, are useful characters for identification of species of Fabaceae. The examined seeds are variable in both shape and size. The size of the smallest seed is about 1 mm in length (*Medicago orbicularis*) and the size of the largest seed is about 6 mm in length (*Vicia sativa* L. subsp. *Sativa*, *Coronilla corpioides* Koch., *Scorpiuru smurcatus*L., *Lathyrus ochrus*L.). Most of the examined seeds are spherical or reniform (*Vicia sativa* L. subsp. *sativa*, *Vicia monantha* Retz., *Vicia hirsute* (L.) Gray, *Medicago hispida* Gaertn., *Lathyrus ochrus* L., *Scorpiurus murcatus* L.). The seed colors also vary among the examined species, from Brown to dark brown (*Vicia monantha* Retz.), Yellow dark to brown (*Scorpiurus murcatus* L. *Medicago*), Yellowish (*Melilotus segetalis*), Red-brown to black (*Coronilla corpioides* Koch.). The purpose of this study was to describe and identify external seed morphological characteristics of nine species belonging to fabaceae, and to evaluate their possible use for taxonomic considerations.

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Table 1. Information on studied species

Scientific name	Common name	Biological type	Biogeographical origin
<i>Vicia monantha</i> Retz.	Hard vetch	Therophyte	Mediterranean
<i>Vicia sativa</i> L.	Common vetch	Therophyte	European-Mediterranean
<i>Vicia hirsuta</i> (L.) S.F. gray.	Hairy tare	Therophyte	European-Mediterranean
<i>Medicago orbicularis</i> (L.) Bartal.	Blackdiskmedick	Therophyte	Mediterranean
<i>Meidcago hispida</i> Gaertn.	Bur clover	Therophyte	Mediterranean
<i>Scorpiurus muricatus</i> L.	Prickly scorpion's-tail	Therophyte	Mediterranean
<i>Melilotussegetalis</i> (Brot.) Ser.	Furrowed melilot	Therophyte	Mediterranean
<i>Lathyrusochrus</i> L.	Cyprus vetch	Therophyte	Mediterranean
<i>Coronillas corpioides</i> Koch.	Yellow crownvetch	Therophyte	Mediterranean



Meriem Hani *et al.***Table 2: Morphological characteristics of species seeds (Shape, Color, Size, Surface)**

Morphological characteristics				
Species	Shape	Color	Size	Surface
<i>Vicia sativa</i> L. subsp. <i>sativa</i>	Spherical	Black to brown	5.50±0.71 mm	Smooth
<i>Vicia monantha</i> Retz.	Spherical	Brown to dark brown	4.20±0.11mm	Smooth
<i>Vicia hirsuta</i> (L.) Gray	Spherical	Greenish straw to reddish straw	4.05±0.08mm	Smooth
<i>Medicago hispida</i> Gaertn.	Reniform	Yellow-Brown-Black	3.98±1.66 mm 2.01±0.32 mm	Smooth
<i>Medicago orbicularis</i> (L.) Bartal	Edged	Yellow dark to brown	0.94±1.37 mm 0.55±1.80 mm	Smooth
<i>Melilotus segetalis</i> (Brot.) Ser.	Ovoid	Yellowish	2.07±0.99 mm 2.17±0.08 mm	Rough
<i>Lathyrus ochrus</i> L.	Spherical	Light brown with waxy layer	5.58±1.80 mm	Smooth
<i>Coronilla scorpioides</i> Koch.	Linear	Red-brown to black	5.35±1.77mm 1.08±0.05 mm	Smooth
<i>Scorpiurus murcatus</i> L.	Reniform	Yellow dark to brown	5.48±0.93 mm 1.01±1.07 mm	Smooth

Table 3: Morphological characteristics of species seeds (Solidity, Brightness, Appendages, Weight per 100 seeds).

Morphological characteristics				
Species	Solidity	Brightness	Appendages	Weight per 100 seeds (mg)
<i>Vicia sativa</i> L. sub sp. <i>sativa</i>	Solid	Bright	None	9.80±0.08
<i>Vicia monantha</i> Retz.	Solid	Pale	None	8.78±0.10
<i>Vicia hirsuta</i> (L.) Gray	Solid	Pale	None	7.38±1.52
<i>Medicago hispida</i> Gaertn.	Solid	Bright	None	7.38±0.10
<i>Medicago orbicularis</i> (L.) Bartal	Solid	Bright	None	4.74±0.92
<i>Melilotus segetalis</i> (Brot.) Ser.	Solid	Pale	None	2.04±0.25
<i>Lathyrus ochrus</i> L.	Solid	Pale	None	9.94±2.04
<i>Coronilla scorpioides</i> Koch.	Solid	Bright	None	3.46±1.18
<i>Scorpiurus murcatus</i> L.	Solid	Bright	None	4.67±2.13

(±SD): Standard deviation

Table 4. Seeds production capability (±SD) of Fabaceae species.

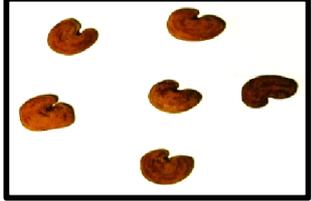
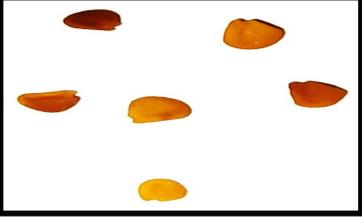
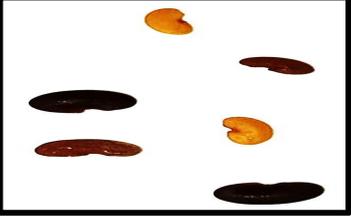
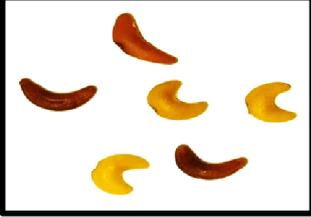
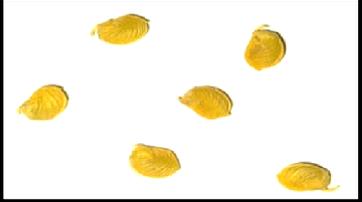
	Number of fruits per plant	Number of seeds per fruits	Number of seeds per plant
<i>Vicia monantha</i> Retz.	30±05	04±02	210±15
<i>Vicia sativa</i> L.	42±02	04±02	150±26
<i>Vicia hirsuta</i> (L.) S.F. gray.	35±15	06±02	240±30
<i>Medicago orbicularis</i> (L.) Bartal.	500±12	01±00	720±17
<i>Medicago hispida</i> Gaertn.	60±22	20±05	900-2000
<i>Scorpiurus muricatus</i> L.	35±04	06±04	210±61
<i>Melilotus segetalis</i> (Brot.) Ser.	04±02	06±01	180±24
<i>Lathyrus ochrus</i> L.	15±08	05±03	155±46
<i>Coronilla scorpioides</i> Koch.	50±15	06±03	634±68

(±SD): Standard deviation





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 <p>Fig.1. Seeds of <i>Vicia monantha</i> Retz</p>	 <p>Fig.2. Seeds of <i>Vicia sativa</i> L.</p>	 <p>Fig.3. Seeds of <i>Vicia hirsuta</i> (L.) S.F. gray.</p>
 <p>Fig.4. Seeds of <i>Medicago orbicularis</i> (L.) Bartal.</p>	 <p>Fig.5. Seeds of <i>Medicago hispida</i> Gaertn.</p>	 <p>Fig.6. Seeds of <i>Scorpiurus muricatus</i> L.</p>
 <p>Fig.7. Seeds of <i>Melilotus segetalis</i> (Brot.) Ser.</p>	 <p>Fig.8. Seeds of <i>Lathyrus ochrus</i> L.</p>	 <p>Fig.9. Seeds of <i>Coronillas corpioides</i> Koch.</p>





Evaluating Machine Learning Models on Soil Dataset with R

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ABSTRACT

In agricultural research, machine learning algorithm plays an imperative role in the agricultural field. The aim of this research work is to evaluate the machine learning algorithms and to find the best algorithm for implementing in the soil dataset and to diagnosis the nutrient level using R - Tool. Diagnosing the nutrient level is very useful for cultivation of different crops; it will be very useful for the farmer to improve their productivity. Agriculture depends on various factors like climate, humidity, soil, fertilizers and pesticides to increases the high yield of crop production. But from these entire factors main key factor is the soil with the maximum nutrients for the high yield of the crops. Soil nutrient is the important factor to decide which crops is suitable to grow in that particular region. This paper focuses on evaluating machine learning algorithm with R – Tool, to find the most accurate model for the dataset. That is the goal of predictive modeling for soil nutrients analysis and crop yield prediction for cultivating the appropriate crop and for enhancing the productivity, for cultivating multiple crops to enrich the productivity based on the soil data sets acquired from Krishnagiri District.

Keywords: Machine Learning, Crops, Soil Nutrients, Decision Tree, R-Tool.

INTRODUCTION

Machine learning algorithm interprets huge data sets and tries to classify that data in some way to describe its structure. Data mining is a process of finding the desired pattern in huge database and also it plays an important role in agricultural field of research. Data mining becomes popular in the field of agriculture for soil classification



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Crop cultivation depends on the soil nutrients and soil fertile. Soil is the important part of natural environment [1]. The soil is analyzed to physical properties and chemical properties such as EC, pH, along with micro nutrients Zn, B, Cu, Fe and macro nutrients N, P, K, S. The essential nutrient required for crop growth is determined during soil testing process. For soil optimum health Macronutrients and micronutrients combination is essential. A lack of any one micronutrient in the soil will limit growth, when even other nutrients are present in sufficient amounts [5]. The aim of this research work is to find the accuracy and kappa of the machine learning algorithm, to predicate the best algorithm for analysis soil nutrient present in soil dataset.

Evaluating Machine Learning Algorithms**Choosing an Algorithm**

The most forceful way to determine good or even best algorithms for the dataset is by trial and error. Evaluating by various set of algorithms on the dataset and observes what works and drops what doesn't. This process is called spot-checking algorithms.

Steps

1. Short list of algorithms to the problem
2. Focus the efforts on those algorithms.
3. Improve the results of the algorithm by tuning the algorithm parameters
4. By combining the predictions of multiple models using ensemble methods
5. Evaluate multiple machine algorithms on a dataset in R.

Spot Check Algorithms in R

Evaluating a suite of algorithms to test a problem in R. The test problem used in this research work is a binary classification of soil dataset [7]. The soil data set is collected from District Agricultural office in Krishnagiri District. Finding the Soil Nutrients level will help the farmer for cultivating suitable crop. This soil dataset has 2617 tuples with 25 instances of data ,it describes the level of soil nutrients present in the soil and find whether boolean output variable macronutrients and micronutrients is sufficient or deficient for cultivating different crops in Krishnagiri District.

EXPERIMENT AND RESULTS

Evaluating the algorithm is divided into three section, they are

1. Defining a test control
2. Building multiple predictive models from the data.
3. Comparing models and selecting a short list.

Test Control

The test control has three key elements:

- a. The dataset is used to train models.
- b. The test options used to evaluate a model (e.g. resampling method).
- c. The metric is used for measuring and comparing.

Test dataset

Soil dataset is used to train the model by loading the required libraries. The libraries are library (mlbench), library (caret)[2]. The caret package in R provides an excellent interface into hundreds of different machine learning algorithms and useful tools for evaluating and comparing models.





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Test options

Test options are a technique used to evaluate the accuracy of a model on unseen data. They are often referred to as resampling methods in statistics.

Test options are:

- **Train/Test split:** huge data is used to build accurate models
- **Cross Validation:** 5 folds or 10 folds provide a commonly used tradeoff of speed of compute time and generalize error estimate.
- **Repeated Cross Validation:** 5- or 10-fold cross validation and 3 or more repeats to give a more robust estimate, only if you have a small dataset and can afford the time.

To train the control 10-fold cross validation with 3 repeats is used with random number seed is used to a variable, so that it can re-set the random number generator before training each algorithm[4]. It is important to ensure that each algorithm is evaluated on exactly the same splits of data and metric used is Accuracy and Kappa

Test Metric

There are many possible evaluation metrics to choose from. Caret provides a good selection .some good test metrics for different problem types it includes:

Classification:

- **Accuracy: Correct Predictions / Total Predictions.**
- **Kappa:** the base distribution of classes into account.

Regression:

- **RMSE:** Roots mean squared error.
- **Rsquared:** the goodness of fit or coefficient of determination.

The evaluation metric is specified the call to the *train()* function for a given model, it will define the metric with all of the model training later[6].

Model Building

There are three concerns when selecting models to spot check:

- a. Choose the models.
- b. Configure their arguments.
- c. Preprocessing of the data for the algorithm.

Algorithms

It is important to have a good merge of algorithm representations (lines, trees, instances, etc.) as well as algorithms for learning those representations.

- **Linear methods:** Linear Discriminant Analysis and Logistic Regression.
- **Non-Linear methods:** Neural Network, SVM, kNN and Naive Bayes
- **Trees and Rules:** CART, J48 and PART
- **Ensembles of Trees:** C5.0, Bagged CART, Random Forest and Stochastic Gradient Boosting

Algorithm Configuration

One feature of the caret package in R is that it helps with tuning algorithm parameters. It can also estimate good defaults (via the automatic tuning functionality and the *tunelength* argument to the *train()* function).



**Samundeeswari et al.****Data Preprocessing**

Some algorithms perform a whole lot better with some basic data preprocessing. For example, many instance based algorithms work a lot better if all input variables have the same scale. the `train()` function in caret specify preprocessing of the data to perform prior to training[3]. The transforms needed are provided to the `preProcess` argument as a list and are executed on the data sequentially. The most useful transform is to scale and center the data.

Algorithm Spot Check

List of models that are used to spot check for soil dataset of nutrients[4].

1. Linear Discriminant Analysis - (LDA)
2. Logistic Regression - (LR)
3. Guassian linear model - (GLMNET)
4. J48
5. Support Vector Machine - (SVM Radial)
6. k-Nearest Neighbor - (kNN)
7. Classification and regression Trees - (CART)
8. C5.0
9. Bagged CART
10. Random Forest – (RF)
11. Stochastic Gradient Boosting (Generalized Boosted Modeling)

These are the eleven algorithms are taken for spot check to choose the best or good algorithm for my research work.

Model Selection

Train a large and varied list of models, to evaluate and compare them. The goal is to select a few, perhaps 2-to-5 different and well performing algorithms to investigate further.

The summarized the results of the algorithms

The results (Table 1) of metric for macronutrients Random Forest, Bagging, C5.0, GBM and J48 do well on this soil dataset. The results (Table 2) of metric for macronutrients Random Forest, Bagging, C5.0, GBM and J48 do well on this soil dataset. It is also useful to review the results using a boxplot and dotplot visualization techniques to get an idea of the mean and spread of accuracies and kappa by Compare Machine Learning Algorithms in R Box Plots and in R Dot Plots. Boxplot comparison of Macronutrients & Micronutrients (Fig. 1, Fig.2), Dot-plot comparison of Macronutrients & Micronutrients (Fig.3. - Fig.4).

CONCLUSION

Machine learning is a massive field, this research Paper is used to choose the best machine learning algorithm; it mostly depends on type of the dataset. This research paper evaluates the different model to choose the best model. The models are support vector machine(SVM) and k-Nearest Neighbor (kNN) from Non-Linear Regression, Classification and Regression Trees (CART), Bagging CART, Random Forest and Gradient Boosted Machines (GBM) from Non-Linear Decision Tree Regression, Logistic Regression and Linear Discriminant Analysis (LDA) from Linear Classification and GLMNT ,C50 and J48 from Classification. The predictor for macronutrients are Nitrogen(N), Potassium(K), Phosphorous(P) and Sulphur(S) and the predictor for micronutrients are Iron (Fe), Copper (Cu), Zinc(Zn) and Boron (B). The metric used is this research paper is Accuracy and Kappa. The results of metric for macronutrients and micronutrients is Random Forest, Bagging, C5.0, GBM and J48 algorithm perform well on this soil dataset and the confidence level is 0.95. Finding the suitable algorithm depends on the predictor and features of the dataset and also the best model may vary according to the dataset what we are using. In future this evaluation of machine learning algorithm will be extended to other algorithms also.





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Table 1. Results of Metric for Macronutrients

Call :

summary.resamples(object = results)

Model s: LDA, Logistic, J48, GLMNET, SVM, KNN, CART, C50, Bagging, RF, GBM

Number of resamples: 30

Accuracy

	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA's
LDA	0.7777778	0.7913815	0.8187023	0.8177259	0.8390805	0.8625954	0
Logistic	0.7786260	0.7938931	0.8206107	0.8176040	0.8349237	0.8620690	0
J48	0.9961832	1.0000000	1.0000000	0.9996183	1.0000000	1.0000000	0
GLMNET	0.7938931	0.7977099	0.8202670	0.8214238	0.8421076	0.8664122	0
SVM	0.9312977	0.9503817	0.9617589	0.9598842	0.9685115	0.9809160	0
KNN	0.9045802	0.9284351	0.9407300	0.9379744	0.9503342	0.9655172	0
CART	0.9272031	0.9387558	0.9770115	0.9649654	0.9913903	0.9961832	0
C50	0.9961832	1.0000000	1.0000000	0.9996183	1.0000000	1.0000000	0
Bagging	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	0
RF	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	0
GBM	0.9923372	1.0000000	1.0000000	0.9997446	1.0000000	1.0000000	0

Kappa

	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA's
LDA	0.5503208	0.5755284	0.6336150	0.6316137	0.6758723	0.7224740	0
Logistic	0.5522423	0.5842981	0.6388623	0.6318476	0.6672799	0.7223896	0
J48	0.9923414	1.0000000	1.0000000	0.9992346	1.0000000	1.0000000	0





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GLMNET	0.5819396	0.5898995	0.6359963	0.6386829	0.6815282	0.7304685	0
SVM	0.8624030	0.9005544	0.9232887	0.9195727	0.9367607	0.9617116	0
KNN	0.8080192	0.8562772	0.8809911	0.8753376	0.9001310	0.9307835	0
CART	0.8529752	0.8764784	0.9538026	0.9293975	0.9827251	0.9923477	0
C50	0.9923414	1.0000000	1.0000000	0.9992346	1.0000000	1.0000000	0
Baggi ng	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	0
RF	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	0
GBM	0.9846244	1.0000000	1.0000000	0.9994875	1.0000000	1.0000000	0

Table 2: Results of Metric for Micronutrients

Call :

summary.resamples(object = results)

Model s: LDA, Logi sti c, J48, GLMNET, SVM, KNN, CART, C50, Baggi ng, RF, GBM

Number of resamp les: 30

Accuracy

	Min.	1st Qu.	Medi an	Mean	3rd Qu.	Max.	NA' s
LDA	0.8893130	0.9083969	0.9216095	0.9211624	0.9301461	0.9465649	0
Logi sti c	0.9045802	0.9196170	0.9274809	0.9280419	0.9341603	0.9538462	0
J48	0.9580153	0.9809160	0.9847036	0.9834396	0.9885387	0.9923664	0
GLMNET	0.9045802	0.9196170	0.9292577	0.9280424	0.9341603	0.9538462	0
SVM	0.9427481	0.9551125	0.9618321	0.9616653	0.9656489	0.9885057	0
KNN	0.9389313	0.9578544	0.9618321	0.9620441	0.9694364	0.9770992	0
CART	0.9427481	0.9580153	0.9694072	0.9675231	0.9770773	0.9885057	0
C50	0.9694656	0.9818556	0.9885057	0.9857336	0.9885496	0.9923664	0
Baggi ng	0.9732824	0.9847328	0.9885277	0.9870058	0.9913903	0.9961832	0
RF	0.9730769	0.9847328	0.9885496	0.9875137	0.9923664	1.0000000	0
GBM	0.9580153	0.9809160	0.9847036	0.9831856	0.9885387	0.9923664	0

Kappa

	Min.	1st Qu.	Medi an	Mean	3rd Qu.	Max.	NA' s
LDA	0.7469189	0.7877181	0.8163853	0.8158890	0.8325270	0.8749062	0
Logi sti c	0.7773775	0.8066335	0.8312176	0.8305818	0.8440928	0.8885714	0
J48	0.8985997	0.9545486	0.9637346	0.9605750	0.9729171	0.9820067	0
GLMNET	0.7773775	0.8066335	0.8321401	0.8305891	0.8440928	0.8885714	0
SVM	0.8597531	0.8911741	0.9074924	0.9074060	0.9180446	0.9728718	0
KNN	0.8509352	0.8991549	0.9094072	0.9092498	0.9274031	0.9460202	0
CART	0.8587449	0.8978811	0.9264544	0.9215275	0.9451438	0.9730567	0
C50	0.9270246	0.9570064	0.9727743	0.9662033	0.9731025	0.9821295	0
Baggi ng	0.9363681	0.9638116	0.9729171	0.9692944	0.9797077	0.9910951	0
RF	0.9361404	0.9637646	0.9729171	0.9704682	0.9820067	1.0000000	0
GBM	0.8993082	0.9547041	0.9637646	0.9602177	0.9728570	0.9820067	0





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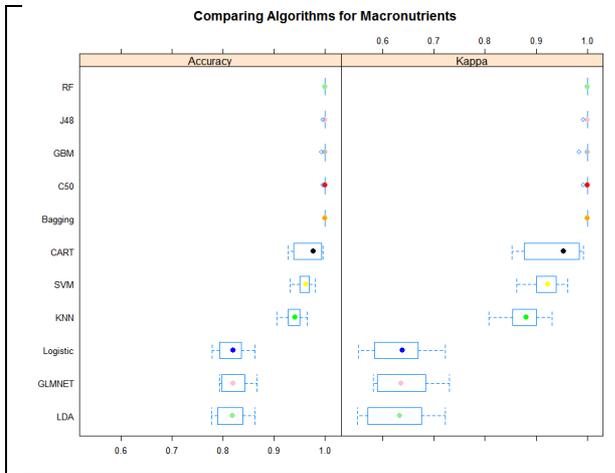


Figure 1: Boxplot for Macronutrients

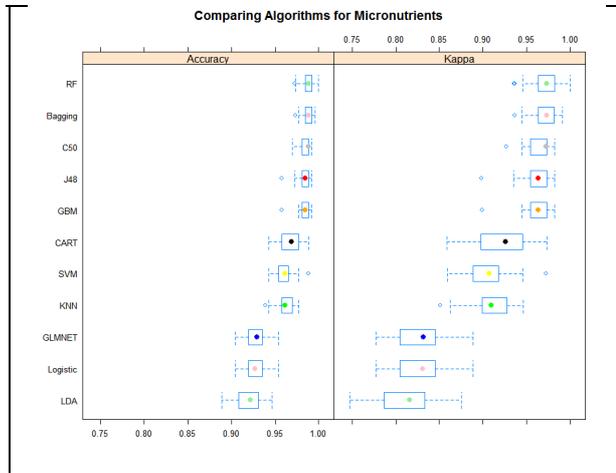


Figure 2: Boxplot for Micronutrients

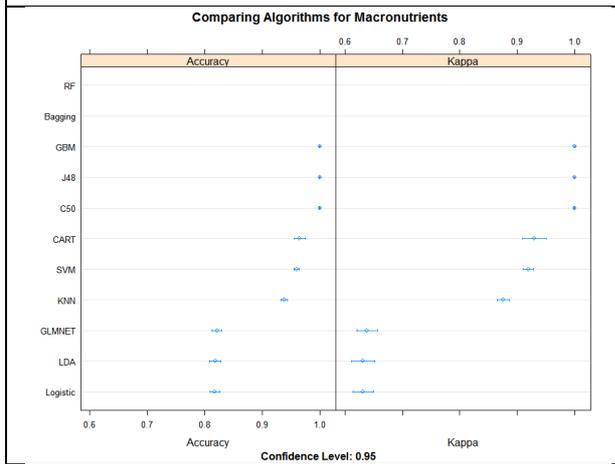


Figure 3: Dotplot for Macronutrients

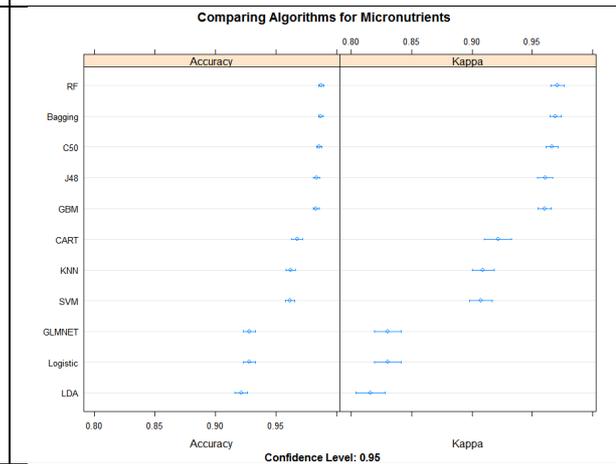


Figure 4: Dotplot for Micronutrients





The Relationship between Spiritual Intelligence and Its Components with Psychological Well-Being of University Students

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ABSTRACT

In order to solve queries related to existence and meaning in life, the term Spiritual intelligence was devised. It integrates the relation between human beings and the surroundings around. A spiritually intelligent individual possesses the Psychological well as add on. The purpose of this study was to assess the relationship between spiritual intelligence and its components with psychological well-being among the students of Jammu University. The study was a descriptive correlation study. In this study, 200 students were selected from University of Jammu through convenient sampling. Data were collected through questionnaires including demographic characteristics, a 24-item questionnaire of spiritual intelligence and its four components and psychological well-being questionnaire having 42 questions was selected. The data obtained from the questionnaires were analyzed through SPSS software. The results showed that there was a significant relationship between spiritual intelligence and psychological well-being of University students. Furthermore, there was a significant association between the components of spiritual intelligence including conscious state expansion, personal meaning production, transcendental awareness, and critical existential thinking with psychological well-being. High level of spiritual intelligence in students help them to improve their psychological well-being and which can lead to the achievement of their goals in life.

Keywords: Spiritual Intelligence, University students, psychological well being.





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INTRODUCTION

Intelligence was considered as an ability for cognitive processes by Alfred Binet in the early 20th century, but now the meaning of intelligence has been changed and also includes other domains such as emotional intelligence and spiritual intelligence also. Salovey considered human intelligence as not only a collaboration of cognitive abilities, but emotional aspect also. One of the most prime models constructing psychological well-being is multi-dimensional Psychological well being Scales by Carol Ryff. Ryff considers psychological well-being as an individuals' endeavour to satisfy their potentials and abilities. This model has been evolved and devised by integrating various theories of personal growth and adaptive functions. Some of the researchers consider Psychological well-being through specific components like emotional processes. Some lay stress on physical processes and also stipulate an association between good quality of life and physical health. Some researchers also describe psychological well-being as a cognitive process with life satisfaction as its indicator. Some researchers, while describing intelligence, opined the role of spiritual processes like having a goal in life to get optimum level of functioning.

MATERIALS AND METHODS

It is a descriptive correlation study on 200 subjects selected through convenient sampling from the students studying in different departments of University of Jammu for finding out the relationship of psychological well-being with spiritual intelligence and its components among students. Data collection tool included four questionnaires: Demographic characteristics including age, gender, religion, Area: Rural/ urban, family type: Nuclear/ Joint, No. of Siblings, birth order of the child, educational qualification of Mother and father, Monthly Income of the family and Believe in existence of God. The Spiritual intelligence Self report inventory by David King (2008) containing four components of 24 items (Critical Existential Thinking, Personal Meaning Production, Transcendental Awareness, and Conscious State Expansion) which were scored 0-4. Ryff Scales of Psychological Well-being included six components of self-acceptance, positive relations with others, autonomy, environmental mastery, purpose in life, and personal growth, which were scored in a Likert 6-point scale from agree to disagree. With 42 questions. The subjects were explained about the questionnaires and later on collected. The data was analyzed by descriptive statistical tests (concrete and relative frequency distribution, mean and SD) and inferential statistical tests (Pearson correlation coefficient) through SPSS.

RESULTS

Table -1. Correlation coefficient between spiritual intelligence and psychological well-being

VARIABLES	NO.	r	P
Spiritual Intelligence and Psychological well-being	200	.45	.001
Critical Existential Thinking	200	.23	.002
Personal Meaning Production	200	.51	.001
Transcendental Awareness	200	.23	.02
Conscious State Expansion	200	.43	.001

DISCUSSION AND CONCLUSION

In this study, significant association was not found between and demographic details and spiritual intelligence like Age, Gender, Address, rural/ urban, Joint or Nuclear family, Education qualification of the mother and father, Monthly income of the family. With respect to the association between spiritual intelligence with psychological well-being, Pearson correlation coefficient was 0.45 (P = 0.001) which indicated the association between the two.. With respect to the association of each component of spiritual intelligence with psychological well-being, Pearson





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correlation coefficient was 0.43 ($P = 0.001$) for conscious state expansion, 0.51 ($P = 0.001$) for personal meaning production, 0.23 ($P = 0.02$) for transcendental awareness, and 0.23 ($P = 0.002$) for critical existential thinking [Table 1].

Spiritual intelligence is the ultimate intelligence that reflects basic values along with meanings, incorporating mental adaptation potentialities in the direction of non-materialistic and non-mandatory aspects. It incorporates spiritual inceptions, values, and stipulations those enhance individuals daily affairs along with the health. Individuals scoring high on spiritual intelligence outstrip the body and also material. Spiritually intelligent people acquaint them with the optimum level of consciousness, solve problems through spiritual sources, and are eventually characterized by reticence, forgiveness, fair mindedness, and humanity. Experiencing no pressure, apprehension, panic and anxiety, along with the increase of spiritual growth fabricate individuals stronger and accomplish opportunities to participate in innovative enterprises while doing their jobs more purposefully. Spiritual intelligence not only makes the individual fearless for accepting any change but also grows his productivity. Spiritual intelligence helps the individuals in regulating their emotions required for balanced personality.

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Design and Development of Diet Recommendation System for Cancer Patients using Classification Techniques

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ABSTRACT

Cancer is caused by an uncontrolled magnification of cells in any of the tissues or components of the body. The most common type of cancer among female is the Breast Cancer. It is a disease with a high prevalence and transience rate. It is important to identify the cancer to predict the diet, so that the patients can follow their needed diet to improve their survival rate. To provide satisfactory results for the task of diagnosis or treatment or diet prediction among the breast cancer patients, a Computational Model is needed. Machine Learning Algorithms are chosen as good candidates to perform the above tasks. Although a number of algorithms have been developed in the recent past, they have several limitations. To fill this significant gap, this research developed a model which includes Ant Colonized Back Propagation Algorithm with the Support of Apriori Association Rule which generates different rules for breast cancer diagnosis and diet prediction. The experimental results demonstrate that proposed algorithms are effective in predicting the diet required for the cancer patients

Keywords: Data Mining, Recommended system, Classification Techniques, Back propagation, ANT Colony Optimization

INTRODUCTION

DATA MINING – is the exploration and analysis of large quantities of data in order to discover meaningful pattern and rules. Data Mining, also popularly known as KDD (Knowledge Discovery in Databases). KDD, refers to as “ then on trivial process of identifying valid, novel, potentially useful and ultimately understandable pattern in data” KDD,



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refers to as “ the non trivial process of identifying valid, novel, potentially useful and ultimately understandable pattern in data”

Origin of the Problem

Cancer is a disease of cells, which are the body’s basic building blocks. The cells generated by the body multiply and die in an orderly way. Sometimes cells don’t grow, divide and die in the usual way. It may cause blood or lymph fluid in the body to become abnormal, or form a lump called tumour.

A tumour can be

- A Benign Tumour – The cells are confined to one area and are not able to spread to other parts of the body. This is not a Cancer
- A Malignant Tumour – This is made up of cancerous cells, which can spread by travelling the bloodstream or lymphatic system

Objective of the Work

To perform optimal control on patient data based on ANT Colony Optimization with back propagation method by the support of Association rule generation using Apriori algorithm. To perform optimal control on patient data based on ANT Colony Optimization with back propagation method by the support of Association rule generation using Apriori algorithm. Using the hybrid of ant colony optimization algorithm (ACO) which has the powerful ability to search for a globally optimal solution, and the back-propagation (BP) algorithm that features rapid convergence on local optima. To accelerate the evolution of neural networks and improve their forecasting precision of breast cancer when classifying the patients as either benign or malignant by using the hybrid mechanism. Recommending good diet for Cancer patient

Literature Review

- Bittern et al. [37] used Artificial Neural Networks to predict the survivability for breast cancer patients. They tested their approach on a limited data set, but their results show a good agreement with actual survival.
- Vikas Chaurasia et al. [38] used Rep Tree, RBF Network and Simple Logistic to predict the survivability for breast cancer patients.
- Djebbari et al. [39] considered the effect of the ensemble of machine learning techniques to predict the survival time in breast cancer. Their method shows better accuracy on their breast cancer dataset comparing to previous results.
- Hybrid machine learning method was applied by Sahan [65] in diagnosing breast cancer. The method hybridized a fuzzy-artificial immune system with the k-nearest neighbour algorithm. The hybrid method delivered good accuracy in Wisconsin Breast Cancer Dataset (WBCD). They believe it can also be tested in other breast cancer diagnosis problems.
- In [99] Sudhir D. Sawarkar et al. applied SVM and ANN on the WBC data. The results of SVM and ANN prediction models were found comparatively more accurate than the human being. The 97% high accuracy of these prediction models can be used to decide to avoid biopsy
- Dr.S.Vijayarani et al., [49] analyses the performance of different classification function techniques in data mining for predicting the heart disease from the heart disease dataset. The classification function algorithms are used and tested in this work.
- KaewchinpornC ‘s [52] presented a new classification algorithm named Tree Bagging and Weighted Clustering, the combination of the decision tree with bagging and clustering.
- Delen et al. [54] had taken 202,932 breast cancer patients records, which then pre-classified into two groups of “survived” (93,273) and “not survived” (109,659). The results of predicting the survivability were in the range of 93% accuracy.
- Even [57] discusses, however, information warehousing, data processing, and decision support systems will scale back the national cancer burden or the oral complications of cancer therapies.



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- Nevine M. Labib [58] analyze the breast masses in a very series of pathologically evidenced tumors using data processing with a decision tree model for classification of breast tumors.
- A. Sudha Pascal Boilot [59] and his team report on the utilization of the Cyranose 320 for the detection of microorganism inflicting eye infections using pure laboratory cultures and the screening of microorganism associated with Ear Nose and Throat diseases using actual hospital samples
- et al. [60] offer an inspiration regarding major critical conditions and their identification using data processing with the minimum range of attributes and creates awareness regarding diseases that end up in death.
- K. Balachandran et al. [61] Early detection of the cancer sickness is crucial in identifying and treating the patient. Thus, it's essential that the ordinary person who has some symptoms and risk factors are higher to endure checkup by a specialist at the earliest.
- Ryua [64] developed data classification method, called isotonic separation. The performances were compared against Support Vector Machines, Learning Vector Quantization, Decision Tree Induction, and other methods based on two-breast cancer data set, sufficient and insufficient data. The experiment results demonstrated that isotonic separation was a practical tool for classification in the medical domain
- Fatma Taher et al. [67] presented a Bayesian classification and a Hopfield Neural Network algorithm for extracting and segmenting the sputum cells for lung cancer early diagnosis.
- Fan Zhang et al. [69] presented a feature-based imaging classification method to classify the lung nodules in low-dose computed tomography (LDCT) slides into four categories: well circumscribed, vascularized, juxta-pleural and pleural-tail

Research Gap

Although a number of algorithms have been developed in the recent past, they have several limitations. To fill this significant gap, this research developed a model which includes Ant Colonized Back Propagation Algorithm with the Support of Apriori Association Rule which generates different rules for breast cancer diagnosis and diet prediction. The experimental results demonstrate that proposed algorithms are effective in predicting the diet required for the cancer patients

Proposed Work

In this research, the proposed method of retrieval of relevant information from the collection of data is a challenging task in Information System. Data mining is a process or method that extracts interesting knowledge from large amount of data. In this research Ant Colony Optimization Algorithm (ACO) and Back Propagation Learning (BPL) are used for clinical cancer data classification. The objective of association rule mining is to determine whether the outcome (class) would be 'Benign' or 'Malignant' of the risk factor of patient's condition for improving their health as possible. The proposed system demonstrates the use of the Random Tree algorithm for decision tree learning for making decisions such as which proper food item should be assigned while planning the menu. To make this decision, the training dataset is provided to classify the decision tree. The Random Tree algorithm is used to take proper decisions among available foods. User choices can be taken into consideration when designing a proper healthy diet plan.

The objective of this study is to consider various important aspects of the user's lifestyle and make sure that these factors are incorporated while the system works on a solution to build and recommend a healthy and nutritious diet for the user. A good nutritious healthy diet and a moderate amount of physical activity can help in maintaining a healthy weight. But the benefits of good nutrition have a lot more to do than just managing the weight. Good nutrition has a direct impact on our health and can help to reduce the risk of some diseases including heart disease, diabetes, stroke, some cancers, and osteoporosis. Combined with physical activity, diet can help you to reach and maintain a healthy weight, reduce the risk of chronic diseases (like heart disease and cancer), and promote overall health. Being fit is all about the 70/30 rule. Here's how it goes, for a person to stay healthy he/she must focus 70% on his dietary intake and 30% on his physical activity/exercise.



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The dietary recommendations are shown in figures. Vegetables must be steamed or cooked in some way. Eating raw vegetables requires you to spend more Qi or energy — energy that you need for healing. Such vegetables are Aduki beans, Broccoli, Broccoli rabe, Carrots, Cauliflower, Celery, Eggplant, Fennel, Garlic, Ginger, Mushrooms, Radishes, Scallions, Soy Beans. Energy giving fruits such as dates, Kiwi, Lemons, Pears, (any type including Asian pears), Pineapple and Watermelon, etc, can be taken. Seafoods such as Clams, Lobster, Mussels, Oysters, Shrimp, Cold water fish (salmon, tuna, flounder, etc.) are also good for health. Nuts such as Chestnuts, Peanuts, Pine nuts, Walnuts and Asian food such as Bamboo tips (available canned), Bamboo shoots (available canned), Black beans, Chinese red dates (Hong Zao), Chinese pearl barley, Chinese white fungus, Green tea, also helps in healing breast cancer.

RESULT

Methodology in this research study is based on the ACBPA algorithm for optimizing the association rules, generated through Apriori algorithm. By the association rule mining and Apriori algorithm, a new algorithm is proposed based on the Ant Colonized Back Propagation algorithm to improve the result of association rule mining. Rule base depending upon the situation can be achieved by using Apriori algorithm support and confident for generating the rule which becomes integrated with Ant Colonized Back Propagation method of approach for the control purposes that yields excellent results, which is the highlight of this research.

FUTURE ENHANCEMENT

Since this work is done on MATLAB Environment, the future direction aims at developing a prototype of the software tool and tests the same in the hospital to help the medical people and patients.

CONCLUSION

The most common type of cancer among females is the Breast Cancer. It is a disease with a high prevalence and transience rate. It is important to identify the breast cancer earlier and the patients should follow their recommended diet to improve their survival rate. So, a Computational model is required for the task of diagnosis, treatment and risk prediction for the Cancer patients.

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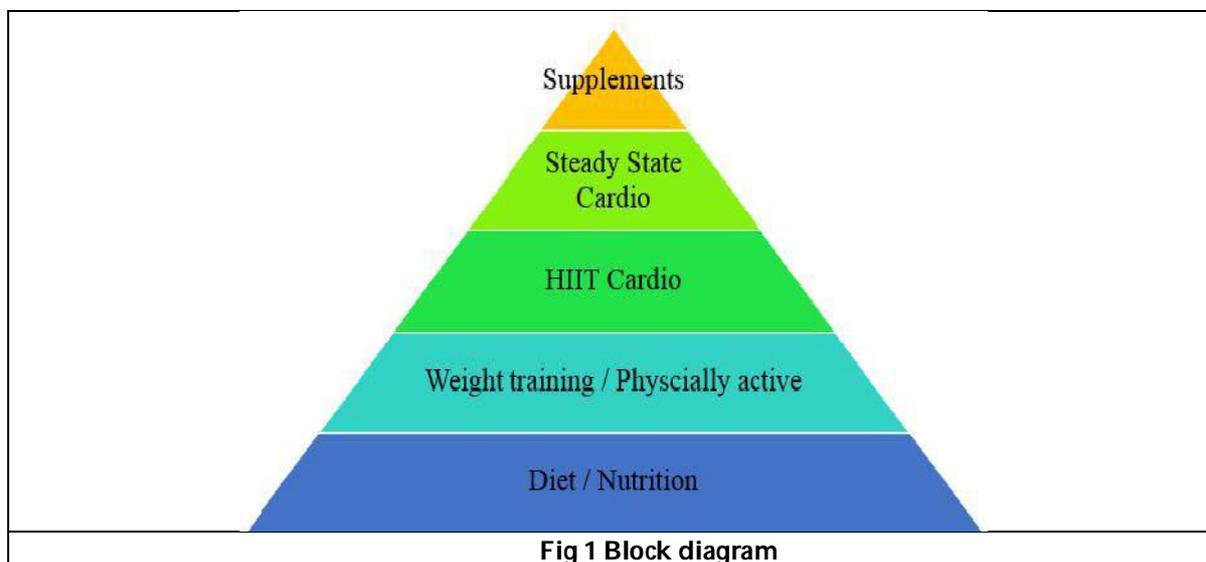
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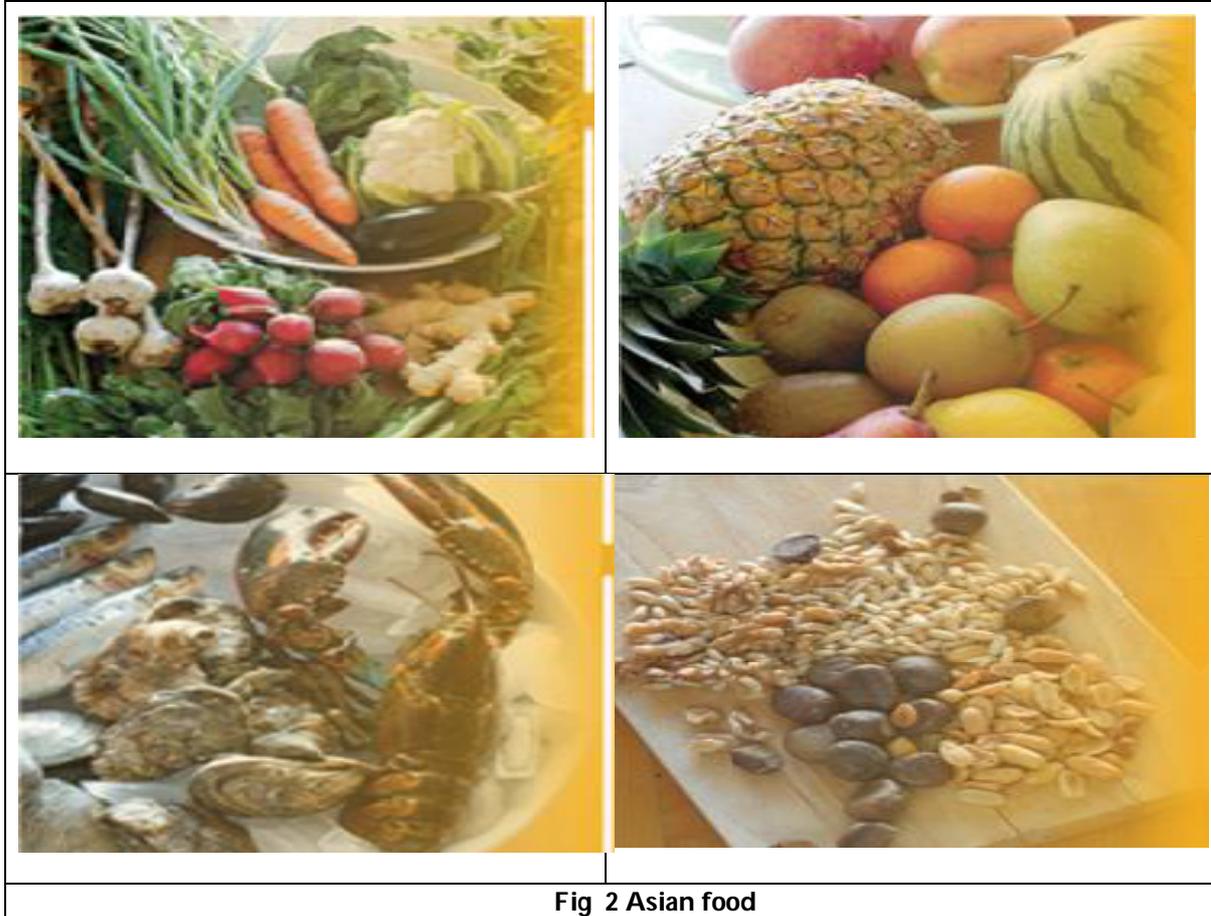


Fig 2 Asian food





Baclofen :A Review

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ABSTRACT

Baclofen is a centrally acting skeletal muscle relaxant used in the treatment of muscle spasticity, alcohol use disorder, spinal cord injury, depression disorder, epileptic disorder, neuropathic pain etc. Baclofen is a γ -amino butyric acid derivative having same analgesic property as that of NSAIDs. It belongs to BCS class III and pharmacological class skeletal muscle relaxants. Baclofen is the only GABA_B receptor agent approved for clinical use. Currently baclofen is available as oral tablets and intrathecal injection in the market.

Keywords: Baclofen, chemistry, pharmacokinetics, uses, pharmacodynamics.

INTRODUCTION

Baclofen belongs to the class of skeletal muscle relaxants [1]. Chemically, baclofen is γ -amino- β -[p chlorophenyl]-butyric acid derived from the inhibitory neurotransmitter γ -aminobutyric acid (GABA). Patients with multiple sclerosis or with spinal or cerebral disorders, muscle spasticity can be treated with baclofen [2]. Baclofen is a centrally acting skeletal muscle relaxant [2]. It has many other medical uses besides treatment for spasticity. Baclofen is effective in treating alcohol dependence, lower back pain, gastroesophageal reflux disorder (GERD), epilepsy, depression disorder [5,7,9,18] etc.



**Sreevidya Venugopal et al.****Chemistry**

Baclofen is a racemic mixture, it comprises of equal amounts of R- and S- enantiomers. Racemic baclofen is often given orally with a reported bioavailability of 70-80% clinically. Baclofen shows saturable absorption because the bioavailability of baclofen has been reported to decrease with increasing doses [3]. Baclofen is found to be a prototypical GABA_B receptor agonist [4]. Baclofen is the only GABA_B receptor agent approved for clinical use [4]. Among racemic baclofen, R(-) enantiomer reside GABA_B agonistic activity primarily [6]. Racemic baclofen (R,S-baclofen) is an optically active compound [6]. It is found that R-isomer is more effective than the racemate. There is a clear stereoselectivity at the GABA_B receptor site for R-baclofen [3]. It has been identified that there is a presence of binding site of positive allosteric modulation of GABA_B receptors topographically distinct from that of neurotransmitter GABA [7].

Pharmacokinetics

Seyed Mohsen Foroutan et al conducted a clinical study for assessing bioequivalence of generic drug and marketed products of baclofen. They selected 12 healthy, non-smoking male volunteers (aged 23-12years, weight 67-85 Kg and height 169-180cm). Their study was conducted to compare the pharmacokinetic variables such as rate and extent of absorption of baclofen. The pharmacokinetic variables were Area under the plasma concentration curve (AUC_{0-t}), Maximum plasma concentration (C_{max}), Elimination rate constant. These pharmacokinetic variables were calculated for each volunteer and product using actual blood sampling times [8]. Results of the assay performance shows that all tablets met the United states pharmacopoeia dissolution specifications(IV) i.e., not less than 80%(Q=75%) of the labeled amount of baclofen is dissolved in 30min [8]. The mean values for the variable AUC for reference and test product were 3980.3 hrng/ml and 4066.7 hrng/ml respectively [8].

Gregory M et al conducted a clinical study to determine the pharmacokinetic disposition and dose proportionality at the absorption site of baclofen by direct infusion of baclofen solution into the duodenum over a prolonged infusion interval [9]. For the study, they selected healthy nonsmoking 21 to 26 old men. All the volunteers were within 15% of the standards of body weight and denied using prescription drug, over the counter medicine and other drug during 7 days before study[9]. All subjects received a aqueous solution of baclofen over approximately an 8 hour period through a nasogastric tube directly into duodenum. Intestinal infusion were repeated 3 times, such that total delivered doses were approximately 12, 24, and 48 mg. Each subject received a bolus dose (24mg) of baclofen in an aqueous solution along with infusion [9]. They concluded that the pharmacokinetic disposition of a drug is best derived from intravenous dose. The absorption profile of the study indicates that infusion rate was limiting. Input from the intestines was not instantaneous as indicated by the average t_{lag} of 28 min associated with intestinal infusion. The bioavailable fraction reported was approximately 70% to 80% [9].

Pharmacodynamics

GABA_B receptors are major inhibitory neurotransmitter found throughout neuroaxis and in some peripheral tissues [9]. Baclofen is a prototypical GABA_B receptor agonist has an affinity for the receptor similar to GABA. Administration of baclofen produces analgesia in acute and chronic pain models. This response is due to the GABA_B receptor mediated inhibition of substance P and from primary afferent terminals. The inhibition of substance P release modifies neurokinin-1 receptor levels in the dorsal horn and thereby decreasing the transmission of pain impulses [11,12]. The R(-) baclofen is reported having skeletal muscle relaxant property [11]. GABA_B receptors are present and functional active in schwann cell of peripheral nervous system. Except for the CNS, GABA_B receptors are found in cutaneous layer on C fibres and keratinocytes. Therefore these receptors provide a new target for the topical treatment of localized neuropathic pain. Topical baclofen was shown to be effective in pain relief [11,14,15].

Mechanism of Action

The precise mechanism of action of baclofen is not fully understood yet. Baclofen inhibits both monosynaptic and polysynaptic reflexes at spinal level and decreases the excitatory neurotransmitter release from efferent terminals



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[16]. Since baclofen is a structural analog of inhibitory neurotransmitter GABA and may exert its effect by stimulation of GABA_B receptor subtype [13]. Topically site of action of baclofen is C fibres [16].

Pharmacological Actions of Baclofen**Treating Spasticity**

Spasticity is characterised as a common complication of spinal cord injury resulting from hyperexcitability of stretch reflexes in an upper motor neuron lesion [21]. It is a well known phenomenon seen in patients of all ages with a wide range of central neurological disorders. Baclofen can cross BBB readily. This will bind to GABA_B receptor and result in hyperpolarization of neurons. Baclofen is an agonist and allowed to bind with membrane receptors. These membrane receptors are normally influenced by GABA. GABA receptors are of two types, i.e., GABA_A and GABA_B [17]. Baclofen exert a direct effect on GABA_B at spinal cord level by inhibiting release of excitatory neurotransmitter used to stimulate a muscle contraction. Baclofen exert side effects along with its benefits. Because of poor penetration to BBB it is to be administered in high doses orally. Smaller doses can be administered intrathecally using indwelling mini- pump [13].

Analgesic

Baclofen is found to be anti nociceptive [21]. GABA_B receptors are linked to potassium and calcium transport channels by means of G protein. The activation of the GABA_B receptors leads to the hyperpolarization of the channels leading to the increased conductance of potassium and decreased conductance of calcium [23]. The sites of action of baclofen responsible for its analgesic action are within the spinal cord and thalamus [15]. Baclofen binds to GABA_B receptor and it acts as GABA agonist which inhibit the release of substance P, glutamate and calcitonin gene-related peptide evoked by electrical stimulation of the dorsal roots. Baclofen is believed to be involved in the transmission of nociceptive impulses in the spinal cord [15]. Baclofen produce a reduction in the frequency and painful flexor spasms rather than true analgesia [22]. Baclofen shows anti nociceptive effect in number of animal models. The anti nociceptive effect in the animal models are reflected as analgesic action in the human [23]. The analgesic effect of baclofen is not due to the motor incoordination or sedation. A study conducted by David Jos Kopsky in a 65-year-old female patient suffering from acromegaly developed neuropathic pain in both legs, from the feet up to her knees showed that the compounded baclofen cream (2% and 5%) provided analgesic action [26].

Antiepileptic

Studies suggests that baclofen shows presynaptic inhibition of the excitatory neurotransmitter release [26]. The antiepileptic activity of baclofen is contributed by its agonistic effect on the GABA_B receptor [27]. Baclofen was intended to be a good brain penetrant. Oral and intrathecal administration of baclofen can be used to treat epilepsy. Baclofen is known to produce anticonvulsant effects in the DBA/2J mouse audiogenic seizure test conducted in a study [15].

Gastroesophageal Reflux Disorder

Gastroesophageal reflux disease (GERD), is defined as a disorder caused by the reflux of gastric contents into the esophagus [29]. Recent evidences suggests that the primary cause for the gastroesophageal disorder is reflux episodes in patients with transient lower esophageal sphincter relaxation (TLESR) [29]. The first-line treatment recommended for patients with GERD are proton pump inhibitors and histamine type 2 receptors antagonists. An alternate approach used for the treatment of the GERD is using baclofen, it reduces the frequency of reflux events and inhibits TLESR.^[29]

Alcohol use Disorder

Alcohol Use Disorder (AUD) is a chronic psychiatric illness identified by harmful drinking patterns leading to negative emotional, physical, and social ramifications associated with high rates of morbidity and mortality worldwide [30]. Baclofen is a selective gamma aminobutyric acid B agonist, which has emerged as a promising drug



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for the AUD. GABA_B receptors, are slow-acting receptors through a complex cascade of intracellular signals, and therefore GABA_B agonists such as baclofen have been studied for treating addiction [31]. Baclofen seems to prevent ethanol-induced locomotor stimulation. Baclofen reduces the intensity of the emotional and physical responses associated with ethanol withdrawal [32]. It also found to enhance abstinence, reduce drinking quantity and reduce craving in alcoholic patients with liver disease [31].

Antidepressant

The mechanisms through which baclofen may have antidepressant properties remain unclear. It has been observed that baclofen has a complex and indefinite action on both the dopaminergic and serotonergic systems. GABA-B receptor agonists like baclofen accelerate noradrenaline by changing the firing rate of GABA neurons without changing postsynaptic receptor density and diminish serotonin liberation by up-regulating serotonin (5HT₂) receptors. But baclofen cannot be categorized into antidepressant class, it merely appears to attenuate the effects of antidepressant drugs [12]. Baclofen is considered to be a surprising psychotropic molecule whose therapeutic prospects in the psychiatric field have surely not yet been totally explored [20].

Neuropathic Pain

David J. Kopsky et al conducted a case study with a 74 year old woman with a partial spinal cord injury lesion at L4 complained of tingling, pins and needles, and burning in her legs. She was treated with pain medication tablets pregabalin 450 mg, acetaminophen 3000 mg, and diclofenac 150 mg daily at the time of first consultation. She scored the pain intensity by 6 on the 11 point numerical rating scale. She was also suffered with reduced stability and balance due to hip extensor weakness. Then the treatment was added with baclofen 5% cream. The cream was applied for 2 to 3 times daily on the neuropathic areas as an analgesic provided additional pain reduction. After one month treatment, the patient reported that the tingling, pins and needles, and burning were completely vanished after application of the baclofen cream, without experiencing any side effects such as dizziness, drowsiness, and muscle weakness seen in oral baclofen treatment. This case points pivotal aspect that baclofen 5% cream is able to control neuropathic pain in a case with paraplegia[22].

Another study was conducted with a 65 year old female who was suffering from acromegaly developed neuropathic pain in both legs from the feet up to the her knees. She indicated pain with characteristics such as tingling, painful cold, tingling, pins and needles, hypesthesia to touch and pinprick. As the patient faced side effects with the oral analgesic treatment, the clinical investigators prescribed a specially compounded baclofen 5% cream and 1g was applied 2 to 3 times daily. 2 weeks after the treatment the pain in her legs and feet were profoundly reduced. Baclofen 2% cream also found to provide the same analgesic effect. The effects of the baclofen were remained stable for the next 6 months and the patient only needed to apply baclofen 2% cream [25].

Alcohol Dependence

GABA is main inhibitory neurotransmitter in the brain, regulates many physiological and psychological processes. Thus, dysfunction of the GABA system leads to several neuropsychiatric disorders, including anxiety and depression. Baclofen is a prototypic selective agonist at GABA_B receptors. Baclofen can modulate neurotransmitter release by depressing Ca₂C influx via voltage-activated Ca₂C channels. Such presynaptic inhibition at GABAergic terminals is involved in the induction of long-term potentiation [32]. It was reported that there was a significant reduction in craving after 12 weeks of treatment with baclofen (30 mg/day) compared with placebo in alcoholic patients with liver cirrhosis [33].

Side Effects of Baclofen**Tetraplegia and paraplegia**

A Jamous MD MSc (Oxon)(1994) et al conducted a little details showing that baclofen exert tetraplegic and paraplegic effect [34]. Overdoses or intoxication of baclofen may cause coma, respiratory failure, seizures, autonomic disturbances and cardiovascular problems which can be fatal [35].



**Sreevidya Venugopal et al.****Muscular dyskensia**

Daniel M. Ryan et al conducted a clinical study in a 75 year old male patient with history of colon cancer and total abdominal colectomy. degenerative joint disease for which he had left total hip arthroplasty. left basal ganglion infarct, questionable seizure disorder, and history of alcoholism has new side effect of baclofen , muscular dyskinesia. He was in treatment with Baclofen (Lioresal). The movements of patient were described as flexion/extension writhing movements of his arms and grimacing of his face. Baclofen was discontinued after showing these symptoms and then his symptoms resolved 2 days later. The mechanism by which baclofen affects spasticity or neuroleptic-induced dyskinesia and how the resulting side effect of dyskinesia developed in the patient is not known. It is however, most probably related to dopamine receptor hypersensitivity and the resulting imbalance of the dopaminergic / cholinergic systems [37].

Drowsiness and Sedation

The commonest side effect associated with baclofen are sedation; insomnia, dizziness, weakness, ataxia, and confusion [41]. Drowsiness and sedation have been reported in up to 63% of patients taking oral baclofen. Therefore patients should avoid operation of automobiles or other dangerous machinery and hazardous activities by decreased alertness [38]. Baclofen shows alteration in the arithmetic tasks. But treatment with baclofen doesn't affect the performance ability of patient. This is showed by a clinical study conducted by Steven .R. Hinderer et al where he found that there is no increase in the error rates across the experimental phases [43].

Adverse Effects of Baclofen

Neurotoxicity from baclofen (80% excreted by the kidneys) is increasingly being recognized in patients having kidney failure. Baclofen-induced encephalopathy in patients with AKI (acute kidney injury), CKD(chronic kidney disease), and ESKD (end-stage kidney disease) is a serious but preventable problem [39]. Baclofen is primarily excreted through kidney, so there is a chance of accumulation of baclofen in the renal impairment patients [45]. Baclofen toxicity is a serious adverse outcome in kidney disease patients. It was recommended to reduce the baclofen dose in patients who have moderately reduced kidney function (estimated glomerular filtration rate, 30-60 mL / min/1.73 m²) and avoiding use in patients with severely reduced kidney function (estimated glomerular filtration rate < 30 mL / min / 1.73 m²) or on renal replacement therapy [38].

Intrathecal baclofen shows concomitant sepsis, psychological issues such as needle phobia [38]. Pierre Alexis Geoffroy et al conducted a clinical study in a 49-year-old white male, presented with no prior somatic or psychiatric history except for alcohol dependence treated with baclofen to reduce alcohol consumption. After 5 months of treatment with baclofen there was no evidence of alcohol consumption, but they noticed that he experienced a state of behavioral disinhibition with inflated self-esteem, decreased need for sleep by approximately 3 hours per night, increased loquacity, flight of ideas, and distractibility. Baclofen , at high doses may induce de novo mania symptoms in the patients with predisposed mood disorders [41].

Interaction with food

Administration of baclofen with food does not alter the bioavailability of the baclofen or gastrointestinal absorption of baclofen [43].

CONCLUSION

The review revealed that the baclofen is a popular drug for its medicinal features in the pharmaceutical sector that can be used for the treatment of neuropathic pain, spasticity, alcohol use disorder etc. Baclofen can be administered orally, as intrathecal injection, topically as alone or in combination. It exerts analgesic effects similar to the other analgesics and NSAIDs. Baclofen is the only GABA_B receptor agonist approved for medicinal use by FDA. New formulations of baclofen are being investigated particularly for local topical effects.



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In OFDM Communication System, Improved ICI Reduction Method

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ABSTRACT

Future mobile networks will have faster data rates thanks to the use of OFDM in a multipath environment. Inter-carrier interference (ICI) caused by phase noise in the local oscillator of the transceiver is a major issue. Because the orthogonal characteristics between the sub-carriers are disrupted, the bit error rate (BER) performance suffers. To reduce CPE and ICI, this project uses the data-conjugate approach to implement ICI self-cancellation. When the normalised 3 dB bandwidth of phase noise is 0.4, the improvement in C/I can exceed 10 dB. As a result, in the data-conjugate method's OFDM, CPE becomes zero. Aside from the OFDM system with phase noise, the data-conjugate approach improves the BER performance significantly and outperforms both the data-conversion method and standard OFDM.

Keywords: BER , ICI ,OFDM, Mobile Networks.

INTRODUCTION

The rapid adoption of mobile phone technology, wireless local area networks (WLAN), and the Internet's exponential expansion have resulted in a surge in demand for new ways to access high-capacity wireless networks. OFDM technology has the potential to be a major tool for meeting the large data capacity and spectral efficiency demands of future wireless communication systems. The IEEE802.11b standard, which has a maximum data rate of 11 Mbps, is currently used in most WLAN networks. Newer WLAN protocols based on OFDM technology, such as

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IEEE802.11a and HiperLAN2, enable a substantially greater data throughput of 54 Mbps. However, future systems will demand WLANs with data rates larger than 100 Mbps, necessitating significant improvements in OFDM systems' spectral efficiency and data capacity in WLAN applications. The available bandwidth is divided into numerous sub channels, with each sub carrier's symbol duration being N times that of a single carrier system in OFDM. To mitigate ISI (if N sub carriers are employed).The advent of Fast Fourier Transforms (FFT), which are an efficient implementation of the DFT, has made OFDM implementation simple. The cost of implementing OFDM has decreased thanks to advancements in integrated circuit technology.

The susceptibility of OFDM to frequency offset between broadcast and received signals, which can be caused by Doppler shift in the channel or a difference in the transmitter and receiver local oscillator frequencies, is a well-known issue. Because of the carrier frequency offset, sub-carriers lose orthogonality, and the signals sent on each carrier are no longer independent of one another, resulting in inter-carrier interference (ICI). The data conjugate self-cancellation strategy is proposed in this study to reduce the ICI in OFDM systems.

OFDM Versus FDM

OFDM differs from FDM in a number of ways. Each radio station transmits on a different frequency in traditional broadcasting, effectively employing FDM to establish a gap between the stations. There is no coordination or synchronisation between these stations, however. The information signals from various stations are integrated into a single multiplexed stream of data with an OFDM transmission, such as DAB. The information is subsequently sent using an OFDM ensemble, which is made up of a dense packing of numerous sub carriers. Because all of the sub carriers in an OFDM signal are time and frequency synced, interference between sub carriers may be precisely controlled. Because of the orthogonal nature of the modulation, these many sub carriers overlap in the frequency domain but do not generate Inter-Carrier Interference (ICI). To avoid interference, FDM transmission signals often require a large frequency guard-band between channels. The total spectral efficiency is reduced as a result. The spectrum of the FDM and OFDM systems is depicted in Figure 1.1. The orthogonal packing of the sub carriers in OFDM, on the other hand, considerably minimises the guard band, enhancing spectral efficiency.

OFDM GENERATION AND RECEPTION

Because it's difficult to make huge banks of phase lock oscillators and receivers in the analogue domain, OFDM signals are usually created digitally. The block diagram of a typical OFDM transceiver is shown in Figure 2.1. The transmitter component translates digital data into a subcarrier amplitude and phase mapping for transmission. It then uses an Inverse Discrete Fourier Transform to convert this spectral representation of the data into the time domain (IDFT). The Inverse Fast Fourier Transform (IFFT) is employed in all practical systems because it performs the same functions as an IDFT but is much more computationally efficient. The predicted time domain signal is then mixed up to the desired frequency in order to send the OFDM signal.

OFDM STANDARDS

Table 1 OFDM Standards

Issues in OFDM

1. Due to the Power Amplifier, the transmitted signal has a high PAR (peak to average power ratio). Non-linearity is a term that refers to the fact that something
2. Because of the frequency inaccuracy of the transceiver oscillator, OFDM is susceptible to phase noise.
3. Doppler shift causes high sensitivity to frequency offset errors.
4. Loss of bandwidth due to the guard interval
5. Mobile channel time fluctuations





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SIMULATIONS AND RESULTS

In terms of BER performance, the data conjugate approach is compared to the original OFDM and the data conversion technique. MATLAB was used to run the simulations in this study. An AWGN channel was used to run the simulations. Table 2: Simulation parameters. The Bit error rate values for the data conjugate technique are comparatively minimal when compared to the normal OFDM and Data conversion method OFDM, as shown in Figure 1.

CONCLUSION

The simulation results demonstrate that the data conjugate approach outperforms the data conversion technique and normal OFDM in terms of BER. As the phase noise variance grows, the BER performance degrades. The BER performance study for $E_b/N_0 = 20$ dB is shown in Table 3. Table 4 shows the BER performance for $E_b/N_0 = 20$ dB. As a result, it is vital to keep phase noise interference to a reasonable level. The CIR performance of this method is significantly enhanced as compared to the other two approaches because the Common Phase error is minimised. The CIR performance study for $E_b/N_0 = 3$ dB is shown in Table 4.

The ICI self-cancellation approach clearly reduces the amount of ICI induced by phase noise, and the improvement in C/I might approach 10 dB when the normalised 3 dB bandwidth of phase noise is 0.4, according to simulation data. When the closed loop bandwidth in a DH-PLL system is 1-3 kHz, which is a good value for the design parameter for low phase noise, switching speed is at least 3 times faster than in a conventional PLL system. It means that we can accomplish both low phase noise and high-speed frequency synthesis with the DH-PLL technology. The CPE of the data-conjugate is zero, hence CIR is enhanced in this manner, according to the analysis. Overall, when compared to the original OFDM, OFDM with convolution coding, and the data-conversion method, the OFDM system of the data-conjugate method performs the best in terms of BER. As a result, the data conjugate ICI self-cancellation approach could be highly advantageous in a high-quality multi-carrier system.

Work in the future

The Raleigh channel can be used with convolutional coding and the self cancellation scheme data conjugate approach. The alphabet size of data symbols can be raised to improve bandwidth efficiency. The input data for OFDM can be a recorded voice signal, and the interference level can be detected and studied.

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Table 1 OFDM Standards

Parameter	Value
Data rate	6, 9, 12, 18, 24, 36, 48, 54 Mbps
Channel Spacing	20 MHz
IFFT used for 20 MSPS	64
Data Subcarriers	48
Pilot Subcarriers	4
Carrier Spacing (F_c)	20 MHz/64 = 312.5kHz
Nominal Bandwidth	312.5kHz*(48+4) = 16.25 MHz
Useful Symbol Period	1/ F_c = 1/312.5kHz = 3.2 μ s
Guard Period	0.8 μ s
Modulation schemes	BPSK, QPSK, 16-QAM, 64-QAM
Coding Rate	$\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$

Table 2: Simulation parameters

PARAMETERS	VALUES
Number of carriers(N)	52
Modulation(M)	BPSK
2 Phase noise variance σ_ϕ	0.02,0.03&0.05
No. of OFDM symbols	100
Bits per OFDM symbol (BPS)	$N*\log_2(M)$
E_b-N_0	1:20
IFFT size	64
Data rate	48Mbps
Sub carrier spacing (Δf)	0.3125MHz
FFT period (1/ Δf)	3.2 μ sec
Channel	AWGN
Symbol time	4 μ sec





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Table 3. BER performance

Phase variance	Normal OFDM BERvalue	Self Cancellation BERvalue	Data Conjugate BERvalue
$\epsilon = 0.02$	0.066923	0.013269	0.002150
$\epsilon = 0.03$	0.146920	0.042115	0.021045
$\epsilon = 0.05$	0.300906	0.199014	0.012496

Table 4 CIR performance

Phase variance	Normal OFDM CIR(dB)	Self Cancellation CIR(dB)	Data Conjugate CIR(dB)
$\epsilon = 0.1$	16.2482	33.4623	45.5725
$\epsilon = 0.2$	9.7108	28.9833	40.8129
$\epsilon = 0.3$	4.8718	21.8956	39.6146

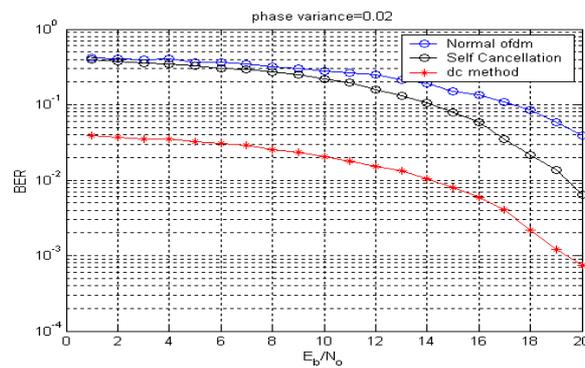


Figure 5. BER performance with Phase noise variance of 0.02





Investigation of Solubility Parameter of Ionic Liquids through Molecular Dynamics Simulation

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ABSTRACT

Ionic liquids being a neoteric solvent were investigated in this work. Solubility is one of the fundamental property of any solvent and is need to understand before it could be used as a potential solvent. To exploit the solvent capacity of ILs for several industrial applications starting from drug solubilization, gas sweetening, and biomass dissolution, the solubility parameter of the ILs were investigated in this work. Solubility parameter of both ammonium and lactam based ILs were calculated by molecular dynamics simulation using Materials Studio software. Amorphous cell module and Forcite modules were used for the geometry optimization, cohesive energy density calculation, followed by solubility parameter determination. The results were compared with the literature and is found to be under good agreement. The results show that for all the studied ILs, the solubility parameter values decreases with increasing anionic carbon chain length and ring size of the cations. The results were also analyzed on the basis of structural changes of ILs. These results would be highly beneficial in enhancing the applicability of ILs as a solvent.

Keywords: Ionic liquid, Solubility Parameter, Hildebrand, Hansen, Density.

INTRODUCTION

Ionic liquids (ILs) are being considered as green solvent since past two decades that are composed of organic cations and organic/inorganic anions [1]. Low volatility, high liquidous range, high ionic and thermal conductivity are few properties that make ILs a suitable industrial solvent [2-6]. Furthermore, the tunable ability of ILs make it a suitable entity that can be utilized in a spectrum of applications starting from biomedical science, energy storage device, organic synthesis, gas sweetener and so on. Several thousand research articles have been published so far that are





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based on fundamental understanding and application perspective of ILs. However, complete understanding of ILs properties are still need to be achieved. In this regard, solubility is one of the very fundamental properties that need to be exploited for ILs as they are mainly regarded as solvent.

In a qualitative sense, solubility refers to the ability of a solvent to separate the solute molecules and make a homogenous solution. To make this happen, solvent molecules should have potential to overcome the energy with which the solute molecules are associated with. The concept "like dissolves like" holds true when the solvent has equal or nearly equal energy with which the solute molecules are combined and also the solvent has the inherent potential to get rid of attraction among the solvent molecules itself. Solubility parameter of a solvent is a numerical value that indicates the relative solvency capacity of a solvent. The solvent and solute having close solubility parameter are readily soluble. Hildebrand solubility parameter take into account the cohesive energy density which in turn is related to enthalpy of vaporization [7,8]. Mathematically Hildebrand solubility parameter is expressed as;

$$\delta = \sqrt{c} = \sqrt{\frac{\Delta H_V - RT}{V_m}} \quad (1)$$

Where, c is the cohesive energy density, ΔH_V is enthalpy of vaporization, V_m is molar volume, R is gas constant, and T is temperature. Hansen solubility parameter is another solubility scale that divide Hildebrand solubility values into three different components such as dispersion force component, a hydrogen bonding component, and a polar component [7,9]. Mathematically, Hansen solubility parameter is given as;

$$\delta_t^2 = \delta_d^2 + \delta_p^2 + \delta_h^2 \quad (2)$$

Where, δ_t is the total Hildebrand parameter, δ_d is the dispersion component, δ_p is the polar component, and δ_h is the hydrogen bonding component. ILs have been successfully used in gas capture, drug carrier agent, biomass dissolution etc [10,11,12] and in all of the cases solubility play an important role. Therefore, solubility parameter determination of ILs is very much necessary from both fundamental understanding and application point of view. For any particular application, solubility parameter would help in screening ILs as a suitable solvent from the pool of millions of ILs. Solubility parameter can be determined both experimentally and theoretically [13]. In experimental way both direct method and indirect method can be employed to determine the solubility parameter. Direct method measurement of solubility parameter for ILs is difficult as it involves the measurement of enthalpy of vaporization. Indirect method measurement can be performed by using inverse gas chromatography technique [7,8].

As millions of ILs can be possible, it is difficult to measure the solubility parameter of ILs experimentally. Therefore, theoretical investigation of solubility parameter of ILs is a feasible and affordable way out. Many theoretical techniques have been proposed to estimate solubility parameters of ILs that include PC-SAFT and Non-random Hydrogen bonding (NRHB) model, Regular Solution Theory, and Lattice Energy Model [14-17]. However, in all of the above mentioned techniques some experimental data is required to estimate the solubility parameter. Therefore, a complete theoretical solubility parameter calculation is more preferable to save money and time. Molecular dynamic simulation has the capability to estimate the solubility parameter of ILs without any experimental data points. Therefore, in this work we proposed to estimate the solubility parameter of ILs using Accelrys Materials Studio software through molecular simulation.

Computational Details

The ionic liquids used for computational calculation are considered as an equimolar mixture of cations and anions. The name of cations, anions followed by ILs name and abbreviation are illustrated in table 1. The ILs ions were constructed using builder module of Materials Studio. Thereafter, the individual ions were geometry optimized using COMPASS forcefield of Forcite module. The geometry optimized structures of used cations and anions are depicted in Figure 1. Electrostatic potential charges were calculated and assigned to each atoms and the charges were





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kept constant during follow up calculations. Bulk ionic liquids model were created using Amorphous cell module of Materials Studio software. The experimental density data of ILs as mentioned in Table 1, were used from literature to construct the Amorphous cell [18,19]. However, the density of ILs can also be calculated by molecular dynamics (MD) simulation using NPT ensemble of Materials Studio [9,20]. For all the ILs, 20 cations and 20 anions were used to construct the simulation model. The systems were equilibrated for 100 ps using NVE ensemble where number of particles (N), system's volume (V), and total energy of the system (E) were conserved. To determine cohesive energy density followed by solubility parameter, NVT molecular dynamics were performed for another 100 ps where number of particles (N), system's volume (V), and temperature (T) were kept constant. The simulation was run at 298.15 K and using Andersen thermostat. Electrostatic and van der Waals terms were calculated using Ewald, and Atom based summation method. Cohesive energy density was then calculated using the same Forcite module and solubility parameters of ILs were extracted from the resulting trajectories. As ILs were treated as a combination of cations and anions, the intramolecular interaction energies (arises due to interaction among same cations/anions) were not included for cohesive energy density calculation as mentioned above. Therefore, blend module was used to calculate the intramolecular interaction energies and added to the cohesive energy density for correction. The solubility parameter was then calculated using the equation 1 from the corrected cohesive energy density that includes intramolecular interaction energies of ILs. A representative example of Amorphous Cell containing propylammonium acetate (PAAc) IL is depicted in Figure 2.

RESULTS AND DISCUSSION

To validate our methodology, we have calculated solubility parameters for imidazolium based ILs using similar methodologies as described above. As can be seen from Table 2, the solubility parameters values show little deviations from that of literatures probably due to some differences in selected parameters during simulations. The total solubility parameter as calculated for ILs is the combination of two components such as van der Waals (dispersive) and electrostatic component. The electrostatic component again is the combination of hydrogen interaction component and coulombic interaction component. As can be seen from Table 3, the total solubility parameter for both ammonium and lactam based ILs, goes on decreasing slowly with increasing the chain length of carbon atoms. This decreasing trend of solubility parameter is consistent with literature data as well for other ILs. The decreasing trend of solubility parameter with increasing carbon chain length could be attributed to the decreasing contribution from electrostatic components. There was no literature value for the studied ammonium and lactam based ILs for comparison. Interesting to note that keeping same anion, if we change cation from ammonium to hydroxyl-ammonium, the solubility parameter increases. This indicates that functional group on cation is also playing a role towards solubility parameter. The fluorine atom added to the acetate ion decreases the solubility parameter of ammonium based ILs as shown in Table 3. Furthermore, with increasing the ring size of cation for lactam based ILs, the solubility parameter decreases. The plausible explanation for this behavior could be decrease in electrostatic interactions with increasing ring size of lactam based ILs. Also, it can be seen from Table 3 that for the same anion, lactam based ILs shows less solubility parameter than ammonium based ILs.

CONCLUSION

Ammonium and lactam based ILs are considered for solubility parameter determination using Materials Studio software. Amorphous Cell module was used to construct ILs in bulk phase and Forcite module was used for geometry optimization, and MD simulation. Using NVT ensemble and experimental density from literature, the cohesive energy density and solubility parameters were calculated. Correction terms also included for ILs considering all the interaction energies. To validate our methodologies, we have compared the solubility parameters date with literature for imidazolium based ILs and the result shows good agreement with the literature. The results for studied ILs shows that with increasing chain length of anion and ring size of cation, the solubility parameter





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value decreases. Furthermore, the addition of functional groups either to cation side or anion side alter the solubility parameter significantly. These obtained solubility parameter results would be highly valuable while considering ILs as solvent whether in drug solubilization, gas absorption, biomass dissolution, or similar kinds of work.

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Table 1: The cations, anions, ionic liquids, abbreviations and density of ILs at 298.15 K

Cation	Anion	Ionic Liquid	Abbreviation	Density [18,19] /g.cm ⁻³
Propylammonium	Formate	Propylammonium Formate	PAF	0.994
Propylammonium	Acetate	Propylammonium acetate	PAAc	0.987
3-hydroxypropyl ammonium	Formate	3-hydroxypropyl ammonium Formate	3HPAF	1.146
3-hydroxypropyl ammonium	Acetate	3-hydroxypropyl ammonium Acetate	3HPAAc	1.112
3-hydroxypropyl ammonium	Trifluoroacetate	3-hydroxypropyl ammonium Trifluoroacetate	3HPATFAc	1.308
Butyrolactam	Formate	Butyrolactam Formate	BTF	1.136
	Acetate	Butyrolactam Acetate	BTAc	1.095
	Hexanoate	Butyrolactam Hexanoate	BTH	1.015
Caprolactam	Formate	Caprolactam Formate	CPF	1.083
	Acetate	Caprolactam Acetate	CPAc	1.056
	Hexanoate	Caprolactam Hexanoate	CPH	0.995

Table 2: Solubility parameters of Imidazolium ILs.

Sl. No.	Ionic Liquid	δ (this work)	δ (Literature)
1	1-Ethyl-3-methylimidazolium bis(trifluoromethylsulfonyl)imide	28.43	27.6 [21] 29.1 [9]
2	1-Butyl-3-methylimidazolium bis(trifluoromethylsulfonyl)imide	27.27	26.7 [21] 27.8 [9] 25.69 [22]
3	1-Ethyl-3-methylimidazolium hexafluorophosphate	35.94	36.7 [9]
4	1-Butyl-3-methylimidazolium hexafluorophosphate	32.68	29.8 [21] 33.3 [9] 28.09 [22]
5	1-Ethyl-3-methylimidazolium trifluoroacetate	34.25	25.56 [8] 36.5 [9]
6	1-Hexyl-3-methylimidazolium trifluoroacetate	30.61	31.1 [9]





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Table 3: Solubility parameter of Ammonium and Lactam based ILs.

Sl. No.	Lactam ILs	δ	Ammonium ILs	δ
1	Butyrolactam Formate	79.10	Propylammonium Formate	80.40
2	Butyrolactam Acetate	71.94	Propylammonium Acetate	73.52
3	Butyrolactam Hexanoate	59.11	3-hydroxypropylammonium formate	82.37
4	Caprolactam Formate	69.20	3-hydroxypropylammonium acetate	74.97
5	Caprolactam Acetate	63.88	3-hydroxypropylammonium trifluoroacetate	65.85
6	Caprolactam Hexanoate	54.01		

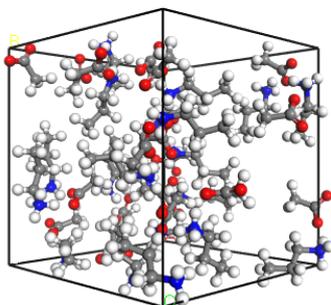
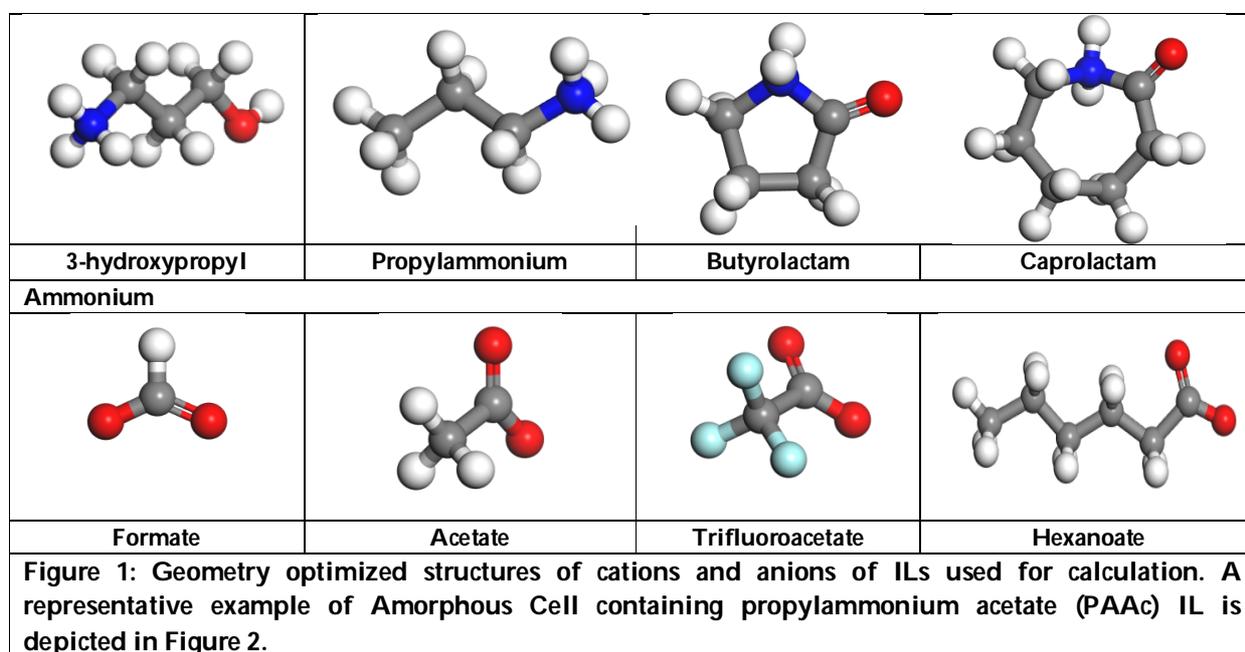


Figure 2: Bulk IL propylammonium acetate (PAAc) prepared in Amorphous cell module of Materials Studio software.





Significant Analysis of Entrepreneurship Course in Engineering Curriculum

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ABSTRACT

Significant transformative changes are observed in Higher Education Institutions in particular, worldwide in entrepreneurship education. Last few decades have seen sincere efforts to introduce entrepreneurship into education. The relevance of entrepreneurship to education has been essentially viewed from economics point of view till now. This analysis worked decently well for elective courses at higher education level while poses problems when introducing the entrepreneurship into lower levels of education. Motivating students towards entrepreneurship seems to be the most difficult and unignorable question. Many researchers felt that the only way to accomplish the above task is by means of learning-by-doing approach. The immediate question that arises is - what are the things to be properly answered using the above approach. Future challenges and opportunities in entrepreneurial education are abundant and compete with each other. This report shall attempt to outline some of them in each of the following sections.

Keywords: Higher Education, Entrepreneurship, Curriculum, Opportunities.

INTRODUCTION

Entrepreneurship competence is the ability to discover and grab the opportunities. In Fig.1, it is the ability to plan, execute and manage creative processes that are of cultural or socio-economic value. What is required is the knowledge of contexts and opportunities, modus operandi of planning and execution, ethics and self-awareness. It includes the problem solving skills besides imagination and critical reflection skills, communication skills, mobilizing human and material resources, coping with uncertainty, and above all skills to handle risk. Also the attitudes of self-efficacy, motivation and stronger will form the key ingredients of an entrepreneurial mind-set. It demands proper weightage to the ideas of peers [1-3]. In order to make the entrepreneurship education effective in developing the

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competence of learners, the capacity of schools to create supportive and stimulating learning environments should go hand in hand with the personal competences and motivation of educators, in the sense both are equally important and in a way complement each other. Entrepreneurship education cannot take place in solitude. Many times it requires working in collaboration with external organizations in order to facilitate learning in other ways [4].

Background

The main aim is to become entrepreneurially minded with the potential to act on this by discover or create business opportunities' and life-long learning process from elementary to adult [5].

Benefits of Entrepreneurship Education

Improved Student Performance

- Increased initiative
- Increased self-confidence
- Improved academic performance
- More ambitious goals for life after graduation

Upgraded academic Performance

- Less likely to be truant or drop out of college
- Encourages youth to employ sophisticated math and science concepts in real-life situations
- Greater interest and improved performance in math and science

Everyone should understand the concepts and processes associated with successful entrepreneurial performance. It provides the unique expertise that entrepreneurs use during the entire process of creating and managing a business. Entrepreneurial education is a promising solution for the increasing uncertainty in the globalized world that we live in (Gibb, 2002). Finally, entrepreneurial education is a means to achieve people empowerment and a means for the organizations to create social value for the benefit of the community (Austin et al., 2006 and Volkmann et al., 2009) [6]. A better feasible beginning position in education can be to recognize entrepreneurial education as a means to create extra interest, to achieve joyful and fruitful engagement and to inculcate creativity among the millennial students (Johannisson, 2010, Lackeus, 2013). The theoretical effects of education on the entry in entrepreneurship are ambiguous. On the one hand, people with a higher level of education may have a higher level of managerial ability, which would increase their possible success if they enter self-employment. On the other hand, the same factor may increase their outside options, as it would be less likely to undertake self-employment [7]. The thriving student importance in social entrepreneurship (Treacey & Phillips-2007) is another typical yet promising beginning position for entrepreneurial education. Interest with the youth to actively take up the task of solving society related challenges is apparent across the world (Youniss et al., 2002). If such an interest can be groomed as a part of academics, it can thrust up on the conceptual knowledge and establish theoretical knowledge to practical work in sensible manner for students. Corporations able to motivated to participate through strong financial income in such activities as an attempt to fulfill the Corporate Social Responsibility [8].

Significant Analysis**Case 1: learning-by-doing works**

It's apt to define Service-learning as refer (Stainke & Fritch-2007), it is the classroom instruction clubbed with society service such as providing food to the needy and deserving people. How the process is taken for learning by doing is presented in Fig.2. Day to day activities are given in the block diagram Fig.3. The assignments given to the students should preferably be innovative, should create value to external stake holders, should help the students identify the opportunities in the process of arriving at the solutions, and should help understand the nuances of design thinking..



**Rajeswaran et al.****Case 2: Activities and Design thinking that trigger entrepreneurial competencies**

The Activities and Design thinking that trigger entrepreneurial competencies is explained following figure.3.

Case 3: Scaling entrepreneurial education

In Fig.4, the model course structure spreading up the good educational practices to the classrooms in a big way is the main concern of the educational reforms. But the fact is that a major chunk of such initiatives fail to influence the classrooms and the teaching practices. [9].

Case 4: Outcome

The most established systems in favor of facilitate educational- institutions outreach able to be found a university level. In a research sequence label “the consumerist university” it is outline how increased collaboration stuck between universities, government entity and industry can be facilitated in accordance. The course activities are shown in Fig.5 [10].

RESULTS AND DISCUSSION

The various course level and completion process are given in Fig.7. We can monitor the progress of participated students in each level and motivate them to complete each level without delay. It is strongly recommended in this report to put the value creation at the heart of entrepreneurial education in order to solve few of the challenges. In an attempt to create value to external stake holders, six different approaches, tools and methods from various fields have been summarized which are capable of contributing with realistic advice to mentors and students. We can also hope for a methodological development allowing researchers to prove any effects of entrepreneurial education in a better way, from a variety of approaches. Here analyze some sample course completion certificates are given in Fig.8 (a),(b).

CONCLUSION

The aim of this paper is to explain some basic tenets of entrepreneurship in education, emphasizing on its relevance and implementation issues. The target listeners of this report are practitioners in various educational institutions all across. This report owes its basis to majorly existing research pertaining to the areas of entrepreneurship, psychology, philosophy, education and other allied areas. The author(s) will effort to give some direction based on their self conducted research, in cases of scanty research. In the near future we will optimistically also be able to see the erection of dedicated support structures in schools, colleges and universities as well as other important management and organizational structures, with an objective to maintain mentors and students to accomplish the task of interacting with the exterior world resulting in value creation. Finally, Entrepreneurship is the buzz word and the order of the day and every institute should make an attempt to make it a part of its fabric.

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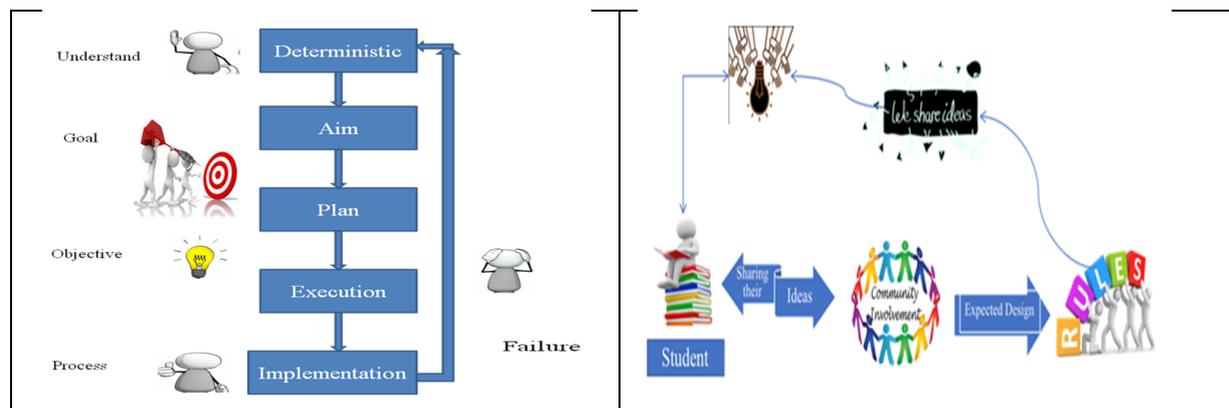


Fig. 1. Implementation chart

Fig. 2. Group activities

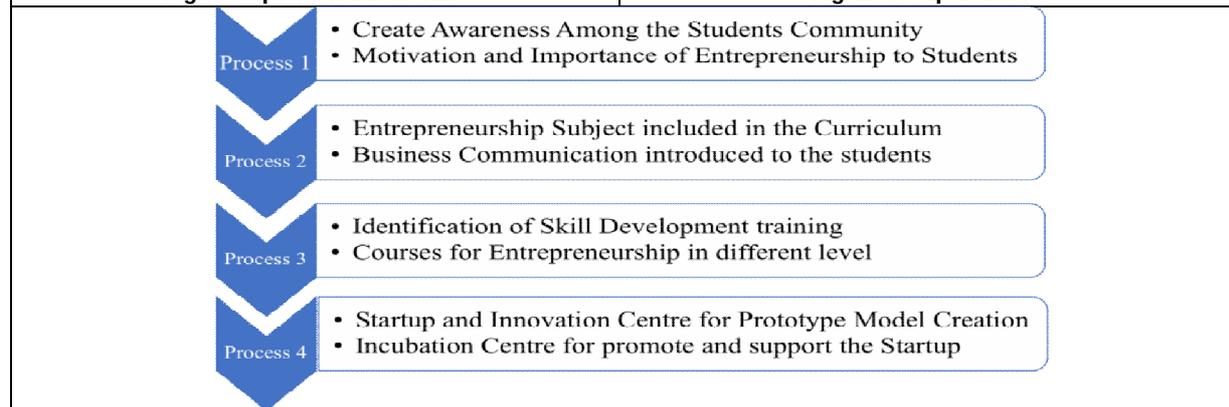


Fig. 3. Block diagram of process





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(a)

(b)

(c)

Fig. 4 (a),(b) (c). Course discussion

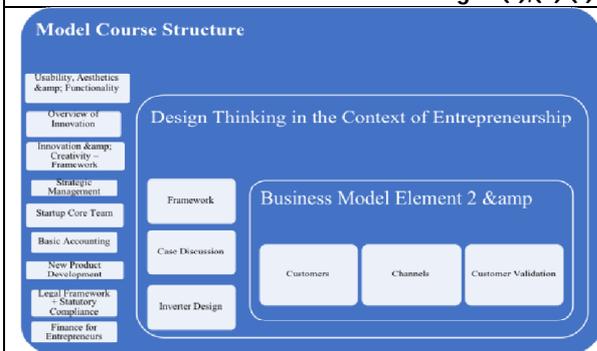


Fig. 5. Model Course Structure



Fig.6 Course activities in the class room

Name	Overview of Year 2 Sep 4th	Video Session - Usability, Aesthetics & Functionality - Session 1 Sep 11th	Video Session - Overview of Innovation Sep 18th	Video Session - Innovation & Creativity - Framework Sep 25th	Video Session - New Product Development - Framework Sep 25th	Video Session - Startup Core Team - Session 1&2 Oct 2nd	Video Session - Strategic Management - Session 1-6 Oct 9th	Assessment: Strategic Management - Session 1-6 Concept Quiz	Video Session - Basic Accounting - Session 1 Oct 23rd	Assessment: Basic Accounting Session 1-3 Concept Quiz	Video Session - Legal Framework - Statutory Compliance Oct 30th	Assessment: Legal Framework - Statutory Compliance Concept Quiz	Video Session - Finance for Entrepreneurs - Session 1-4 Nov 1st	Assessment: Finance for Entrepreneurs - Concept Quiz
Empaty Akhila	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed
BALA KRISHNA	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed
Sai Chandra Manogna Dhotipala	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed
Sachith Divan	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed
VANISH DODDIGARI	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed
kundana gangam	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed
Sahana Halady	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed
Krutika Jakkola	Completed	Completed	Not completed	Not completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed
Thushara Luxmi	Completed	Completed	Not completed	Not completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed
Lohithaimallik	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed
Vurli Manidhar	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed
Madhurala Meghana	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed
Deepak Pasala	Completed	Completed	Not completed	Not completed	Completed	Not completed	Not completed	Not completed	Not completed	Not completed	Not completed	Not completed	Not completed	Not completed
Pabba Sahithya	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed
Kodamagundla Sharan	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed
Sai Sampath Thagiria sainadh varikollu	Completed	Completed	Not completed	Not completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed
Naimisha Vetcha	Completed	Completed	Not completed	Not completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Not completed
Karishma Wadhe	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed

Fig.7. Progress of course participations





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Fig. 8 (a),(b) Certificates of Completion





A Study on the Convex Median and Anti-Median Graph with Some Graph Operators

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ABSTRACT

In this work, convex median and anti-median graphs are exists in bipartite graph k-partite graph and also with embedding center. Some Theorems and properties are proved to exist a median and anti-median on a connected and square of bipartite graphs. In advance, convex median and anti-median help to justifies an upper bound to maximum status difference in the graphs. All are applicable to a larger class of graphs then line graphs as only some of the forbidden subgraphs of line graphs are used.

Keywords: Anti-median, Graph Theory, linegraphs, Median

INTRODUCTION

The mathematical structures known as graphs are used to model pair-wise relations between objects from a certain collection. The study of graphs-Graph Theory-is the branch of mathematics originated in 18th century. Leonhard Paul Euler (1707-1783) was the pioneering Swiss mathematician who led the foundation of very vast and important field of graph theory- created the first graph and hence solved the first problem using graph theory-The Konigsberg bridge problem which was considered to be one of the toughest problems during that time. The study of games and recreational mathematics have always motivated the development of graph theory and by the end of 19-th century, a great deal of progress in this mathematical discipline has made graph theory to be a branch of mathematics which have applications in many areas-anthropology, architecture, biology, chemistry, computer science, economics, physics, psychology, sociology and telecommunications to name a few. Also, graph theory is considered to be the branch of mathematics which is ideally suited for the rigorous analysis of the very large scale interconnection (VLSI) networks. Tamir [1] presented locating two

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obnoxious facilities using the weighted maximum criterion. Leclerc [2] announced the median procedure in the semilattice of orders. Smart and P.J. Slater [3] detailed of the Center, median, and centroid subgraphs. Minieka [4] recommended Anticenters and anti-medians of a network. F.R. Mc Morris et al [5,6] suggested the median procedure in a formal theory of consensus, The median procedure on median graphs. G.R.T. Hendry [7,8] proposed On graphs with prescribed median I, median II.

Operators on Median and Anti-Median Graphs

In this chapter we will provide a survey of results on the three operators specified, all graphs are connected and all subgraphs mentioned.

Existing Results of Median and Anti-Median Operators

The median of a graph is one of the centrality concepts, together with the notions such as centre and centroid, is defined using distance, which is one of the widely used concepts in graph theory. In network theory these concepts are known as 'facility locations'. The problems of finding facility location naturally arise in situations like placing post offices, warehouse or emergency services such as hospitals or fire stations. For instance, the median of a graph is a node in a graph or network which minimizes the sum of the distance to other nodes in that graph. In network theory, the problem of finding the median is significant as it is related to the optimization problems involving the placement of network servers, the core of the entire networks, especially in very large interconnection networks. The studies on the structure of facility locations started with, where it is shown that the center and the centroid of a tree consists of one vertex or two adjacent vertices. The number of vertices used for such a construction was shown to be $\leq 2|V(G)|$, and it was improved to $2|V(G)| - \delta(G) + 1$ in [21]. Median location is shown to be the optimum location for minimizing the transportation costs to a facility and center to be the optimum location for an emergency response facility, studies and surveys on locations in graphs are presented.

When the graph operators under consideration maps a graph into its subgraphs, the problem of finding a common root graph is also referred to as a simultaneous embedding problem. For instance, in [21] it is shown that given two graphs G_1 and G_2 , there exists a graph H with G_1 as the median and G_2 as the center and still be disjoint. In another words, there is a common rootgraph H such that $M(H) \cong G_1$ and $C(H) \cong G_2$. Later, $d_H(G_1, G_2)$ can be any integer n in such a construction. The problems of finding common roots for different operators such as center, periphery, median, anti-median, centroid, etc., However, the median constructions for general graphs cannot be directly applied to many networks as their underlying graph belong to different classes of graphs. Hence, the study of the median operator for different classes of graphs is also significant. We note that the underlying graphs of many networks are bipartite. For example, most of the analysis in network communities are done using preference networks and they are modeled using bipartite graphs. We present a study on the root graphs of k -partite graphs and some related sub-classes under median and anti-median operators.

Security has become one of the most important area of concern in networks, which deals with the sharing and transaction of different forms of data. A convex structure in a subnetwork allows a safe data transaction through the shortest paths available between any two nodes in it. Thus the term 'convexity' in graphs can equally be used in place of the word 'security' in data transactions in networks. Consider the problem of simultaneous embedding of two graphs G_1 and G_2 in graph H such that $M(H) \cong G_1$ and $AM(H) \cong G_2$. Also, consider an additional requirement that any shortest path between the vertices of G_1 (and G_2) is within these facility locations. This will give these locations an advantage of transporting the materials without affecting the outside regions. This requirement can be made by keeping both G_1 and G_2 convex subgraphs of H . A construction with $M(H) = G_1$ and G_1 is convex in H . For a positive integer r , let $H = (G_1, G_2, r)$ denote a graph with $d_H(G_1, G_2) = r$, $M(H) \cong G_1$, $AM(H) \cong G_2$ and both G_1 and G_2 are convex subgraphs of H . Such a construction for the graphs which satisfy $r \geq \lfloor d(G_1)/2 \rfloor + \lfloor d(G_2)/2 \rfloor + 2$.





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Median and Anti-Median Problems on Bipartitegraph

This chapter deals with the median problem on k-partite graphs and some of its sub classes. We prove the existence of k-partite graphs as the root graphs of k-partite graphs, for some k, under the median and anti-median operators. Similar results for some subclasses of k-partite graphs are also presented in this chapter. The commutative properties of the median and anti-median operators with two graph operators, the bipartite graph of a graph and the square of a graph, are also discussed. When presenting the results for k-partite graphs, we use different methods for the cases when $k=2$ and $k \geq 3$.

Bipartite Graphs with Prescribed Median and Anti-Median.

Theorem 3.1.1

Given a bipartite graph G of n vertices, there exists a connected bipartite graph H such that G is an induced subgraph of H and all the vertices of G in H have equal status in H .

Proof

Let X, Y be a bipartition of $V(G)$ and X', Y' be the copy of X, Y such that v' denote the copy of vertex $v \in V(G)$. Consider two new vertices v_x and v_y . Make v_y adjacent to all vertices of $X \cup X'$ and v_x adjacent to all vertices $Y \cup Y'$. Also for each $v \in X(Y)$ makes v' adjacent to $Y \setminus N(v)(X \setminus N(v))$. Now, when $v \in X$, $S_{H'}(v) = 1. |N(v) \cup Y \setminus N(v) \cup \{v_y\}| + 2. |X \setminus \{v\} \cup X' \cup \{v_x\}| + 3. |N(v) \cup Y \setminus N(v)| = 4n + 1$. A similar calculation when $v \in Y$ gives $S_{H'}(v) = 4n + 1$, for all $v \in V(G)$. Also, it follows from the construction that H' is bipartite.

Remark

The graph H' is called the bipartite gadget graph of G . Let $|x| = n_1$ and $|y| = n_2$. Then we have, in H' , $S(v_x) = 4n + 1 - (2n_1 - 2)$, $S(v_y) = 4n + 1 - (2n_2 - 2)$ and $4n + 1 \leq s(v') \leq 4n + 1 + 2\Delta(G) + 2 + \max(n_1, n_2)$, for each $v \in V(G)$.

Theorem 3.1.2

Given a bipartite graph G there exists a bipartite graph H such that $M(H) \cong G$.

Proof

The proof is by construction. Let H' be the bipartite gadget graph G . Choose a positive integer $s > \max(n_1, n_2) - 1$. Introduce s copies of K_2 and make one end of each K_2 adjacent to all the vertices of X and the other end to all the vertices of Y . Denote this graph by H . Then for each vertex $v \in V(G)$, $S_H(v) = S_{H'}(v) + s + 2s = 4n + 1 + 3s$. Also, for each $v \in V(H \setminus G)$ the status is increased by $5s$. Let x be an arbitrary vertex from the newly added s copies of K_2 . It easy to verify that $S_H(x) \geq 4n + 1 + 5s$. Hence $S_H(v) < S_H(u)$, for all $v \in V(G)$, for all $u \in V(H \setminus G)$, hence $M(H) \cong G$.

Median and Anti-Median Based on bipartite graphs and Connected Graphs

Median and Anti-Median Problems on Symmetric Bipartite Graphs

Theorem: 4.1.1

Given a symmetric bipartite graph G , there exists a connected symmetric bipartite graph G' such that G is an induced subgraph of G' and all the vertices of G in G' have equal status in G' .

Proof:

Let $(X, Y)_f$ be a symmetric bi-partition of G . Let X', Y' be the copy of X, Y such that v' denote the copy of a vertex $v \in V(G)$. Consider two new vertices v_x and v_y . Let $A = X \cup X' \cup \{v_x\}$ and $B = Y \cup Y' \cup \{v_y\}$. Define a map g from A to B such that $g(v) = f(v), g(v'), \forall v \in X$ and $g(v_x) = v_y$.

Then, makes v_y adjacent to all the vertices in A and v_x adjacent to all vertices of B . Also, for each $v \in X(Y)$ make v' adjacent to $Y \setminus N(v) \cup \{g(v)\}(X \setminus N(v) \cup \{g^{-1}(v)\})$. Call this graph of G' and $S_{t,t'}(v) = 4n + 1$, for all $v \in V(G)$.

The graph G' is called the symmetric bipartite gadget graph of G .





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Theorem: 4.1.2

Given two symmetric bipartite graphs G and J there exists a symmetric bipartite graph H with $M(H) \cong G$ and $C(H) \cong J$.

Proof:

The proof is by construction. Let G' be the symmetric bipartite gadget graph of G with symmetric bi-partition $(A, B)_f$ and $(R, S)_g$ be a symmetric bi-partition of J . For $k \geq 3$, introduce two ladder graphs $\{X_i, Y_i\}_{i=1}^{k-1}$ and $\{u_i, v_i\}_{i=1}^{k-1}$ with symmetric bi-partitions $(X_1, Y_1)_{f_1}$ and $(X_2, Y_2)_{f_2}$ respectively.

Make x_i adjacent to $X \cup \{v_x\}$, y_1 to $Y \cup \{v_y\}$, x_{k-1} to R, y_{k-1} to S , u_1 to R and v_1 to S . Denote this graph by H_0 . Introduce s copies of K_2 and $a_i b_i, i = 1, \dots, s$ be the edges in sK_2 . Make $\{a_i\}_{i=1}^s$ adjacent to all the vertices in X and $\{b_i\}_1^s$ adjacent to all the vertices in Y . Denote this new graph by H . Clearly $C(H) \cong J$ with $e(v) = k + 2$, for all $v \in V(J)$ and $S(x) = S(y) = 4n + 1 + (2k + 1)(2k + 2 + |R|) + 3s$, for all $x \in X, y \in Y$.

For a vertex $u \in V(H)$, let $S^*(u) = d(u, a_m) + d(u, b_m)$, where $a_m b_m$ be an edge in the s copies of K_2 in H . Then, $S^*(u) = 3, u \in V(G)$ and $S^*(u) \geq 5, u \in V(H \setminus G \setminus \{a_m, b_m\})$. Hence $M(H) = G$, when $s > SD(H_0)/2$.

When k is even, let $A' = A \cup X_1 \cup X_2 \cup R \cup \{b_i\}$ and $B' = H \setminus A'$. Let h be the function defined on A' by $h(x) = f_i(x)$, when $x \in A$, $h(x) = g(x)$, when $x \in R$, $h(x) = f_i(x)$, when $x \in X_i, i = 1, 2$, and $h(b_i) = a_i, 1 \leq i \leq s$. It is clear that (A', B') . Redefining $h(x) = g^{-1}(x)$, for the vertices $x \in S. (A', B')_h$ becomes a symmetric bi-partition of H .

CONCLUSION

In this result the root graphs of some graph operators are studied. We have shown the existence of root graphs of different graph classes and provided solutions to some of the existing problems in graph theory. The solutions to the problems of finding common root graphs of median, anti-median, center operators are also given. An algorithm to find the root line graph based on a partition on the edge set of a line graph is provided. We list below some problems which we found are interesting, but could not be attempted for various reasons.

1. Given three k - partite graphs G_1, G_2 and G_3 , find a k -partite graph H such that $M(H) \cong G_1, AM(H) \cong G_2$ and $C(H) \cong G_3$.
2. Check the existence of the graph of the form (G_1, G_2, r) with a prescribed center, for $r \geq 1$.
3. Find the relation between $M(G^k)$ and $M(G)^k$. Similarly for AM operator.
4. Find upper bounds of $SD(G)$ in different graph classes.
5. Find root line graphs of some more graph classes.

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Renewable Energy (The Alternate Source of Energy)

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ABSTRACT

The people of the world mostly depend on petroleum products like petrol, diesel, natural gas, coal etc. By the use of their products, the resources of fuel eventually decrease, which makes the fuel costly and make environment more polluted. It damages the environment. This article shows the positive as well as negative effects of renewable source of energies, so according to the positive effects of renewable energy resources. Renewable energy is most useful in place of non-renewable energies is a better choice for the benefits of environment, society and economic issues of the community. As population of the world is growing so the requirement of the energy is also increasing. Energy is required at every moment of life. Sources of energy are divided into two parts; one is renewable energy and another is non-renewable energy. We know that the non-renewable energies are finished by some more years, so everyone understands that renewable energy is the alternate source of energy.

Keywords: Renewable Energy, Water energy, sun energy, Fossil fuel

INTRODUCTION

Renewable energies are obtained using the process which are replaced after a certain year. By the use of different processes, it obtains from the rays of Sun, speed of Wind, water from Rain, saline water of ocean means Tides, renewable liquid and gaseous fuel from Biomass, and generation of electric power from geothermal resources. In the year 2008, global final energy came from renewable is 19%, the percentage of energy from biomass is 13 and hydroelectricity provides energy of 3.2%. The part of renewable in electricity generation is about use of energy 18% with 15% came from hydro electricity and 3% from new renewable. The use of non-renewable energies increases the greenhouse effect. The technologies of renewable energy are more continuous than non-renewable sources of energy. We have to satisfy with the continuity of renewable sources. In general, the renewable energy is not adjustable to the community due to two causes, one is the natural resources distribution which is dependent on the locations of geographical areas and the other one is infrastructure growth rate. These energies are derived from the unlimited resources. So first we have to decide that energy sources are used where and how. Then consider the terms





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cleanliness, cost factor, stability of source, effectiveness and effect on environmental. Most of the countries are generate electricity by using the fossil fuels. For the production of electricity fossil fuels are more effective. So, if we think for long run it is not advantageous. One day fossil fuel will deplete and we have to depend on renewable sources. Moreover, the environment is polluted and causes ecological hazards. [1,2]

Water Energy

Let us discuss water source of renewable energy. By the use of water renewable energy gives us benefit economically, technically as well as environmentally. So worldwide people give emphasis on the use of water energy. Consider an example of China, with largest resources of water energy of 649GW potential. For developing the use of water energy, we have to minimise the non-renewable energy dilemma and control the pollution of environment which helps China growth economically and many countries also. water renewable energy produced due to water flowing by using mechanical energy, electric energy is generated. Now researchers try to generate electric energy from wave and tidal. Now a day's scientists are trying to generate energy from ocean waves. Water energy is more advantageous in the generation of electric energy. Water energy renewable sources are including reliability, efficiency, very low operating and maintenance costs.

Hydropower is a useful power generation technique which doesn't give up carbon to the air. Hydro power technology is a carbon free and unlimited resource. Hydropower plant doesn't pollute environment. The thermal power plant emits fly ash during production. So, it is said that it causes the acid rain and smug. Despite positive effects the hydropower plant has also negative impacts on environment like greenhouse gas emission. It affects the aquatic organisms. The hydropower plants have different several impacts on the environment. The quality of water degrades. The greenhouse gas emissions occur during three phases of hydropower plant. I.e. the construction, operation and maintenance and the decommissioning of the plant.

Sun Energy

Sun energy is a most suitable renewable energy on earth. Though it is rich, out of 100%, 99.96% of the total energy are not used. Solar energy produces steam due to the heat of sun. The steam power that generates electricity. It requires less operation cost and gives more productivity. Solar energy is a good renewable resource. We can gather more bulk of sun energy. It doesn't pollute air, also doesn't create greenhouse gas like oil-based energy does. It also doesn't produce any waste like nuclear reactions. It reduces the noise pollution. It can be used in residential purposes which has little impact on the surroundings. There are no moving parts in solar panels and require very little maintenance. The initial cost to install the panels, maintenance cost and repair cost is very low. Photovoltaic cells are made from some toxic material which convert sunlight to electricity. It uses potentially dangerous fluids to transfer heat. It could be harmful to the environment [1]. Our world population is growing day by day. But the earth has only a fixed quantity of petroleum products. Sun energy is the richest source of renewable energy, which produces 173,000 tera watts of energy in each moment. We know nonrenewable energies are not pure and also not ecofriendly. The cost of the fossil fuels is increasing very fast.

Air Energy

Air energy is the most affordable way of renewable energy. Air makes moment in the turbine and convert mechanical energy to electrical energy. For production of electrical energy mechanical energy is required. The produced energy is stored in an alternator which is converts to electrical energy to a network which is transfer to a generating station. Air energy has so much more positive effects on environment. It reduces greenhouse gas emission. It uses the turbines to move by the air and produces electrical energy means electricity which decreases the costs. Air needed for turbine to function. Air is available by nature which is free and everywhere. Wind is free and unlimited source never decreases, while use the advantages. So, everyone should encourage themselves to use the advantageous of air which makes our environment clean and healthier. [1,3]



**Sasmita Jena****Fossil Fuel (The Run out Energy)**

Fossil fuels are mostly compounding of hydrocarbon which are made up petroleum products. Use of petroleum products has many ill effects on the environment. Petroleum products are not feasible means coal, oil and natural gases will exhaust day by day. When we burn these fuels, they will produce many non-ecofriendly gases. Carbon dioxide is the most noticeable gas in the environment. Because carbon dioxide is responsible for global warming. It receives the sunlight and increases the heat of the surrounding and creates problem for everyone. With increase in temperature, the glaciers start melting which increases the sea level. By which flood situation created and makes the Agricultural fields unfertile. Also affects fishing. In the world most middle east countries stored a large amount of petroleum products by which other countries depends on them for the petroleum products. For exporting of petroleum products an organization was made up of 12 countries in a group. These countries are accountable to produce 40 per cent of the world's total oil production. When we burn petroleum products, it gives rise gases like NO (Nitrogen Monoxide), NO_2 (nitrogen dioxide), SO_2 (Sulphur Dioxide) and CO (carbon monoxide). The mentioned vapors directly pollute our environment. By which smoke is created and harms the health of human beings. Due to the presence of Sulphur dioxide vapor in the air mixes with rain water and becomes acidic; it destroys monuments which are made up white marble becomes yellowish (cause of Tajmahal becomes yellowish), also harvest of different crops. When ship carried by oil in sea sinks that oil merged with sea water that kills the sea creatures [4].

Significance of Alternate Energy Sources

Important features of alternate energy sources are adequate storehouse. Alternate energy sources are unlimited. It is hygienic sources of energy. It has lesser negative impacts on environment. Now a day's everyone knows the harsh effect of nonrenewable energies. Due to clean and sustainable nature of renewable energy, everyone understands the benefits and requirement of these energies. Most of the researcher work on alternate source of energies for finding more results. Researchers searching for the ways to use the alternate sources of energies in an effective mode. By burning the coal, natural gas and oil, the global warming is increasing. The burning of petroleum products is more dangerous to the earth and all species. Petroleum products causing accidents every parts of world. To end this devastation, we must apply to renewable sources. We know that renewable sources clean and don't pollute the atmosphere, also the sources of petroleum products are limited. Petroleum products will finish after a certain period of time. [5]. As we know the petroleum products will finish then we have made a habit of use of alternate sources of energy. So, we have to take the substitution of non-renewable sources of energy to alternate source of energy for generation of electric current. Alternative sources of energies are reliable, abundant, also lower cost. Alternate sources of energy are new in most of the countries. It can attract many investors. By which unemployed able to get employed. So, alternate sources of energy play a vital function to bring down an employability ratio.

CONCLUSION

This is a top task to make all the people understand the goodness of alternate sources energies. Public should know the bad effects of use of petroleum products. We should use the safety measures while using the sources of nature. As we are currently use both the CNG (Compressed Natural Gas) and petroleum products which increases the population but the resources are decreased day by day. Environmental effect is depleted and terrifying to the sustainable world. The process by which we used the petroleum products as a result it's threatening us. From 2001 to 2021 during this period of time the use of petroleum products to an optimum stage. More use of petroleum products increases the heat of earth and also increases the greenhouse effect. By using fossil fuel, the factories and industries release harmful gases to the surrounding and becomes the cause of global warming. So, time has come for saving ourselves, youngsters, atmosphere as well as the world by using alternate sources of energies which are clean and ecofriendly.





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There are no doubt common people understand the positive effects of alternate energies while many things are there to do. For motivating the people, we should start advertise from gram panchayat level to new research areas for the research scholars. As a result, labor to engineers understand and make a habit to use alternate source of energies. People convince themselves not to use the petroleum products for safety of our environment and reduce the global warming. Courses in renewable energy must be compulsory at every step of study for aware our future generation. The government should work on power policies to revise.

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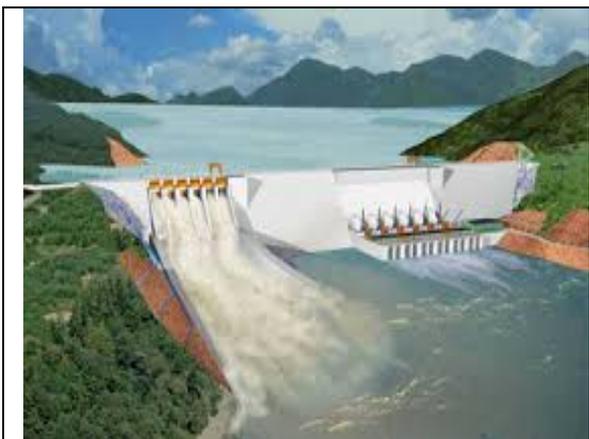


Figure 1. of water renewable energy



Figure 2. of Solar panel renewable energy



Figure 3. of Wind power renewable energy





Devanagari Numeric and Offline Character Recognition by Multiple Classifiers & Feature: A Comparative Study

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ABSTRACT

To study and recognize the Devanagari handwritten characters and numeral values using machine learning, pattern recognition techniques and AI based ideas is playing an important role in the field of Character Recognition system, in nowadays. It would be treated as an innovative and challenging field of human life to find out the best results for scanned or handwritten data recognition in today's digital world. OCR system is also providing a new way to recognize the handwritten documents or scripts in different languages like: Nepali, Spanish, Bengali, Russian, English, Japanese, etc. In this paper, we have planned a research work or study for scanned data (Hindi Lipi) recognition with the help of various procedures and classifiers.

Keywords: HCR, Features, classification, Optical Character Recognition, classifiers, K-Means.

INTRODUCTION

Nowadays, Handwritten characters and numeral digit recognition technique has been one of the most fascinating and complicated study area of artificial intelligence with various approaches of machine learning. Devanagari language/script is widely used in India and most of other countries around the world. Devanagari handwritten scripts and scanned documents have not identified easily by the computer system. The different writing styles and shapes played a critical role not to recognize the handwritten data or documents/reports also [1]. Handwritten Character Recognition (HCR) system is the detection of scanned/printed data items from any electronic images, handwritten messages on papers/cards, cheques, or scripts. A large number of academicians/researchers had been worked to solve this problem with different techniques and writings for recognition of handwritten data clearly. The handwritten reports in different languages have been also recognized with the help of image processing and pattern

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recognition techniques [2,3]. Devanagari handwritten characters or scanned documents are converted in the digital form by Optical Character Recognition (OCR) technique, to be recognized by the computer system [4, 5]. The results by different classifiers to recognize the data, provides a new way for this study and interest [6]. In this research work, we will evaluate the performance of six different classifiers and features to modified/used the information / images (gradient and curvature) as a result to be recognized [7, 8]. The various Classifiers like: Euclidean distance (ED), Subspace method (SM), Support vector machines (SVM), Mirror image learning (MIL), Projection distance (PD), Modified Projection distance (MPD) have been used for this research work, here [9, 10]. In this phase, we have discussed about the introduction of Devanagari script.

DEVANAGARI SCRIPT

Devanagari script is well known in Indian culture to communicate and writing for various purposes. A number of languages are spoken in India but Devanagari script is treated as native language of India. The various religious books and epics are written in Devanagari script (lipi), in ancient time. Devanagari language is much famous and widely used in all around the globe [2, 11]. Devanagari handwritten characters' recognition is an interesting and demanding field for research work. The research works related to recognize the various scripts such as Russian, Chinese, Korean, Nepali have already been carried out with the help of different technologies and approaches around the globe [2]. It is complicated task to recognize the various handwritten characters by the computer system because of different patterns of writing skills of human beings and printed/scanned data also. Devanagari lipi consists of 49 primary alphabets, 13 vowels (Swars), and 36 consonants (Vyanjans), and 10 digits (Ankas) [12, 13]. Following figures are providing a glance of Vowels and their Corresponding Modifiers, and Consonants in Hindi Scripts-

Feature Extraction

There are four sets used to recognize the data. These sets are divided into two types of sets separately for both types of images. First two sets are responsible to contain the image information (gradient) only and other two sets are required to calculate the curvature information with gradient image also. We used dataset based on grey-scale to get the binary features and these images were converted as in digital form using the method of "Otsu" [10, 14]. The length (parameters) for all sets have fixed at 392 dim. And the calculation techniques for feature sets have written below accordingly [9, 11]:

Calculation of gradient feature

A filtering (2×2) is being applied on the put in image (4 times) & normalization (non-sequential size) over the picture [11]. The picture is tabulated by the pixels (148×148) and separated with groups (49×49). With the help of pixels, the groups are derived in meaningful format having the value of $A = (49/148) \times (p-1) + 1$ and $B = (49/148) \times (q-1) + 1$. Here p and q are showing the dimensional manner for pixels (148×148) and A, B are showing the dimensional information for groups, individually. The gradient image derived from normalized image is produced by a filter named "Roberts". After that, the slope of curve with tangent value is primarily segmented throughout the thirty-two ways with the gaps of $\pi/4 \times 4$ and the capacity of slope is calculated for every estimated way of situations. With the help of given formula, the capacity of slope/gradient can be measure: $SG = \sqrt{(\Delta u)^2 + (\Delta v)^2}$
& for the way of slope ($\theta(x, y)$) we mean $\theta(x, y) = \tan^{-1} \frac{\Delta v}{\Delta u}$

At last, the groups (49×49) are reduced by small groups/blocks (7×7) with the help of filter (Gaussian) and repetitions have also reduced with eight routes, there after the dimensional feature vectors ($7 \times 7 \times 8 = 392$) are obtained [12].

Computation of curvature feature

We calculated curvature feature with various ways and methods. The algorithm having many phases is written below to get the improved features [15]:





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1. The gradient’s direction is divided to 32 levels.
2. The shape of curve is calculated by bi-quadratic and interpolation methods for three levels of divisions. (It is assumed t=0.15 for experimental work.)
3. The gradient’s strength is gathered with thirty-two ways/routes, separately.
4. From thirty two routes, the sixteen routes/directions are filtered [1 4 6 4 1]. In addition, Gaussian-filter provides the well ordered groups (7 × 7) from the big groups/blocks. With the help of curve’s shape, the features are examined (3 × 392=1176 dim.)
5. The structural feature is reduced by 392 from 1179 spatial with the help of principal component analysis. It is using by the classifiers intended for evaluation and analysis of result.

ABOUT THE CLASSIFIERS

The detailed information is written below to understand about the various six Classifiers (ED, SM, SVM, MIL, PD and MPD) used here for image/offline data recognition purpose with applied work and processes:

The ED (Euclidian Distance)

Using this classifier, the put in prototype and mean vector can easily produce the length for the calculation as follows:

$$g_i^2(X) = \|X - M_i\|^2$$

Where X denotes the put in aspect vector of size n and M_i indicates about the class of vector (mean). The structured class is defined by put in vector which is responsible to reduce the required length. Hence forward, the sake of uniformity is overlooked by the denoting class of sub-scribble I.

The SM (Subspace method)

With mode of X=1, the value of M is being treated as: zero, for a division (bipolar) on a circular surface because the bipolar division is symmetric with respect to starting point (origin).so that, the projected distance for the distribution is measured by the following terms:

$$g^2(X) = 1 - \sum_{i=1}^k \{\varphi_i^T X\}^2$$

Where Φ_i designates the ith eigenvector of the matrix (autocorrelation) [14].

The PD (Projection Distance)

The distance for the projection can be measured by

$$g_{pd}^2(Y) = \|Y - N\|^2 - \sum_{a=1}^k \{\varphi_a^T(Y - N)\}^2$$

It produces the length between Y manner (entered) & shortest shaped mistake hectic surface and would be calculates the sampled to the circulations. The Euclidean distance is reduced by the projected distance (When k=0).

The MIL (Mirror Image Learning): The MIL acts as a remedial knowledge system which can Progress the knowledge usefulness of group restricted circulations. It creates an echo picture of a prototype that intends a couple of puzzling modules to resizing the model of knowledge for an other group [14].

The MPD (Modified Projection Distance)

The MPD is calculated by

$$g^2(Y) = \|Y - N\|^2 - \sum_{a=1}^b \frac{(1 - \alpha) \lambda_a}{(1 - \alpha) \lambda_a + \alpha \sigma^2} \{\varphi_a^T(Y - N)\}^2$$





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Here, α -parameter takes the value [0, 1]. The used classifier provides the similar value (When $\alpha=0$) that of projected distance and similar value of Euclidian Distance (When $\alpha=1$). Here, the primary experimental work would provide the value of α .

The Support Vector Machine (SVM) An SVM is used to define the problems of two-classes.

It provides the best possible region that can increase the space for the near by samples of classes, known as SVs. The collected data (N) for training purpose is given : $\{x_n | n=1, \dots, N\}$. The formula is used for the same as follows:

$$f(x) = \sum_j \alpha_j x_j \cdot x + b$$

Where $\{x_j\}$ denotes about the groups of support vectors, both parameters: b & α_j have been determined by the solution of a problem (quadratic) [16]. With the replacement of inner product can be treated as the non-linear classifier which may be upgraded to the linear SVM. The master method is defined as: $A(a, b) = \varphi(a) \times \varphi(b)$. It must clarify the condition of Mercer's [16, 17].

Classification Principle

In the data analysis and database management technique clustering is one of the data structure management technique. Lots of data can be sub divided into subgroup. Same type of data can be placed in same group. Using this method, we can define task of identification. Basically find homogeneous subpart inside the data point. Euclidean-based distance or correlation-based distance is use to identify this method. It is an application-specification. Base on the features sub grouping clustering analysis is used [4, 18]. Clustering is an unsupervised machine learning method. Clustering can be done in different way. Partition the dataset features which are taken from Convolutional neural network (CNN). Each partition of dataset is non-overlapping clusters where every point of features is belonging only one groups. Decide the total number of clusters. First centroid the random data point and iterating data. If centroids are not change then iterating repeatedly. Data points assign in same cluster. After that calculate the sum of the squared distance between data points and all data centroids.

$$j = \sum_{i=1}^m \sum_{k=1}^K w_{ik} \|x^i - \mu_k\|^2$$

After that call SVM algorithm to evaluate k number of clusters. Sort number is denoted as a T . create a condition where every value can be evaluate as a newly generated solution. Then it will give kSVM solution.

$k_{svm-model} = \{(c1, Lsvm1), (c2, Lsvm2) \dots (ck, Lsvmk)\}$;

Where, k = local model = no of cluster;

y = it is presented as parameter which is hyper of kernel function of RBF;

c = the error rate of SVM. And in the very last return the global best solution. Repeat till all such cluster is pruned.

And it gives final classification. Then we can classify and identify the characters and numeric values very efficiently. And calculate the accuracy of the character's recognition [19, 20].

In the fields of Machine Learning, perhaps K-Means is the most known and studied method for clustering analysis [20-28]. K-means is a method of clustering which helps to feed up new scanned data or images into required form of blocks for handwritten character categories. Using a desktop GUI form / web portal, a client can demand and visualize the historical images with the past gathered data from the server [29-35].



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DISCUSSIONS AND RESULTS

Data is collected from various sources/individuals for present proposed research work. We experienced 38152 samples of Devanagari basic characters and numeral images for the development of dataset, here. This dataset is separated by 6 sub-sets for training purpose and the remaining sub-sets are used for matching/testing process of experimental/study work. The average accuracy rate of recognition is produced by the entire tests, held during the experimental work using six various classifiers. The results are calculated for couple of pictures/images. The results have clearly shown in Table 1.

As per results, we can analysis that MIL classifier produced highest average accuracy (94.95%) rate of results for data recognition and another classifier have given the less accuracy rate to recognize the data for both the images, accordingly. The ED classifier has given the lowest average accuracy (78.99%) rate for data recognition, among all the used classifiers. According to outcomes for recognized data by all classifiers, it is founded that the curving feature produced a high rate of accuracy results than gradient features in all the classifiers except SM and PD, SVM, MPD. The results produced by different classifiers are shown through a graph in figure 7.

CONCLUSION

The results given by various classifiers to recognize the Devanagari handwritten characters provides a new way for related research work in future. Here, we used six different classifiers to find the best result of the recognized data for Devanagari handwritten characters and numeral values. In this comparative study, the results of different classifiers are analyzed and discussed for the better result finding process. It is distinguished that the MIL (Mirror Image Learning) classifier has provided in general average accuracy outcomes (94.95%), here. This research work will be supportive for further research work.

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Table 1: Comparison of classifier’s results

Classifier	Grey image		Binary image		Average (%)
	Gradient (392 dim.)	Curvature (392 dim.)	Gradient (392 dim.)	Curvature (392 dim.)	
ED	77.95	80.07	77.90	80.09	78.99
SM	92.63	93.65	92.62	93.37	93.06
PD	92.77	93.78	92.79	93.59	93.23
MIL	94.76	95.20	94.78	95.10	94.95
MPD	93.93	94.45	93.84	94.48	94.19
SVM	93.40	94.53	93.60	94.38	93.97



Figure 1. Swars-Devanagri



Figure 2. Vyanjan- Devanagri

Vowels	अ	आ	इ	ई	उ	ऊ	ए	ऐ	ओ	औ	ॐ	अः	ऋ
Modifiers		ा	ि	ी	ु	ू	े	ै	ो	ौ	ँ	ः	ॄ

Figure 3. “Swars with Modifiers in Devanagri”

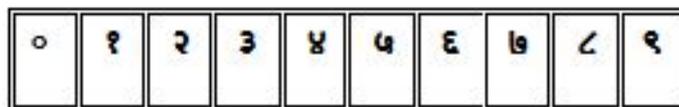


Figure 4. “Anka in Devanagri”





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अअअ	औऔऔ	जजज	ददद	ननन
आआआ	अंअंअं	झझझ	धधध	ववव
इइइ	आंआंआं	ञञञ	ननन	शशश
ईईई	ककक	टटट	पपप	ससस
उउउ	खखख	ठठठ	फफफ	षषष
ऊऊऊ	गगग	डडड	बबब	हहह
ऋऋऋ	घघघ	ढढढ	भभभ	क्षक्ष
एएए	ड.ड.ड.	णणण	ममम	त्रत्रत्र
ऐऐऐ	चचच	ततत	ययय	ज्ञज्ञज्ञ
ओओओ	छछछ	थथथ	ररर	

Figure 5. Some similar shaped printed Devanagari handwritten characters

$$j = \sum_{i=1}^m \sum_{k=1}^K w_{ik} \|x^i - \mu_k\|^2$$

Figure 6. SVM Calculation

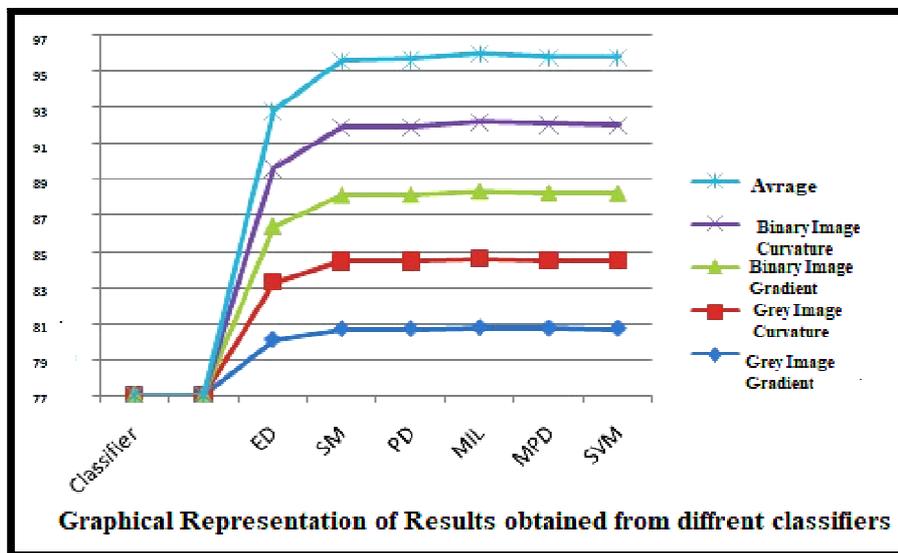


Figure 7. Pictographic view of results by various classifiers





Recent End Milling Operation on Metal Matrix Composites: A Review

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ABSTRACT

Abstract: In the current global competition, nonconventional machining process is having specific interest. The different machining characteristics developed over conventional milling operation are focused basically on quality of the product. The demand of high performance parts in various field of industrial or academic application attracts the modification in milling process. The improvement in surface finish, material removal rate (MRR), stress free surface, burr free textures, tool life enhancement, multi operational system by optimizing the production time, tool replacement time CNC end milling has a significant role. As in the field of smart material revolution, metal matrix composites (MMCs) are widely appreciated for its light weight and good functional property, mostly used in aerospace, automobile field. This article significantly focused on study of critical parameters on end milling operations of MMCs. The influence of milling process parameters i.e. spindle speed/Cutting speed, feed rate, cutting thickness, surface roughness, tool wear, chatter stability, tool and work piece interface temperatures are well described. The optimization of burr formation in end milling of MMCs still requires more attention in the field of research. The micro structural studies of MMCs develop the surface quality including robust mechanical performance after the end milling operation. This review presents the overall study of governing parameters in end milling operation of MMCs.

Keywords: Milling machining, CNC machining, cutting parameter, chatter stability, metal matrix composite material, micro-structural studies.



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INTRODUCTION

The significant objective of this paper is to represent the manufacturing of MMCs with its convenient composition and demand in the field of milling operation. It is focused about the performance enhancement by controlling significant factors, i.e. MRR, surface roughness, machining time. These output responses depend on the input factors such as spindle speed, feed rate, cutting thickness. The most predominant factors concentrate on desired superior quality of surface roughness, machining time and machining cost.

As in the current scenario, MMCs are having specific interest due to its good physical and chemical property with excellent development of mechanical property also. Composite is a versatile product amidst high strength to weight ratio, lightweight, fire resistance, electrical properties, chemical and weathering resistance, translucency, design flexibility, low thermal conductivity and manufacturing economy. MMC's high strength, fracture toughness and stiffness are offered by metal matrices than those offered by their polymer counterparts. Most metals like Titanium, Aluminium and Magnesium are the popular matrix metals currently in vogue, which are particularly useful for aircraft applications being its light weight.

End Milling

In the end milling, the cutter is thin as compared to the work piece width. Most of cases this type of milling operation is used for slot operation. The slot operation is done on the work piece. The surface roughness is elaborately defined by Alauddin et al. [1] with the mathematical model in end milling operation. The highly automated CNC end milling machine requires to model for prediction of tool flank wear. Here machining occurs on LM25 Al/SiC_p alloy as explained by Arkiadass et al. [2]. Sammy et al. [3] described the AA6351-B4C composite material has been manufactured by the stir casting method and subjected to end milling machining operation. Here it is analyzed the parameter of the milling operation as the chip thickness, surface roughness, temperature rises and critically studied tool flank wear. In the experiment the titanium nitride (TiN) coated solid carbide tool with four flute end mill [3]. The surface integrity of particle metal matrix composite material is affected by the parameter or surface formation by the MMCs. Reddy et al. [4] used Al/SiC as work piece and TiN/Al coated carbide tool inserts. The performance characteristics of S545C medium carbon steel is described by Chang et al. [5] used for evaluating roughness in end milling process along feeding direction, axial direction and waviness. Palaniadaja et al. clearly explained the machining characteristics of LM 25 Al/SiC_p composite material along with TWR by RSM (Response Surface Methodology) and CCD (Central Composite Design) method. Also tool flank wear was found out, which is mostly built upon the tool dimension or tool geometry and cutting fluid [6]. Öktem [7] experimented and certainly obtained the performance of various machining parameters of end milling operation on AISI 1040 steel using TiAIN solid carbide tool by ANOVA and Regression method.

Tool Material

The tool is most important for machining and its performance depends on the material, shape and design. Most of the cases in the end milling, the High Speed Steel (HSS) (W:Cr:V = 18:4:1), Titanium coated carbide tool, cemented carbide tools are used. According to Arkiadass et al. [2], CNC vertical milling machine is used in the machining the flat end coated solid carbide tool with 12 mm diameter, 45° helix angle, 10° rake angle and 4 flutes. Vishnu et al. [8] explained the significance of tool holder BT30-ER16 for tool material used as CVD brass coated tool with its diameter 16 mm and 4 teethes on CNC vertical milling machine while operated on work piece EN-31 steel. Karakas et al. experimented for the Al-4Cu-B₄C MMCs by using both multiple coated and uncoated tool and investigated the variation in cutting speed with tool wear behaviour. The uncoated tool is used as cemented carbide tool and coated tool as (TiCN+Al₂O₃+TiN) cemented carbide tool with 0° rake angle, 11° relief angle and 60° insert angle [14]. Chang et al. described for side milling operation done on B8 CNC machining centre up milling operation with cutting fluids. High Speed Steel tool coated Tin with specification of 12 mm tool diameter, 4 no of flutes, 35° helix angle is used [5]. Huang et al. explained the use of high speed milling machining on (SiC_p/Al) MMCs. Poly crystalline



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diamond (PCD) & TiC based Cermets are used as the tool considering the similar tool property. The tool cutting edge angle is 90° , tool minor cutting edge angle is 0° and tool nose radius is 0.4 mm [9]. Samy et al. [3] explained that the Al-B₄C particulate MMCs used by end milling operation by monolayer Titanium nitride (TiN) coated carbide tool with tool diameter is 8mm, 4 no flutes and helix angle is 30° . Jayakumar et al. [10] described the tool work piece interface temperature of (Al/SiC_p) MMCs using two uncoated cemented carbide insert (R 390-11T3 04E-NL-H13A) cutter. The diameter 16 mm, nose radius 0.4 mm, thickness 3.59 mm, width of cutting edge 0.9 mm and relief angle 21° . Fanghong et al. [11] described Al-SiC particulate composite material is subjected to DMU70V high speed milling machine by TiN-Al coated Carbide tool having 2 edges. The tool is affected the surface integrity and cutting force. Findik et al. [12] experimented the face milling operation on Al-SiC_p MMCs by uncoated cemented carbide tool & TiCN+TiN coated carbide tool having single tooth, the nose radius is 0.8. Mm, rake angle, relief angle and insert angles are 0° , 11° and 60° and studied the change in different characteristics.

Cutting Parameter

The most significant milling parameters are spindle speed, cutting force, cutting speed, machining thickness, axial depth of cut, radial depth of cut, feed rate, feed direction etc. Among all the parameter, three main parameters that mostly affect the milling operation are cutting or spindle speed, feed rate and machining thickness.

Cutting Speed or Spindle Speed

Vishnu et al. [8] experimented and optimized the value of spindle speed (796, 935, 1094) m/min using L₉ (3⁴) Taguchi method on end milling operation of En-31 steel. Reddy et al. [4] described the machining response by controlling cutting speed on milling operation of Al/Sic particulate MMCs. Ghani et al. [13] explained the influence of cutting speeds (224 m/min, 280 m/min, 355 m/min) on end milling operation of hardened steel AISI H13. The influence of cutting speed (100, 125, 150, 175, and 200) m/min of end milling operation is critically studied by Jayakumar et al. [10] on Al-SiC_p MMCs. Palaniradja et al. [6] described milling operation on MMCs, with the carbide tool. The value of the spindle speeds 2000, 2500, 3000, 3500 and 4000 rpm are optimized by RSM methods [10]. Karakas et al. [14] proposed that end milling operation done on B₄C_p reinforced hybrid aluminium MMCs considering the tool geometry & cutting condition with varying cutting speeds (100, 130, 169, 220, 286) m/min. Premnath et al. [15] concluded the impact of varying spindle speed (1500, 3000, and 4500) rpm on milling operation done on AA6061 aluminium hybrid MMCs. Samy et al. [3] also described the spindle speed influence on end milling performance on B₄C particulate aluminium reinforced composite material.

Feed Rate

Vishnu et al. [8] described the influence of feed rate (50, 100, and 150) mm/rev on surface roughness of end milling operation on En-31 steel. Reddy et al. [4] describes the micro structural changes with varying feed rate (0.10, 0.15, 0.20, 0.25, and 0.30) mm/rev on milling operation of Al/Sic particulate MMCs. Ghani et al. [13] explained the chip morphology of hardened steel AISI H13 when used for milling operation by controlling feed 0.1 mm/tooth, 0.16 mm/tooth, 0.25 mm/tooth. Jayakumar et al. [10] critically studied the tool-work piece interface temperature of end milling operation done on Al-SiC_p MMCs optimizing the feed rate (0.1, 0.15, 0.2, 0.25, and 0.3) mm/rev by Taguchi method. Arokiadass et al. [6] investigated about the tool flank wear on MMCs used in milling process using carbide tool with different feed rate values are 0.02, 0.03, 0.04, 0.05 and 0.06 mm/rev. Karakas et al. [14] proposed the influence of the tool geometry and cutting condition on end milling operation done on B₄C_p reinforced aluminium hybrid MMCs by varying cutting speed with fixed feed rate 0.20 mm/teeth.

Cutting Thickness

Karakas et al. [14] suggested the both radial and axial depth of cut impact on the chip thickness and tool flank wear on end milling operation done on B₄C_p MMCs considering the cutting thickness value is 10 mm and the axial depth of cut value is 1.5 mm. Samy et al. [3] studied the tool wear and chip rate of flow in end milling process on AA6351-B₄C metal MMCs using L₂₇ Taguchi method for optimum value of depth of cut (0.5, 1, 1.5) mm respectively. Fanghong et al. [11] studied the distribution of cutting temperature & surface integrity in milling operation done on



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aluminium based metal matrix composite material with the depth of cut value is 0.5 mm. Yakup et.al [16] used two types of tool to verify the impact of cutting speed, feed and thickness on the cutting force and surface roughness during milling operation of Al/SiC MMCs. Vishnu et al. [4] describe that the milling machining on EN-31 steel material on varying cutting thickness (0.5, 1.0, 1.5) mm. Reddy et al. [4] obtained various surface integrity with various depth of cut (0.2, 0.4, 0.6, 0.8, 1) mm on the Al/SiC metal matrix composite material.

Significance of Response Parameters

In CNC milling machining operation, the different input parameters are used in different level (low, medium, high). The output result of the milling machine is the surface roughness, cutting force, tool wear, tool flank wear, tool work piece interface temperature etc. In manufacturing the composite material, the output parameter are the tensile strength, hardness, stability, types of defect, porosity etc. These are the responses which depend on the input factors.

Surface Roughness/Surface Integrity

Vishnu et al. [8] defined milling machining operation on EN-31 steel. The input factor is taken as cutting speed, feed rate, depth of cut & coolant flow. It affects the surface roughness of the work piece. Surface roughness measured by the surface roughness tester. Reddy et al. [4] explained that the milling machining done on Al/SiC particulate metal matrix composite material. In this experiment the input factor taken as cutting speed, feed and depth of cut. This input factor affected the output response. In the experiment the surface integrity is taken as the output response. The surface integrity defined by that surface roughness, micro hardness & residual stresses. These are varied with the metal composition of the metal matrix composite material. Yakup et al. [16] defined milling machining operation done on Al/SiC metal matrix composite material. The cutting speed, feed rate and machining thickness are taken as the input parameter. These input factors are affected the surface roughness. In this experiment the input parameter is taken in two different type of tool, one is coated tool and another is uncoated tool. The surface roughness is different in both the tool with the roughness decreasing in uncoated tool and increasing in coated tool.

Tool Wear – Tool Flank Wear Rate

Wang et al. [9] explained that here the milling machining done on cast iron & the carbide cutter is used as the tool for the machining process. The tool wear is taken as output response in result it defined that the tool wear is different in single tooth tool and multi tooth tool. The tool wear rate compared with the power. Karakas et al. [14] describe that here milling operation done on Al-4%Cu-B₄C metal matrix composite material. In the experiment it defined that the tool performance on composite material. The tool is used as 3 types. These are uncoated tool & coated tool. In output response it defined that the flank wear rate as compared with the chip formation & tool wear rate.

Burr Formation

Luo et al. [20] concluded that in the research paper burr formation occur on Al alloy in slot milling operation. Burr formation depend open the parameter. The burr formation is significant by the chip quantity. It defined by exit angle of the tool. Niknam et al. [21] explained that the calculation of burr thickness in milling operation of ductile material. It calculated by the parameter (cutting speed, feed per tooth, machining thickness, tool material, work piece material). The burr formation calculated by the shear angle, friction angle & burr thickness.

Chatter Stability

Campatelli et al. [19] defined that Chatter prediction depends open the cutting force coefficients and frequency response, mostly it depends open the spindle speed the better cutting force coefficients is done by high speed milling machine. The material used for the machining tests is an Al-6082-T4 alloy. The chatter stability depends open the stability lobes diagrammed on milling machine is defined the chatter stability machine vibrations. Mainly the stability lobes diagrammed is two type radially and tangentially. The chatter production depend open the depth of cut. Scippa et al. [18] purposed that, cutting force depend open the cutting force model; it is mostly used to optimize parameters which are affected on the milling operations. The cutting force depends open the spindle speed and the cutting force model depend open the tangentially, radially, axially. Here the work piece used as Aluminium 6082



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with TiN coated tool and calculated 17 runs of cutting coefficients evaluated by least mean square approach. The cutting coefficients is influenced by the chip thickness & feed per tooth. It is concluded that cutting force coefficients and chip production depend open the spindle speed, feed rate, machining thickness, radially, tangentially, axially coefficients of cutting force of feed rate.

Tool – Work piece interface temperature

Jayakumar et al. [10] defined that milling experiment is done on Al/SiC_p metal matrix composite material. In this experiment 4 process parameters are considered as input. These factor are cutting speed (V_c), feed (f), depth of cut (d), vol% of SiC_p. These parameters are affected by the tool – work piece interface temperature. The interface temperature is measured by non contact type radiation pyrometer. Here it is analysed the input parameter vs. the interface temperature.

Micro structure studies of composite material and tool after machining

Reddy et al. [4] defined that the Al/SiC particulate metal matrix composite material is used in end milling process. Here the input parameter is cutting speed, feed rate, and depth of cut. It affected the output response these are surface roughness, micro structure, micro hardness, and micro hardness. Microstructure is studied by the Scanned electron microscopy (SEM) machine. It depend open the hardness, mixing composition of the metal matrix composite material. It is varied by the input parameter. Samy et al. [3] described about the milling machining operation on B₄C particulate Al aluminium composite material. The design of experiment done was L₂₇ Taguchi method. The cutting speed, feed rate & depth of cut are taken as input the microstructure of tool and work piece are varied. The micro structure is varied as compare with the spindle speed, feed rate & depth of cut.

CONCLUSION

The critical study of review on end milling operation on different alloys and MMCs concludes the impact of various process parameters on improvement of surface integrity, chip morphology, heat distribution and micro structural study. Most of cases the coated tool & uncoated tool is used in the milling machining operation. Still a lot of research gap arises considering in different field of application, i.e. based upon the revolution on material field due to its improved performance. The different types of milling operations can be used in most of the industrial area composite like in face milling, up milling etc. It can be also suggested for milling operation of new functional graded materials, polymer composites, hybrid metal matrix composites application in different field, which are having most significant demand in aerospace, nuclear, ship building etc.

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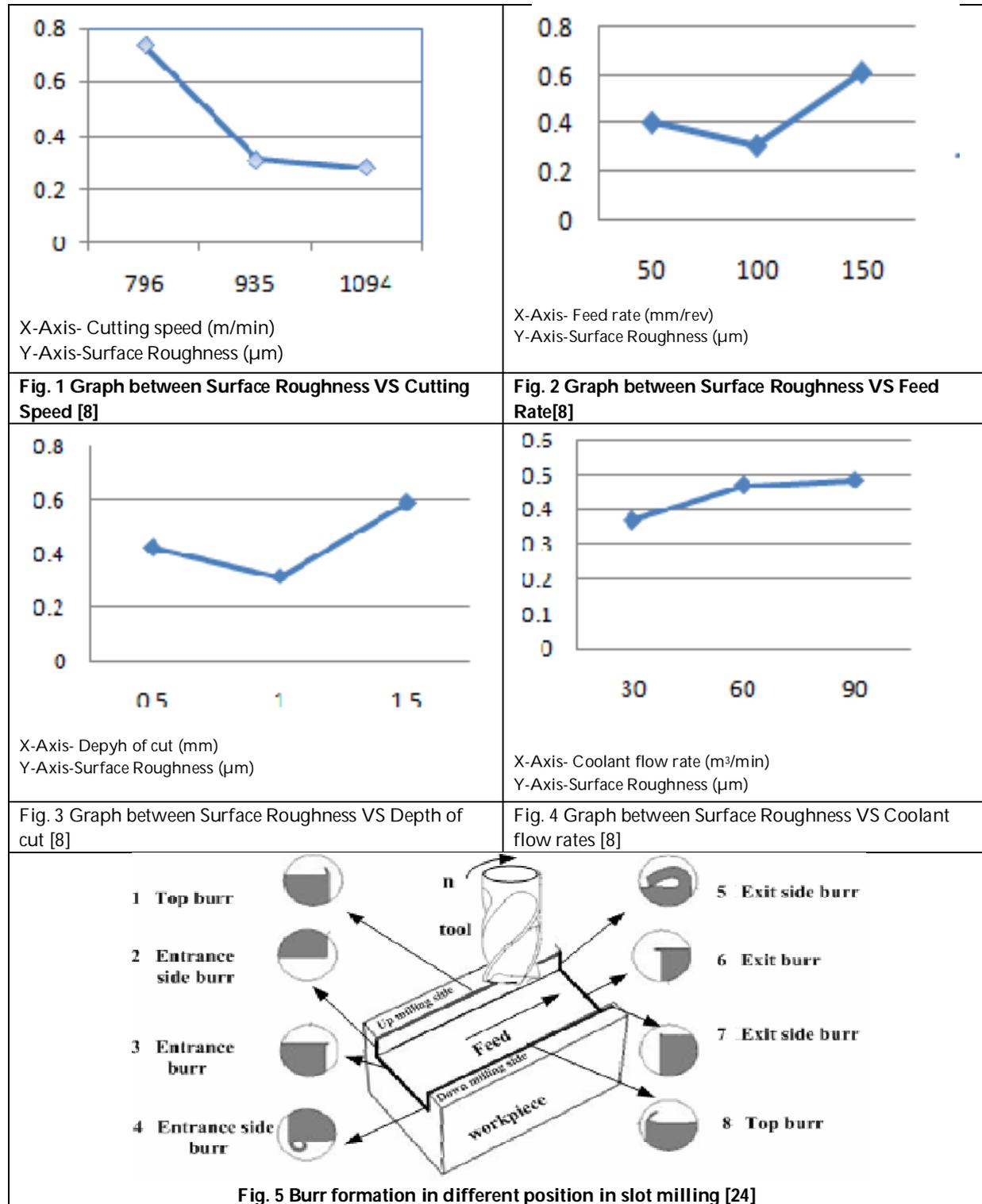
Table 1 End milling process [1]

Work piece Material	I/P Parameter	O/P Parameter
190 BHN Steel	Speed, feed rate & Cutting Thickness	Surface Roughness
Hardened Steel AISI H13	Speed, Feed Rate & Cutting Thickness	Surface Roughness & Cutting Force
Aluminium, Brass, Mild Steel	Speed, Feed Rate & Cutting Thickness	Surface Roughness Chip Morphology
Aluminium, Aluminium Alloy	Speed, Feed Rate & Cutting Thickness	Surface Roughness, Tool Flank Wear
Inconel 718 Nickel Based alloy	Speed, Feed Rate & Cutting Thickness	Surface Roughness, Power Consumption, Tool Wear
AISI 304	Speed, Feed rate & Cutting Thickness	Specific Energy , Tool Life & Surface Roughness
OHNS Steel	Speed, Feed rate & Cutting Thickness	MRR , Surface Roughness
EN 31 tool Steel	Speed, Feed Rate & Cutting Thickness	Surface Roughness & toolVibration
EN 31 Steel	Spindle Speed, Feed Rate & Cutting Thickness	Surface Roughness





Ramesh Chandra Mohapatra





Ramesh Chandra Mohapatra

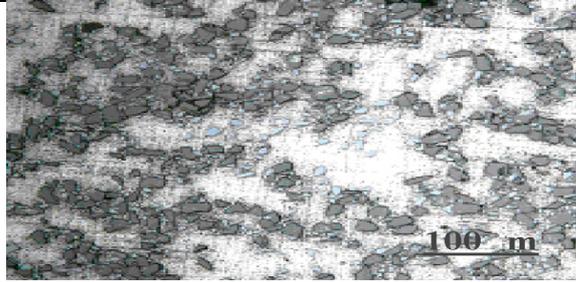


Fig. 6 Microstructure study of MMCs

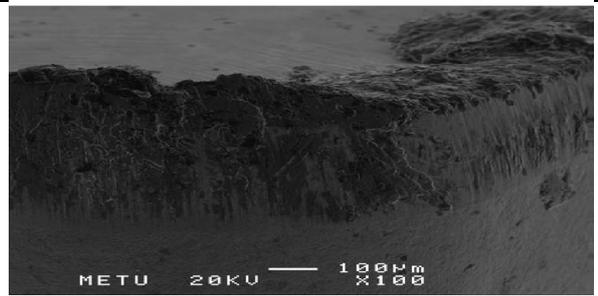


Fig. 7 SEM View of tool wears after machining [14]

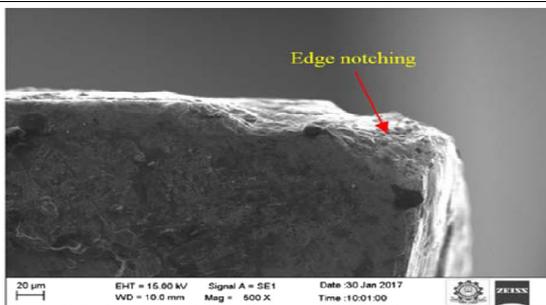


Fig. 8 Micro Structure of Tool wear rate at 3000rpm [3]

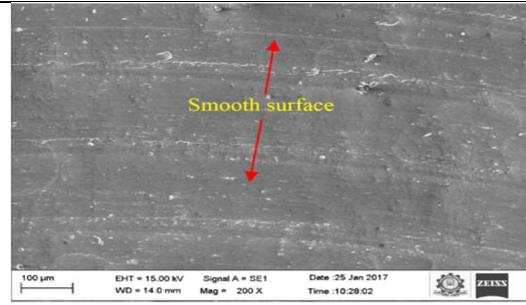


Fig. 9 Micro structure of surface morphology at 3000 rpm [3]





Precision Agriculture with IoT and Big Data Analysis

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ABSTRACT

As technology is growing quickly, the idea of utilizing knowledge in the agriculture sector has also been developed gradually. However, since recent years, a revolutionary idea of using sensor and Internet of Things had emerged. Internet of Things is basically the interconnections of physical devices over the network such as camera, home appliances, vehicles and traffic lights in which data are collected and send it to the cloud. These data can be remotely forced easily through handheld devices and controllers. The Internet of Things has been evolving in all application areas and so a lot of companies are focusing towards IoT enabled systems.

Keywords: Precision Agriculture, Big data, Microcontroller, Sensor.

INTRODUCTION

We are live in a world of digitization. Almost all very soon about us is touch by digitisation. The role the knowledge has to play in agriculture sector is attractive more and more observable day by day. Since year of its inception announcement has played an main part in agriculture, it was not just limited to in area of crop diagnostics but it has played pivotal role in the adaption of age old agricultural practices. One can also witness development in different methodologies and technologies being used in the agricultural organization. On the different, the agriculture sector in India is witnessing losing ground every day that has affected the production capacity of the ecosystem. There is an up-and-coming need to solve the problem in the said domain to restore vibrancy and put it back on higher growth. A large scale agricultural system requires a lot of maintenance, knowledge, and supervision. In the given paper we are aiming to automate the Maintenance, Control of Insecticides and pesticides, Water Management Irrigation and Crop Monitoring.



**Manoharan and Ashish Gupta****Literature survey**

The IoT technology has started coming across the agriculture sector and assisted the pace of the growth in agriculture into a large extent. This technology has gradually changed the way of farming which has been practiced and implemented in many developed Indian countries. Crops and plants are monitored with complicated devices with different parameters so as to ensure the growth of particular plants is stable and healthy. The system first checks the moisture of the soil. If the moisture is less than the threshold value then the irrigation system is checked. If the irrigation system is not working then the farmer and the service team is informed about the issue and necessary actions are taken to fix a system. If the irrigation system is working normally then the water level at the reservoir is checked. Is the water level is low then the farmer and servicing are informed about the situation and water in the tank is leveled. If the water level is sufficient then crops are irrigated.

Proposed Methodology

To the extent of our information, there has not been a application for an interactive cultivation sensing system via instant messaging applications. In this section, we give details in brief some of the IoT automation systems which we used as a reference while creating and executing our future system. This agriculture kit is mount with multiple sensors used to retrieves information which affects the growth of crops. These data include water level, soil moisture, temperature, humidity, pH level, and carbon dioxide level. Images of the crops are also obtained using a camera. Both data and images would then be analyzed to conclude the quantity of growth.

The farming kit is up to with a network function, and sensor data is collected by the server. Based on sensor data collected in various home gardens and other outdoor environment, machine learning can be performed as big data, collectively with image data. Thus it is possible to associate the development status of the crops with sensor information. The next applications can be expected to be developed by realizing the interactive agriculture sensing system.

Software arrangement

The software for controlling interactive devices consists of the following modules. Fig 2.

Sensor Module

The various sensors are activate base on the schedule set for each crop, and the essential data are formatted. By utilizing the time organization function installed by the operating system (OS), flash photography is performed at night. An infrared camera was used for crops that had a prohibition period of lighting. The program and the settings in the module are switched depending on the type of crops.

Communication Module

The data formatted by the sensor component is sent to the server. Besides that, based on the consequence of learning by the server, the approximate condition of the crops is transferred to the speech module.

Speech Module

Based on the estimation situation from the server a function to convey the situation to the farmer as a voice is realized.

External database

Sensor information and images from sensor modules would be collected and combined with cultivation advice from well established farmers to produce appropriate cultivation advice as output. This advice would be transmitted as reference for new farmers in case they face difficulties in crop cultivations depending on the situation of crops. In cooperation with many other interactive devices big data for cultivation support according to a variety of regions, climates and environment are constructed.





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CONCLUSION

We aspire to make a system which study the agricultural circumstances in India by utilizing different available sensors and technologies. As the worldwide population of the world continues to rise, the demand for additional crops is growing day by day. There is a need to eliminate the gap between production and consumption. This can be achieved by reducing waste and continuous monitoring of soil situation so that the plantations do not die due to lack of nutrition. Air pollution, which is often ignored is also one of the key factors which causes wastage of agricultural product.

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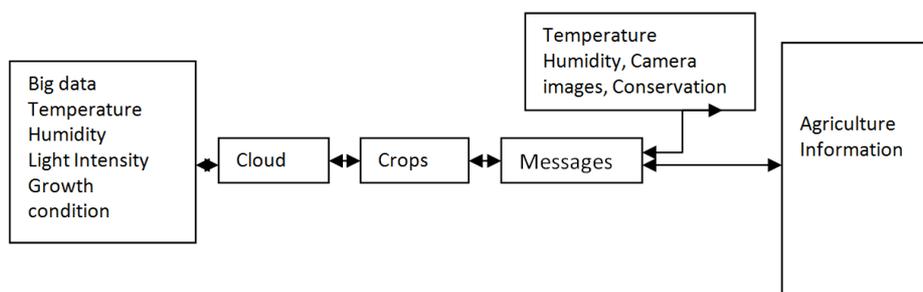


Fig 1. Interactive agriculture sensing system.

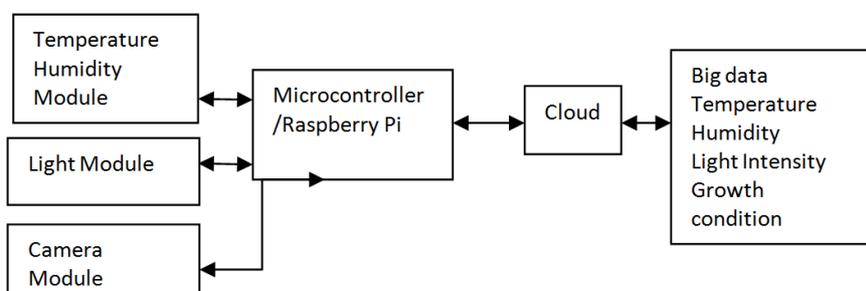


Fig 2. Software for controlling interactive devices





Coronavirus Infection and Immune System: Correlation between Procent of Lymphocytes and Infections

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ABSTRACT

The immune system corresponds to all the defense mechanisms implemented by the body to combat the attack of foreign elements such as viruses, the bacteria, parasites or cancer cells. When the immune system is solicited, we speak of immune response. There are two types of immune responses: the innate immune response and the acquired immune response. From March 18, to April 26, 2020, we analysed 61 patients with a diagnosis of cancer and symptomatic and asymptomatic COVID-19. 48 (80%) patients had a mild COVID-19 disease course without the need for hospitalization. 3 (4%) patients died. 40 (65%) patients were undergoing chemotherapy or radiation therapy before testing positive for COVID-19. We found no significant effect on mortality for patients with immunotherapy, chemotherapy, targeted therapy, radiotherapy and Covid-19 infection. Mortality from COVID-19 infection in cancer patients appears to be associated with comorbidities and lung damage given by infection. The study did not show that cancer patients undergoing treatment are at an increased risk of mortality from COVID-19 disease.

Keywords: Immune system, cancer, lymphocytes, SARS-CoV-2 viruses, comorbidities.





INTRODUCTION

The immune system corresponds to all the defense mechanisms implemented by the body to combat the attack of foreign elements such as viruses, the bacteria, parasites or cancer cells. When the immune system is solicited, we speak of immune response. There are two types of immune responses: the innate immune response and the acquired immune response. Innate immunity is a so-called "nonspecific" immune response, that is, it works without distinguishing the type of infection being fought. It is at stake immediately and is not specific to the pathogen. Acquired immunity, also called adaptive, is antigen-specific and intervenes later (1-2).

The role of the immune system in cancer

Immunosurveillance is a concept that the cells of the immune system are able to recognize and destroy malignant cells that cause cancer. The hypothesis of an association between the immune system and tumorigenesis is issued for the first time in 1909 by Paul Ehrlich (Ehrlich, 1909), who postulated that the cancers increased in the absence of immune system. The limitation of knowledge to this period did not allow this hypothesis to be explored and it will not be until 1957 that MacFarlane Burnet (3) associates the onset of virus-induced cancers with one immune response. Two years later, Thomas will suggest a Darwinian evolution of the immune system extending its anti-infective role to cell recognition neoplastics (4). The emergence of this theory then led several teams to conduct experiments to induce experimental immunosuppressions (such as thymectomy) to study its impact on the growth of spontaneous or induced tumors. These experiments led to mixed results (5,6). In 1966, athymic Nude mice were described (7), offering the possibility of an immunosuppression model and it was in 1974 that Osias Stutman used these animals to demonstrate that the incidence and mean time of onset of induced tumors by a chemical agent, 3-methylcholanthrene, are identical in wild mice and of Nude Mice (8). These experiments will help put the bushel under the theory of immunosurveillance for nearly twenty years. However, significant biases to this experience will be updated later, such as the presence of a system complete and functional innate immune system in these animals, presumably capable of activate in the face of the appearance of tumor cells (9). The return of the theory of immunosurveillance will be done in the 1980s, with the description tumor antigens or tumor-associated antigens, the therapeutic use of interleukin-2 (IL-2), a cytokine capable of activating and proliferating T lymphocytes and NK cells (10), the detection of T lymphocytes infiltrating tumors (then called "TILs" for Tumor-Infiltrating Lymphocytes) and ex vivo of these lymphocytes with interleukin-2 (IL-2) and tumor antigens for generate "LAK" killer cells, for "Lymphokine-Activated Killers") in largenumber before re-injection in cancer patients (11).

The role of the immune system in Sars Cov2 infection

Many questions regarding the progression of the Covid-19 since the emergence of the SARS-CoV-2 viruses remain unanswered. This is cellular immunity (for common coronaviruses, SARS and MERS, antibodies disappear after 2 to 3 years, cellular immunity persists for 11 years. (8) Indeed, the role of humoral immunity has not been demonstrated in this cross-immunity. An April 2020 publication (12) tests an isolated monoclonal antibody in a patient survivor of 2003 SARS-Cov-1 and attempts to show cross-neutralization of SARS-CoV-2 of 2019. This monoclonal antibody is directed against the binding domain of the protein spike present on the surface of the virus and characteristic of coronaviruses. But it is a pseudovirus (recombinant between MLV - murine leukemia virus and SARS); they study in vitro neutralization on Vero cells transfected with human ACE2 (hence a single "receptor" of the virus). So this study too far from what might happen in vivo cannot prove humoral immunity cross between SARS-CoV-1 and SARS-Cov-2. It is therefore necessary to turn to cellular immunity against this virus. Reminder on cellular immunity CD4 + and CD8 + cells are effectors of and cooperate with cellular immunity B lymphocytes responsible for antibody production and therefore humoral immunity. C cells are activated during an infection. These 2 cell types synthesize cytokines having different roles. Rather, CD8 + are "killer" lymphocytes capable of destroying cells infected with cytotoxicity and produce necrotizing cytokines, CD4 + instead produce interferons and interleukins which are effector cytokines of Th1 responses (oriented towards cellular immunity) and Th2 (antibody-oriented). These cells are responsible for both beneficial (pathogen removal) and deleterious effects (Immunopathologie). The role of cross-



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immunity with other coronaviruses (common cold viruses) has been raised in 2004 following the 2003 SARS-CoV-1 epidemic (13). In April 2020, in Berlin Braun et al., looked for cellular reactivity to SARS-CoV-2 in patients who developed moderate or severe Covid-19. Only the epitopes (antigenic determinants) of the Spike protein were tested. Only CD4+ cells were tested (not CD8+). 83% of patients had CD4+ reactive epitopes of the protein spike. Reactivity crossed with common cold coronaviruses concerns spike epitopes different from the receptor binding domain. All healthy donors (not infected with Covid-19) had antibodies against HCoV (common human coronavirus) (14). In April 2020 Grifoni study the cellular response of young adults exposed to SARS-CoV-2 and having developed a benign or moderate infection. The answer of the CD4+ and CD8+ cells are found in 100% and 70% of convalescents, respectively. This reactivity is directed against all epitopes tested (which concern structural and non-structural proteins) and it is proportional to the assumed abundance of each protein in the cells infected. So reactivity is not only directed against the Spike protein and its domain of binding to suspected virus receptors in target cells. The reactivity of CD8+ is not dominated by the protein spike. In most moderate Covid convalescents, the answer immune was mostly Th1 type with very little or no Th2 response (the Th2 response is susceptible; such as ADE (antibody dependent enhancement), to give phenomena immuno pathologies (14).

MATERIAL AND METHODS

All 61 patients who were consecutively tested for SARS-CoV-2 infection between 22 February and 1 December 2020 from Oncofort Hospital Bucharest. Patients were undergoing chemotherapy or radiation therapy. In all cases, the viral infection was sought and confirmed using real-time PCR with reverse transcription and next-generation sequencing. Patients with radiological or clinical diagnosis of COVID-19, without a positive RT-PCR test were not included in this analysis. Patients with active cancer were defined as those with metastatic cancer, or on anticancer treatment in any setting (curative, radical, adjuvant, or neoadjuvant chemotherapy or treated within radiotherapy). Stages of tumour were divided into those into primary tumour localised, which were localised to organ and therefore potentially resectable; primary tumour locally advanced, which had spread locally from the primary organ and was not resectable; metastatic, when there has been distant spread (stage IV).

RESULTS

Our study included 61 patients with active cancer who had documented SARS-CoV-2 infection presenting as symptomatic and asymptomatic COVID-19 disease. Median age of the patients was 59 years, comorbidities were common, including hypertension, diabetes, cardiovascular disease, and obesity (table 1). 18 (29.5%) patients were listed as having no comorbidities, that had only cancer diagnosis. Approximately than half of the patients had metastatic cancer. The commonest primary tumour sites (Table 2) was breast cancer, cervical cancer, pulmonary cancer and colorectal cancer. In terms of the pattern of COVID-19 presentation, most patients presented with fever, cough, or shortness of breath. However, diarrhoea, nausea and vomiting but only in one patient, ageusia, and anosmia were also identified as presenting symptoms. A mild COVID-19 severity category was recorded in 90% of patients, with patients not requiring hospital admission. 10% patients required oxygen, and only 4 patients received intensive therapy unit. Of these 61 patients, 3 died. Compared with the rest of the cancer cohort, patients who died had 45, 61 and 69 years. The median value of lymphocytes was 1,02 / mm³. Lymphopenia is defined as a circulating lymphocyte count of less than 1500 / mm³ in adults. The statistical correlation between age and lymphocyte value was -0.205883158, a weak and reverse correlation, resulting in the value of lymphocytes decreases with increasing age. In general, the lowering of the immunoreactive threshold in the neoplastic patient affects the numerical balance of lymphoid cells in the peripheral circulation, appearing deviations from the normal percentage values of different cell sets and subsets, especially of T lymphocytes. Therefore, the determination of lymphocytes is useful in evaluating patients with immune status affected by cancer, the values of the parameters obtained can be correlated, either with the immunodepressive status given by the tumor, its stage of expansion and the consistency of the body's immunoreactive means.



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DISCUSSIONS

The immune system is made up of a set of cellular and molecular effectors capable of recognizing and eliminating both foreign pathogens and altered self cells. Cellular immunity (for common coronaviruses, SARS and MERS, antibodies disappear after 2 to 3 years, cellular immunity persists for 11 years (8)). Indeed, the role of humoral immunity has not been demonstrated in this cross-immunity. An April 2020 publication tests an isolated monoclonal antibody in a patient survivor of 2003 SARS-Cov-1 and attempts to show cross-neutralization of SARS-CoV-2 of 2019. This monoclonal antibody is directed against the binding domain of the protein spike present on the surface of the virus and characteristic of coronaviruses (14).

In this study, we focused on admission laboratory values of lymphocytes for cancer patients undergoing treatment. Lymphopenia is defined as a circulating lymphocyte count of less than 150 in adults. Lymphopenia can be global or selective, affecting a particular lymphocyte population. The etiologic diagnosis should take into account age, context, associated clinical/biological manifestations, and received therapeutics. Adult lymphopenias may be schematically related to: (1) production deficiency (zinc deficiency, corticosteroid therapy, primitive immune deficits...), (2) excess catabolism (radiation therapy, chemotherapy, immunosuppressive treatments, HIV or systemic lupus, etc.), (3) a change in lymphocyte distribution (viral infections, septic shock, extensive burns, hypersplenism, granulomatosis, etc.), (4) multifactorial or unidentified etiologies (chronic renal failure, certain lymphoid hematological diseases, solid tumor, ethnic causes, etc.)

Although persistent lymphocytopenia is associated with poor outcomes after diagnosis with sepsis in this study was not seen to be associated with mortality or with severity of the disease. In general, the lowering of the immunoreactive threshold in the neoplastic patient affects the numerical balance of lymphoid cells in the peripheral circulation, appearing deviations from the normal percentage values. Immune status is affected by cancer, the values of the parameters obtained can be correlated, either with the immunodepressive status given by the tumor, its stage of expansion and the consistency of the body's immunoreactive means, or with the immunological status resulting from the application of immunosuppressive treatments (chemo-, radio- or immunotherapy) (15-16). Worldwide, emphasis has been placed on vaccinating the population and especially patients diagnosed with cancer. Previous studies indicated that lower mortality and morbidity rates from influenza observed in cancer patients receiving influenza vaccination [17-19], suggesting an efficient immune response. In cancer patients undergoing treatment seroconversion and seroprotection rates are expected to be lower than in the general population but not in patients receiving immunotherapy [20-27].

CONCLUSIONS

Mortality from COVID-19 infection in cancer patients appears to be associated with comorbidities and lung damage given by infection. The study did not show that cancer patients undergoing treatment are at an increased risk of mortality from COVID-19 disease.

CONFLICTS OF INTEREST

The Authors declare that they have no competing interests in relation to this study.

AUTHORS' CONTRIBUTIONS

BH was responsible writing of the manuscript. AZ and BH were responsible for reviewing and editing of the manuscript. AZ, BH, XB, LI, PCG and DCB made substantial contributions to the conception or design of the work. RA were responsible for the critically reviewed the manuscript. All Authors read and approved the final manuscript.

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Tabel 1 Comoridity of patients with cancer and COVID-19 disease

Comorbidity
Varicose veins lower right limb
Fibrillation, Hypertension, Grade IV Obesity
Hypertension gr. II, Type II Diabetes, Carotid Syndrome, Cerebral Infarction Sequelae, Dyslipidemia
NYHA IV Congestive Heart Failure
Hereditary Thrombophilia
Probably Crumbous Thrombosis in the right common iliac vein
NA
NA
Exophthalmos, Hypopituitarism, Sinus Bradycardia, BAV gr I
Ureter reimplantation in the bladder + installation of bilateral JJ probe after HTAB
NA
NYHA class II-III ICC, Nonobstructive Hypertrophic Cardiomyopathy with preserved LVEF, mild mitral regurgitation, mild aortic regurgitation, Ascending aortic and aortic club ectasia
Acute myocardial infarction (2019), Hyperthyroidism
Acute renal failure
Operated right pleurisy (14.03.2019) - right thoracoscopy: evacuation 1200 ml serohematic pleural fluid, parietal pleural biopsies, chemical pleurisy with talc; Recurrence of right pleurisy - ultrasound-guided evacuation





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puncture 400 ml sero-citrine (30.05.2019)
DZ type II insulin requirement
Hypertension grad II
NA
Hypertension grad II
Hypertension grad I
NA
Hypertension gr I
NA
NA
Secondary Epilepsy
Diastolic dysfunction LS type altered relaxation, superimposable pulmonary hypertension,
NA
Type II diabetes, high blood pressure, chronic hepatitis B.
HVS, artritarematoidea
Arterial hypertension std III, Diabetes, Arterial fibrillation, Obesity
Hypertension
Hypertension
Hypertension
Symptomatic epilepsy, Obesity
Hypertension, Cronic renal failure
NA
Hypertension
Arterial hypertension, Diabetes
Cerebral microangiopathy, Relapsed skin erysipelas
NA
Obesity gr I
HIV std A3 infection in treatment, Hypertension std II, Bilateral MI polyneuropathy, Sequelae stroke, Obesity gr II
Hypertension
Arterial hypertension, Diabetes, Parkinson disease
Arterial hypertension, Diabetes
NA
NA
Arterial fibrillation
NA
Acute renal failure
Hypertension
NA
NA
Hypertension
Hypertension
Hypertension





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Table 2 Relationship between type of cancer, type of treatment and stage

Type of cancer	Type of treatment	Stage
Glioblastoma	RT-CHT	NA
Breast cancer	CHT	cT4 cN3 M1LYM, M1HEP
Brain cancer	CHT-RT	NA
Breast cancer	CHT-IO	cT4 cN2 M0 IIIB, ypT2 ypN1, M1LYM, M1PLE, M1OSS
Breast cancer	CHT-HT	cT1 Cn2 M0 IIIA, ypT1mi ypN0/ ypT0 (IHC)
Breast cancer	CHT	cT3 cN1 M1 OSS, M1PUL, M1MAR
Breast cancer	NA	cT1b cN1
Prostate cancer	HT-IO	cT2 cN1 M1OSS, M1HEP in
Meningioma	RT	NA
Cervical cancer	RT-CHT	cT2a2 cN0 M0, stg IIA
Cervical cancer	RT-CHT	cT3 cN1 M0, stg IIIB
Prostate cancer	RT	scor Gleason 7 (4+3),
Cervical	RT	cT3a cN0 M0, stg IIIA
Melanoma	CHT+ RT M1OSS	IV- M1OSS, M1HEP, M1PUL, M1PER, M1ADR, M1LYM, M1OTH
Breast cancer	RT, CHT+HT	cT2 cN1 M0, stg IIB->progresie M1LYM, M1PLE
Prostate cancer	RT, HT, IO	M1OSS, M1LYM, stg IV
Colorectal cancer	RT, IO, CHT	pT3 pN2b M1PER, V1L0N0
Cervical cancer	RT-CHT	cT2b cN0, stg IIB
Pancreas cancer	RT-CHT	cT4 N2 M1HEP, M1PER
Breast cancer	RT	cT1c(m) cN2a Mx- ypT0 ypN0
Prostate cancer	HT-IO	cT4 cN0 M1OSS
Breast cancer	CHT-IO	cT4b cN1 c M1OSS, M1LYM, M1 SKY, M1PUL?
Breast cancer	CHT- target therapy	c T4d N2b M1HEP M1OSS M1LYM
Breast cancer	Target therapy	pT1c pN0 M0
Breast cancer	PCT	cT4 cN1 M1 PUL, M1OSS, M1 BRA
Melanoma	Target therapy	M1LYM
Breast cancer	PCT-Target therapy	cT2, cN1 M1OSS, M1HEP, M1PLE, M1PER, M1OTH
Colorectal cancer	CHT	M1LYM
Pulmonary cancer	CHT	pT2a Nx M1
Colorectal cancer	CHT	pT3N2aMx, M1 HEP, M1PUL
Colorectal cancer	CHT-IO	ypT3 N2b, M1LYM, M1HEP
Colorectal cancer	RT-CHT	cT3 cN2 cM0
Cervical cancer	RT	c T3a cN1 M0 (std IIIA)
Brain cancer	RT	NA
Colorectal cancer	RT-CHT	cT3 cN1
Breast cancer	NA	c T2 cNx Mx
Cervical cancer	CHT	pT3a pNx pM1
Breast cancer	cht	cT4b N1 M1HEP, M1OSS
Breast cancer	HT-CHT-IO	cT2 cN1 M1
Breast cancer	CHT	NA
Renal cancer	immunotherapy	pT3a Nx M1
Colorectal cancer	CHT	pT3 pN0




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Breast cancer	HT	c T2 CN2 , pT1c pN0 pMx
Breast cancer	CHT-HT	ypT2 ypN2 M1HEP
Melanoma	CHT	pT4b pNx M0
Breast cancer	HT-IO	STADIUL IV T4 N1 M1OSS M1 LYM
Breast cancer	CHT	pT2 pNx M1PUL
Breast cancer	RT	yp T2 YpN1a
Coorectal cancer	CHT	M1HEP, M1LYM
1. Breast cancer 2. Urothelial cancer	RT	cT4N1M0- rT2N0Mx
Breast cancer	RT+ CHT+ IO	cT2N0
Prostate cancer	RT; HT	cT4N1
Ecrin carcinoma	RT-CHT	NA
Colorectal cancer	RT-CHT	pT3(m) pN2b (9/9 ggl), G3
Prostate cancer	RT, HT, IO	cT3N1M1- M1OSS, M1LYM, suspiciune M1HEP
Bazocelular carcinoma	RT	pT2 pNx R1
Penil cancer	RT-CHT	pT3, R0
Pulmonary cancer	CHT	IV
Pulmonary cancer	RT	IV
Breast cancer	RT	II B





Bicycle Frame Analysis of Different Materials – Regression Analysis

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ABSTRACT

Bicycle frame analysis has been considered for the present study with practical loads acting on the three main junctions of the frame. Analysis has been carried out for different materials which are existing in the present scenario. The variable Parameters in this study are the materials used i.e., Structural Steel, Stainless Steel, Grey Cast Iron, Copper Alloy, Titanium Alloy, Aluminum Alloy. The Output parameters are Displacement, Direct Stress, Combined Stress, Shear Force and Bending Moment. Analysis is carried out using Finite Element Analysis Software ANSYS Workbench Module. After getting results, the Design of Bicycle frame is done by considering Strength and also Economy point of View. Then the regression Analysis taken into consideration for the best suitable Equation for all the materials involved in the study and also involving the Correlation coefficient for the Output parameters.

Keywords: Bicycle Frame, materials, finite element analysis, Direct stress, Displacement, Strength.

INTRODUCTION

An edge is significant key segment of a bike structure, on this segment every single other frill like haggie bar are mounted. The primary capacity of the casing is to move the delivered mechanical vitality by the rider to the back wheel. In bike various kinds of burdens will be following up on the edge, to realize that heaps and qualities we need to do some specific tasks or analyses on Analysis workbench. Essentially, outline is comprised of carbon and other material. When an idea was chosen and sketch explicit structures that would use the idea settled on already. While the precious stone structure is the center of most bikes assembled today, some casing developers are exploring different avenues regarding new minor departure from this exemplary plan. For instance, some carbon-fiber outlines are being made with oval tubing, making the bike increasingly streamlined. New full-suspension bicycles have adjusted the precious stone plan to take into consideration a huge stun to be mounted on the seat stem.



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Bike outlines must be worked to deal with an assortment of burdens. To begin with, the casing needs to help itself and different segments of the bike. These are viewed as static burdens. Furthermore, the casing should have the option to deal with the cyclist's weight, the powers of accelerating and slowing down, and the impacts of the street's surface. These are dynamic burdens; they are the most dangerous for a casing manufacturer since, as the name suggests, they move and shift in force. A precious stone casing was chosen to be planned as it was the most essential casing to be broke down. This ANSYS programming is utilized to perform different kinds of Structural, warm, Fluid and Electromagnetic investigation and It likewise incorporates CAD availability, computerized fitting, and an undertaking level update instrument.

Creative Mechanism Design Methodology

The methodology used in this paper consists of modeling the bicycle-frame in ANSYS workbench software only and analyze the frame using ANSYS Software. we have to draw a sketch in 3D in Geometry part after giving all accurate values we can go for modeling to get that sketch to be meshed as a finite element method.

Modelling and Analysis

Analysis Workbench Platform has been considered for the Analysis of 3Dimensional Bicycle Frame. For this 8 Nodes and 12 Edges has been selected for the Modelling. Modelled Bicycle Frame is represented in the Figure 2. Meshing has been done with coarse as an criterion and has become the statistics of Nodes: 1650 and Elements: 827. Finite Element Model has been presented in the Figure 3. The Bicycle frame analysis has been carried out with Forces(loads) on Joint of Peddle, front Joint, Back Joint. The applied loads has values of 540 N, 120 N, 80 N respectively and is representing in Figure 4.

Design Requirements**Properties of Materials Used for Modelling**

Generalization and Number Synthesis: After Assigning the loads and support conditions, then Bicycle Frame analysis can be done and the Output Parameters for the consideration into regression analysis as Deformation, Direct stress, Combined Bending Stress, Shear Force, Bending Moment. The above parameters will be compared in Bicycle Frame for all the Materials considered. Then the regression analysis with Correlation Coefficient and degree of Equation for the Parametric rise or fall will be determined.

Deformations

The Deformation is one of the output parameter in the analysis of Bicycle Frame. Figure 5 to 8 represents the Deformation Figures for Different Materials.

Direct Stresses

The Stresses is one of the output parameter in the analysis of Bicycle Frame. Figure 9 to 12 represents the Stresses Figures for Different Materials.

Combined Stresses

The combined Stresses is one of the output parameter in the analysis of Bicycle Frame. Figure 13 to 16 represents the combined Stresses Figures for Different Materials.

Shear Force

The combined Stresses is one of the output parameter in the analysis of Bicycle Frame. Figure 17 to 20 represents the combined Stresses Figures for Different Materials.

Bending Moment

The combined Stresses is one of the output parameter in the analysis of Bicycle Frame. Figure 21 to 24 represents the combined Stresses Figures for Different Materials.





Regression Analysis

The utilization of linear regression model is significant for the accompanying reasons:

- Distinct – It helps in investigating the quality of the relationship between the result (subordinate variable) and indicator factors
- Modification – It changes for the impact of covariates or the confounders.
- Indicators – It helps in assessing the significant hazard factors that influence the reliant variable
- Degree of forecast – It helps in examining the degree of progress in the free factor by one "unit" would influence the reliant variable
- Expectation – It helps in measuring the new cases.

Suppositions for Linear Regression

The basic suppositions for straight relapse are:

- The estimations of autonomous variable "x" are set by the analyst
- The free factor "x" ought to be estimated with no test blunder
- For each estimation of "x," there is a subpopulation of "y" factors that are ordinarily conveyed all over the Y-hub
- The fluctuations of the subpopulations of "y" are homogeneous
- The mean estimations of the subpopulations of "y" lie on a straight line, along these lines suggesting the supposition that there exists a direct connection between the ward and the autonomous factors
- All the estimations of "y" are free from one another, however subject to "x."

Coefficient of Determination, R^2

The coefficient of assurance is the bit of the absolute variety in the reliant variable that can be clarified by variety in the free variable(s). When R^2 is + 1, there exists an ideal direct connection among x and y, i.e., 100% of the variety in y is clarified by variety in x. At the point when it is $0 < R^2$.

Regression Analysis of Deformation Plot

Figure 25 represents the Deformation plot for Different Materials in Bicycle Frame. Regression analysis has been considered for finding out the Approximate Equation of the Stream Line. Hence to suit the equation for the deformation plot, various trials like Exponential, Linear, Logarithmic, Polynomial, Power has been done

Linear Trend line $y = 0.013x + 0.6734$; $R^2 = 0.0076$

Logarithmic Trend line $y = 0.0751 \ln(x) + 0.6365$; $R^2 = 0.0319$

Exponential Trend line $y = 0.5774 e^{0.0436x}$; $R^2 = 0.0402$

Power Trend line $y = 0.5546 e^{0.1759x}$; $R^2 = 0.0822$

Polynomial Trend line with degree 2, $y = -0.0161x^2 + 0.1258x + 0.523$; $R^2 = 0.0326$

Polynomial Trend line with degree 3, $y = 0.0467x^3 - 0.5065x^2 + 1.6064x - 0.654$; $R^2 = 0.3967$.

Polynomial Trend line with degree 4, $y = -0.0525x^4 + 0.7821x^3 - 4.0108x^2 + 8.1196x - 4.4359$; $R^2 = 0.9815$.

Out of the Above Equations, it is clear that Polynomial Trend line with degree 4 suits for the deformation plot since the regression coefficient value close to the 1 ($R^2 = 0.9815$).

Regression Analysis of Direct Stresses Plot

Figure 26 represents the Direct Stress plot for Different Materials in Bicycle Frame. Regression analysis has been considered for finding out the Approximate Equation of the Stream Line. Hence to suit the equation for the Direct Stress plot, various trials like Exponential, Linear, Logarithmic, Polynomial, Power has been done

Linear Trend line $y = -7E - 06x + 0.2151$; $R^2 = 0.4139$

Logarithmic Trend line $y = -2E - 05 \ln(x) + 0.2151$; $R^2 = 0.331$

Exponential Trend line $y = 0.2151 e^{-3E-05x}$; $R^2 = 0.4139$

Power Trend line $y = 0.2151 e^{-9E-05x}$; $R^2 = 0.3331$

Polynomial Trend line with degree 2, $y = 1E - 06x^2 + 3E - 06x + 0.2151$; $R^2 = 0.4465$

Polynomial Trend line with degree 3, $y = 1E - 06x^3 - 2E - 05x^2 + 4E - 05x - 0.2151$; $R^2 = 0.4932$.





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Polynomial Trend line with degree 4, $y = 4E - 06x^4 - 5E - 05 x^3 + 0.0002x^2 - 0.0004x + 0.2154$; $R^2 = 0.9874$.
Out of the Above Equations, it is clear that Polynomial Trend line with degree 4 suits for the Direct Stress plot since the regression coefficient value close to the 1 ($R^2 = 0.9874$).

Regression Analysis of Combined Stresses Plot

Figure 27 represents the Combined Stress plot for Different Materials in Bicycle Frame. Regression analysis has been considered for finding out the Approximate Equation of the Stream Line. Hence to suit the equation for the Combined Stress plot, various trials like Exponential, Linear, Logarithmic, Polynomial, Power has been done

Linear Trend line $y = 0.0003 x + 14.06$; $R^2 = 0.4084$

Logarithmic Trend line $y = 0.0007 \ln(x) + 14.06$; $R^2 = 0.4153$

Exponential Trend line $y = 14.06 e^{2E-05x}$; $R^2 = 0.4084$

Power Trend line $y = 14.06 e^{5E-05x}$; $R^2 = 0.4153$

Polynomial Trend line with degree 2, $y = -4E - 05 x^2 + 0.0005 x + 14.06$; $R^2 = 0.4252$

Polynomial Trend line with degree 3, $y = -6E - 05 x^3 + 0.0005x^2 - 0.0013 x + 14.061$; $R^2 = 0.4959$.

Polynomial Trend line with degree 4, $y = -0.00014x^4 + 0.0017 - 0.0078x^2 + 0.0142x + 14.052$; $R^2 = 0.9443$.

Out of the Above Equations, it is clear that Polynomial Trend line with degree 4 suits for the Combined Stresses plot since the regression coefficient value close to the 1 ($R^2 = 0.9443$).

Regression Analysis of Bending Moment Plot

Figure 28 represents the Bending Moment plot for Different Materials in Bicycle Frame. Regression analysis has been considered for finding out the Approximate Equation of the Stream Line. Hence to suit the equation for the Bending Moment plot, various trials like Exponential, Linear, Logarithmic, Polynomial, Power has been done

Linear Trend line $y = -59.286 x + 79904$; $R^2 = 0.1063$

Logarithmic Trend line $y = -160.1 \ln(x) + 79872$; $R^2 = 0.0973$

Exponential Trend line $y = 79905 e^{-7E-04x}$; $R^2 = 0.1069$

Power Trend line $y = 79872 e^{-0.002x}$; $R^2 = 0.0976$

Polynomial Trend line with degree 2, $y = -33.946 x^2 + 178.34 x + 79588$; $R^2 = 0.1807$

Polynomial Trend line with degree 3, $y = -85.324 x^3 + 861.96 x^2 - 2526.4 x + 81738$; $R^2 = 0.9963$.

Polynomial Trend line with degree 4, $y = -4.1875x^4 - 26.699x^3 + 582.59x^2 - 2007.2x + 81436$; $R^2 = 0.9988$.

Out of the Above Equations, it is clear that Polynomial Trend line with degree 4 suits for the Bending Moment plot since the regression coefficient value close to the 1 ($R^2 = 0.9988$).

Regression Analysis of Shear Force Plot

Regression analysis has been considered for finding out the Approximate Equation of the Stream Line. Hence to suit the equation for the Shear Force plot, various trials like Exponential, Linear, Logarithmic, Polynomial, Power has been done

Linear Trend line $y = -0.0257 x + 235.65$; $R^2 = 0.2813$

Logarithmic Trend line $y = -0.058 \ln(x) + 235.63$; $R^2 = 0.1791$

Exponential Trend line $y = 235.65 e^{-1E-04x}$; $R^2 = 0.2814$

Power Trend line $y = 235.63 e^{2E-04x}$; $R^2 = 0.1792$

Polynomial Trend line with degree 2, $y = -0.0121 x^2 + 0.0593 x + 235.54$; $R^2 = 0.4151$

Polynomial Trend line with degree 3, $y = 0.0056 x^3 - 0.0705x^2 + 0.2354 x + 235.4$; $R^2 = 0.4638$.

Polynomial Trend line with degree 4, $y = 0.0158x^4 - 0.2161x^3 + 0.9858x^2 - 1.7279x + 236.54$; $R^2 = 0.9653$.

Out of the Above Equations, it is clear that Polynomial Trend line with degree 4 suits for the Shear Force plot since the regression coefficient value close to the 1 ($R^2 = 0.9653$).





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CONCLUSIONS

1. After the analysis under the Load and Different Materials in a Bicycle Frame, study can be concluded that among all the Materials, Structural Steel is the best as per the Strength and deformation point of view.
2. The order of priority for usage in Bicycle Frame is Structural Steel > Stainless Steel > Grey Cast Iron > Copper Alloy > Titanium Alloy > Aluminum Alloy.
3. As per the Economy point of also Structural Steel is the best option. The order of Priority will be Same.
4. Regression Analysis of Deformation Plot: Polynomial Trendline with degree 4 over Correlation Coefficient 0.9815.
5. Regression Analysis of Direct Stress Plot: Polynomial Trendline with degree 4 over Correlation Coefficient 0.9874.
6. Regression Analysis of Combined Stress Plot: Polynomial Trendline with degree 4 over Correlation Coefficient 0.9443.
7. Regression Analysis of Shear Force Plot: Polynomial Trendline with degree 4 over Correlation Coefficient 0.9653.
8. Regression Analysis of Bending Moment Plot: Polynomial Trendline with degree 4 over Correlation Coefficient 0.9988.

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Table 1: Properties of Materials Used for Modelling:

Structural Steel: Young's Modulus : 2 E+11 Pa Poission's Ratio :0.3 Density :7850kg/m ³ Tensile / Compressive Strength: 2.5 E+08 Pa Tensile Ultimate Strength: 4.6 E+08 Pa	Stainless Steel: Young's Modulus : 1.93 E+11 Pa Poission's Ratio :0.31 Density :7750kg/m ³ Tensile / Compressive Strength: 2.07 E+08 Pa Tensile Ultimate Strength: 5.86 E+08 Pa
Titanium Alloy: Young's Modulus : 9.6 E+10 Pa Poission's Ratio :0.36 Density :4620kg/m ³ Tensile / Compressive Strength: 9.3 E+08 Pa Tensile Ultimate Strength: 1.07 E+09 Pa	Gray Cast Iron: Young's Modulus : 1.1 E+11 Pa Poission's Ratio :0.28 Density :7200kg/m ³ Tensile / Compressive Strength: 0 Pa Tensile Ultimate Strength: 2.4 E+08 Pa
Copper Alloy: Young's Modulus : 1.1 E+11 Pa Poission's Ratio :0.34 Density :8300kg/m ³ Tensile / Compressive Strength: 2.8 E+08 Pa Tensile Ultimate Strength: 4.3 E+08 Pa	Aluminium Alloy: Young's Modulus : 7.1 E+10 Pa Poission's Ratio :0.34 Density :2770kg/m ³ Tensile / Compressive Strength: 2.8 E+08 Pa Tensile Ultimate Strength: 3.1 E+08 Pa

Table 2: Deformations in various Materials of Bicycle Frame

Sl. no	Nodes	Deformation(mm) in different materials					
		Structural steel	Aluminium alloy	Grey cast iron	Stainless steel	Titanium alloy	Copper alloy
01.	1	0.36266	1.0259	0.66249	0.37792	0.76019	0.66285
02.	2	0.16394	0.46291	0.29379	0.16446	0.33449	0.28962
03.	3	0.3713	1.0487	0.67564	0.38554	0.77643	0.67827
04.	4	0.17174	0.48438	0.31201	0.17766	0.35972	0.3127
05.	5	0.40784	1.1497	0.74075	0.42268	0.84969	0.74208
06.	6	0.40774	1.1419	0.73943	0.4185	0.84869	0.74223
07.	7	2.8655e-005	4.29e-004	1.53e-004	2.4596e-004	1.659e-004	1.433e-004
08.	8	2.8211e-004	4.84e-004	1.39e-003	2.4058e-004	1.055e-004	1.525e-004

Table 3: Direct Stresses in various Materials of Bicycle Frame

Sl.no	Members	Maximum Direct Stresses(MPa) in different materials					
		Structural steel	Aluminium alloy	Grey cast iron	Stainless steel	Titanium alloy	Copper alloy
01.		0.21512	0.2151	0.21513	0.21511	0.21507	0.21509

Table 4: Combined Stresses in various Materials of Bicycle Frame

Sl.no	Members	Combined Stresses(MPa) in different materials					
		Structural steel	Aluminium alloy	Grey cast iron	Stainless steel	Titanium alloy	Copper alloy
01.		14.06	14.061	14.06	14.061	14.062	14.061





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Table 5: Shear Force in various Materials of Bicycle Frame

Sl.no	Members	Shear Force(N) in different materials					
		Structural steel	Aluminium alloy	Grey cast iron	Stainless steel	Titanium alloy	Copper alloy
01.		235.6	235.54	235.7	235.6	235.44	235.5

Table 6: Bending Moment in various Materials of Bicycle Frame

Sl.no	Members	Bending Moment(N-m) in different materials					
		Structural steel	Aluminium alloy	Grey cast iron	Stainless steel	Titanium alloy	Copper alloy
01.		79979	79480	79581	79965	80002	79174

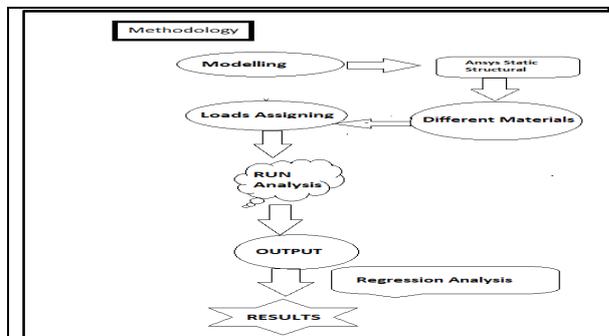


Figure 1. Methodology of the Study

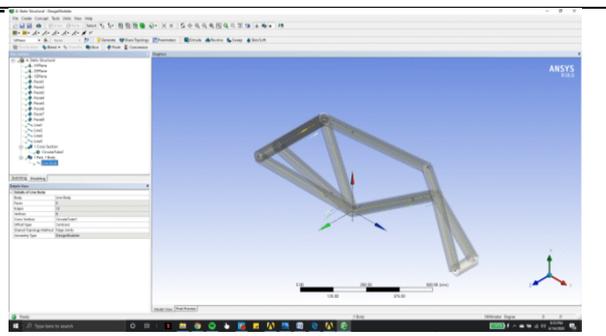


Figure 2. Modeling of Bicycle frame

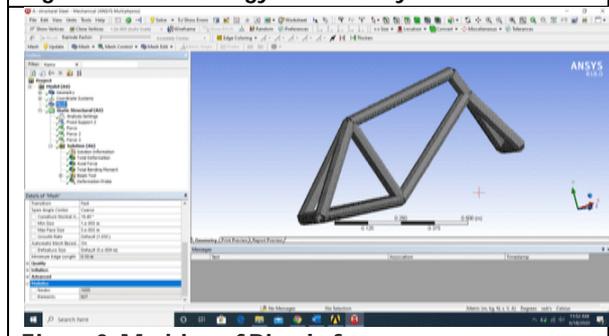


Figure 3. Meshing of Bicycle frame

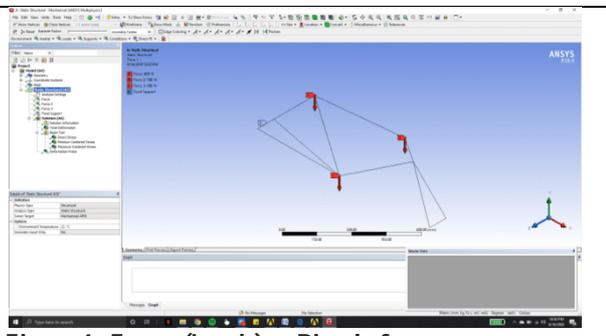


Figure 4. Forces (Loads) on Bicycle frame

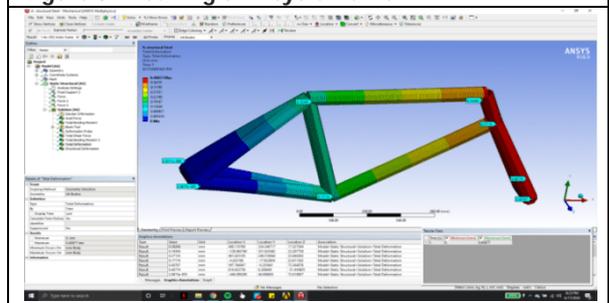


Figure 5. Deformation of Bicycle under Structural steel

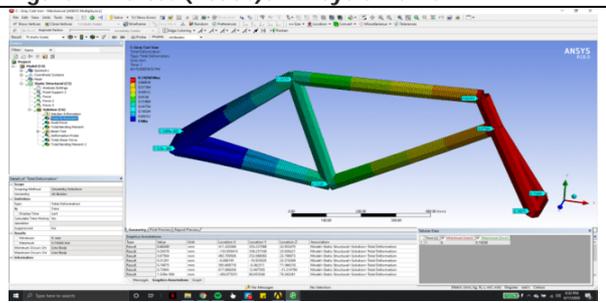


Figure 6. Deformation of Bicycle under Grey cast iron





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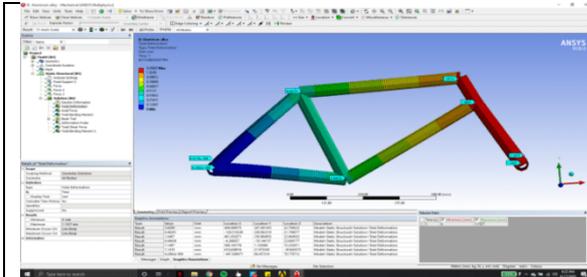


Figure. 7. Deformation of Bicycle under Aluminium alloy

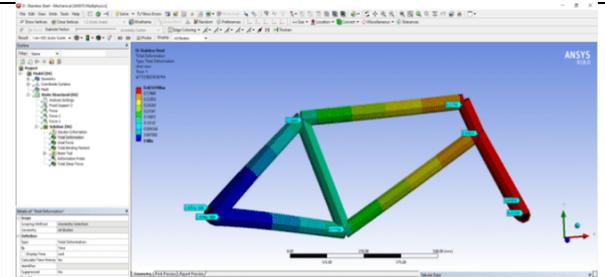


Figure 8. Deformation of Bicycle under Stainless Steel

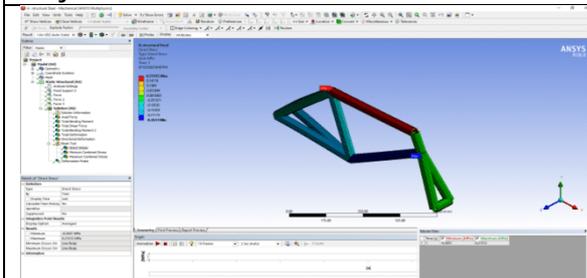


Figure. 9 Maximum direct stress under Structural steel

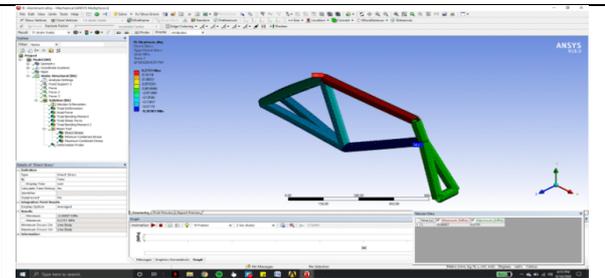


Figure. 10 Maximum direct stress under Aluminium alloy

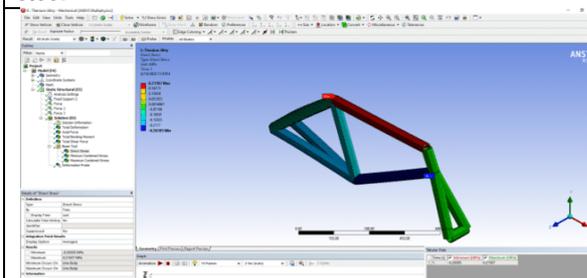


Figure. 11 Maximum direct stress under Titanium alloy

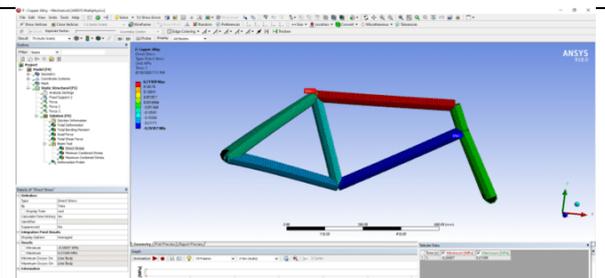


Figure. 12 Maximum direct stress under Copper alloy

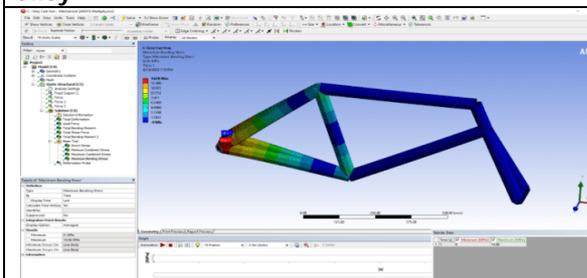


Figure. 13 Max combined stress under Grey cast iron

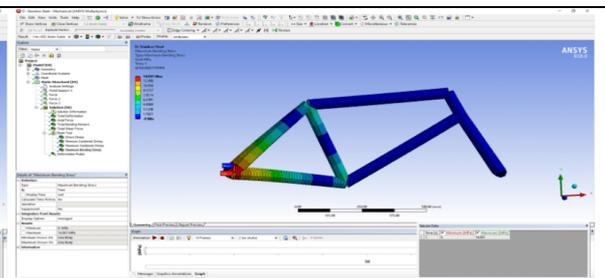


Figure. 14 Max combined stress under Stainless steel





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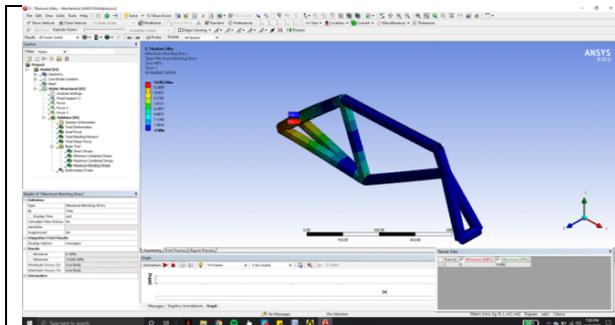


Figure. 15 Max combined stress under Titanium alloy

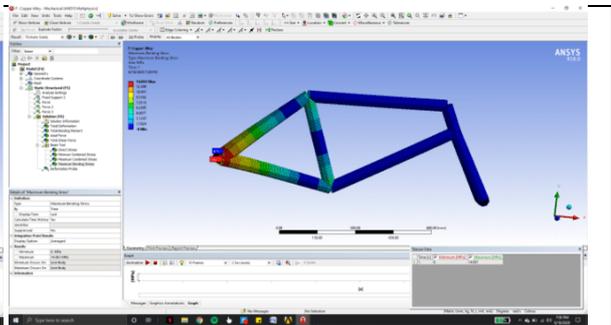


Figure. 16 Max combined stress under Copper alloy

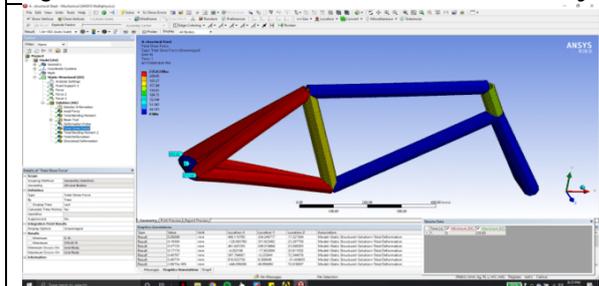


Figure. 17 Max Shear force under Structural steel

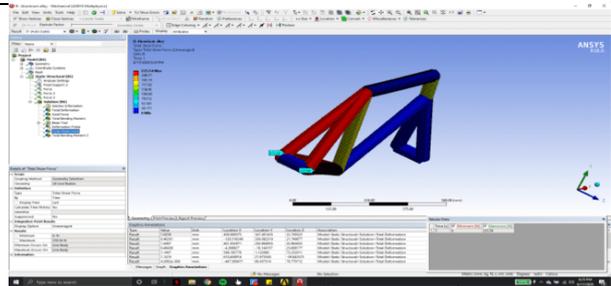


Figure. 18 Max Shear force under Aluminium alloy

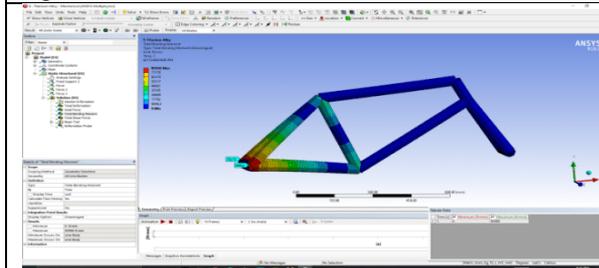


Figure. 19 Max Shear force under Titanium alloy

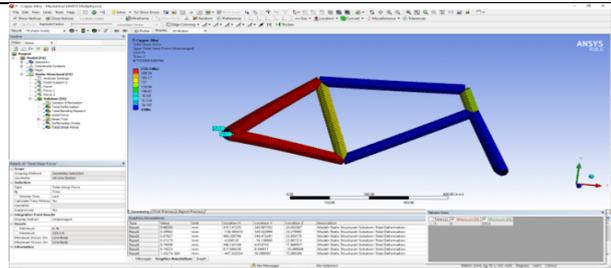


Figure. 20 Max Shear force under Copper alloy

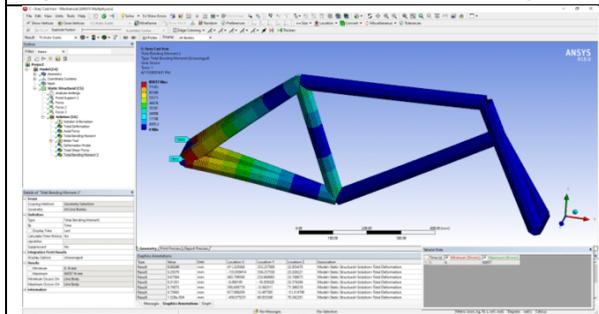


Figure. 21 Max Bending Moment under Grey cast iron

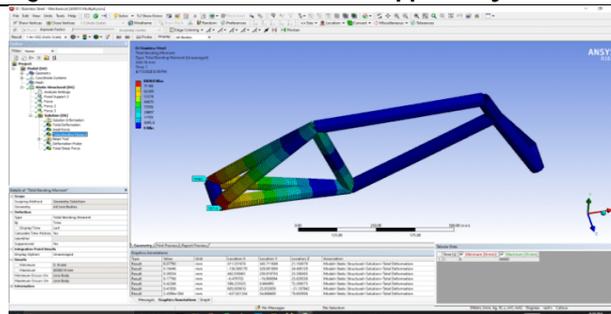


Figure. 22 Max Bending Moment under Stainless steel





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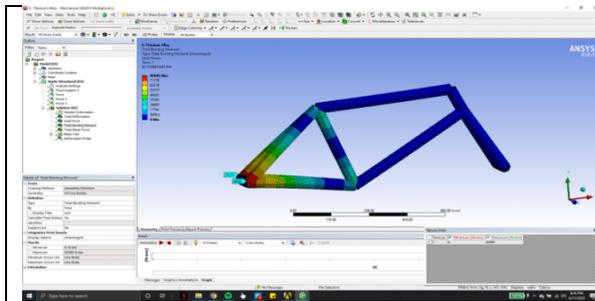


Figure. 23 Max Bending Moment under Titanium alloy

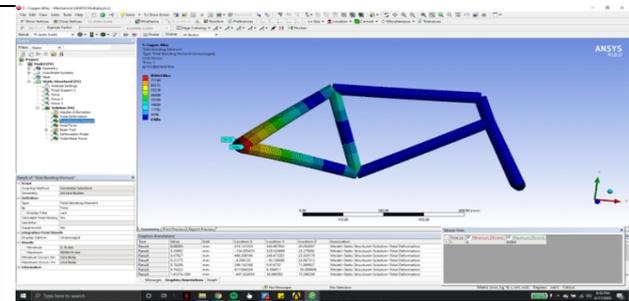


Figure. 24 Max Bending Moment under Copper alloy

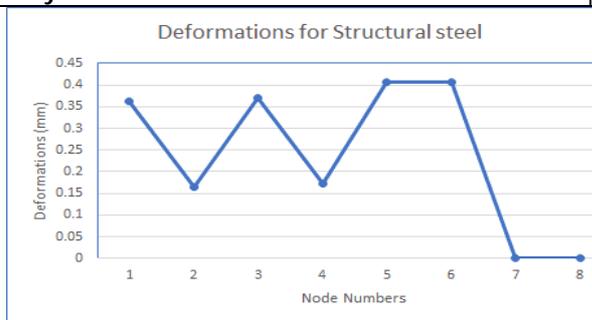


Figure. 25 Deformation values for Structural steel

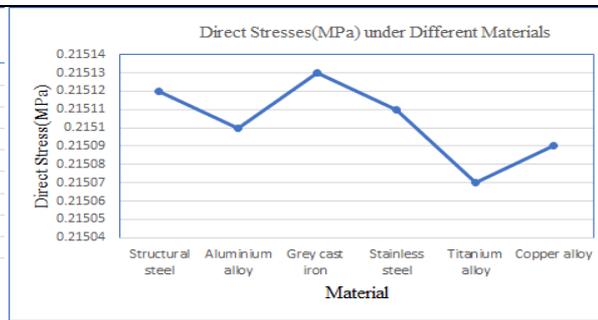


Figure. 26 Direct Stresses for Different Materials

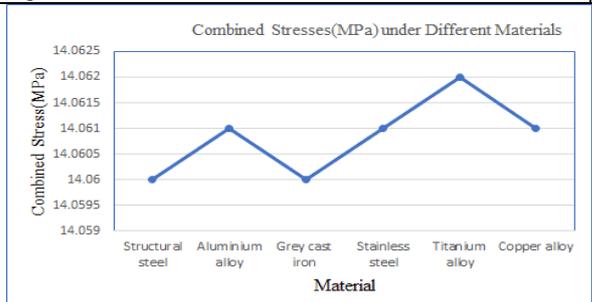


Figure. 27 Combined Stresses for Different Materials

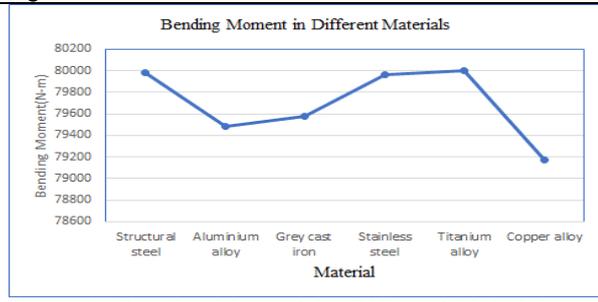


Figure. 28 Bending Moment for Different Materials





Comparative Facts Review of COVID Treatment Blogbuster Antiviral Drugs

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ABSTRACT

Here we are reporting the most recent updates on investigational medications successfully utilised in the treatment of the sickness caused by the SARS-CoV-2 coronavirus, commonly known as COVID-19. There are currently no therapeutic options available for coronavirus disease 2019 (COVID-19), a deadly infectious disease. The medications now used to treat COVID-19 are frequently chosen and studied based on their efficacy in other diseases such as influenza and AIDS, and their main targets have been identified as viral protease, host cell generated protease, viral RNA polymerase, and the viral protein-host cell receptor interaction site. All documentary information, including clinical trials, original research and reviews, the government's database, and treatment guidelines, was critically and fully analysed in this article. Furthermore, by focusing on the body's defensive mechanism against viruses, it was attempted to offer the most common and effective drugs and techniques, as well as suggest a viable treatment method for COVID19. Among the three drugs compared here, remdesivir was considered as safest and with less incidence of adverse events. Various clinical trials also indicated the better safety and efficacy of remdesivir than the others.

Keywords: Anti virals, COVID-19, Therapeutic drugs, Remdesivir, Favipiravir, Lopinavir.

INTRODUCTION

The terrible outbreak of the COVID-19 (coronavirus disease 2019) pandemic around the world has swept the healthcare system of every country. Most (if not all) are caught off guard, and there are not enough defense mechanisms to control and control this pandemic [1]. Outbreaks of novel emerging infections, such as coronavirus disease 2019 (COVID-19), present significant challenges to health professionals in terms of selecting effective therapeutics/pharmacological therapies in a clinical setting with limited time for new medication development [2]. On March 11th, 2020, the World Health Organization declared COVID-19 a pandemic. As of May 1st, 2020, the

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disease had expanded to over 185 countries, with over 3,200,000 confirmed cases, over 230,000 confirmed deaths, and over 1,000,000 total recoveries worldwide [3]. Mandatory isolations/quarantines have impacted the lives of hundreds of millions of people. If SARS-CoV-2 spread and virulence are not suppressed, or successful therapies are not created, this pandemic has the potential to overtake national healthcare systems and have significant implications for the global economy [4]. Coronaviruses are named for the crown-like spikes on their back, and they are divided into four groups: alpha, beta, gamma, and delta. SARS-CoV-2 is a 29,891-base positive-sense single-stranded RNA virus, 96% of its genome is identical to that of bat coronavirus, and its sequence identity with SARS-CoV is 79.6% [6]. SARS-CoV-2 encodes a spike S protein with a receptor binding domain (RBD) that binds to human angiotensin-converting enzyme 2 (ACE2) and promotes membrane fusion and virus uptake through endocytosis in human cells such as the lung. SARS-CoV-2, like other coronaviruses, takes over or hijacks the protein synthesis machinery in human cells to synthesize viral proteins and assemble them for viral replication.⁶ Viruses, once within the human body, cause a variety of positive and negative host responses, including autophagy, apoptosis, stress response, and innate immunity [7]. Fortunately, the majority of SARS-CoV-2-infected people (more than 80%) are asymptomatic or have minor symptoms, which is most likely attributable to the activation of the good response. These successful responders will most likely stimulate the body's innate immune system by triggering antiviral defense mechanisms such as natural killer cells and antiviral T cells, as well as inducing interferon production (IFN) [8-10].

Unfortunately, about 20% of SARS-CoV-2-infected adults, including the immunocompromised, elderly, and patients with serious health issues such as cardiovascular and pulmonary problems, diabetics, hypertension, obesity, chronic obstructive pulmonary disorder (or COPD, such as emphysema), pulmonary fibrosis, asthma, and interstitial lung disease, will develop more serious illness. Acute respiratory failure syndrome (ARDS) and even death may result from severe respiratory symptoms. It's worth noting that ARDS develops later in the course of the illness and is followed by acute lung damage (ALI) [11]. SARS-CoV and MERS-CoV seem to have developed mechanisms to attenuate or postpone IFN development, resulting in enhanced inflammatory host responses and significant lung injury, according to a report. This abnormal host immune response, characterized by the release of strong inflammatory cytokines, was discovered in SARS-CoV and MERS-CoV-infected patients and was linked to disease severity and poor prognosis [12-13]. Excessive cytokine release caused by SARS-CoV-2 infection is linked to lung tissue injury and COVID-19 pathogenesis [14]. This approximately 20% of patients with SARS-CoV-2 infection having more serious disease is most likely due to genetics, epigenetics, and/or other causes, including a weakened innate immune response to combat the virus. Reduced innate immune response to the virus, combined with increased viral load, results in a cytokine storm, a strong inflammatory/oxidative stress response, and severe lung damage as a result of ARDS. Although it is clear that COVID-19 patients' respiratory systems are severely impacted, research suggests that other organ systems are also affected. SARS-CoV-2 can cause damage to other organs, including the heart and brain, according to new research. Nearly 20% of COVID-19-positive hospitalized patients show signs of cardiac injury. In addition, patients have documented neurologic complications, and SARS-CoV-2 infection has been discovered in the brainstems of humans and laboratory animals [11].

There is currently no specific therapeutic medications available to combat SARS-CoV-2. As a result, deciding the alternative treatment regimens to prevent and cure the chronically ill COVID-19 patients remains a big obstacle. Many scientific attempts are currently being made around the world to produce medicines to combat COVID 19. Patients with COVID-19 have been treated with "repurposed" medications that have been approved by the FDA in the United States for other uses before new medicinal drugs targeting SARS-CoV-2 become available. Early diagnosis, prompt notification, isolation, and complementary treatments are all critical lines of defense against COVID-19 infections in the absence of conclusive and specific treatment regimens. Patients of SARS-CoV-2 infection are now treated mostly by repurposing available therapeutic medications and depending on symptomatic conditions. Antibiotics, antiviral therapy, systemic corticosteroids, and anti-inflammatory medications are often used in treatment regimens for ARDS, which is often accompanied by secondary infections. In addition to antiviral interferers and antibiotics, COVID-19 has been treated with neuraminidase inhibitors, RNA synthesis inhibitors, convalescent plasma, and conventional herbal medicines [15]. A variety of candidate drugs have been identified that





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may prevent SARS-CoV-2 infection and replication. Inhibitors of TMPRSS2 serine protease and inhibitors of angiotensin-converting enzyme 2 are examples of such medicines (ACE2). Antiviral drugs such as the nucleotide analogue remdesivir, HIV protease inhibitors lopinavir and ritonavir, broad-spectrum antiviral drugs arbidol and favipiravir, and antiviral phytochemicals can restrict the spread of SARS-CoV-2 and COVID-19 pandemic morbidity and mortality.

Remdesivir and ritonavir / lopinavir, which have recently been shown to target MERSCoV in mice and to suppress Ebola virus RdRp and SARS-CoV-2 proteases in humans, are now being tested for therapeutic effectiveness in COVID-19 patients in two international clinical trials (SOLIDARITY Trial and Discovery Trial) [16]. The current review will concentrate on the efficacy of currently available COVID-19 medicines, as well as their methods of action, pharmacokinetics, dosing, safety, and future prospects. Hence the study aims to provide the review of all the three antiviral drugs (Remdesivir, Favipiravir, Lopinavir) in a nutshell for the readers for quick reference and easy to remember the various aspects of these antiviral drugs in comparison base. This article will help all the health care fraternity and as well to the better understanding for a common man.

SEARCH METHODOLOGY

All documentary information was acquired from international databases such as Google Scholar, PubMed, Scopus, Web of Science, and Science Direct for this paper, including clinical trials, original research, and reviews. In addition, the government's databases and treatment standards were critically and completely examined. As a result, it was attempted to offer the most common and effective drugs and tactics in order to suggest a viable COVID19 therapy strategy that focused on the body's defensive system against viruses.

DISCUSSION

Drug Name	REMDESIVIR	FAVIPRAVIR	LOPINAVIR
Indication	broad-spectrum antiviral agent against filoviruses (Ebola, Marburg), coronaviruses (SARS-CoV, MERS-CoV, SARS-CoV-2), paramyxoviruses (parainfluenza type III virus, Nipah virus, Hendra virus, measles, and mumps virus), and Pnemoviridae (respiratory syncytial virus)	A Pyrazinamide antiviral agent used in treatment for influenza; A, B, Avian. (in treatment resistant cases). Also used in Ebola virus, Lassa virus, and now COVID-19	Lopinavir is an HIV-1 protease inhibitor that is used to treat HIV-1 infection in adults and children in conjunction with other antiretroviral drugs (14 days and older). For the treatment of COVID-19, it is now used in combination with Ritonavir.
Dosage Form	<ul style="list-style-type: none"> ✓ 100mg - single-dose vial for reconstitution. ✓ 100 mg/20 mL (5mg/mL) injection 	<ul style="list-style-type: none"> ✓ Tablets: 125mg ✓ Tablets: 250 mg ✓ Tablets: 500 mg 	<ul style="list-style-type: none"> ✓ Tablets: 200 mg ✓ Tablets: 100 mg ✓ Oral solution: 80 mg
MOA	Remdesivir is a phosphoramidite prodrug of a monophosphate nucleoside analog that inhibits viral RNA-dependent RNA polymerase (RdRp) replication. Remdesivir is metabolized into pharmacologic active analog	Favipiravir is metabolized into favipiravirribosyl triphosphate (favipiravir RTP) by an intracellular enzyme. Favipiravir RTP selectively inhibits RNA polymerase (RNA-dependent RNA	Lopinavir, an inhibitor of the HIV-1 protease, prevents cleavage of the Gag-Pol polyprotein, resulting in the production of immature, non-





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	adenosine triphosphate, which competes with ATP for integration by the RdRp complex into the nascent RNA chain, resulting in RNA synthesis termination and viral replication limitation Remdesivir showed potent antiviral activity against SARS-CoV-2 in human lung cells and primary human airway epithelial cultures in vitro. Remdesivir inhibited SARS-CoV-2 replication in a dose-dependent manner, with a half-maximal effective concentration.	polymerase) of the influenza virus, preventing replication of the influenza virus. Effective against all types and sub-types of human influenza A, B, and C viruses in vitro, showing a wide range of anti-viral activity against various influenza virus strains including avian and swine viruses. favipiravir-RTP also shows a positive effect on SARS CoV-2 by cytopathic effect which is induced by the virus, reduction in the number of viral RNA and infectious particles	infectious viral particles. Lopinavir is rapidly degraded in the human body by the host proteases, hence is given with ritonavir (another protease inhibitor) at a lower dose, which helps lopinavir remain active for a longer time by inhibiting the metabolizing enzyme cytochrome P450.
Drug Class	Novel Antiviral Drug; Nucleotide Analogue	Viral RNA Polymerase Inhibitor	Viral protease inhibitor
Drug Target	Replicase polyprotein 1 ab	RNA dependent RNA Polymerase Enzyme	Protease enzyme
Drug Effect	Inhibit viral replication	Inhibits the viral transcription and replication	Inhibits the viral entry
Pharmacokinetics	<p>Absorption</p> <ul style="list-style-type: none"> • rapidly absorbed; • peak plasma concentrations achieved in 0.67-0.68 hours (Tmax). • Cmax - 2229 (19.2) ng/mL AUCtau of 1585 (16.6) ng*h/L was obtained after repeated dosing <p>Distribution</p> <ul style="list-style-type: none"> • Bound to plasma proteins - 88-93.6 %, • while its metabolites GS-441524 and GS-704277 bind 2% and 1%, respectively. <p>Metabolism</p> <ul style="list-style-type: none"> • Remdesivir undergoes esterase-mediated hydrolysis to a carboxylate form, then cyclization to eject the phenoxide moiety, and finally hydrolysis of the cyclic anhydride to yield the observable alanine metabolite . 	<p>Absorption</p> <ul style="list-style-type: none"> • Bioavailability – 97.6% • Mean Cmax – 51.5 µg/mL • AUC over a 12 hour dosing interval – 55-59.1 µg·h/MI <p>Distribution</p> <ul style="list-style-type: none"> • Bound to plasma proteins - 54% • Favipiravir - 65% is bound to serum albumin and 6.5% is bound to α1-acid glycoprotein • Volume of distribution – 15 - 20 L <p>Metabolism</p> <ul style="list-style-type: none"> • Undergoes Hydroxylation. • primarily by aldehyde oxidase and to a lesser extent by xanthine oxidase to an inactive metabolite, T705M1 <p>Elimination</p> <ul style="list-style-type: none"> • Favipiravir's metabolites are 	<p>Absorption</p> <ul style="list-style-type: none"> • Cmax - 9.8 ± 3.7 µg/mL 4 hours after administration • AUC over a 12 hour dosing interval - 92.6 ± 36.7 µg·h/mL • In humans, the absolute bioavailability of lopinavir co-formulated with ritonavir has not been determined. • No change in the absorption rate in the presence of food <p>Distribution</p> <ul style="list-style-type: none"> • Bound to plasma proteins - 98-99% • Lopinavir binds to both alpha-1-acid





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	<p>The monophosphate form of remdesivir is either hydrolyzed again to yield the bare nucleoside metabolite or phosphorylated by cellular kinases to yield the active triphosphate form.</p> <p>Elimination</p> <ul style="list-style-type: none"> remdesivir is 74% eliminated in the urine and 18% eliminated in the feces. 49% of the recovered dose is in the form of the metabolite, and 10% is recovered as the unmetabolized parent compound. A small amount (0.5%) of the GS-441524 metabolite is found in feces. <p>Half-life:- Remdesivir has an elimination half-life of 1 hour following a single 30-minute intravenous infusion. The nucleoside triphosphate metabolite has a half-life of approximately 20 hours in humans</p>	<p>predominantly renally cleared.</p> <ul style="list-style-type: none"> Half-life – range from 2 to 5.5 hours 	<p>glycoprotein (AAG) and albumin</p> <ul style="list-style-type: none"> Volume of distribution – 0.16-0.66L/kg <p>Metabolism</p> <p>The liver cytochrome P450 system, namely the CYP3A isozyme, is responsible for extensive oxidative metabolism. Ritonavir is a powerful CYP3A inhibitor that has been proven to activate metabolic enzymes and, as a result, its own metabolism.</p> <p>Elimination</p> <p>In urine and faeces, unchanged lopinavir accounted for around 2.2 and 19.8% of the given dose, respectively. Only about 3% of the lopinavir dosage is eliminated unaltered in the urine after numerous doses. The apparent oral clearance (CL/F) of lopinavir is 5.98 ± 5.75 L/hr (mean ± SD, n = 19). Half-life – 5-6 hrs</p>
<p>Adverse drug reactions</p>	<p>Cardiovascular: Hypotension, arrhythmias, and cardiac arrest Pulmonary: Dyspnea, Acute respiratory failure, acute respiratory distress, pneumothorax, pulmonary embolism Hematological: Anemia, lymphopenia Endocrine: Hyperglycemia</p>	<p>Cardiovascular: chest pain Pulmonary: asthma, rhinitis, nasopharyngitis Hematological: increased WBC, decreased reticulocyte count, and increased monocytic count Endocrine: hyperuricemia Gastrointestinal: nausea, vomiting, diarrhea, poor appetite.</p>	<p>Gastrointestinal:Diarrhea, nausea, vomiting Pancreatitis, diarrhea</p> <p>Cardiovascular: QT prolongation</p> <p>Endocrine: hypercholesterolemia, hypertriglyceridemia,</p>





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	<p>Infectious: Pneumonia, septic shock</p> <p>Gastrointestinal: elevated lipase, nausea, vomiting, diarrhea, constipation, poor appetite, gastroparesis, and lower GI bleeding</p> <p>Hepatic: Hepatic manifestation characterized by Grade 1-4 increase in serum transaminases (ALT and/or AST) are the most common adverse effects seen. Other abnormalities include hyperbilirubinemia</p> <p>Renal and Metabolic: Acute kidney injury or worsening of underlying chronic kidney disease, hypernatremia, hypokalemia</p> <p>Neurological: Headache, lightheadedness</p> <p>Skin: Rash, contact dermatitis, pruritus</p>	<p>Hepatic: Hepatic injury, increased levels of AST, ALT and Gamma GTP</p> <p>Renal and Metabolic: Acute kidney injury or worsening of underlying chronic kidney disease, hypernatremia, hypokalaemia</p> <p>Skin: Rash, eczema, pruritus</p>	<p>Hepatic: Elevated liver enzymes, dyslipidemia, mild hepatotoxicity</p> <p>Others: asthenia, headache and skin rashes</p>
Contraindications	<p>Patients with alanine aminotransferase (ALT) levels >5-times upper limit of normal or severe hepatic dysfunction</p> <p>Adult and pediatric patients (>28 days old) with severe renal impairment described as eGFR< 30 ml/min</p> <p>Neonates (at least 7 days to ≤ 28 days old) with serum creatinine ≥1 mg/dL</p>	<p>Contraindicated while using these drugs: Pyrazinamide, Acyclovir, Aminophenazone, Apomorphine, Benzyl penicillin, Chloroquine, Digoxin, Doxorubicin, Edoxaban, Fluorouracil, NSAIDs, Hydrocortisone, Hydroxychloroquine.</p> <p>Contraindicated in patients having history of uric acid metabolism abnormalities.</p> <p>Contraindicated in patients with gout or history of gout.</p>	<p>Alfuzosin, Dronedarone, Colchicine, Rifampin, Lurasidone, Pimozide, Dihydroergotamine, ergotamine, methylethergonovine, Cisapride, Elbasvir/grazoprevir, Lovastatin, simvastatin, Sildenafil, Triazolam</p>
Special Population	<p>Pregnancy - The amount of evidence is insufficient to determine whether the treatment is linked to a risk of serious birth defects, abortion, or adverse maternal or fetal outcomes.</p> <p>Lactation - There are no reports on remdesivir's involvement in human milk, its effects on breastfed infants, or its effects on</p>	<p>Pregnancy -Favipiravir mainly causes early embryonic death when studied in animals. Recommendation of this medication should be avoided to pregnant women.</p> <p>Paediatric - Safety and efficacy have not been established in pediatric patients (less than 18 years of age).</p>	<p>Pregnancy – safe to use</p> <p>Pediatric – data not available under 14 yrs of age</p>





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	<p>milk quality.</p> <p>Pediatric - The safety and effectiveness for the treatment of COVID-19 have been established in pediatric patients 12 years and older and weighing at least 40 kg</p> <p>Geriatric - Patients above the age of 65 do not need any dose adjustments. In general, when administering remdesivir and monitoring elderly patients, extra care should be exercised.</p> <p>Renal Impairment - The pharmacokinetics have not been evaluated in patients with renal impairment</p> <p>Hepatic Impairment - The pharmacokinetics have not been evaluated in patients with hepatic impairment</p>	<p>Geriatric - Caution should be exercised in the administration and monitoring of favipiravir in the elderly reflecting the greater frequency of decreased renal function and concomitant use of other drugs.</p> <p>Renal Impairment - The dosage should be reduced in patients with renal dysfunction. Acute renal failure has developed in patients with renal disease who received larger than recommended doses of famciclovir.</p> <p>Hepatic Impairment – use with caution</p>	<p>Geriatric – use with caution</p> <p>Hepatic impairment – use with caution</p>
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NOTE: The informations mentioned in the table are obtained from the following sources
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**CLINICAL SAFETY AND EFFIACY
 REMEDESIVIR**

Remdesivir (GS-5734) is a nucleotide prodrug with broad antiviral action in vitro and therapeutic effectiveness in nonhuman primate models of lethal Ebola virus and Nipah virus infection. Remdesivir prevents the replication of a diverse variety of coronaviruses, including MERS-CoV, in human airway epithelial cells. It is being considered as a possible drug candidate for repurposing against the COVID-19 based on existing awareness of its application in SARS-CoV2 infection. Studies of efficiency in mice shows that when provided before the peak of virus replication, remdesivir had therapeutic effectiveness against Severe Acute Respiratory Syndrome (SARS)-CoV and MERS-CoV in Ces1c/ mice, which are defective in a secreted carboxylesterase responsible for the weak pharmacokinetics profile of remdesivir in mice[17].



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Despite the existence of a viral proofreading exoribonuclease, *in vitro* experiments with mouse hepatitis virus revealed that remdesivir prevents coronavirus replication by interfering with the viral polymerase [18]. The drug demonstrated therapeutic and prophylactic effectiveness against both SARS and MERS coronaviruses in Rhesus macaques, showing its ability to treat and prevent a variety of coronaviruses, including SARS CoV2 [17].

Despite the drug's failure to combat Ebola, preliminary findings from *in vitro* and *in vivo* preclinical trials, as well as case reports, suggest that it is effective against SARS-CoV2. Remdesivir has recently been shown to block viral infection in Vero E6 cells at low concentrations with a high selectivity index [19]. The drug also greatly decreased lung viral titers in a Cers1c-knockout mouse model of SARS-CoV infection, though survival and lung pathology were not improved [20]. In a 35-year-old COVID-19 patient in Washington, USA, treatment with intravenous remdesivir on day 7 of hospital admission markedly increased the health situation by the next day [21]. Remdesivir has been used in the clinical management of COVID-19 patients with a modified early warning score (MEWS) ranging from less than 3 to more than 4 in Italy (200 mg every 12 hours as a loading dose, followed by 100 mg every 12 hours for 10 days by intravenous route) [22]. According to a recent survey, Clinical benefit was seen in 36 of 53 extreme COVID-19 patients (68 %) in a cohort trial with the compassionate use of remdesivir [23].

Another research found that remdesivir was superior to placebo in reducing the time to recovery in adult COVID-19 patients hospitalized. By 14 days, mortality rates were 7.1 % with remdesivir and 11.9 % with placebo in 1059 participants, with 538 in the remdesivir group and 521 in the placebo group in the study, which was performed at 60 sites and 13 subsites in various parts of the world [24]. Another clinical trial of remdesivir in extreme COVID-19 patients without mechanical ventilation assistance found no substantial difference between the 5-day and 10-day courses of remdesivir treatment by day 14. However, by day 14, 64 percent of patients in the 5-day group and 54 percent of patients in the 10-day group had improved clinically by 2 points or more on the ordinal scale out of 7-point or more [25]. Remdesivir is a nucleotide analog that gets inserted into the virus's replicating genome after being translated to its triphosphate form. The triphosphate forms compete with adenosine triphosphate (ATP) for the role of RDRP substrate, and have been shown to be significantly more effective than ATP in terms of incorporation. Until terminating the growing RNA chain, Remdesivir adds three more nucleotides. The extra three nucleotides can prevent the inhibitor from being removed by viral 3'-5' exonuclease operation, resulting in resistance not being acquired [26].

FAVIPRAVIR

Favipiravir is a potent nucleotide analogue that selectively inhibits the viral RNA-dependent RNA polymerase or induces lethal mutagenesis when incorporated into viral RNA. Since SARS-CoV-2 has a genome sequence that is 75–80% similar to SARS-CoV, the current drug favipiravir for SARS and MERS may be useful in the development of COVID-19 therapeutics [27-28]. In a recent study, Cai and colleagues discovered that favipiravir had slightly improved treatment effects on COVID-19 in terms of disease development and viral clearance rate. They compared the effects of favipiravir vs Lopinavir/Ritonavir on COVID-19 therapy. They discovered that favipiravir was linked to faster viral clearance and a higher rate of progress in chest imaging. In comparison to Lopinavir/Ritonavir, their results indicated that favipiravir had slightly greater treatment effects on COVID-19 in terms of disease development and viral clearance. Also in the experimental study, the side effects of FPV were rare and tolerable, and none of the patients had to discontinue it [27]. Also, according to a research letter written by a group of Chinese researchers, they used Vero E6 cells infected with SARS-CoV-2 at a multiplicity of infection (MOI) of 0.05 to study the efficacy of the influenza antiviral favipiravir *in vitro*. And they found that favipiravir is efficient in limiting viral replication, with a half-maximal effective concentration (EC50) of 61.88 μ M [19]. Chen and coworkers [29], who published the findings of a controlled, open-label clinical trial of Favipiravir and Umifenovir (UFV) for the care of COVID-19 adult patients, affirm the clinical promise of Favipiravir in combating the emerging COVID-19 pandemic. And patients with moderate Covid-19 infections who received Favipiravir had a higher clinical recovery rate at Day 7 than those who received UFV, and FPV also increased the abeyance of cough and fever relief [29]. Favipiravir's side effects were also moderate and manageable [29].



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While witnessing possible adverse effects after Favipiravir, it includes decreased red blood cell (RBC) production, increased liver function parameters such as aspartate aminotransferase (AST), alkaline phosphatase (ALP), alanine aminotransferase (ALT), and total bilirubin, as well as increased vacuolization in hepatocytes. Toxicity of the testes has also been reported [30]. Since favipiravir is known to cause teratogenicity, it should be prevented in women who are pregnant or think they are pregnant [30].

LOPINAVIR

In a recent clinical trial, lopinavir ritonavir treatment did not enhance the time to clinical improvement or the mortality rate in 199 very ill patients with proven SARS-CoV2 infections and some patients were also reported adverse effects like gastrointestinal disorders [31]. A 47-year-old patient who had failed to respond to methylprednisolone and interferon therapy improved quickly after taking lopinavir and ritonavir pills [32]. Some studies were published regarding the severe hepatic damage of the Lopinavir [33]. Diarrhea and gastrointestinal disturbances are the most prevalent side effects of ritonavir/lopinavir. Minor side effects include elevated liver enzymes, dyslipidemia, asthenia, headaches, and skin rashes [34-36].

CONCLUSION

The latest coronavirus outbreak poses a serious threat to human life. The entire globe must work together to provide access to drugs and find a solution as quickly as possible. Despite massive attempts to stop SARS-CoV-2 from spreading over the world, the high mortality and person-to-person transmission constitute a serious threat to global public health. However, there is no definite treatment for the covid-19. However, there are a number of medications that have received FDA approval for treatment of other disorders that might be utilized in the COVID-19 trial and termed repurposed medications. Antivirals, antimalarials, ACEIs, ARBs, statins, and monoclonal antibodies are all examples. Remdesivir, favipiravir, lopinavir-ritonavir combo, arbidol, and tocilizumab have demonstrated benefits in several clinical studies based on compassionate usage to save the lives of COVID-19 patients; consequently, these treatments could be a promising drug therapy against this lethal disease in the future. However, among the comparative review among the three antiviral drugs used for the treatment of COVID-19, remdesivir was found to more safer and effective than the others. SARS-CoV-2 is a virus with a lot of diversity that gets modified, therefore new SARS-CoV-2 mutations are likely to appear at random times. As a result, most medications that target the present SARS-CoV-2 strain may be ineffective against a mutant SARS-CoV-2 strain. To prepare for future outbreaks involving mutants, there is an urgent need for the development of new broad-spectrum medications that target conserved locations. Some medications, such as ivermectin and auranofin, are in the early stages of development for use against COVID-19, and these medicines could be viable treatment agents in the future.

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Study on Air Flow Pattern in Orifice meter using CFD Modeling

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ABSTRACT

Air flow is measured by the quantity of the fluid that passes through the pipe, duct or an open channel. In the present experiment focus has been given on the flow velocity, volume flow rate, residual calculation, pressure inside the orifice plate, determination of turbulence zone near the orifice and also to calculate the Reynold's no. of the flow in the orifice plate using ANSYS V18.2 fluent. Navier-Stocks equations have been employed to describe the velocity, pressure and to determine the zone of Vena contracta using CFD code of ANSYS for incompressible fluid. Later on this model is being validated by a wind tunnel with a regulator plate inserted in it at a distance of 30cm from the inlet. This study helps in better understanding of the effect of orifice or regulator on the air flow behavior in the wind tunnel and in determination of the zone of vena contracta at the orifice point.

Keyword: Orifice meter, ANSYS, κ - ϵ turbulence model, vena-contracta, CFD, wind tunnel.

INTRODUCTION

The measurement of flow rate is important in many industrial applications including rocket propellant stages. It is the determination of the quantity of the fluid that passes through the pipe, duct or an open channel. Flow can be measured by measuring the velocity of fluid over a known area. The accurate measurement of a fluid is important to obtain specific proportions as per process requirements. It is important to maintain a definite flow rate for maximum efficiency and production. Flow can be measured through various instruments like venturi meter, orifice Plate, rotameter, pitot tube, flow nozzles, etc. Out of these orifice-meter is chosen for its least coefficient of discharge, simplicity of its design, reliability (no moving parts), & low manufacturing cost [1]. Generally, a conventional orifice has a single circular opening made in the centre of the disc which is usually mounted inside a pipe line. It suffers from high pressure drop due to lower discharge coefficient. This difficulty can be avoided by introducing a multi





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hole orifice flow meter. Combining Bernoulli & continuity equations & using pressure drop for mass flow estimation the equation of mass flow rate can be expressed

$$q_m = \frac{1}{\sqrt{1-\beta^4}} \frac{\pi}{4} d^2 \sqrt{2\rho\Delta p} \dots\dots\dots [1]$$

Where, β is the Contraction coefficient defined as the square root of orifice to duct cross-section area ratio. Mathematically

$$\beta = \sqrt{\frac{A_{or}}{A_d}} = \frac{d}{D} \dots\dots\dots [2]$$

Equation (1) is valid only for the laminar flow of an incompressible, frictionless fluid in a horizontal channel. The effect of ratio on mass transfer rate behind the orifice was numerically studied by [2] & [3]. CFD tools are generally used in modeling & analyzing orifice meter [4-6]. Some studies have focused on obtaining the associated discharge coefficient [7] & pressure drops [8]. The characteristic length & velocity scales in different regions of orifice flows using PIV was studied by [9]. Tukiman et al [10] used CFD to predict the flow features in the orifice flow meter & the results are consistent with other published data. The objective of this experiment is to study an optimum air flow velocity model in normal and modified conditions and ANSYS orifice model is validated by comparing with the experimental data's conducted at the wind tunnel.

Theoretical Approach

The Pitot-static tube is an instrument used for measurements of high velocity. It works on the principle of pressure exerted by flowing air. It is not capable of measuring average velocity directly but measures the velocity at a given point in the airway/duct. This instrument consists of two concentric tubes i.e inner & outer tube. The outer tube measures the static head while the inner tube measures the total head. The total pressure tapping generally measures the total pressure with reasonable accuracy. The static pressure tapping needs to be suitably positioned on the outer tube to minimize the effect of interference created by the stem and the total pressure tapping. The nose is designed so as to give least resistance to flow.

For velocity measurements, the two connections i.e., total and static pressure connections are attached to the two limbs of a manometer which will read the velocity pressure, which is related to the total and static pressures as

$$P_v = (P_t - P_s) P_a \dots\dots\dots [3]$$

Where

P_v = Velocity pressure in Pascal (p_a)

P_t = Total pressure in Pascal (p_a)

P_s = Static pressure in Pascal (p_a)

The readings of velocity pressure, static pressure and total pressure are in mm which needs to be converted into Pascal (P_a).

By using the relation

$$P = \rho g h (P_a)$$

Where





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ρ =Density of the liquid used in the manometer (kg/m³),
 g = Acceleration due to gravity (9.81 m/s²)
 h = Difference of the two limb readings of the manometer (m)
 Now, the actual air velocity (V) is related to the velocity pressure (P_v) as

$$V = \sqrt{\frac{2P_v}{\rho}} \dots\dots\dots[4]$$

Where
 ρ = Actual density of air (kg/m³)

Experimental Approach

In the present work, a Wind tunnel with a regulator pipe is used to conduct the experiment. After that 11 grids are taken from upper point to the lower point. A pitot tube is inserted in between the fan and the regulator plate and the bar is marked from 1 to 11 as accordingly. It has two ends which are connected to a Betz manometer to calculate the pressure in water column. First the initial pressure of the wind tunnel is noted & then the pressure is measured by the betz manometer. The Pitot Tube reading point is set at the top most point i.e. point no 1 and the reading of the Betz Manometer is noted that is the water column height. Then the Pitot tube is lowered gradually one by one and its reading is noted from the Betz Manometer. Each reading is taken two times so that we can get a average value and the error percentage can be reduced. The formula for velocity factor is $V = 4.25\sqrt{h} \times 60$. The same process is been repeated with the Pitot tube inserted in between the regulator plate and outlet of the Wind Tunnel.

Governing equations & Modeling assumptions

CFD uses numerical methods and algorithms to solve and analyze fluid flow problems. Generally, it gives a qualitative and quantitative prediction of fluid flow by means of mathematical modeling (partial differential equations), numerical modeling (discretization and solution techniques) and software tools (solvers, pre-and post processing utilities). It enables scientists and engineers to perform ‘numerical experiments’ (i.e. computer simulations) in a ‘virtual flow laboratory’. The governing equations (continuity and momentum) with the appropriate Reynolds stress closure need to be solved. For most CFD codes, the modeling of transitional flow is usually not provided. But since most cases, the transitional flow only covers a small region of the total flow domain, it could be neglected and still acceptable results could be obtained. In underground mine ventilation, most flow state in mine openings are turbulent flow which can effectively disperse and remove contaminants in the workplaces. A large variety of turbulence models have been developed to solve turbulent flow problems. In the present work, the standard κ - ϵ turbulence model is used as it is the most common model used in computational fluid dynamics (CFD) to simulate mean flow characteristics for turbulent flow conditions. The flow of the fluid is assumed to be steady & incompressible. Hence the governing equations in the present experiment are independent of time.

Continuity equation or conservation of mass:

$$\frac{\partial \rho}{\partial t} - \nabla \rho V = 0 \dots\dots\dots[5]$$

Momentum equations or Newton’s second law:

$$\frac{\partial \rho}{\partial t} + \nabla(\rho V \cdot V) = -\nabla p + \nabla T + \rho q \dots\dots\dots[6]$$





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Problem specification

The model of the orifice is shown in figure 3 above. In this figure, the flow through an orifice meter with throat diameter 5mm & length 2mm can be investigated through CFD simulations. The length of the upstream flow & total length of the pipe are taken as 246 mm & 494 mm respectively. The inlet diameter of the pipe is 12.3 mm. The effect of patched boundary conditions on the flow through the orifice can be avoided by using adequate length at the upstream & downstream of the orifice plate. The upstream of the orifice plate is provided with fully developed turbulent flow. The working fluid is air. The relative pressure drop between inlet & out let can be obtained by assigning static pressure to the outlet pipe. The inlet velocity profile is assumed to be uniform. The pipe is modeled as solid wall with no slip condition. The *k-ε* model was chosen for the turbulence model and the numerical accuracy was set to first order. All the discretized equations were solved in a segregated manner with the SIMPLE (Semi Implicit Pressure Linked Equation) algorithm.

RESULTS AND DISCUSSIONS

The velocity contour plot & velocity vectors are shown in figure 4. From the figure it is found that the flow forms a free flowing jet in the down stream fluid as the air flows from a narrowing orifice plate & the velocity is at its maximum. The separation of boundary layer is seen at the downstream side of orifice plate where as turbulent & wake region together with recirculation zones can be seen just the downstream of the orifice meter.

"Surface Integral Report"

Mass-Weighted Average Velocity Magnitude	(m/s)
inlet	1.85
interior-partbody	10.113476
orifice	0
outlet	1.411644
Net	10.087149

Pressure inside the tunnel can be calculated by using ANSYS which is shown in figure 5. Considering figure 5& surface integral report the change in the pressure can only be seen at the inlet, the interior body and the outlet part.

"Surface Integral Report"

Mass-Weighted Average Total Pressure	(pascal)
inlet	2494.5382
interior-partbody	892.70003
orifice	0
outlet	0.87148827
Net	893.79812

the Reynolds No of the flow at the various sections of the tunnel is shown in figure 6. From the figure & surface integral report it is found that the Reynolds Number reaches its highest value at the outlet of the regulator plate i.e. 60.





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"Surface Integral Report"
 Mass-Weighted Average
 Cell Reynolds Number

inlet	0.2248959
interior-partbody	4.7989897
orifice	0
outlet	1.6433612

Net	4.7869971

The turbulent kinetic energy model is shown in figure 7. From the figure, it is found that the velocity difference can be seen at the outlet of the regulator plate where as in surface integral report it is in between inlet, outlet and the interior body part

"Surface Integral Report"
 Mass-Weighted Average
 Turbulent Kinetic Energy (k) (m2/s2)

inlet	1
interior-partbody	40.907852
orifice	0
outlet	5.3617837

Net	40.790772

Central axial velocity profiles for experimental as well as computational with & without orifice are shown in figure 8 & 9 respectively. Their values are presented in table 1 & 2 respectively. Considering both the figure it is found that the velocity increases as the flow approaches the throat of the orifice meter, further it travels downstream of orifice meter & reaches at its maximum value. This point of maximum value is known as vena-contracta. Beyond this value the velocity decreases. From the above experiment we can see that the average velocity of air through the regulator plate that we got from the ANSYS figure is almost equal to the average velocity of air flow in the wind tunnel in both inlet and outlet. Hence, the model which was established in this experiment get validated in terms inlet and outlet velocities of both the mine gallery and wind tunnel.

CONCLUSION AND RECOMMENDATIONS

The experiment is done by putting a regulator plate inside the wind tunnel and the flow velocity test is done at different heights measured by Betz Manometer. The experimental results agree well with the computational results in terms of flow pattern & velocity profile. The location of vena-contracta was determined from CFD simulations. The flow rate has been established at different sections of the orifice plate at different pressures. It is also concluded that the CFD technique can be used as an alternative and cost effective tool towards replacement of experiments required for estimating discharge coefficient, empirically. Further work to use orifice meter on different liquids and gases at different beta ratios are to be carried out in future

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Table 1 The observations of Pitot tube between orifice plate and exhaust fan

Physical Model Velocity (m/s)	Numerical Model Velocity (m/s)
5.7	4.9
4.84	5.25
5.2	5.95
5.37	6.3
7.6	6.65
7.36	7
6.71	7.3
7.36	6.3
7.83	5.95
4.84	5.6
5.7	5.25

Table 2. The observations of Pitot tube between orifice plate and inlet

Physical Model Velocity (m/s)	Numerical Model Velocity (m/s)
1.34	6.28
2.32	9.41
9.96	3.16
23.08	1
23.47	34
17.77	60
5.54	33
-2.32	18
-1.34	-6.28
2.125	3.16
3	0.02





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Fig. 1 Pitot Tube

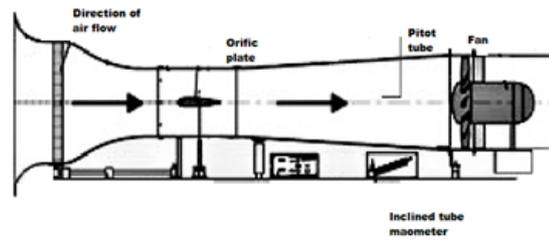


Fig.2 Experimental set up of orifice mete

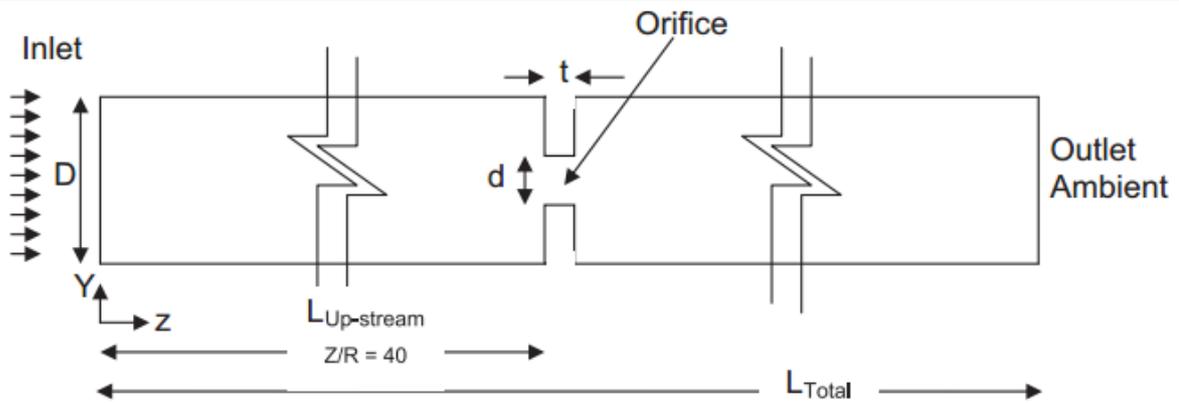


Figure 3. The Orifice Geometry

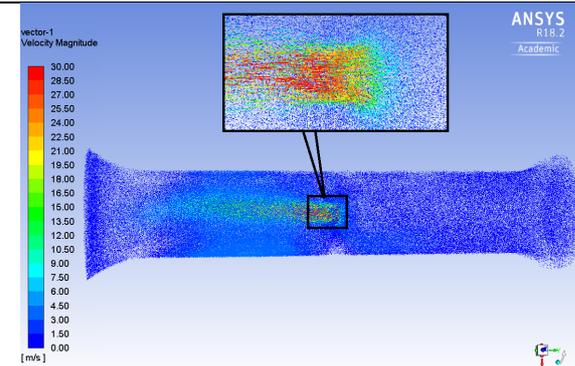


Fig. 4 Velocity contours & Velocity vectors

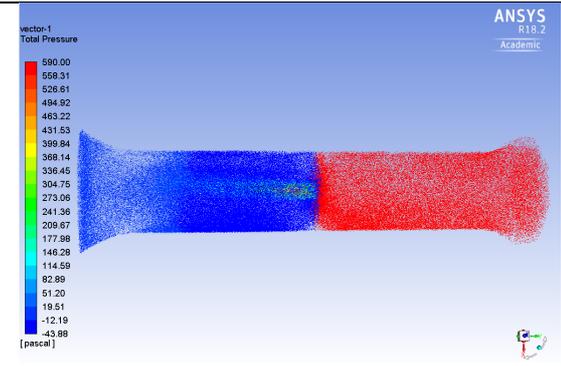


Fig.5 Total Pressure model





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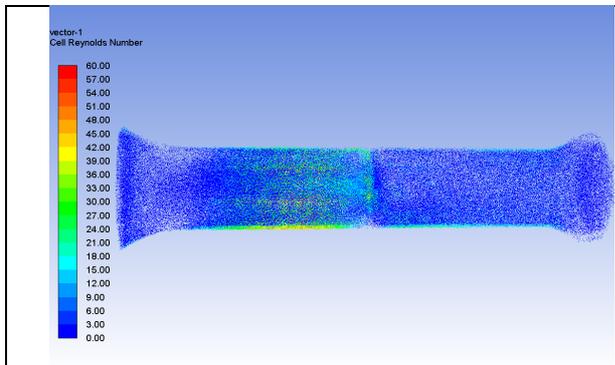


Fig 6 Cell Reynolds Number model

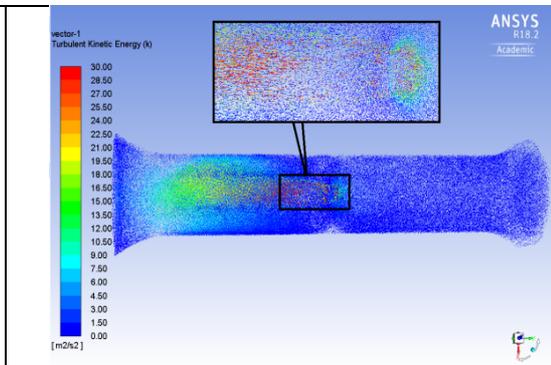


Fig. 7 Turbulent Kinetic Energy model

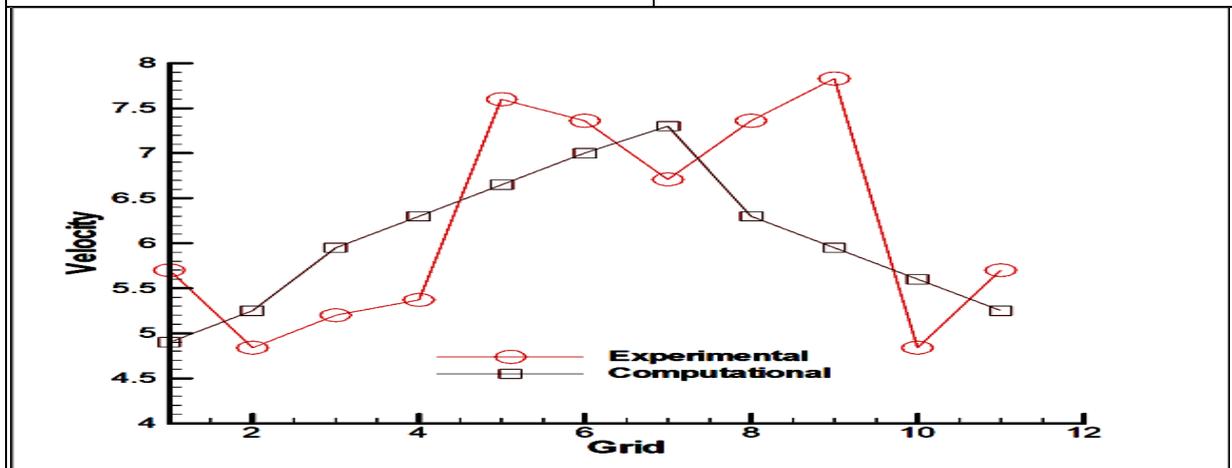


Fig.8 Wind Tunnel without Orifice & Model

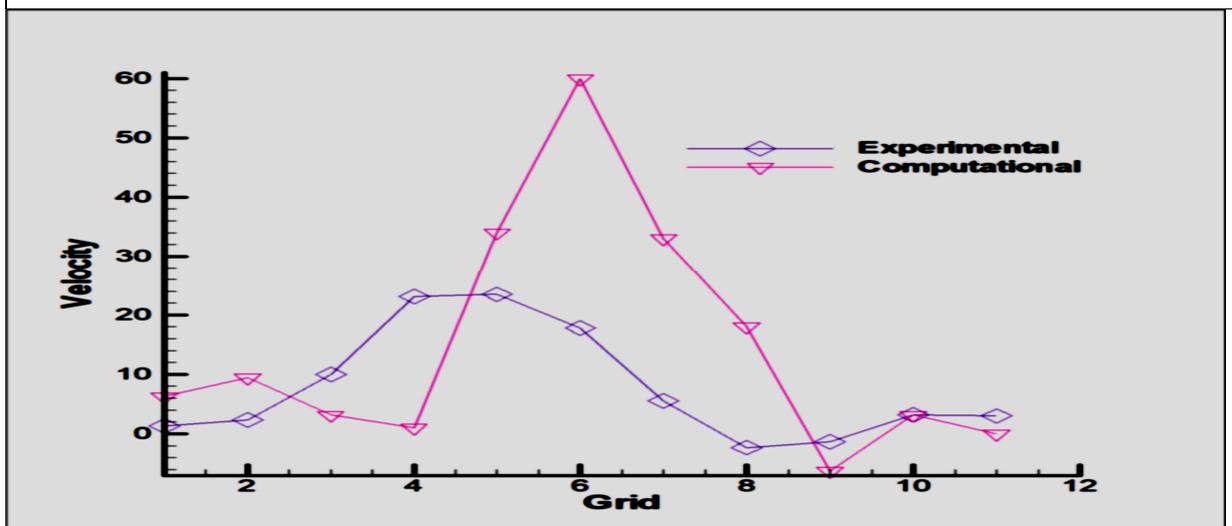


Fig. 9 Wind Tunnel with Orifice & Model





Randic Type Lodeg Index of Specific Graphs

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ABSTRACT

The Randic type Lodeg index is a degree – based molecular structure descriptor, defined as

$$R_{Lo\ deg}(G) = \sum_{uv \in E(G)} \ln(d_u) \ln(d_v).$$

Where d_u and d_v denotes the degree of the respective vertices. It's a computational paper which is having the generalization of the Randic type Lodeg index of double graphs, subdivision graphs and complements of some standard graphs.

Keywords : Randic type Lodeg index, double graphs, subdivision graphs, k-complement, k(i)-complement. AMS Subject Classification: 05C50.

INTRODUCTION

Topological indices and spectral analysis are the popular topics in Graph Theory. There are different sorts of topological indices such as degree-based topological indices, distance based topological indices etc., Topological indices correlate certain physicochemical properties such as boiling point, stability, enthalpy of vaporization of chemical compounds etc., These are oftenly used to study QSAR of pharmaceuticals to analyze their molecular characteristics by numerical computation.

Randic type Lodeg index is one of the topological indices defined as follows[13]:

$$R_{Lo\ deg}(G) = \sum_{uv \in E(G)} \ln(d_u) \ln(d_v)$$





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Representing a chemical structure in the form of graph is very easy and the graph obtained is known as the molecular graph. $\{v_1, v_2, \dots, v_n\}$ represents the vertex set and m mentions the number of edges. The following definitions are important for our next results.

Definition 1. The subdivision graph (S(G)) of a simple graph G is defined as the new graph obtained by adding an extra vertex into each edge of G. The subdivision graphs have been studied in literature, [3].

Definition 2. For a graph G with vertex set $V(G) = \{v_1, v_2, \dots, v_n\}$, we take an other copy of G with vertices labeled by $\{v_1, v_2, \dots, v_n\}$, this time, where v_i corresponds to v_i for each i. If we connect v_i to the neighbours of v_i for each i, we obtain a new graph called the double graph of G. It is denoted by D(G). [4]
In this paper we compute the Randic type Lodeg index for different graph structures.

RANDIC TYPE LODEG INDEX OF SOME STANDARD GRAPHS

Randic type Lodeg index is a degree based index, in this section we compute this index for some well known and much studied graphs.

Theorem 1.

$$R_{Lo\ deg}(G) = \begin{cases} (n-3)[\ln(n-3)]^2 & \text{if } G = P_n \text{ for } n \geq 3 \\ n[\ln(2)]^2 & \text{if } G = C_n \\ \frac{n(n-1)}{2}[\ln(n-1)]^2 & \text{if } G = K_n \\ mn[\ln(m)\ln(n)] & \text{if } G = K_{m,n} \\ 0 & \text{if } G = K_{1,n-1} \\ n[\ln(2)]^2 + 2n[\ln(2)\ln(2n)] & \text{if } G = F_n^3 \\ (n-1)[\ln 3]^2 + (n-1)[\ln 3 \ln(n-1)] & \text{if } G = W_n \\ (p+q-4)[\ln(2)]^2 + 3\ln 2 \ln 3 & \text{if } G = T_{(p,q)} \end{cases}$$

Proof. In path graph P_n , there are $n-3$ edges between the vertices with degree 2 and two edges between the vertices having degree 1 and 2. According to the definition of Randic type Lodeg index,

$$\begin{aligned} R_{Lo\ deg}(P_n) &= (n-3)(\ln(n-3)(\ln(n-3))) + 2(\ln 1 \ln 2) \\ &= (n-3)[\ln(n-3)]^2 \end{aligned}$$

The same proof technique can be used to other graph structures.





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RANDIC TYPE LODEG INDEX OF DOUBLE GRAPHS

Theorem 2.

$$R_{Lo\ deg}(D(G)) = \begin{cases} (16n - 32)[\ln 2]^2 & \text{if } G = P_n, n \geq 3, \\ 4[\ln 2]^2 & \text{if } G = P_n, n = 2 \\ 4n[\ln 4]^2 & \text{if } G = C_n \\ 2n(n - 1)[\ln(2n - 2)]^2 & \text{if } G = K_n \\ 4(n - 1)[\ln(2n - 2)][\ln 2] & \text{if } G = K_{1,n-1} \end{cases}$$

Proof. We prove the theorem for Double graph of Path P_n . The same proof methods can be used for other graphs. In this graph structure, eight edges are there between the vertices of degree 2 and 4. Also it has $4n - 12$ edges between the vertices of degree 4 each. Proof follows by the definition of Randic type Lodeg index.

RANDIC TYPE LODEG INDEX OF SUBDIVISION GRAPHS

Theorem 3.

$$R_{Lo\ deg}[(S(G))] = \begin{cases} (2n - 4)[\ln 2]^2 & \text{if } G = P_n \\ 2n[\ln 2]^2 & \text{if } G = C_n \\ 2mn[\ln 2][\ln m + \ln n] & \text{if } G = K_{m,n} \\ [2(p + q) - 4][\ln 2]^2 + 3[\ln 2][\ln 3] & \text{if } G = T_{(p,q)} \end{cases}$$

Proof. Subdivision graph of complete bipartite graph will have $2mn$ edges. There will be mn edges between the vertices with degree 2 and n , remaining mn edges exist between the vertices with degree 2 and m . thus apply the definition of the index, one can get the desired result. Same proof method can be.

RANDIC TYPE LODEG INDEX OF GRAPHENE

Graphene is an important chemical structure which will be used for different purposes in industries. The structure is the honey comb lattice formed by carbon atoms. Here we compute the Randic type Lodeg index of the grapheme.

Theorem 4.

Randic type Lodeg index of grapheme with x rows of benzene rings such that y benzene rings are placed in each row is given by

$$R_{Lo\ deg}(graphene) = \begin{cases} (x + 4)(\ln 2)^2 + (2x + 4y - 4)(\ln 2)(\ln 3) + (3xy - 2y - x - 1)(\ln 3)^2 \\ 6(\ln 2)^2 + (4y - 4)(\ln 2)(\ln 3) + (y - 1)(\ln 3)^2 \end{cases} \quad (1)$$

Proof. The molecular graph of Graphene is having x rows and y benzene rings in each row, $x + 4$ edges between the vertices of degree 2 each in addition to $2x + 4y - 4$ edges between the vertices of degree 2 and 3. Also there are $3xy - 2y - x - 1$ edges between the vertices of common degree 3. Thus





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Case -1. Randic type Lodeg index of grapheme for $x \neq 1$ is

$$R_{Lo\text{deg}}(\text{graphene}) = (x + 4)(\ln 2)^2 + (2x + 4y - 4)(\ln 2)(\ln 3) + (3xy - 2y - x - 1)(\ln 3)^2.$$

Case-2. When $x = 1, 6$ edges between the vertices with degree 2 each, $4y - 4$ edges between the vertices of degrees 2 and 3 and $y - 1$ edges between the vertices of degree 3 each. Thus,

$$R_{Lo\text{deg}}(\text{graphene}) = 6(\ln 2)^2 + (4y - 4)(\ln 2)(\ln 3) + (y - 1)(\ln 3)^2.$$

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IPSEC-Based Virtual Private Network

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ABSTRACT

Tunneling for mobile devices IPSec allows end users to securely access information on their or network (for example, an intranet) over a public network such as the Internet. A VPN using IPSec is a connection that has the appearance of a dedicated link and many of the benefits of one, but it is built over a shared network. Data packets are sent through a public routed network, such as the Internet or another publicly accessible network, in a private tunnel that simulates a point-to-point link, using a technique known as "tunnelling." This method allows network traffic from multiple sources to pass through the same infrastructure through separate tunnels. VPN with IPSec allows us to save money and be more flexible on the Internet while still protecting our confidential business data. Two machines can be linked securely using IPSec, which is known as the Road Warrior Configuration. This is accomplished by the use of Transport mode. The operating system used for this may be Windows or Linux. Two subnets can be connected securely using VPN, which is known as Subnet-to-Subnet Configuration. Packets are encrypted only between two subnets/clients in this situation, but not between Routers. Tunnel Mode is used to do this. VPN Server also uses firewalling to filter unwanted packets through the organization's network. It's also used to prevent people on the network from accessing websites.

Keywords: Virtual Private Networks, Mobile Tunnelling, Shared Networks, Security.



**Sheela and Suresh Kumar²**

INTRODUCTION

Enterprise networks are no longer limited to local or even interoffice connections. They now link consumers, partners, and remote users around the Internet. Virtual Private Networks (VPNs) are crucial in this situation. They allow you to take advantage of the Internet's cost-cutting and versatility while still safeguarding your confidential business data. VPN solutions provide robust protections for your expanded network, as well as the versatility and manageability that long-term expansion necessitates. One or more of these solutions may be appropriate for your business, depending on your needs and plans.

Analyze the System

Remote access is becoming more and more popular in the workplace. It allows you to increase efficiency and maintain competitiveness in a highly competitive market world that has already gone "electronic." Remote access is a business "must" that allows for further connectivity and interaction. It gives mobile workers and remote users access to essential information at any time and from any location. It also allows businesses to collaborate efficiently with contractors and consultants, as well as clients, associates, and suppliers, beyond their own employees. Traditionally, remote access has been achieved using leased line dial-up methods. While successful, this approach is typically hampered by slow transmission speeds and high network costs, making it difficult to provide the service levels your customers need to conduct business efficiently.

As a result, when a user connects to a remote server to access his account and transfer data over the internet, his secret password and sensitive data can be exposed to other internet users (those attempting to hack) through Man-in-the-middle, ip spoofing, and network monitoring.

Proposed system

A Virtual Private Network (VPN) allows end users to access information on their corporate network (e.g., an Intranet) in a secure manner over a public network infrastructure such as the Internet. A virtual private network (VPN) is a connection that has the appearance and many of the benefits of a dedicated connection but operates over a public network. Data packets are sent through a public routed network using a technique known as "tunnelling." in a private "tunnel" that simulates a point-to-point link, such as the Internet or another publicly accessible network. This method allows network traffic from multiple sources to pass through the same infrastructure through separate tunnels.

VPN solutions provide robust protections for your expanded network, as well as the versatility and manageability that long-term expansion necessitates. One or more of these solutions may be appropriate for your business, depending on your needs and plans. The most important advantage of all, however, is that VPNs enable businesses to concentrate on their core business goals rather than managing corporate networks. The value of remote access has shifted dramatically. Remote access is no longer an executive toy or an IT luxury; it is now critical to business operations. However, as the size of remote access deployments has grown, as has the demand for connectivity, the cost of owning and maintaining conventional remote access technology has skyrocketed. This is mostly due to the telephone system's high long-distance costs. VPN will be a standard component in the future of remote access to overcome these competing demands and pressures. As the technology matures and service providers provide cost-effective data access, VPN implementation can accelerate.

Snap Shots

configuration Of Ipsec. Conf File In Vpn1



**Sheela and Suresh Kumar²****System Performance**

IPsec is incredibly versatile, since it works at the network layer, and it can be used to encrypt virtually any form of Internet traffic. However, there are two applications that are extremely popular: By encrypting all contact between the sites, a Virtual Private Network, or VPN, enables multiple sites to communicate safely over an insecure Internet. "Road Warriors" connect to the office from their homes or, in some cases, from a hotel. Vendors are flocking to the applications because they provide ample opportunity. IPsec is mainly used to support these applications and is integrated into routers, firewall components, and major operating systems. We support both of those applications, as well as a number of lesser-known IPsec applications, but we also have our own: The ability to set up Opens wan gateways such that any two of them can encrypt to each other and will do so as packets pass between them is known as opportunistic encryption.

Future Improvement

The project's potential growth would require it to be improved in the following ways:

1. To increase the VPN Server's computing power;
2. To configure DNS and WEB using Shell Script coding rather than configuring.
3. To make security policy modification easy, even a layman may specify it.

RESULTS AND DISCUSSION

When the only communication between two networks is via a third network that they do not trust, a VPN allows them to communicate safely. Between each of the interacting networks and the untrusted network, a security gateway machine is placed. The gateway machines encrypt and decrypt packets entering and exiting the untrusted network, forming a safe tunnel across it. If the cryptography is good, the implementation is cautious, and the gateway administration is professional, the tunnel's protection can be fairly trusted. The two networks then act as if they were one big private network, with some of the connections being encrypted tunnels via untrusted networks. VPNs are frequently more complicated. One company can have fifty branch offices, as well as suppliers and customers, with whom it must securely communicate. Another company could have 5,000 stores or 50,000 POS terminals. The Internet does not have to be the untrusted network. Regardless, when two departments try to interact privately with each other on a corporate or institutional network, problems occur. The administrative benefit of many VPN configurations is that large portions of them are static. Most of the machines' IP addresses are known to you. More importantly, you are certain that they will not abandon you. This makes certain administrative tasks easier. In the event that the addresses do change, proceed to the next segment.

CONCLUSION

Virtual Private Network (VPN) technology can be used in both small and large businesses to secure network communication over a public network (the Internet) and save money on phone bills. Virtual private networks (VPNs) that are industry-standard are ushering in the next wave of network access. According to most estimates, internet-based VPNs would be widely adopted because they provide significant cost savings and new market opportunities for both businesses and NSPs. Many of these advantages can be obtained by quickly forming new forms of mutually beneficial business partnerships. Corporations are combining VPNs with their existing remote access solutions to optimise the benefits. As a result, the company now has an integrated remote access solution that lowers total costs by lowering long-distance charges. As the technology matures and service providers provide cost-effective data access, VPN implementation can accelerate.





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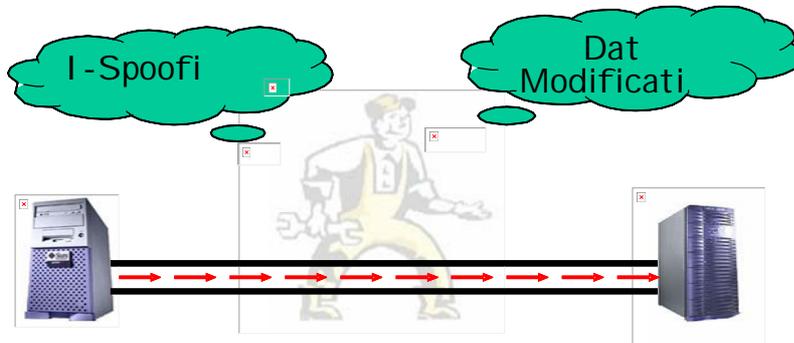


Fig.1. IP Spoofing

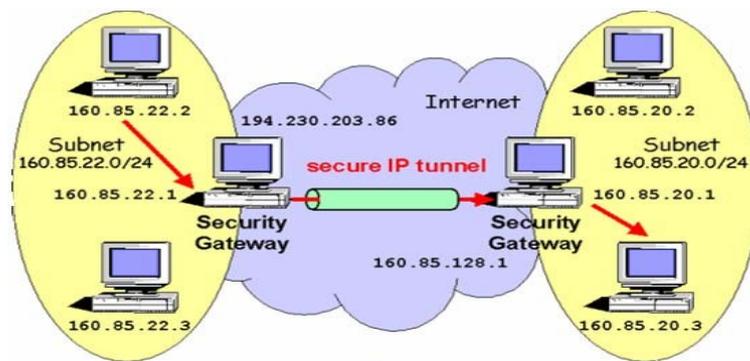


Fig.2. Proposed VPN System





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```
version 2.0
config setup
    interfaces="ipsec0=eth0"
conn net-to-net
    left=100.0.0.1
    leftsubnet=10.0.0.0/8
    leftnexthop=100.0.0.2
    right=200.0.0.2
    rightsubnet=172.16.0.0/16
    rightnexthop=200.0.0.1
    # To authorize this connection, but not actually start it,
    # at startup, uncomment this.
    authby=secret
    auto=start
conn road
    left=100.0.0.1
    leftsubnet=10.0.0.0/8
    leftnexthop=100.0.0.2
    right=0.0.0.0
    rightsubnet=
    rightnexthop=
    # To authorize this connection, but not actually start it,
    # at startup, uncomment this.
    authby=secret
    auto=add
#Disable Opportunistic Encryption
include /etc/ipsec.d/examples/no_oe.conf
```

Fig. 3. Configuration Of Ipsec. Conf File In Vpn1





Assessment and Analysis of Sound Levels over Hyderabad

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ABSTRACT

In all metro cities noise, is one of the biggest pollutants, but the risk is often ignored in spite of many health problems linked with it. Unplanned urbanization, industrialization coupled with a tremendous increase in vehicular volume leading to an increasing trend in sound level exceeding the ambient standards over Hyderabad. In the present study, we have evaluated and analysed the monthly mean sound levels of last five years from 2016 to 2020, monitored at 11 different locations of the city. The study reveals that commercial zones are highly exposed to noise pollution followed by industrial, residential and sensitive zones. It was also observed that five year mean values of sound levels at all locations except at Jeedimetla and Gaddapotharam exceed the permissible limits both at day and night hours. The statistical overview of sound level discloses that there is a considerable difference in day-time and night-time sound levels across all the stations. To quantify the significance difference of the means, a two-sample t test analysis with 95% confidence level for day-time and night-time shows that noise exposure level differs significantly with $p < 0.05$ across all zones. The results show an instrumental contribution with a statistical approach to the policy makers to implement certain measures to control the noise pollution in the city.

Keywords: Sound levels, noise, traffic, day-time, night-time.

INTRODUCTION

In urban environment, the most undesirable sound which interferes our day-to-day life is noise. Over the two decades, exposure to the noise pollution was increasing rapidly due to the population growth. The sources for noise are numerous in number like vehicles, rails, industries, air, neighbourhood and recreational commotion. The World Health Organisation [WHO] published that noise pollution is ranked second among the series of environmental stressors on public health in Europe [1]. Specifically, road traffic is considered to be the major source of noise in the

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urban environment which leads to non-auditory effects of traffic noise such as annoyance and sleep disturbance [2]. The noise value levels show variable intensities in urban areas like residential, commercial, sensitive and industrial zones. Reference [3] reported that commercial areas have high noise levels, followed by industrial and residential in the capital city of India, Delhi. The impact of noise pollution was observed to be more in the morning and afternoon hours with variable intensity values [4]. Night-time noise exposure leads to a serious impact on long term health issues such as cardiovascular disease, obesity and diabetes [5-7]. All these investigations have clearly shown the adverse effects of noise pollution. In consideration of these effects, the Central Pollution Control Board (CPCB), India, developed a National Ambient Noise Monitoring Network Programme, which includes the installation of noise monitoring stations all over India. This programme was initiated in the phase wise over 7 metropolitan cities that include Bangalore, Chennai, Delhi and Hyderabad. Hyderabad, the capital city of Telangana State is located at 17.37 °N, 74.48 °E and lies on hilly terrain in the southern part of India. The city is spread over 650 sq. km with a population of 10,269,000. It was subjected to a persistent increase in urbanisation and industrialisation activities. Hyderabad has been recording a steady growth in the number of vehicles over the years. As per the statistics, number of vehicles in Hyderabad before 2011 is around 4 million and the figure now shot up to 10 million. The noise monitoring stations are installed in the city areas like residential, commercial, industrial and sensitive zones. In order to assess the impact of noise pollution, very few studies were carried out over this city of Hyderabad. In view of the above, the main objective of this paper is to provide a statistical analysis over the variations of noise pollution levels during day and night hours in these zones of Hyderabad. This study will facilitate for better understanding of noise pollution in the city for preventing and/or taking necessary corrective measures.

METHODOLOGY

As stated earlier, Real Ambient Noise Monitoring of Hyderabad has been carried out at 11 locations. At each station the data was recorded instantly on the daily basis using sophisticated equipment and thereby processed and disseminated monthly mean values in its website. This study is based on the mean data collected from the website of Telangana State Pollution Control Board (TSPCB) for five years from Jan 2016 to Dec 2020. These monitoring stations provide day (6 AM to 10 PM) and night (10 PM to 6 AM) noise levels over Hyderabad that includes five commercial zones, two industrial zones, two residential zones and two sensitive zones. Few data gaps are filled with linear interpolation. The details of the monitoring stations are depicted in Table 1. To study the noise pollution generated by various sources CPCB has set standards for noise pollution (regulation and control) rules, 2000 for different categories of areas, separately for day-time and night-time, listed in Table 2. In this study, two-sample t-test was used to analyse parametric noise levels for each station between day and night hours. The test statistic is given by

$$T = \frac{\bar{x} - \bar{y}}{s \sqrt{\frac{1}{n} + \frac{1}{m}}} \quad (1)$$

where 's' is the pooled sample standard deviation and 'n' and 'm' are the numbers of observations in the 'x' and 'y' samples. The test was made with significance of 95 % confidence interval for the true difference in mean.

RESULTS

A statistical overview of sound levels

The average value of sound level over 11 stations in Hyderabad for day and night hours during the study period with their standard values was depicted in Table 3. It was observed that during the day-time and night-time, the five year mean values were exceeding the prescribed standard values across all the stations, except for JDM and GPM. At these two sites the mean value meets the ambient noise standards. Overall, the sound level ranges between 56.8 dB(A) and 72.3 dB(A) with mean value of 66.42 dB(A) for day-time whereas 54.26 dB(A) and 70.60 dB(A) with mean value of 63.40 dB(A) for night-time in the city of Hyderabad. The mean sound level in the city was found to be high -3 dB(A) in day hours when compared to night hours. The frequency of occurrence of monthly mean sound levels at



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each station during the day and night times are shown in Table 4. A majority of occurrences during day-time were found to be in between 56 - 65 dB(A) and 66 - 75 dB(A), rarely crossing 75dB(A). Similarly, during night-time majority of occurrences were observed to be in the same range as in day-time, except at ZOO, where the majority levels fall in the range 46 – 55 dB(A). The frequency distribution of sound levels for all the stations during the study period is depicted in the Figure 1. The frequency of occurrence in the night-time sound levels was well in comparison with day-time. It was observed that the frequency distribution of sound levels during the day-time and night-time are well above the standard values for commercial places (66 - 75 dB(A)) like ABD, JNTU, PAR, RCP, SAN. Similarly, the residential zones like JBH, TAR were also recorded the highest values for day-time and night-time which are much higher than the standard values. This indicates that, due to dense population, heavy traffic and commercial activities leads to high values of sound level over commercial and residential zones. Particularly during night-time, the high values of sound level result in the disturbance of sleep in the residential zone. Out of all 11 stations, 100% exceedance was observed in 9 stations during day and night times.

Further, in this study boxplot was used as a standardized way to display the distribution of data. The graphical representation of noise level for different stations during day-time and night-time over the study period was depicted in Figure 2. The central box comprises values of 25 (Q_1) and 75 (Q_3) percentiles, and whiskers show the range of value falling within 1.5 times of inter-quantile range beyond the box. The solid line within the box represents the median value. The outliers defined as data points beyond the inner fence are represented with '+' symbol. The Figure shows clearly that the median values of sound level during night-time are less than day-time at all stations. These levels were found to be high at five commercial sites (ABD, JNTU, PAR, RCP and SAN), followed by industrial (JDM, GPM), residential (JBH and TAR) and sensitive (ZOO and GCB) areas. In general, more outliers are observed at commercial sites than compared to other stations, except ZOO. This indicates that, a large variation of sound levels was observed at commercial sites. In our study period, median values of sound level for day-time and night-time were found to be same at PAR, JDM and GPM. Residents staying and passengers crossing commercial sites are exposed to a high level noise, especially during day-time. At these sites, apart from traffic noise, other invasive noise source that includes loud speaker, hawking and human conversation may contribute to environmental noise pollution. The low population density (sensitive) areas have low irritation responses due to this noise. The station wise statistical values of ambient noise levels for day and night-time, are tabulated in Table 5. The median value of sound levels were observed to be high at Abids (73 dB(A)) during day-time and found to be as high as 72dB(A) at PAR during night-time. The levels are found to be minimum at ZOO both during day (56.00dB(A)) and night (52.17 dB(A)) time. High standard deviations during night-time compared to day-time across all stations, except at PAR indicates a large deviation of sound level. At PAR, the deviation was almost same during day-time and night-time.

Yearly trends of ambient sound level

The monthly data of each year were averaged on yearly basis, both for day-time and night-time and the results for all the stations are shown in Figure 3. Close examination of data reveals that sound levels at ABD, JNTU and SAN have shown an overall decreasing trend both for day-time and night-time in the last five years. At TAR, a clear increase of sound level around 3dB(A) and 5dB(A) was observed in the years 2019 and 2020 during day-time and night-time respectively. At ZOO, the sound levels shows a decreasing trend from 2016 to 2019, but suddenly shoots up in 2020 during day-time. Whereas, during night-time sound levels were found to be almost same from 2016 to 2019 and rises in 2020. There is no much variation of yearly averaged sound level at JBH, JDM, GPM and GCB both during day and night time.

Monthly trends of ambient sound level

In order to study zone wise trends of sound level, the available data of day-time and night-time for all the stations were averaged falling under respective zones as listed in Table 1. Later, the data was averaged month wise of all years (2016 to 2020), for all zones to study the monthly trends of sound levels during day-time and night-time and



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the results are depicted in Figure 4. The monthly variations of day-time and night-time sound levels for industrial zone were well within the ambient noise standards. The monthly mean values of day-time and night-time sound level in all zones except industrial zone are well above the ambient standards. Close examination of the above results reveals that the difference of sound levels was much higher during night-time (~ 10 dB(A)) when compared with day-time difference (~ 5 dB(A)). The day – night sound levels have not shown any clear monthly variation in residential and commercial zones, while slight variations were observed in industrial and sensitive zones. These observations of sound level, in the last five years, shows that the commercial, residential and sensitive zones require immediate noise control measures.

Day-time and Night-time difference in ambient sound level

To understand more effectively about the impact of sound levels for day and night hours the difference in sound levels of day-time and night-time were calculated and are depicted in figure 5 as bar graph for different zones. It was observed that the difference in day-time and night-time sound levels show high in the commercial zone, followed by residential, sensitive and industrial zones. Surprisingly, the industrial zone is not showing much variation in the values of day-time and night-time sound levels. This indicates that the noise contributed by the industries was same in day-time and night-time and they are very much within the limits of standard values. The difference in day and night sound levels ($L_D - L_N$) for the past five years shows a difference of 4.07 dB (A) for commercial, 3.79 dB(A) for residential, 3.42 dB(A) for sensitive and 2.23 dB(A) for industrial.

Two sample t-test analysis of sound level data

The results of two sample t-test analyses on the difference of day-time and night-time sound level is depicted, station wise and zone wise in Table 6. The result of hypothesis test shows that the Boolean value (H value) is zero for PAR and GPM indicating that the hypothesis of equality is accepted for these two stations whereas, the test value is one for the remaining stations. Hence out of eleven stations, nine are having the samples where the hypothesis of equality is rejected. Further, the analysis shows a significant difference ($p < 0.05$) in day-time and night-time sound levels across all the stations except PAR and GPM where there is no significant difference ($p > 0.05$). This indicates that the means of day and night time sound levels have significant difference at all stations except PAR and GPM. Further, two sample t-test analysis was performed zone wise and the result shows a significant difference between day-time and night-time sound levels with Boolean value (H value) one and $p < 0.05$. Hence the hypothesis of equality is rejected and the means of day-time and night-time sound levels show significant difference across all zones.

DISCUSSION

To evaluate the impact of sound level on a target individual, the measurements of sound level over 11 stations in the city were used to assess the impact. The above result gave some important findings and the possible reasons of annoyance with the existing noise environment. It has been observed that the mean values of sound levels for the study period was exceeding ambient noise standards. Out of 11 sample stations, five are under commercial zone which are busy areas in Hyderabad city. Within these commercial zones, ABD was found to record maximum sound level during day hours followed by PAR, SAN, JNTU and RCP. The high noise intensity was associated with heavy movement traffic and high population density during day hours. The significant difference of sound level between day-time and night-time was observed to be more in commercial zone indicating low night-time activities. Surprisingly, at PAR, there is no difference between day-time and night-time sound level as it is the busiest location surrounded by many commercial buildings, malls, hotels, hospitals, railway station and bus stations. Minimum sound level recorded in these commercial zones also exceeds the ambient noise standard, which clearly indicates that the rising noise level has a serious effect on the health of citizens leading to various problems like irritation, trauma, dizziness, and cardio vascular problems. Noise exposure among different zones and their persistent effect on health problems was studied by many researchers [8-10].



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General life, household activity, sound coming from construction works, shouting of hawkers, children play, etc., are some of the sources of noise in residential zones. Both JBH and TAR are highly populated areas in Hyderabad. As per the statistical figures in 2020, the population density at TAR is 17705 people per km² with total population 40779. Whereas, at JBH the population density was recorded as 11,071 people per km² with total population 1,48,869. Out of two residential stations TAR shows higher sound level when compared with JBH. Reference [11] reported that, noise levels in the residential area were exceeding the prescribed limits. Year to year variation of sound level, both at day and night times was much higher at TAR when compared with JBH. Automobiles especially three and two wheelers' movement at TAR may also be the main reason for high values of sound level at TAR. Reference [12] reported that the noise levels in residential and commercial zones is almost 1.5 times more than CPCB standards. Reference [13] found levels in commercial and silent zones of Visakhapatnam are slightly higher than the prescribed limits of ambient air quality noise standards. Stress related illness, diseases such as cancer, kidney failure, mental retardation, hearing failure or complete deafness are the main health hazards experienced by industrial workers due to high sound levels in industrial zones. In our present study, even though sound levels at JDM and GPM are within the limits of ambient standards, long exposure to these levels may result the above health problems. Another observation related to these industrial zones is the less difference (- 2.25 dB(A)) between day and night sound levels when compared to other zones. This indicates that the source of sound levels is same for both day-time and night-time.

As per the noise pollution (regulation and control) rules 2000, an area not less than 100 metres around religious places, courts, educational institutions and hospitals were stated as silence zones. Interestingly, the sensitive zones, namely ZOO and GCB also breach the noise levels in the area. Reference [14] reported that the day-time and night-time noise levels in the silence zones were above the ambient standards. The key reason for this is, sensitive areas are becoming the hub for commercial activity coupled with vehicular traffic as a result the demarcation laid down between sensitive and other zones is slowly fading. The Zoo Park is one of the most iconic tourist places in Hyderabad. Among sensitive areas, ZOO recorded higher sound level than permissible noise levels, especially during night hours. The biggest prevailing source of night-time noise level at ZOO is from heavy vehicles with an indiscriminate usage of horns as it is one of the major routes to enter the city from NH7. In recent years, GCB, one of the sensitive areas became an IT hub and many software companies established their offices in and around GCB. In addition to this many business establishments, malls are also started in this area. An increase in population, vehicles, and construction of high range buildings are some of the factors for an increased intensity of sound level at GCB. On the other hand, the statistical two sample t-test analysis reveals that there was a significant difference ($p < 0.05$) in sound level during day-time and night-time over the study period. This indicates a continuous increase of vehicular volume at road junctions or busy roads, commercial centres and high-density residential area were major contributors to high intensity of sound levels.

CONCLUSIONS

In our present study, five years of monthly mean sound level data (2016 to 2020), downloaded from TSPCB website over Hyderabad was analysed and the results are reported in this paper. The annual and monthly means of day-time and night-time sound levels observed during the study period exceeded the permissible ambient noise standards at almost all sample stations. The measured sound levels vary with different characteristics of the location like heavy traffic volume, vehicle horns, unmuffled vehicles, etc., are the reason for high mean value of sound level (70.33 dB(A) (67.56 dB(A))) during day-time (night-time) at commercial zones, respectively. In residential zones, the high sound levels (61.89 dB(A), (58.2 dB(A))) during day-time and night-time respectively, may be due to the coupled effect of traffic volume, commercial activity and high-density population. Interestingly, selective sensitive locations are also record high noise levels due to fading of demarcation between sensitive and other zones. A statistical analysis shows that the noise exposure levels are differs significantly ($p < 0.05$) during day-time and night-time across all zones. This shows a risk of excess noise exposure among the people staying in Hyderabad, which may lead to many health issues such as noise – induced hearing impairment and psychological effects like



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susceptibility to irritation, sleeping disturbance, especially among the people residing near commercial, residential and sensitive areas where the mean sound level exceeds much higher than standard values.

RECOMMENDATIONS

In view of high intensity of sound level over Hyderabad, the present study recommends various evocative measures. Different techniques and tools were to be used to control the noise pollution in different zones. For example, rubber sealing or noise dampers are to be used to reduce the noise produced by machines in industries. Preventive and control measures like usage of ear plugs and mufflers are required to the industrial workers. Noise sensors help to reduce sound level in residential and sensitive areas thereby provide protection against adverse effects of noise. Graphic display boards are to be installed in sensitive areas like hospitals, schools and religious places, for bringing awareness to the public. The use of noise absorbing materials in the construction of buildings in commercial zones needs to be encouraged. Suitable noise reduction measures like installation of noise barriers especially near schools, hospitals and religious places, excessive tree plantation, monitoring and control of loudspeakers, generators sets, etc. should be taken to control the noise over Hyderabad. Proper planning and design are essential to control the noise due to traffic. Smooth flow of traffic causes less noise than stop and go traffic. Regular and thorough maintenance of vehicles helps to avoid noise pollution. Implementation of staggered times of schools, offices etc. can reduce the traffic in peak hours so that noise pollution can be reduced to some extent. Sharing of transport (Vehicle pooling) and using public transportation instead of using private vehicles also reduces the vehicular volume thereby reduces the noise. In residential zones, stringent implementation of vegetation around houses and communities is highly recommended. Policy makers and stakeholders can play an important role in formulating and enforcing stringent rules and to create awareness among the general public about risk and complications of high noise exposure. To conclude, the loss of hearing due to noise exposure is irreversible. So, there is need to involve the community, stake holders and policy makers to effectively reduce the magnitude of the noise problem worldwide.

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Table 1. Details of monitoring stations in Hyderabad

S.No.	Station Name	Category	Latitude	Longitude
1.	Abids (ABD)	Commercial zone	17°23' 27.42" N	78°28' 25.59" E
2.	Sanathnagar (SAN)	Commercial zone	17°25' 27.77" N	78°27' 3.74" E
3.	Jeedimetla (JDM)	Industrial zone	17°30' 44.12" N	78°28' 10.43" E
4.	Zoo (ZOO)	Sensitive zone	17°22' 8.44" N	78°28' 17.42" E
5.	Jubilee Hills (JBH)	Residential zone	17°26' 22.08" N	78°23' 58.28" E
6.	Tarnaka (TAR)	Residential zone	17°25' 43.57" N	78°32' 15.83" E
7.	Gaddapotharam (GPM)	Industrial zone	17°36' 4.1" N	78°22' 19.8" E
8.	Gachibowli (GCB)	Sensitive zone	17°27' 36.1" N	78°20' 3.3" E
9.	Paradise (PAR)	Commercial zone	17°26' 36.7" N	78°29' 15.9" E
10.	JNTU, Kukatpally (JNTU)	Commercial zone	17°29' 45.3" N	78°23' 39" E
11	R C Puram (RCP)	Commercial zone	17°30' 30" N	78°18' E

Table 2. Ambient standard values of noise level

Category of area / zone	Limit in dB(A) L_{eq}	
	Day-time	Night-time
Residential	55	45
Commercial	65	55
Industrial	75	70
Sensitive	50	40

Table3. Comparison of mean sound levels (2016-2020) with ambient noise standards

Station	JBH	TAR	ABD	JNTU	PAR	RCP	SAN	JDM	GPM	ZOO	GCB
Day-time											
Standard	55	55	65	65	65	65	65	75	75	50	50
Mean	60.52	63.27	72.35	69.83	70.34	69.12	70.03	67.74	68.97	56.80	61.65
Night-time											
Standard	45	45	55	55	55	55	55	70	70	40	40
Mean	56.72	59.68	69.08	66.97	70.16	66.33	65.26	64.90	67.52	53.96	56.87

Note: All values are in L_{eq} dB (A)





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Table 4. The frequency of occurrence of monthly mean sound level data for five years across all stations

Station	JBH	TAR	ABD	JNTU	PAR	RCP	SAN	JDM	GPM	ZOO	GCB
Day-time											
Standard	55	55	65	65	65	65	65	75	75	50	50
<45	0	0	0	0	0	0	0	0	0	3	0
46-55	0	0	0	0	0	0	0	0	0	15	0
56-65	59	38	1	1	3	0	2	11	10	37	53
66-75	1	15	50	59	19	36	48	47	45	5	7
>75	0	0	1	0	3	0	1	1	0	0	0
Night-time											
Standard	45	45	55	55	55	55	55	70	70	40	40
<45	0	0	0	0	0	0	0	0	0	1	0
46-55	15	15	1	0	2	0	0	4	1	43	26
56-65	45	24	3	3	1	2	21	24	17	11	30
66-75	0	13	53	50	30	35	23	32	38	5	3
>75	0	0	0	0	1	0	0	0	2	0	1

Note: All values are in L_{eq} dB (A)

Table 5. Station wise statistical values for day and night time

Parameter	Median		Min.		Max.		Std.		Q1		Q3	
	DT	NT	DT	NT	DT	NT	DT	NT	DT	NT	DT	NT
JBH	60.62	56.44	55.00	45.00	68.39	63.14	1.79	2.50	59.40	55.41	61.09	58.00
TAR	62.00	58.50	55.00	45.00	73.91	72.57	4.01	5.94	60.00	55.00	66.10	65.00
ABD	73.00	69.99	59.42	52.09	77.00	74.00	2.61	4.24	72.31	69.00	73.40	71.04
JNTU	70.00	67.01	62.87	55.00	72.50	69.77	1.52	2.13	69.00	66.84	71.00	68.00
PAR	72.00	72.00	52.00	50.00	79.67	75.08	6.02	5.89	68.03	68.33	73.00	73.01
RCP	69.00	66.79	65.00	55.00	70.37	68.13	0.97	2.04	69.00	66.00	70.00	67.00
SAN	70.25	65.74	61.15	56.90	77.00	75.00	2.31	2.77	68.87	64.54	71.00	66.61
JDM	68.00	66.87	49.00	48.00	78.00	75.00	4.86	5.74	66.00	61.00	71.00	69.01
GPM	69.00	69.05	60.00	53.00	75.00	76.70	3.49	4.81	66.70	64.16	72.00	70.80
ZOO	56.00	52.17	42.19	37.00	69.93	69.30	4.67	6.05	55.00	51.00	58.00	55.17
GCB	61.00	56.70	50.00	40.00	70.00	78.06	3.31	5.54	59.95	53.09	63.83	59.28

Note: All values are in L_{eq} dB (A); DT - Day-time and NT - Night-time

Tables 6. Two sample t-test analysis of sound level data

Parameter	H	p-value	CI limits		t stats
Station Wise					
JBH	1.00	0.00	3.01	4.59	9.57
TAR	1.00	0.00	1.65	5.52	3.68
ABD	1.00	0.00	1.92	4.61	4.81
JNTU	1.00	0.00	2.19	3.53	8.44
PAR	0.00	0.91	-2.90	3.26	0.12
RCP	1.00	0.00	2.05	3.53	7.53
SAN	1.00	0.00	3.77	5.77	9.47
JDM	1.00	0.00	0.93	4.77	2.93
GPM	0.00	0.07	-0.12	3.03	1.83





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ZOO	1.00	0.00	0.88	4.79	2.88
GCB	1.00	0.00	3.12	6.42	5.73
Zone Wise					
Residential	1.00	0.00	2.64	4.76	6.86
Commercial	1.00	0.00	2.28	3.55	9.02
Industrial	1.00	0.00	0.88	3.41	3.34
Sensitive	1.00	0.00	2.44	5.17	5.49

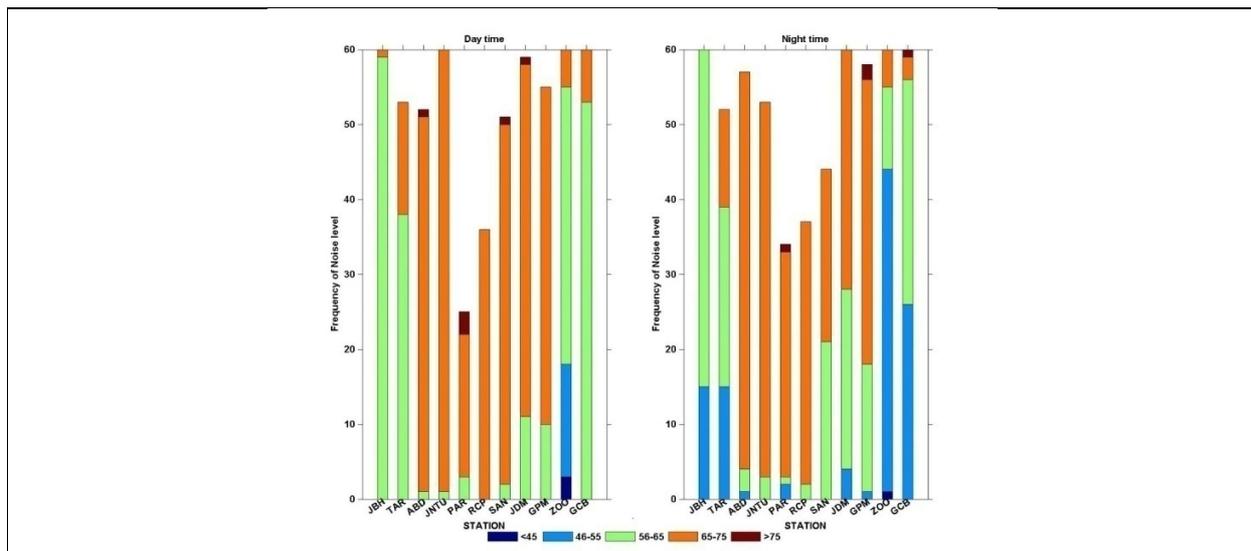


Fig 1. Frequency distribution of sound levels for all the station during the study period for day-time and night-time.

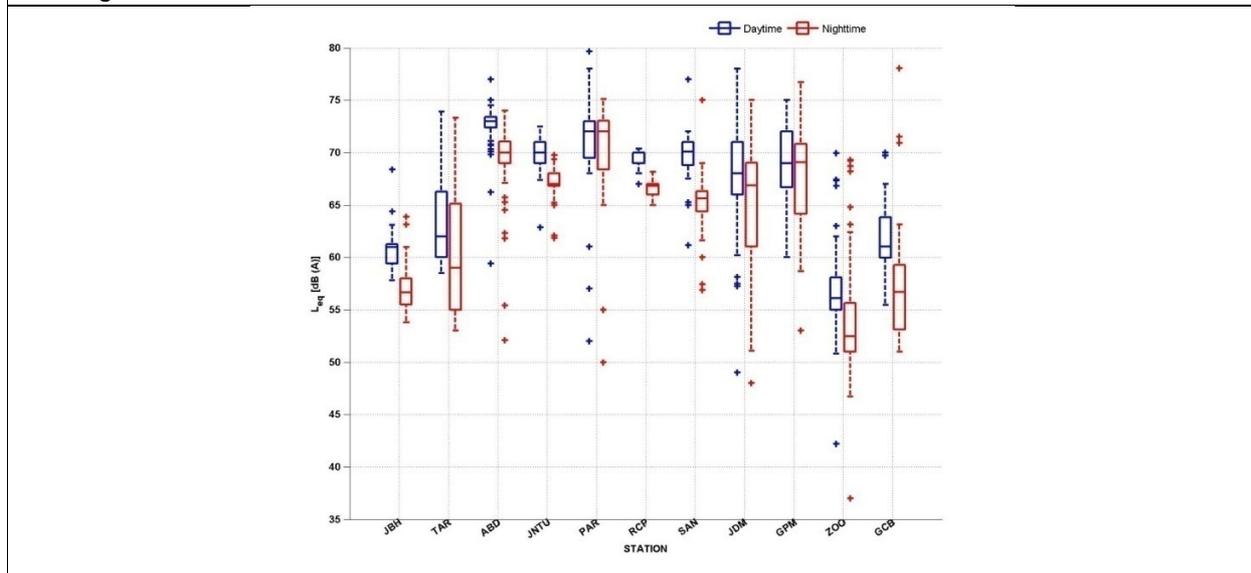


Fig 2. The sound levels of day-time and night-time for different stations during study period with median values (solid line within box), 25 and 75 percentiles and whiskers. The outliers are represented with '+' symbols.





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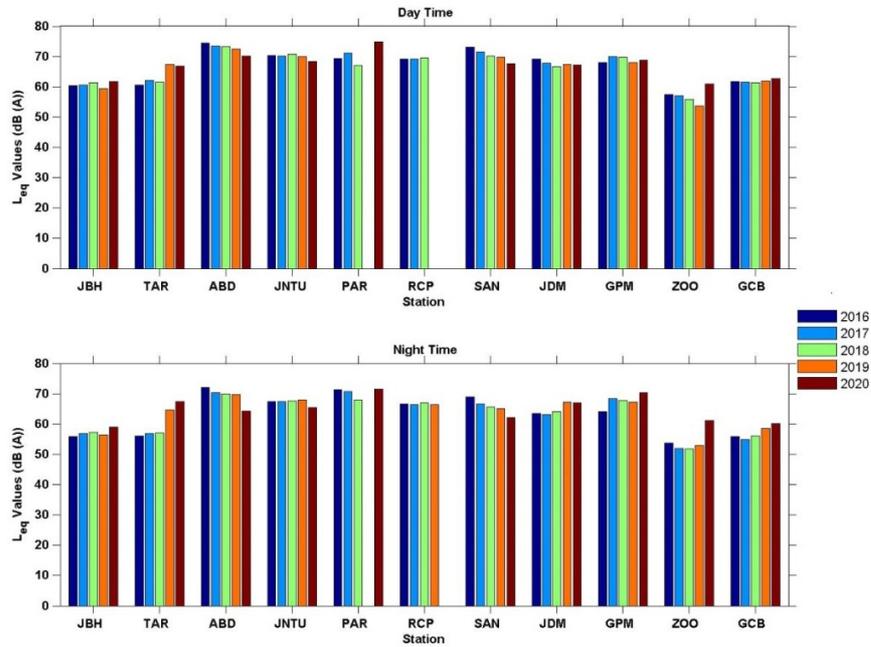


Fig 3. Year to year variation of sound levels

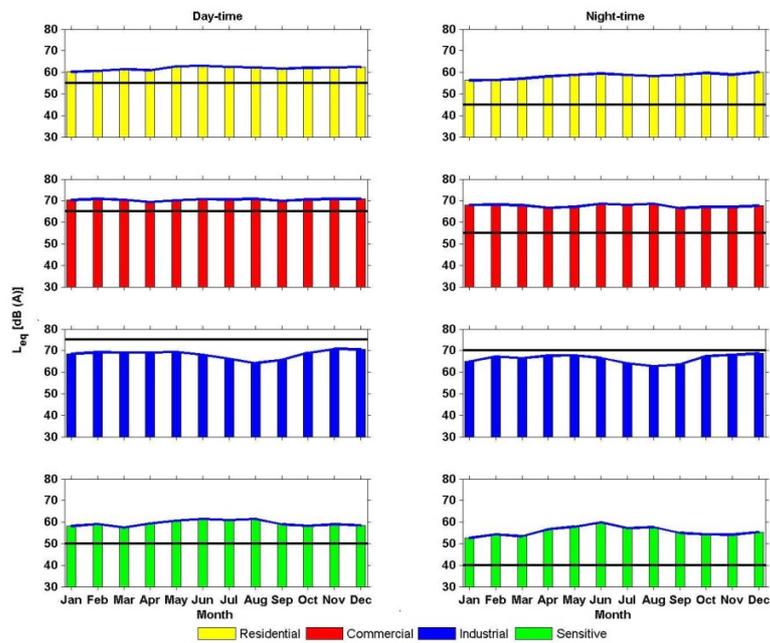


Fig 4. Monthly trends of sound levels during day-time and night-time





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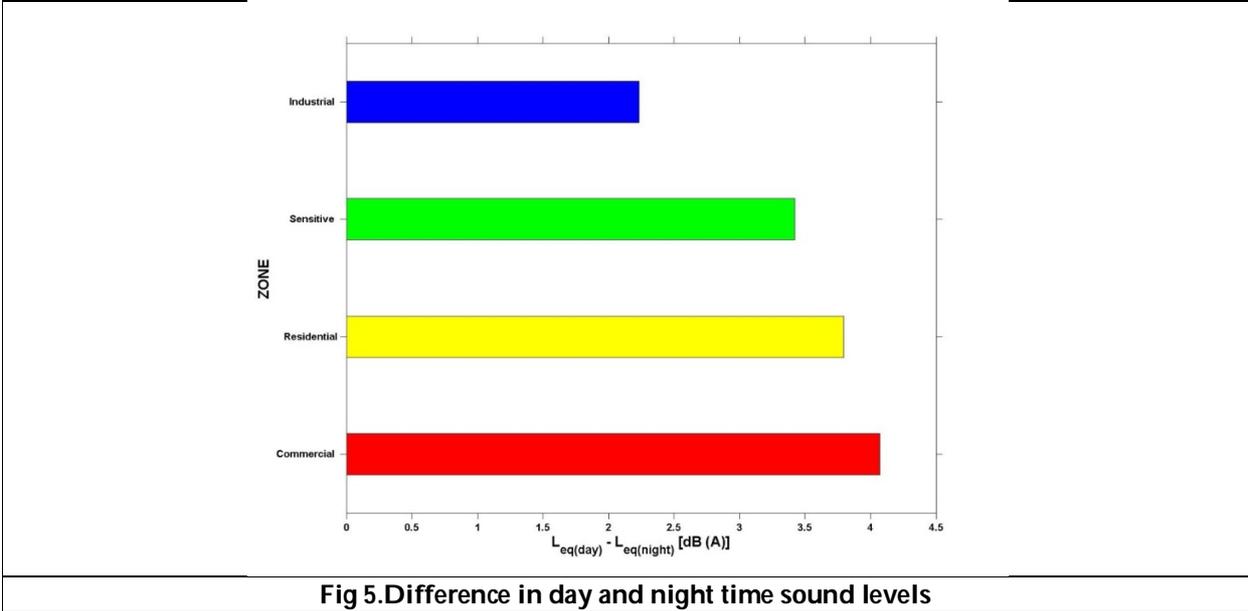


Fig 5. Difference in day and night time sound levels





Economic Analysis of Sweet Potato (*Ipomoea batatas* L.) Varieties and Alfonso Mulberry Tree Variety Intercropping Schemes to Different Fertilizers

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ABSTRACT

COVID-19 pandemic is affecting societies and economies at their core. The impact of the pandemic will vary from country to country, it will most likely increase poverty and inequalities at a global scale. The objectives of this study are to (i) determine the net income of sweet potato + Alfonso mulberry tree variety as affected by the different sweet potato varieties; (ii) determine the net income of sweet potato + Alfonso mulberry tree variety as affected by the different fertilizers; & (iii) determine the net income of sweet potato and Alfonso mulberry tree variety as affected by the interaction effect of sweet potato varieties and different fertilizers. This study was laid out in a 4 x 4 following the split plot RCBD factorial design replicated three times. The following factors were tested: main plot (V_1 – Seven Flores, V_2 – Seri Kenya, V_3 – Immitlog and V_4 - Violeta) and subplot (F_0 – No fertilizer application, F_1 – RR 100% chicken compost, F_2 – RR 100% urea and F_3 – 50% RR chicken compost + 50% Urea). Result of this study revealed that the net income of intercropping schemes between sweet potato & Alfonso mulberry tree variety as affected by sweet potato varieties was highly significant highest in treatment Immitlog sweet potato Variety + Alfonso mulberry trees variety with 184,181.29 pesos per hectare but comparable to the net income of Seven Flores sweet potato variety + Alfonso mulberry trees variety ranked second with 137, 881.71 pesos per hectare. On the other hand, effect of different fertilizers to the net income of sweet potato variety and Alfonso mulberry trees variety revealed highly significant highest to the plants applied with $\frac{1}{2}$ RR chicken compost and $\frac{1}{2}$ RR N with 159,198.00 pesos per hectare but comparable to plants applied with 100% RR Urea alone that ranked second with 128,643. 00 pesos net income per hectare. However, there was no significant effect on the interaction between sweet potato varieties and different fertilizers to the net income of sweet potato + Alfonso mulberry tree variety intercropping

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schemes. This study concluded that intercropping of sweet potato varieties and Alfonso mulberry tree with the application of fertilizers is a good intercropping scheme that can help to increase the income of the farmer's particularly in rural areas and consequently alleviate poverty. And recommended that if the concern of the farmers is to get higher income intercropping of Immitlog sweet potato variety, Seven Flores sweet potato variety + Alfonso mulberry tree variety applied with 50% RR Chicken Compost (3t/ha) + 50% urea (60+0+0 kg/ha) and or applied with 100% urea (60+0+0 kg/ha) are the best intercropping schemes. Conduct related study with the use of other sweet potato varieties and fertilizers.

Keywords: Covid 19, Economic Analysis, Agroforestry, Sweet potato Varieties, Different Fertilizers, Alfonso Mulberry Tree Variety & Intercropping.

INTRODUCTION

COVID-19 crisis has disrupted our lives in a manner unprecedented in modern times, more than low-income working families with children. Unemployment has spiked sharply, and families have experienced income losses & increasing their economic hardship. Compounding this loss of income, widespread physical school closings have meant that millions of children have lost access to subsidized school meals that play a key role in helping families with children meet their basic food needs. Food insecurity is a measure that indicates a household has experienced limited access to adequate food due to a lack of money and other resources. A recent survey that specifically asked whether children in a household were not eating enough because the family could not afford enough food found that 17% of mothers reported that their children were experiencing food insecurity. Food insecurity was predicted to hit its lowest point of 10.1% in March 2020 & 0.6 percentage points lower than the 2018 average. The food insecurity rate from the April 2020 COVID Impact Survey is 22.8% and is more than double the predicted level for March 2020 (Schanzenbach and Pitts, 2020).

Moreover, UN (2020) reported that COVID-19 pandemic is far more than a health crisis: it is affecting societies and economies at their core. While the impact of the pandemic will vary from country to country, it will most likely increase poverty and inequalities at a global scale, making achievement of SDGs even more urgent. Without urgent socio-economic responses, global suffering will escalate, jeopardizing lives and livelihoods for years to come. Immediate development responses in this crisis must be undertaken with an eye to the future. Development trajectories in the long-term will be affected by the choices countries make now and the support they receive. Anislag, (2019) mentioned that to improve the livelihood and nutrition status of the people of the Philippines and the world as well, the viable agricultural solution to this problem is to adopt the practice of agroforestry systems. Because Agroforestry is the combination of agriculture and forestry practices within a farming system. It involves the combination of trees and crops that increase the environmental and economic value of land while sustaining food security. Among the agroforestry systems that would be an effective tool to solve land degradation, poverty and malnutrition is intercropping. Intercropping is a sustainable practice to increase diversity and productivity in the farming system. High value agricultural crops like sweet potato and trees like mulberry applied with different fertilization strategies is an efficient intercropping system (Anislag, et al., 2020).

This study would encourage the farmers all over the world to promote intercropping of sweet potato varieties and Alfonso mulberry tree variety as high value Agroforestry crops while community quarantine is implemented because this farming system helps to increase their daily incomes, maintain good health condition and food sufficiency for survival while pandemic is still go on. Ghosh et al., (2017) mentioned that mulberry leaf is solely used for feeding and rearing the silkworm, Bombyxmori for the production of silk yarn. It is estimated that mulberry silk contributes around 90% of the total global raw silk production and it is a very attractive economic activity mostly to the rural people. In addition to the utilization of mulberry leaves as silkworm feed, it is also used for many other



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purposes such as the fruit. Mulberry fruit due to its high nutritive value and delicious taste is getting importance as valuable foodstuff. The mulberry bark and wood are also useful for the manufacturing of paper and sports goods items. Popescu&Matei, (2013) concluded that production of mulberry trees has a positive effect leading to an increased profitability. Moreover, Belen et al., (2018) revealed that sweet potato provides strategic opportunities to improve nutrition and rural incomes in several countries and regions affected by micronutrient deficiencies. All in all, growers are not too afraid, because sweet potatoes are recording increasing demand worldwide (Mulderi, 2016).

Domestic measures to maintain adequate levels of domestic production and farmers' income might be used to support the economy and ensure food security. While farmers may boost domestic production, purchasing locally produced products helps to reduce physical distance, it should not disrupt trade flows. Supporting farmers' incomes can also be achieved through direct payments, decoupled from production decisions, as a potentially more cost-efficient approach (FAO, 2016). In the Philippines and other parts of the world no studies have been conducted on economic analysis of sweet potato (*Ipomoea batatas* L.) varieties and Alfonso mulberry tree variety intercropping schemes to different fertilizers hence this study.

OBJECTIVES

1. Determine the net income of sweet potato + Alfonso mulberry tree variety as affected by the different sweet potato varieties;
2. Determine the net income of sweet potato + Alfonso mulberry tree variety as affected by the different fertilizers; &
3. Determine the net income of sweet potato and Alfonso mulberry tree variety as affected by the interaction effect of sweet potato varieties and different fertilizers.

METHODOLOGY**Research Design**

The study was laid out following the 4 x 4 split plot technique in Randomized Complete Block Design (RCBD) replicated three times (Figure 1). The sweet potato varieties were the main plot and the different fertilizers were the subplot. Each subplot measured 2 m by 1.25 m and per main plot measured 8 m by 5 m. The treatments used were as follows:

Main plot: Sweet potato varieties (V)

Subplot: Different Fertilizers (F)

Experimental Procedure

A total land area of 480 sq m Alfonso mulberry tree variety plantation of Sericulture Research Development Institute (SRDI) in Don Mariano Marcos Memorial State University North La Union Campus Compound, Sapilang, Bacnotan, La Union was prepared by removing all the weeds and undesirable vegetation with the use of a spading fork and bolo. Alfonso mulberry trees were pruned at thirty five (35) cm from the ground. Prior to land preparation, the area was flooded to make the soil soft and provide moisture before it was cultivated twice using a tractor to loosen the soil. Furrows were constructed between rows of Alfonso mulberry tree variety plantations with the use of a carabao drawn plow at 25 cm deep and wide. Chicken composts were applied in furrows following the basal method at 2.4 kg/subplot for RR organic fertilizer; 106.66 g/subplot for RR inorganic fertilizer and 1.2 kg chicken compost and 53.33 g urea for ½ RR organic and ½ RR inorganic urea, respectively. After basal fertilizer application, irrigation was done to dilute the fertilizers for an easy absorption of nutrients by the crops.

The second fertilizer application was done twenty five (25) days after planting of sweet potato. This was done by two points drill method with a distance of twenty (20) cm per plant to avoid burning the root system. Irrigation

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followed after fertilizer application. Two hundred eighty eight (288) sweet potato cuttings per variety were prepared. These cuttings were matured 30 cm long and with 5 nodes/cuttings as recommended by (DA et al., 2011; Abidin et al.,2017). The cuttings were put in rice sacks and placed in a pail filled with water and stored in a cool place before they were planted. Planting of cuttings was done at 30 cm between hills and 50 cm between rows of Alfonso mulberry tree variety plantation. Half of the length of cutting with 3 nodes was buried to the ground using a hand trowel. There were 24 plants/subplots. Irrigation was done just after planting and every other two weeks thereafter to facilitate the development of the roots and stems of sweet potato varieties and Alfonso mulberry tree variety until the termination of the study to maintain the moisture of the soil. Replanting was done a week after planting sweet potato varieties. The cuttings that died were immediately replaced so that the yield of sweet potato varieties will not be affected. Weeding was done two weeks after planting by hand weeding to avoid disturbing the development of storage roots of the sweet potato varieties. Hilling-up of sweet potato plants was done fifteen (15) days from planting to fully cover the root systems with soil. Hilling- up of sweet potato tubers would minimize direct sunlight exposure thus, preventing tubers to become green and not fit for consumption. In fact, green potatoes can carry toxins and become poisonous. Weekly pest surveillance was done after planting to monitor the presence of insect pests, disease incidence and degree of damage.

Harvesting of the Alfonso mulberry leaves was done 60 days from pruning as a cultural practice of Sericulture Research Development Institute of Don Mariano Marcos Memorial State University North La Union Campus Compound .Harvesting of sweet potato was done 90 days after planting of sweet potato using a spading fork and pruning of Alfonso mulberry tree variety using pruning saw. The spading fork was inserted below the ridges of the plants and turned upright to expose the storage roots. The vines with storage roots were uprooted and the tubers were handpicked and placed in net bags. The harvested vines were transported to SRDI storage room building using the wheelbarrow for data collection. After data gathering, the tubers were sorted and classified into damaged, large, medium and small sizes as recommended by (Abidin et al., 2017; Sweet Potato Production Guide, 2018). The harvested leaves of Alfonso mulberry tree variety and harvested sweet potato cuttings and tubers were marketed to the people who raised silkworms and consumers living near the research site. The price of Alfonso mulberry leaves was priced as low as 7.00 pesos per kg, sweet potato cuttings was priced 7.00 pesos per 30 cm cutting and sweet potato tubers were priced 80.00 pesos per kg as the highest local market of La Union Province of the Philippines.

Data Gathered

Inputs and outputs generated in the intercropping schemes were gathered and recorded as the basis of computing the net returns. Production (materials and labor) inputs were quantified and priced with the prevailing market prices. Outputs concentrated in three major products as cuttings and storage roots for sweet potato and leaves for Alfonso mulberry tree variety. These were quantified and priced using the prevailing market prices. Net income or net returns was estimated as Gross income – total production cost (materials, labor and fixed cost and contingency cost). The following were the data collected by this study to determine the net income.

- Weight of leaves of Alfonso mulberry tree variety (kg) per hectare. This was taken by the use of an electronic weighing scale.
- Length of cuttings (m) of sweet potato per hectare. This was taken by the use of tape measure.
- Weight of storage roots (kg) per hectare. This was taken by the use of an electronic weighing scale.
- Calculation of net income of intercropping schemes of sweet potato varieties and Alfonso mulberry tree variety was generated from the harvested yield per hectare using this formula:

$$\text{Yield per ha (kg)} = \frac{\text{Yield per sub plot}}{\text{Area per subplot}} \times 10000 \text{ sqm}$$



**Marjohn V. Anislag****Data Analysis**

All agronomic and yield components of data gathered were subjected for the analysis of variance (ANOVA). Treatment means were compared using Least Significance Difference Test (LSD) at 5% level of significance to evaluate the treatment effects.

RESULTS AND DISCUSSION**Economic Analysis**

To assess the profitability of intercropping schemes of different varieties of sweet potato and Alfonso mulberry tree, production in yield per hectare was priced using the prevailing prices in the locality. Likewise, production inputs (materials & labor) and fixed cost (land rent, water pump and other facilities) and contingency cost were estimated. Net income was calculated by deducting the production cost to the gross income from the products.

Effect of Sweet Potato Varieties

Figure 2 shows the net income of intercropping schemes of sweet potato and Alfonso mulberry trees variety as affected by the different sweet potato varieties. Statistical analysis revealed that the net income of Immitlog sweet potato variety + Alfonso mulberry tree variety was highly significant highest over other treatments with 184,181.29 pesos per hectare. Nevertheless, comparable to sweet potato Seven Flores variety + Alfonso mulberry tree variety with 137,881.71 pesos per hectare. However, the Seven Flores sweet potato variety + Alfonso mulberry tree variety ranked second highest net income but similar to sweet potato Violeta variety + Alfonso mulberry tree variety with 80,592.00 pesos and Seri Kenya sweet potato variety + Alfonso mulberry tree variety with 68,370.38 pesos net income per hectare. The result implies that intercropping schemes of Immitlog sweet potato variety, Seven Flores sweet potato variety + Alfonso mulberry tree variety is a sound intercropping scheme as to higher production and income per hectare.

Effect of Different Fertilizers

Figure 3 shows the net income of intercropping schemes of sweet potato + Alfonso mulberry tree variety as affected by the different fertilizers. Statistical analysis revealed that the net income of sweet potato + Alfonso mulberry tree variety applied with 50% RR Chicken Compost (3t/ha) + 50% urea (60 + 0 + 0 kg/ha) was highly significant highest over other treatments used in the study with 159,198.00 pesos per hectare. But comparable to the net income of the sweet potato + Alfonso mulberry tree variety applied with RR 100% urea got 128,643.00 pesos per hectare. However, net income of intercropping schemes of sweet potato + Alfonso mulberry tree variety applied with RR 100% urea and RR 100% chicken compost were comparable with each other and significant lower over the intercropping schemes applied with 50% RR Chicken Compost + 50% Urea. Net income of intercropping schemes of sweet potato and Alfonso mulberry tree variety applied with 100% chicken compost and no fertilizer application were comparable with each other and significantly lowest over the other treatments used in the study. This result implies that application of 50% chicken compost (3t/ha) + 50% urea (60+0+0 kg/ha) highly favored to have higher yield and consequently income of intercropping schemes of sweet potato varieties + Alfonso mulberry tree variety per hectare.

Interaction Effect

As to the net income of the interaction effect between sweet potato varieties X different fertilizers to the sweet potato variety + Alfonso mulberry tree variety, statistical analysis revealed no significant variations were observed. Net incomes ranged from 68,370.38 to 184,181.29 pesos per hectare. This implies that any of the used factors of this study can be used for intercropping schemes.





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CONCLUSION

This study concluded that intercropping of sweet potato varieties and Alfonso mulberry tree variety with the application of fertilizers is a good intercropping scheme that can help to increase the income of the farmer's particularly in rural areas and consequently alleviate poverty.

Recommendation

This study recommended that if the concern of the farmers is to get higher income intercropping of Immitlog sweet potato variety, Seven Flores sweet potato variety + Alfonso mulberry tree variety applied with 50% RR Chicken Compost (3t/ha) + 50% urea (60+0+0 kg/ha) and or applied with 100% urea (60+0+0 kg/ha) are the best intercropping schemes. Conduct related study with the use of other sweet potato varieties and fertilizers.

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Main Plot	Subplot	
V ₁ - Seven Flores	F ₀ - No Fertilizer Application (control)	
V ₂ - Seri Kenya	F ₁ - Organic Fertilizer (RR 100% Chicken Compost - 3t/ha)	
V ₃ - Immitlog (Check Variety)	F ₂ - Inorganic Fertilizer (RR 100% Urea – 60kg/ha)	
V ₄ - Violeta	F ₃ - 50% RR Chicken Compost + 50% RR urea	
BLOCK		
I	II	III
V ₁ F ₂	V ₄ F ₁	V ₂ F ₁
V ₁ F ₀	V ₄ F ₀	V ₂ F ₂
V ₁ F ₃	V ₄ F ₃	V ₂ F ₃
V ₁ F ₁	V ₄ F ₂	V ₂ F ₀
V ₄ F ₁	V ₂ F ₃	V ₄ F ₃
V ₄ F ₀	V ₂ F ₂	V ₄ F ₂
V ₄ F ₂	V ₂ F ₀	V ₄ F ₀
V ₄ F ₃	V ₂ F ₁	V ₄ F ₁
V ₂ F ₀	V ₃ F ₂	V ₃ F ₃
V ₂ F ₂	V ₃ F ₃	V ₃ F ₁
V ₂ F ₃	V ₃ F ₁	V ₃ F ₀
V ₂ F ₁	V ₃ F ₀	V ₃ F ₂
V ₃ F ₂	V ₁ F ₁	V ₁ F ₂
V ₃ F ₀	V ₁ F ₃	V ₁ F ₀
V ₃ F ₃	V ₁ F ₂	V ₁ F ₃
V ₃ F ₁	V ₁ F ₀	V ₁ F ₁

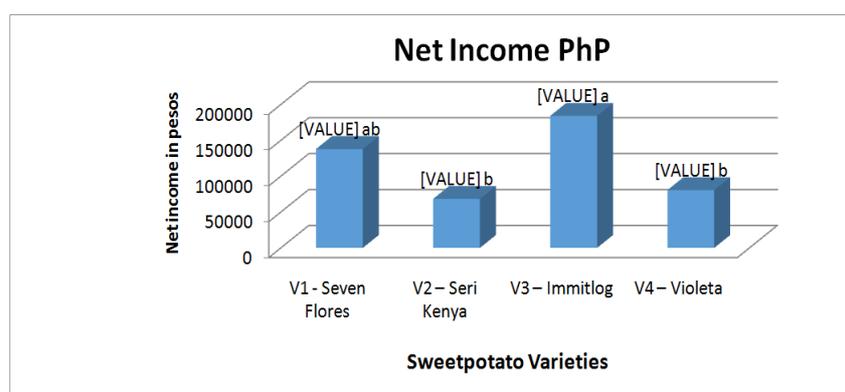
Legend:

Main plot - (Sweet Potato Varieties) Subplot - (Different Fertilizers)

Size per subplot: 2.00 m x 1.25 m = 10 m²

Size per main plot: 8.0 m x 5.0 m = 40 m²

Fig. 1. Experimental Lay out



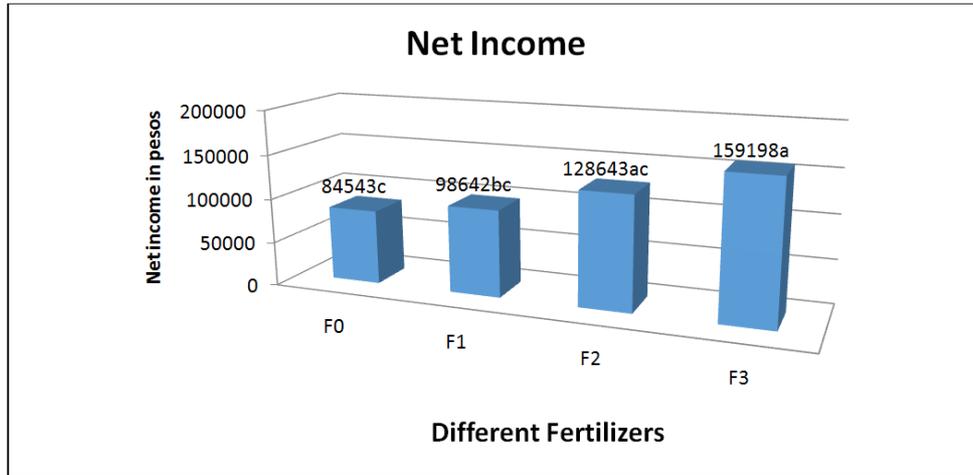
* Means with the same letter are not significantly different at 0.05 (LSD)

Figure 2. Net Income of Intercropping Schemes of Sweet Potato + Alfonso Mulberry Tree Variety as Affected by Sweet Potato Varieties





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* Means with the same letter are not significantly different at 0.05 (LSD)

Legend: F₀ - No Fertilizer Application (control), F₁ - RR (100% Chicken Compost 3t/ha),
F₂ - RR (100% Urea 60kg/ha), F₃ - RR 50% Chicken Compost + RR 50% Urea

Figure 3. Net Income of Intercropping Schemes of Sweet potato + Alfonso Mulberry Tree Variety as Affected by the Different Fertilizers





Famotidine: Pharmaceutical Aspects and Related Facts

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ABSTRACT

Famotidine is a receptor H₂ blocker secretion in the stomach. Famotidine is currently used for the treatment of gastric ulcer, Zollinger elision syndrome and GRED. However, randomized clinical trial revealed that duodenal ulcers. Famotidine is a BCS classification IV drug with low aqueous solubility and permeability. The oral bioavailability of famotidine ranges from 40-50% with usually preferred oral dose of 40mg. The protein binding was found to be 15-22% with minimum first pass metabolism. Among the H₂ receptor blocker like Cimetidine & ranitidine, famotidine is 100 times more potent than cimetidine and 6 to 17 times more potent than ranitidine. Famotidine is classified as reGENCY category B drug and can be used during reGENCY if needed. Different formulate approaches were developed to enhance the gastric residence time and controlled delivery of drug like floating effervescent tablets, microbeads, proniosomes and mucoadhesive systems. Famotidine can be estimated in plasma by HPLC, micelle rextaction technique, tanden mass spectroscopy. A recent study revealed the ability of Famotidine to reduce canine gastric blood flow induced by NSAIDS. The current approach of developing famotidine formulation is based on the enhancement of drug release and to achieve more controlled release pattern. Since Famotidine specifically works by reducing the amount of acid produced in the stomach.

Keyword : Famotidine, Zollinger-ellison, Gastric esophageal reflux disease, HPLC.

INTRODUCTION

Famotidine is a histamine H₂ blocker antagonist. The drug is commonly used in the treatment of gastric ulcer, duodenal ulcer, Zollinger-ellison syndrome, reflex disease, endoscopically diagnose and esophageal reflex disease. In the treatment of benign duodenal and gastric ulcer, the oral dose and around 40 mg, daily for 4 to 8 week in bed time. Where as in GI reflux the dose will be 20 mg orally for around 6 to 12 weeks. In case of esophageal ulceration the oral doses is around 40 mg twice in a day. In in case of heartburn or non-ulcer dyspepsia the dose is around 10

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mg twice daily, where as in Zollinger-ellison syndrome the initial dose is 20 milligrams orally given for 6 hours and if necessary the dose is increased to 80 milligram daily [1]. Oral Famotidine is used for the treatment of pathological GI hypersecretory condition. IV formulation is given for hospitalized individuals with pathological GI hypersecretory condition when oral administration is not possible. The plasma half-life is around 2.5 to 4 hrs. in single dose. It has a bioavailability of 40 to 50 percentage when given orally that favors the sustained release of drug. Usually therapy will be designed with appropriate delivery system and that too the drug picture more advanced type of dosage form is sustained release, which is selected for better Pharmaceutical activity by selection and longer duration of action. Thus Famotidine can be used for sustained release formulation [2]. According to biopharmaceutical classification system (BCS), Famotidine belongs to the class IV drugs that have low permeability and poor aqueous solubility. So that the oral formulation is ineffective because of lower water solubility issues and critical pharmacokinetics parameters with low oral bioavailability. Its marketed product is available ascapsules, tablets and even chewable tablets for adults. For oral suspension, powder form is being employed, but after reconstitution, stability is restricted to 30 days and sometimes it shows bitter taste [3].

PHARMACOKINETIC STUDIES

The pharmacokinetic process of Famotidine when given as a single dose is well explained with oral and IV administration. The steady state data after oral administration of Famotidine is not well reported. In biological fluid, the assay of famotidine was done by HPLC and Fluorophotometry and the distribution into human tissues and fluid is not yet concerned.

Absorption

As we know that C_{max} is around 1-3 hrs. After oral administration, the mean concentration reported for 20 mg oral was 60µg/ml, 30 mg was 29 to 33µg/ml, and 5mg was 17 -22µg/ml. But usually given the oral dose 40 mg and the C_{max} is 78µg/ml.

Distribution

The Apparent volume after IV was found to be 1.14 to 1.42 litre/kg, but it has no relation with the oral administration or distribution into human tissues and certain fluids. The protein binding of in humans are comparatively low. This was proved by giving oral administration of famotidine 20 mg to 5 healthy people and the mean value of plasma protein binding was found to be 21.8 % after of 2 hours administration followed by 19.3 % for 3 hrs and 15.1 % for 4 hrs [4].

Elimination

Elimination is through feaces and kidney. Around 67 to 79 % is been eliminated over 72 hours. In total patients with renal insufficiency the dose was reduced by 25 and 50 percentage with moderate clearance that is 0.21 to 4.2L/hr., 35 to 70 ml per minute in severe cases ; CL_{cr} <0.21l/hr. i.e.; 35ml/ min [5].

Mechanism of Action

Famotidine is a competitive H₂ receptor antagonist that binds to the H₂ receptor that is located in the basolateral membrane of parietal cells of stomach. According to the pharmacological response the result in the inhibition of gastric secretion by suppressing with concentration and volume of gastric secretion. As such the drug inhibits the nocturnal and basal gastric acid secretion which eventually reduces the gastric volume and acid secretion stimulated by food and caffeine [6].

PHARMACODYNAMIC STUDIES***In vivo- In vitro studies***

This studies explained about the Famotidine as a histamine H₂ receptor antagonist without agonist or antagonist effect on other histaminergic, muscarinergic, and nicotinic alpha or beta receptors. Since Famotidine is relatively an inhibitor of gastric acid secretion both in vivo and also in animal GI tract preparation. In in-vitro cases the biding



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between Famotidine and H₂ receptor site is dissimilar from the other H₂ receptor blockers i.e.; ranitidine receptor interaction. This happens because famotidine dissociates from receptor site. Potentially we can say that Famotidine is 100 times more potent than other H₂ receptor blockers like cimetidine and 6 to 17 times than ranitidine in suppressing the H₂ mediated acid secretion and acetylcholine cycle's activity in gastric tissue. Usually the degradation study of famotidine was done under isothermal and non-isothermal conditions. In isothermal testing, the temperature was placed constant as samples were taken simultaneously and studied by analytical method i.e.; HPLC from the sample solution of Famotidine and pH buffer. Here the tray temperature is increased from 25 to 55, 70 and 80. The sample will run at certain isotherm will be extended to include 3 t_{1/2} of the initial material. Finally it was conducted and the sample run time at 25°C is almost 20 hrs. Whereas change in concentration in case of 85°C. In non-isothermal testing: as the above case same temperature will be maintained from 25 to 50 over 72 min and samples are withdrawn followed by analysis by HPLC and the samples of single set of vials is required with the same pH as used in previous case.

STABILITY STUDIES

The oral solution form of famotidine is not frequently available. So that the inadequate stability of its available liquid dosage forms help to develop and evaluate as 10µg/ml solution which shows stability at 25°C for at least 2 hrs. Most of the literature reviews explain that there was no much information described about the physiological properties of Famotidine. The pK_a value of Famotidine was reported to be 7.1 at 25°C, 6.45 at 37°C and 6.7 (no temperature is indicated). These values do not provide any precise result by spectrophotometry and potentiometric methods. Followed by this the ionization behavior Famotidine was not yet reported. The low solubility of Famotidine restricted its degradation in plasma and urine.

SIDE EFFECTS

The data about the side effects is obtained from short term controlled and open studies of peptic ulcer treated patients. Even the patient treated for long term around (10 week), shows that famotidine given twice daily or 40mg at bedtime has been well tolerated [11]. The overall side effect was reported in 3 to 7% of the patient as frequent headache, dizziness, constipation and diarrhea [12].

TOXICITY

Famotidine's package insert, oral doses outside of FDA-approved doses of up to 640 mg per day have been given to adult patients with pathological hypersecretory states with no serious adverse outcomes. Cases of overdose are similar to those encountered in normal clinical experience. Treatment of an overdose should include removing unabsorbed medications from the gastrointestinal tract, the patient should be monitored accordingly and supportive therapy should be provided. Famotidine is classified as pregnancy category B drug and should be used during pregnancy only if needed. Famotidine is secreted through breast milk, and the decision for a mother to breastfeed during therapy should be based on the balance of risk to the infants and treatment benefits to the mother [13].

DIFFERENT PURPOSE OF USING FAMOTIDINE**Formulation as Floating Effervescent Tablet**

This work is done to prolong the GI residence time, increase drug bioavailability and to target gastric ulcer, giving the oral administration of Famotidine. The effervescent system was possible with gas foaming agents like sodium bicarbonate, citric acid, HPMC and carbopol 934P. Later on preparations were undergone for pre compression studies and followed by evaluation. The invitro studies like lag time, swelling index is important for evaluation. The formulation has been modified to SR for around 124 hrs. which shows 98% of release required [14].

Formulation with Cod liver oil entrapped Calcium alginate Beads Containing Famotidine

In this work the drug Famotidine is taken as cod liver oil entrapped Calcium alginate beads containing Famotidine which helps in floating in GI and further studies were taken care off. The set of beads has been prepared by emulsion gelation method with mixture of hydrophilic copolymers such as carbopol 934P, HPMC K 15 M, with mixture and single form of sodium alginate in different concentrations. Floating properties of the percentage oil, amount of



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polymers were to evaluated followed with the beads to study the drug loading, entrapment efficiency, in vitro floating studies. Here the Rostle Rice test apparatus was used to conduct these studies. Finally result confirmed that cod liver oil entrapped Calcium alginate can act as a carrier for intragastric floating drug delivery systems [15].

Formulation and valuation of Famotidine by Guava Starch Binding

For the preparation of tablets binding property is a major concern. So in this study an attempt is made to improve the solubility and dissolution rate of the dug with help of guava starch as the binder. Since guava contains more amount of starch and taken at different concentration in famotidine tablet. From this the result obtained, was compared between standard and prepared form. And the factors that affect the formulation is hardness and dissolution time is also been taken and improvement as final drug release at 3.54%. So we can use these mode of formulation for tablet binder [16].

Formulation and Optimization of Famotidine Proniosomes an *In vitro* and *Ex vivo* Study

The design of the study was develop the form, which could effectively release entrapped drug for an extended release. Here the excipients used is Span 60 and cholesterol from which the method employed will be coacervation phase separation methods. To know the different characteristics FTIR, SEM and XRD studies has been taken. From above studies % drug loading can be calculated and found to be around 78-89%. Required level is maintained by increasing cholesterol and surfactant, can help in the encapsulation efficacy but just further increment can lead to deactivation of the product. Both the in vivo & ex vivo studies showed a significant increase in % drug release when compared with marketed form [17].

Extraction Proceeded For Isolation of Famotidine From Aqueous Samples

For extracting from aqueous Famotidine samples liquid liquid and solid phase method is being employed. Further isolation and spectrometric detection is done on the basis of complexation with tymol blue as indicator. The quantification of Famotidine was done at 544nm using dichoromethane as solvent or 434 nm for methanolic extracts. These 2 were used as the extraction solvents to obtain product [18].

Micellar Extraction to Isolate Famotidine from Aqueous Samples

Micellar study was done to extract famotidine from aqueous samples. The extraction process is done with the help of a mixture of anionic sodium dodecyl sulfate and nonionic Triton X 114 surfactants. Electrolyte, surfactant concentration, pH of sample, temperature and centrifugation parameters were evaluated to know their effect on efficiency in the extraction process. Since the final product is obtained from aqueous sample, foreign substance is also been evaluated. This follows with the application for HPLC and UV detection of drug along with the natural water samples. Finally the comparison between 2 samples has been taken [19].

Determination of Famotidine by Development, Validation of Spectrophotometric and Pre-column Derivatization HPLC Method for Determination of Famotidine in Pharmaceuticals by Reaction with Sodium Nitroprusside in direct & combined tablets

In this study, pharmaceutical formulation of famotidine was analyzed through spectrometric and HPLC methods with help of sodium nitroprusside. The former method can be estimated on the red color flame after the reaction with sodium nitroprusside. Later this is subjected to HPLC method with C18 column, mobile phase is with buffer at pH 4, and the absorbance at 498nm. According to the result, the linear absorbance obtained around 20- 500µg/ml. This precise results were obtained due to quality of the method adopted [20].

Determination of famotidine by rapid HPLC method in human plasma using a monolithic column

This study has been designed for the estimation of famotidine in plasma using a rapid and sensitive HPLC method with monolithic column. This study helps the evaluation of famotidine for therapeutic drug monitoring with low detectable limit of around 5mg/ml. One step extraction process is the method used and the separation was carried out in reversed phase condition using monolith performance column. The column process the mobile phase of



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isocratic which contains 0.03M disodium hydrogen phosphate and acetonitrile with pH adjust to 6.5. The UV determination was at 267nm. The analytical recovery is almost normal with linear curve in the calibration status [21].

Determination of famotidine in human plasma by HPLC using solid-phase column extraction

Determination of Famotidine in human plasma with the help of HPLC is being employed. The drug and reference Sample were separated chromatographically from plasma essentials with help of certain cartridge for solid phase separation with mobile phase, which contains triethylamine in water and acetonitrile. The absorbance was measured and finally compared with different samples with patients [22].

HPLC with column switching method in determining famotidine in human plasma

Estimation of Famotidine in human plasma can also be determined by HPLC method with column stitching and an internal standard. Extraction is by cation exchange solid phase method to isolate famotidine and reference. With the help of inertasil C4 column issued for chromatographic separation with mobile phase as acetonitrile / phosphate aqueous solution, which has been joined by switching valve to BDS. The absorbance was measured at 267nm followed with the standard to obtain linear. According to the daily reading the concentration obtained is less than 10% and for subsequent days it was accessed by samples. The process has been utilized in clinical studies when given orally and the limit for estimation was given as 1mg/ml [23].

Determination of famotidine in human plasma by HPLC in alkaline media using solid phase extraction

The study was done to determine the Famotidine by solid phase extraction from alkalized human plasma. The method employed is reverse phase HPLC using mobile phase acetonitrile / alkalinebuffer with mosidomine as reference standard. For evaluating at different concentration of Famotidine acetonitrile or buffer is used as acetonitrile as buffer mobile phase. Since alkaline media helps in the drug to show an intense absorption at 286nm. So working in alkaline media is widely used because the peaks can be separated and also shows success in the kinetic studies [24].

Validating and Quantitative Determination of Famotidine in Human Plasma

The experiment was designed to validate and quantitatively determine the famotidine in human plasma using a reverse phase HPLC method. Here the separation between Famotidine and reference is by chromatographic method and peaks are achieved using C18 column. The mobile phase is the mixture of 0.1% triethylamine: buffer at pH 6.8: acetonitrile in ratio of 70: 15:15% v/v/v. The procedure for evaluation is reverse phase HPLC and UV spectroscopy was used at 274nm. The result obtained will produce better accuracy, precision over a linear range of 4-40µg/ml of standard curve [25].

Determination of famotidine in low-volume human plasma by normal-phase liquid chromatography / tandem mass spectrometry

Determination of Famotidine in human plasma and urine using a sensitive process with LC coupled with tandem mass spectrometry. Test and sample were isolated from human plasma sample by cation exchange. Solid phase used was benzenesulfonic acid cartridges. Urine assay was done by direct injection of diluted urine sample. With the help of BDS hypersil silica column the chromatographic separation was done. The mobile phase was taken as HPLC water. The sample introduction was done by positive ionization mode using electrospray technique. Calibration curve was obtained from samples, and from the single day studies the level was <10% and for subsequent studies by running the quality sampling each day. This studies can be performed in infants of maximum 12 months. [26]

Spectrophotometric Determination of Famotidine Using Sulphonphthalein in Dyes

In this study quantitative estimation of Famotidine was done by four new extraction free spectrometric methods. In this the formulation is based on yellow ion pair complexes, between FMT and four sulphonphthalein dyes such as



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bromothymol blue, bromophenolblue, bromocresol purple, and bromocresol green, in acetone. The result obtained was comparatively successful with better accuracy followed with standard curve [27].

Quantitatively determine famotidine in human maternal plasma, umbilical cord plasma and urine by high-performance liquid chromatography & mass spectrometry

In this study the determination of Famotidine in human urine and umbilical cord plasma is done by liquid chromatography with electrospray ionization mass spectrometry. With the help of ammonium hydroxide the plasma samples were alkalinized and extracted twice with ethyl acetate. Primary result show that extraction of drug in maternal umbilical cord ranged from 53 to 64 and 72-79%. Followed with the urine samples which are directly diluted with mobile phase and then only injection to HPLC column. The mass spectrometric detection was done in positive mode with ion monitoring method. Internal standard was taken as Carbon -13 labelled Famotidine. The calibration curve obtained linear and relative deviation method was <14% excess for inter and inter days assay. Final accuracy obtained was around 95-110% [28].

Role of Famotidine and Other Acid Reflux Medications for SARS-CoV-2: A Pilot Study

In this work the H₂ blocker Famotidine has been suggested by FDA which shows the potential in treatment of COVID 19 patients and even reduce the symptoms. According to the conclusion there is no association with incidence of COVID 19 and the use of reflux medication, including Famotidine when given orally to decode the high dose [29].

Enhancement of famotidine dissolution rate through liquisolid tablets formulation: In vitro and in vivo evaluation

Purpose of the study was done to enhance Famotidine dissolution through formulation into liquisolid system and to carry out in vitro in vivo evaluation process. To know Famotidine crystallinity DSC (Differential scanning calorimetric) and XRD (x-ray diffraction) show loss on the liquid solid formulation. And later confirm by SEM analysis. Almost all test liquid-solid shows increased drug dissolution rate than the directly compressed tablets^[30].

Potentiometric determination of famotidine in pharmaceutical formulations:

Famotidine in the pure form and any one of the tablet form was analyzed with 2 new potentiometric methods. In the primary method for poly (vinyl chloride) (PVC) matrix-type famotidine ion-selective membrane electrode is used for the potentiometric determination of famotidine in pharmaceutical preparations. The electrode exhibited a linear response of famotidine solutions over the pH range 1–5. Common organic and inorganic solvents showed negligible interference. These are done with the commercial product also. The results obtained reveal good percentage release [31].

Famotidine: kinetics of acid catalyzed hydrolysis

In this work the kinetics of hydrolysis of the drug Famotidine were studied with hydrochloric acid of 0.01-0.10 of 2mg/ml using stability indicating HPLC assay. Here kinetics observed was pseudo first order with concentrations of famotidine. The observed rate constant was found to depend on hydrogen ion concentration, which is not influenced by the ionic strength. The temperature dependence of famotidine hydrolysis was investigated in 0.1 M hydrochloric acid. It was estimated that at gastric pH 1-2, gastric emptying half-life is 50 min in normal young adults and about 5.3-35.8% of an oral dose of famotidine would undergo degradation in the stomach. This percentage might be even increased to 12.0-57.8% in the elderly [32].

Formulation and in-vitro evaluation of effervescent floating tablets of an antiulcer agent'

In this study, the drug release in stomach & intestine from floating drug delivery system was studied. Work was done to increase the absorption in stomach. Polymers like HPMC of different grades are taken with citric acid and sodium bicarbonate as effervescent moisture. After formulation, evaluation of the prepared tablets was done. Further



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parameters such as effect of effervescent agents & polymers were done and compared with marketed formulations [33].

Formulation and Characterization of Effervescent Floating Matrix Tablets of Famotidine Hydrochloride

Work was done to increase promote gastric residence time and to improve bioavailability of drug. Formulation was developed with different polymers such as HPMC K 100M and K4M, followed by evaluation. Comparing both grades of formulation, optimized and detected the values [34].

Design, development and optimization of famotidine gastro retentive drug delivery system

Work was done to formulate the control release of Famotidine floating tablets to improve bioavailability and gastric residence time. Both natural and synthetic polymers has been taken and evaluated the parameters like drug content, floating property [35].

Preparation and evaluation of floating tablets by non aqueous wet granulation method of famotidine'

The study was designed in a way to develop gastric resistant drug delivery system of Famotidine by wet granulation method. Certain synthetic polymers has been used & checked the evaluation data and including buoyancy test & was compared with all polymers to know the best result [36].

Preparation and characterization of famotidine microcapsule employing muco adhesive polymers in combination to enhance gastro retention for oral delivery'

Study based on sustained release of micro capsulated drug delivery system with the help of certain polymers. These capsules formulated by orifice ionic gelatin method using Famotidine as model. Synthetic polymers of different concentration was used followed by the evaluation. Data collected and statistically analyzed with modern tool ANOVA [37].

Famotidine prevents canine gastric blood flow reduction by NSAID

To evaluate Famotidine on gastric blood flow reduction caused by diclofenac sodium. In this method gastric irritation by laser Doppler Fluorimetry was used. The examination was done in a crossover single-blinded fashion. All dogs underwent both famotidine (0.5 mg/kg) and placebo (saline) injection simultaneously with the administration of diclofenac. In addition, the tissue concentration of prostaglandin E2 was measured [38].

CONCLUSION

From the recent articles it explained that the use and effect of Famotidine in different preparation has enabled the better advantage of the drug. Here mostly related articles mentioned about the purpose over other H2 blocker agents. The different controlled delivery system were developed using famotidine mainly to increase drug gastric residence time and specificity. Various studies on the effervescent floating tablet with different grades of polymers has been employed. Following with some comparison with the marketed product to make sure which one shows better effect. And even the preparation with some natural product like guava starch, marine sources like cod liver oil. In this tablets will be enclosed and compared the studies. Different analytic method such as HPLC, Tandem microscopy, mass spectroscopy is also been used for development and validation. In this cases the reaction with sodium nitroprusside will direct and combined tablets has been used. And even the effect of Famotidine in ulcer treatment, Zollinger elision syndrome has been noted. And even using of Famotidine in human plasma by HPLC method with certain medium used. And a brief discussion on the drug Famotidine about the basic criteria, pharmacodynamics, pharmacokinetics adverse effects, toxicity uses has been mentioned in the earlier phases.





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Electric Vehicular Adhoc Network based on Impulse Radio Technology

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ABSTRACT

A Vehicular Ad-Hoc Network, or VANET, is a form of mobile ad-hoc network that allows vehicles to communicate with each other and with Fixed equipment, such as roadside equipment, is located nearby. VANET is used in the military, and it provides safety alerts, congestion warnings, and other services. Infotainment is a term that refers to the combination of entertainment and information. VANETs are self-organizing not-for-profit networks need a fixed network system or a central base station. They're dependable, scalable, and flexible and versatile, with energy transfer efficiency and the ability to produce and use location data. Vehicular Ad-hoc Networks are supposed to use a wide range of wireless technologies, including Dedicated Short Range Communications (DSRC), a form of WiFi. Cellular, satellite, and WiMax are some of the other wireless systems that could be used. Vehicular Ad-hoc Networks (VANs) are a kind of Intelligent Transportation System (ITS)

Keywords: Short-Range Communications , Electric Vehicles ,Intelligent Transportation System, Vehicular Ad-hoc Networks ,Worldwide Interoperability for Microwave Access.

INTRODUCTION

This project's aim is to create broadcast protocols that improve the reliability of broadcast message delivery in VANETs. We base our assumptions on the fact that a node in a VANET can detect collisions and congestion simply by examining the packets it has recently received. In a VANET, each node broadcasts its status at least 10 times per



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second to its neighbours. Impulse Radio Technology is a low-power scheme for radio transmission that can transmit data at extremely high speeds. Radio impulse wireless technology can be used to increase the efficiency of Vehicular Ad-hoc Networks where radio communications need a high data rate and low power. Power use that is error-free and immune to external noise and interference. The desired characteristics can be achieved by using radio impulse as a carrier in VANET communication. A ns-2 software tool can be used to model performance characteristics.

An Ad-Hoc Vehicular Network, or VANET, is a form of mobile ad-hoc network that allows vehicles to communicate with each other and with Fixed equipment, such as equipment for the roadside is located nearby. The key aim of VANET is to ensure passenger security and ease of use. To accomplish this, each vehicle will be equipped with a special electronic system that Ad-Hoc Network access will be provided. Passengers would have internet access. This network is more likely to run without the need for any networks or legacy client-server communication. Each vehicle is equipped with a VANET system can act as a node in the Ad-Hoc network, receiving and relaying messages over the wireless network. Confrontation alert, road sign warnings, and in-place traffic view can provide the driver with the necessary resources to make the best decision possible. Collision alert, road sign warnings, and view of traffic in real time can provide the chauffeur with the information they need to choose the right direction.

This project's aim is to create broadcast protocols that improve the reliability of broadcast message delivery in VANETs. Fig 1. We base our assumptions on the fact that a node in a VANET can detect collisions and congestion simply by examining the packets it has recently received. In a VANET, each node broadcasts its status at least 10 times per second to its neighbours. Although a node has no way of knowing whether or not the packets it sends are transmitted correctly, it does know what percentage of packets sent to him by neighbouring nodes are successfully received. This strategy is unique in that there is no contact control overhead. Furthermore, the proposed methodology would not necessitate any changes to the current 802.11 network. Instead of focusing on the parameters used by 802.11, the specification focuses on optimising the parameters used by 802.11. As a result, we assume this method has a reasonable chance of being commercially viable. This project will focus in particular on the production of:

1. Prioritized access protocols,
2. Adaptive contention window protocols,
3. Adaptive transmission range control protocols,
4. Dynamic transmission power control protocols are all examples of prioritised access protocols.

Literature survey

The aim is to create a reliable vehicular communication system. An evolving cryptographic strategy, community signatures, and tamper-resistant devices are among our main arms (chips). Vehicular networks are seen as a large-scale distributed system. All device accesses should be approved. A maintainable vandal device in the vehicle enforces managed access. In addition, A dependable tamper-proof device in the vehicle enforces the managed access. Furthermore, all messages sent should be signed, and all messages received should be checked using the community signature technique to achieve accountable privacy. In vehicular networks, the system would ensure the following properties: Authenticity: the device ensures that the packets/data is sent from a legitimate source. Integrity: the system ensures that data has not been tampered with or changed after it has been developed. Anonymity: the identity of the vehicle transmitting each packet/data is hidden. In the event of a dispute, the system will assign actions to the person that triggered those actions. Constraints on real-time communication: the security approach allows for low-latency communication.





METHODOLOGY

Developing Efficient Vehicular Applications By In-Vehicle Database Management Techniques

A vehicle's data has evolved as quickly as today's vehicles in terms of both volume and form fitted with an increasing number of functions/applications (e.g., navigation, music, vehicle diagnostic, driving log, and calendar). In order to achieve effective vehicular applications, data processing has become a critical problem. Currently, different applications in the same vehicle use various Currently, various systems in the same vehicle use proprietary data management methods, which has a variety of disadvantages, including a data problems with data sharing and incorporation exchanging incapacity and facts to update data dynamically. We will develop effective strategies to resolve specific challenges in in-vehicle data management in this project.

RESULTS OF THE SIMULATION

Parameters for Simulation

For evaluating the route lifetime algorithm, The simulation is done in NS2. Table 1 indicates the relevant The following parameters were chosen for the NS2 simulation.

The graph shows how it performs on various metrics such as

1. end-to-end latency
2. throughput
3. The ratio of packets delivered

The throughput in the network is depicted in Figure 2. It is known as the total the quantity of packets received at a given time at the destination side. Figure 3. In a network, the packet distribution ratio is higher than for other protocols. It's also directly proportional to the passage of time. As time passes, the packet delivery ratio increases in lockstep.

Work in the Future

For many examples, research in the discipline of intelligent vehicular ad-hoc networks (InVANET) is currently underway. Applications for traffic situations, Sensor networks, phone systems, and potential battle systems are of particular interest. According to new studies concentrated on topology-related issues including routing methods, range management, and address systems, as well as security concerns include traceability and encryption, as well as routing mechanisms or address systems. There are also very particular study interests include the impact of directional antennas on wireless communication. In VANETs and sensor network consumption of energy. The majority of this study's goals are to either take a broad a strategy for cellular networks or to concentrate on a very specific topic.

CONCLUSION

The efficiency of the Vehicular Ad-hoc Network has been enhanced by using radio impulse wireless technology, which includes a high data rate, low power consumption, and low error rate, as well as resistance to external noise and interference. The desired characteristics can thus be achieved by using radio impulse as a carrier in VANET communication. The desired characteristics can thus be achieved by using radio impulse as a carrier in VANET communication ns-2 software tool was used to simulate the performance characteristics.





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Table 1. Literature survey

Types of Traffic	CBR
CBR Rate	512 bytes x 6 per second
The total number of connections is	50

Table 2. Parameters for Simulation

Time for Simulation	100s
Size of the topology	700m x 700m
The total number of nodes	70
MAC Type	MAC 802.11
Model of Radio Propagation	Free Space Model
Range of Radio Propagation	250m
Pause for a moment	0s
Maximum Speed	4m/sec-24m/sec
Energy at the Start	100J
Sending Power	0.3W
Obtain Power	0.2W
Types of Traffic	CBR
CBR Rate	512 bytes x 6 per second
The total number of connections is	50





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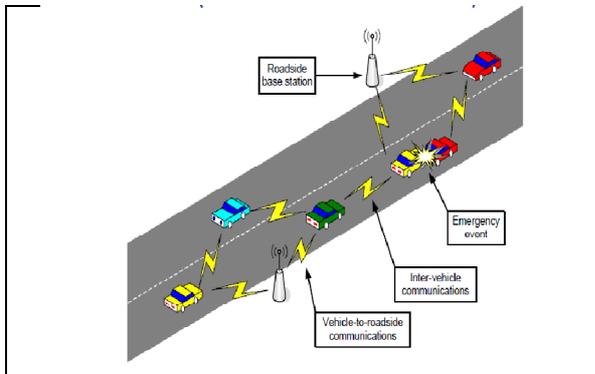


Figure 1.VANET (Virtual Area Network)

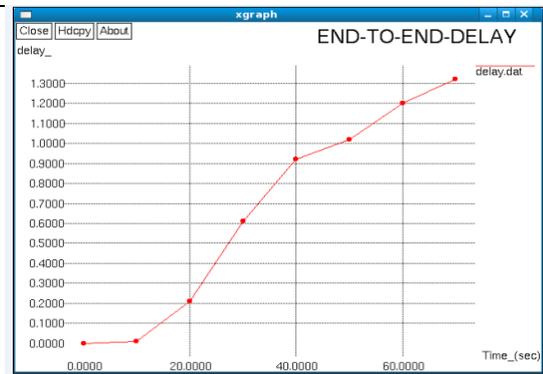


Figure 2. depicts the end-to-end delay, which can be described as the time difference between nodes

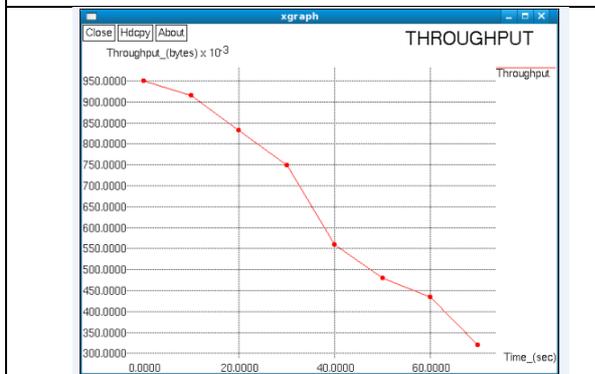


Figure 3. It is known as the total the quantity of packets received at a given time at the destination side

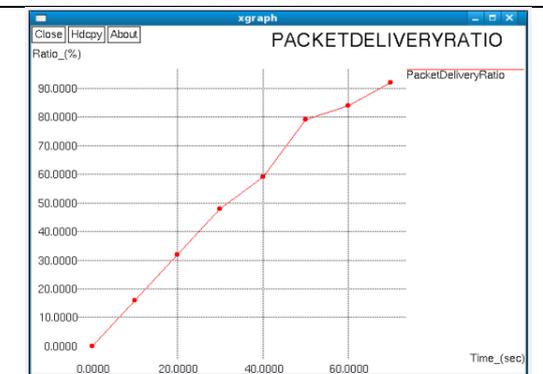


Figure 4. In a network, the packet distribution ratio is higher than for other protocols





Impact of Agricultural Reforms on Indian Economy in Present Scenario of Pandemic Covid-19

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ABSTRACT

In the year 2020, during the global pandemic when the GDP of India was in negative, it was only the agriculture sector which rescued the Indian economy and results in positive GDP growth. During this pandemic, the government brings reform in agriculture laws by introducing three farm bills which were passed by the parliament in less than the period of one week. At present, the country is witnessing a huge protest of farmers against these reforms which has questioned the validity of these laws but here the question is whether there was any need to pass such laws hastily amid of the global pandemic? And what will be the impact of these reforms in long run on the economy of India at large? These questions need to be focused taking into consideration of the present scenario. This chapter intends to discuss the importance of the agriculture sector in the economy of India along with the pros and cons of these new agriculture laws and its impact on the economy of India after the Covid-19 pandemic era. The new reforms can be more effectively enforced if the state governments support the same. There is a need to boost the confidence of farmers to trust the reforms as it benefits the community at large. The chapter elaborates on how the farmers and the common man will be affected by these three laws. The research also finds that how empowering farmers will empower the economy in the light of recent agriculture developments.

Keywords: Farms law, Covid-19, Indian Economy, Agriculture sector.

INTRODUCTION

“Agriculture is the greatest and fundamentally the most important of our industries. The cities are but the branches of the tree of national life, the roots of which go deeply into the land. We all flourish or decline with the farmer.” – Bernard Baruch.

As the quotation stated by famous philanthropist Bernard Baruch, the agriculture sector is the basis of development for any nation and its economy. After independence, India was an agriculture-based economy with 72 percent of the

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total population was indulged in the agriculture sector which contributes 50 percent to the nation's income. At present, this contribution is declined to 18 percent, however, the overall growth of the Indian economy is determined by the production in agriculture. At present, India is the second-largest producer in the agriculture sector with 8% of global agriculture production. Hence, the agriculture sector still remains an influential sector of the economy of India. Agriculture sector plays a major role in the economy of India as it contributes over 18% to the total GDP with the large populace of approx 263 million across the country who are directly indulged in the agriculture sector. With such an important role in the Indian economy, the agriculture sector needs to evolve by time for better performance and more contribution. Post-independence, the focal point of the Indian government was on the method used for farming and distribution of food grains in the market. For this purpose, the area of agriculture land was increased to boost productivity. In addition to that, the government of India introduced a new reform in the agriculture sector in 1966- 1967 which is famously known as Green Revolution of India. It is said to be the major initiative taken by the government for the growth of the farming sector, especially in the northern states of India. The sole purpose of the Green Revolution was to introduce farmers with the modern methods and technologies like HYV seeds (high yielding variety seeds), use of fertilizers, new equipment, multiple cropping and so on. Along with this, the government launched some new schemes for states suffering from drought and opened a few agriculture research institutes [1]. The government also faced backlash for the damaging environment by extensive use of pesticides and fertilizers. Farmers were also facing financial issues as the government failed to provide them financial assistance and number of farmer suicide case was increased.

Lately, the government of India introduced three most controversial farm bills which were passed by both the houses of parliament and become law on 27th September 2020 with the assent given by the president. The three farm laws, namely – The Farmers' Produce Trade and Commerce (Promotion and Facilitation) Act 2020, The Farmers (Empowerment and Protection) Agreement on Price Assurance and Farm Services Act 2020, and The Essential Commodities (Amendment) Act 2020 are being highly criticized by farmers, especially in Punjab, Haryana, Rajasthan and Uttar Pradesh. The farmers are demanding to revoke all three Acts for the reason that the big corporate houses can easily exploit not-so-educated farmers through these acts as there will be no intervention on the part of the government and no minimum support price (MSP) will be given to the farmers. Whereas, the government is contending that the farmers are being misinformed and the Prime Minister has given the assurance that these laws will benefit the farmers and the economy of India as a whole, in spite of that, a huge number of farmers are fighting on the ground to revoke the new agricultural reform [2].

RESEARCH METHODS

The author has adopted the analytical doctrinal methods of research which includes the legislations on agriculture, judicial pronouncements, reports, articles and recommendations of various committees and law commission.

RESULT AND DISCUSSION**Agriculture Market System**

The farmers are being abused from ages, earlier by English men during the British raj and later by zamindars, traders and middlemen. They were being pressurized to sell their production at lower prices. To abolish such an oppressive practice, the government intervenes and took measures such as obtain transparency in the system, proper implementation of the law, provide better storage, warehouses and transport facilities. Another measure step taken by the government was to guarantee MSP for their produce and constitute Agriculture Produce Market Committee (APMC) also known as *Mandis* which is regulated Agriculture Produce Marketing Regulation Act. In layman language, *Mandi* is a market place set up by the government where farmers sell their produce to a trader on certain price according to the demand of the product through a middleman. There are more than 7000 *mandis* in all over India regulated by the state governments.



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In April 2016, the Union Agriculture Minister Shri Narendra Tomar has launched an online platform namely e-NAM (National Agriculture Market) where farmers and traders can sell and purchase the produce on accurate prices. There is a total of 841 *mandis* registered on e-NAM of 18 states.

Why India needs Mandi System?

From many years farmers are trading their agrarian produce through *mandis* and they have witnessed the evolution and growth in the agriculture sector. *Mandis* plays a crucial role in the food supply chain across the country, mainly in north India. *Mandis* are not only a place for farmers and traders but also a major source of livelihood for middlemen and transporters. APMC bridges the gap between farmers and traders as it facilitates seller and purchaser in one shed for smooth functioning. Apart from that, it is a primary duty of the committee to ensure accurate prices of the produce, to ensure fair transaction between the parties and reduces the complexity of trading. However, APMC has many major loopholes in its functioning such as the monopoly of *mandis*, cartelization by commission agents, entry fees which are barred by government, heavy taxes and outstanding payments. These issues with *mandis* are needed to be resolved for the betterment of the agriculture sector.

The need for Minimum Price Support

The concept of Minimum Price Support (MSP) is considered as a safeguard for the farmers of India. MSP is a system where the price is fixed by the government as per the advice of Commission for Agricultural Costs and Prices (CACP), upon which the farmers sell their produce directly to the government when the farmer is unable to incur the cost of production from the open market. Twice in a year, 23 goods fall under the mechanism of MSP. (cacp.dacnet.nic.in) It protects farmers from an unstable market and fluctuation in prices which results in sustainable farmers' income. However, the ground reality differs from the main purpose of MSP as there is lack of awareness in farmers which give the opportunity to middlemen to loot them. Additionally, it would be fair to say that the minimum support price converts into the maximum price in such circumstances.

Impact of Covid-19 on Agriculture Sector

The agriculture sector has been tremendously hit by covid-19 and the consequent worldwide lockdown. There was a sense of foreboding that the agriculture sector would be crushed when the government announced nationwide lockdown in March 2020. Due to the transport restrictions, it has been highly challenging to deliver products across the nation. Labour based farming was in trouble as the labours were fleeing back to their home town and the production was directly suffered. Regardless of all the obstacles, initially, the sector was not much affected by it and the prices of produce agriculture were stable as compared to other countries. Only the agriculture sector among all three sectors was performing efficiently during Phase 1 of lockdown. However, the farmers were not able to deliver their production to *mandis* in Phase 1. In June, the government announced Unlock 1.0 which lifted the transport restriction and the arrival of production was resuming in *mandis* as shown in figure 1.

Later, it was observed that after Phase 5, there was a decline in arrivals of production in *mandis* as shown in figure 1, increase number of farmers' suicide cases and hike in prices. Hence, the consequences of Covid-19 have been equally suffered by the Indian economy, farmers and the common man. In May 2020, it was discovered that 26 percent of families of India has reduced the consumption of food for the reason that they were out of work and suffering financial crisis. To minimize the hardship of vulnerable groups, the government of India launched a scheme in June which helped around 800 million people and provide free ration to 90 percent of ration card holders which includes the number of farmers. (IDinsight) Yet millions of families which fall under below poverty line (BPL) were unable to receive the benefits of the scheme which shows the inefficiency on part of the government [3].

A shortfall was noticed in the production and availability of food from the month of March to June 2020 as there was a delay in the arrival of food production in *mandis* and local markets. The intermediators took the advantages of adverse time of pandemic and create problems such as black marketing and hoarding. The agriculture sector has experienced a delay in the harvesting of Rabi farming and unstable supply chain due to the lockdown and



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unavailability of labours. The nationwide shutdown results in temporal closure of restaurants, hotels and travels which decrease the demand of agriculture products in the markets and hence, the demand and supply chain was crushed causing huge loss to all sectors of Indian economy [4].

The Agriculture Reforms 2020

The Farmers (Empowerment and Protection) Agreement on the Price Assurance and Farm Services Act, 2020- According to this act, private companies can directly purchase the produce of farmers by entering into a legal agreement where they can negotiate on prices. The company, in advance, can put down the particulars of the product and delivery required from the farmer in the legal agreement. Also, to avoid delay in payments, the farmers will receive their payments in advance. The act provides the provision of Dispute Settlement Mechanism which resolves any dispute arising out of the contract. The farmers protesting against the law claims that the law will give the opportunity to the private player can effortlessly exploit the illiterate farmers by including various clauses in favour of companies and majority of farmers will not be able to avail legal assistance [5].

The farming Produce Trade and Commerce (Promotion and Facilitation) Act, 2020-

The new legislation provides the option to farmers to sell their produce in or outside the *mandis* by removing the barriers of intra-state dealing. The government has given the liberty to farmers to choose a marketplace where they can receive higher prices and gain more profits. The act also permits agriculture trading on online platforms. Additionally, no tax can be imposed on farmers and traders by the state government on the sale of produce outside the *mandis*.

The act is being criticized by the state government for not imposing taxes on private companies which may result in loss of state revenue. This act is more beneficial for big farmers as small and marginal farmers are not economically sound enough to incur conveyance cost. Farmers' income will also depend upon the fluctuation of price in the market and the government will not provide MSP in case of sell outside the *mandis*. Hence, if the cost of cultivation is higher than the market prices then the farmer will suffer the loss [6].

The Essential Commodities (Amendment) Act, 2020

The legislation for essential commodities was first introduced in 1955. This act categorized certain commodities as essential to avoid artificial demand in the market via black marketing and hoarding. Before the amendment, the list of essential commodities includes medicines, fertilizers, food items, fuel and seeds and so on. After the amendment, the government has removed cereals, pulses, potato, onion, edible oilseeds and oil which means these commodities will only be regulated by the government in case of war, famine, high price rise and natural calamities. This may sound beneficial for farmers but also there are high chances of hoarding and an increase in prices. Here, the government contends that there will be intervention by government in the situation of the rise in prices. However, there are certain conditions to that too. The government will only intervene if there is a 50% increase in the price of non-perishable items and 100% increase in the price of perishable items [7].

New Agriculture Laws and its Impact on the Economy of India:

In the middle of the pandemic, when the farmers were suffering misery, the government rushed to pass three bills in the parliament without discussion and consultation as claimed by opposition parties which raise a question on legislative scrutiny of the country. The three bills were converted into law within weeks but farmers straightway reject all three Acts claiming it unfavourable for them. The new laws are facing backlash from opposition parties and thousands of farmers, mainly from the states of Punjab, Haryana, Rajasthan, Uttar Pradesh and Madhya Pradesh, protest on borderline of the capital. [8] Whereas, the government is continuously claiming that the reforms are for the welfare of farmers and the economy of the nation. The opinion of the nation is divided on the new reforms in the agriculture sector. According to the government and several economists, these reforms will cease the monopoly of commission agents in the *mandis* and permit the corporate companies to enter in the sector and offer much better prices to the farmers against their produce which will boom their income and help them to get rid of their debts.





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Liberalizing the trade in the agriculture sector will boost the economy which will help to generate more revenue. Certainly, the private companies will introduce new methods, tools and technology for effective and efficient farming which will ultimately bring advancement in the agriculture sector. Effective and efficient farming will boost production and it will result in an increase in export. Also, the law promises better competitive market with fairer prices to the farmers, therefore, will open more option for farmers to sell their produce [9].

The farmers and opposition argue that these farm laws will bring agony to the lives of farmers as the new legislation did not guarantee MSP outside trading of *mandis*. The concept of contract farming already exists in the agriculture sector where corporate enters into the contract with farmers and the price are pre-determined and the raw material is provided by the corporate. Companies like Hindustan lever Ltd, PepsiCo, Nestle India Ltd, Himalaya Drugs Ltd, Unicorn Agrotech Ltd etc. are involved in contract farming. The idea of contract farming is beneficial for big farmers only as it has been seen small farmers are subject to exploitation because they often agree on lower prices [10].

During the lockdown, the GDP of India crippled but only the agriculture sector results in positive growth. Post Covid-19, the new agriculture reforms will aid the Indian economy by liberalizing agriculture trade for farmers as well as private companies. The new laws will bring advancement in farming by introducing modern methods of farming and technologies. The role of commission agent has been minimized by this law and the cost-cutting of transportation through this law will increase the income of farmers. The initiative taken by the government by permitting online trading in farming has been highly praised and this move will prove favourable in long-run for the Indian Economy [11].

CONCLUSION

The nation has witnessed the manner in which the central government has passed the farm bill in both the houses of parliament which is subject to high criticism and destructive for the basic structure of the constitution. The state government has absolute power to make law on agriculture, despite the fact, the centre invades the jurisdiction of the state government. It is detrimental to pass a law in such an undemocratic way in a country like India. As far as the new agriculture reform is a concern, the nation has divided opinion. The reforms made by the centre were much needed but there are plenty of loopholes and uncertainty which are needed to be addressed by the government. The protest shows that the farmers have no confidence in the government which needs to be restored. The hands which feed the nation are now freezing in cold, fighting for their demands. The government needs to resolve the issue and bring farmers' confidence back. The economy of India does not lie in the urban economy but in the rural economy which will vanquish the economic crisis.

SUGGESTIONS

The number of *mandis* should be increased by the government which will reduce the cost of conveyance and increase the profit margin of farmers. These *mandis* need the independent regulatory body to keep a check on middlemen, commissioner agents and officials. The government should take some effective initiatives to educate the farmers regarding inaccurate weighing machines, price determination, use of online platforms and new technologies. The issue of improper storage and warehouse facilities should be dealt with by the government. The center should launch schemes which provide loans to the farmers at the lowest interest rate or zero interest rate. This will encourage farmers and improve their productivity. The implementation of MSP is irregular and deficient, the respective governments of state should re-examine the process and rectify the lacuna.

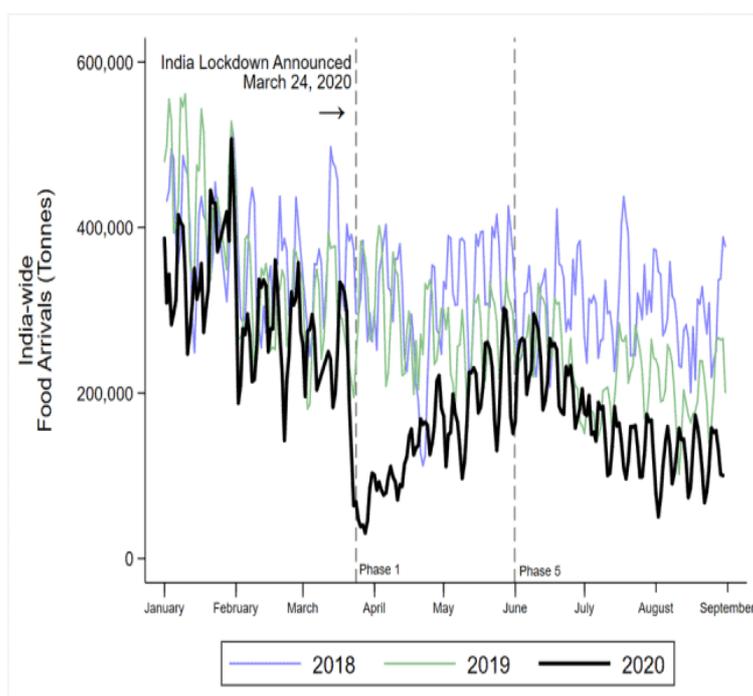




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(Source: <https://agmarknet.gov.in/>)

Figure. 1. Impact of Covid-19 on Agriculture Sector





Mechanical Properties of Concrete Containing Densified Micro Silica as Partial Replacement of Cement

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ABSTRACT

Concrete has gain vast popularity in the infrastructural development because of its tremendous advantages over strength and durability concerns. Cement is considered as one of the important ingredients for the preparation of concrete. In India the production of cement is significantly increasing to fulfil the demand of concrete production That's why we can substitute a material that may have partially or fully similar properties like cement which can be used to prepare concrete by considering various aspects such as environment friendly, cost effective and satisfying the desired other properties of concrete. Since micro silica which is a by-product of silicon metal and also satisfies different properties of cement like chemical as well as physical properties due to its pozzolanic activity can be taken as a replacing material of cement for the concrete preparation to enhance the strength. Here in this paper the effect of commercial densified silica fume with the replacing percentage of 0%, 3%, 6%, 9%, 12% and 15% respectively to cement has been carried out and discussed. The results of mechanical strengthening properties have been shown by testing the compressive, splitting tensile and flexural strength for concrete mixes. In order to enhance various properties, super plasticizer has been added in a percentage of 1%, 1.1%, 1.2%, 1.3%, 1.4%, and 1.5% as chemical admixture

Keywords: Cement, pozzolanic activity, densified silica fume, concrete mixes.

INTRODUCTION

Concrete which is also known as a versatile construction material is the most used material in the world as it can be designed based on environmental condition and client demand. Continuous research is going on to improve its strength and durability using chemical admixtures and supplementary cementitious materials. That's why now a days most of the concrete are prepared by adding or replacing various types of cementitious materials fulfilling



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partially or fully the constituents and other properties of concrete with the similar effect in case of strength and durability. Those replacing materials can be a by-product or any other collection of wastes products such as fly ash, GGBS, micro silica, copper slag, RCA etc. by any industry or structure which can be used for the preparation of concrete in a wide range. The major benefits of replacing the SCMs are that, they can be used in the preparation of concrete by partially replacing the cement without hampering its properties due to its similar cementation constituents and as well as it also helps to enhance different characteristics of fresh and hardened concrete in various ways. Mostly, the concrete produced day today includes fly ash and slags which is again compared in between the both by considering their optimum concrete mixing properties. It has been found that use of fly ash or slag in concrete lead to drastic reduction in strength properties. Effect of addition of these alternative materials depends upon the extent of their pozzolanic reaction with calcium hydroxide liberated from cement. So, to replace cement without much affecting the strength properties, an alternative binder having higher degree of pozzolanic activity is required. Micro silica a byproduct of silicon industry in this regard can be considered to be perfect alternative binder as per the requirement due to its higher fineness and pozzolanic activity.

According to Panjehpour *et al.* (2011), the concrete mix prepared by micro silica gives significant mechanical results. The investigation done by Singh *et al.* (2016) states that the SiO₂ vapours produced at a high temperature nearly about 2000°C oxidizes and condense in low temperature zone to small particles which consists non-crystalline silica. A report investigated by Newman and Choo (2003) states that, filtration of gases was started before 1970s and was used in a large scale and the micro silica formed firstly having the standard NS 3050 was granted to use in case of factory-made cements. As per Thomas *et al.* (2012), the fine particles presence in the micro silica makes the concrete mix denser and increases its cohesiveness. The substitution percentage of micro silica with cement should lie between 7% to 9% by mass of binding material according to Bhanja and Sengupta (2005).

Several research works have been performed to enhance the strength of concrete using different contents of micro silica. For instance, Perumal and Sundararajan (2004) have investigated the influence of micro silica on the strength properties of concrete and found that 10% micro silica can enhance the strength of concrete of any grade. Similarly, Hanumesh *et al.* (2015) have investigated the influence of addition of 5 - 20% micro silica on mechanical properties of M20 concrete. It is found that the optimum gain in compressive strength is observed at 10% micro silica. Besides, as per Katkhuda *et al.* (2009), the maximum enhancement in compressive strength is recorded for 15% micro silica content. In addition, Ismeik (2009) has used 5- 15% micro silica at 2.5% intervals with varying w/c ratio i.e., 0.30, 0.35 and 0.40. It is revealed that the highest enhancement in compressive strength is observed at 10% micro silica content with 0.30 w/c. Similar investigation carried out by Amudhavalli and Mathew (2012) reveals that he maximum gain in compressive strength at 28 days is observed at 15% micro silica. Kumar and Dhaka (2016) have studied the effect of 5%, 9%, 12% and 15% micro silica on concrete properties. The optimum percentage replacement of micro silica has been found as 12%. Investigation of Ajileye (2012) also reveals an increasing trend in compressive strength up to 10% of micro silica and gradual fall in strength beyond this content. It has been mentioned in ACI Committee 226 (1987) report that the real effectiveness of micro silica in enhancing the strength of concrete usually starts at 3 days of normal curing. Furthermore, other notable researchers also have similar opinion about addition of micro silica in enhancing the mechanical properties of concrete (Mohyiddeen and Maya, 2015; Memon *et al.*, 2013; Mazloom *et al.*, 2014). As discussed in the above literature that most of the studies have been conducted with micro silica as binder, which enhances the strength. But in order to produce high strength concrete it requires use of appropriate super plasticizer in addition to the micro silica. Therefore, in this research work the experiment has been carried out by gone through various testing procedures with the replacement of 0%, 3%, 6%, 9%, 12% and 15% micro silica with cement respectively and adding appropriate doses of super plasticizer.

Aim and Objective

The aim of this research work is to find out various mechanical properties like compressive, splitting tensile and flexural strength of concrete replaced by micro silica with OPC in various proportions by adding chemical admixture.



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Scope of the Present Work

The investigation work has been done for the preparation of M40 grade of concrete by replacing micro silica at various proportions like 0%, 3%, 6%, 9%, 12%, 15% with cement and by adding 1%, 1.1%, 1.2%, 1.3%, 1.4%, and 1.5% by conducting different tests.

Experimental Programme

A comprehensive experimental programme has been designed to accomplish the objective of the study. The experimental procedures followed in the investigation are discussed below.

MATERIALS AND PROPERTIES

43 grade Ordinary Portland Cement of Ultratech Cement Company was taken from local market of Bhubaneswar for the test procedure by confirming the standard IS: 8112. Elkem micro silica of 920u (Elkem India Pvt. Ltd.) was collected through internet to use in the investigation. Siliceous type fine aggregates consist of finely divided rocks and minerals were taken from Kuakhae River, near Hansapaal, Bhubaneswar. Crushed granite stone chips (angular) of 20mm nominal size were collected from Tapanga, Khurda, Odisha for the work. Normal portable water was taken for the preparation of mixes and curing process. Sika Visco Flow®-3105 NS as super plasticizer was used from the local market of Bhubaneswar. The physical properties of binders i.e., OPC and micro silica were evaluated by following the test procedures of IS 4031 (Part 1 to Part 11) are shown in the Table 1. Similarly, Table 2 shows the chemical compositions of OPC as per IS 8112 and micro silica as per ASTM C 1240 respectively. Properties of aggregates i.e., both fine aggregate and coarse aggregates were evaluated by considering different parts of IS 2386 and the values are shown in Table 3.

Concrete Mix Design

To fulfill the objective of producing high strength concrete using micro silica, it requires preparation of six concrete mixes including the control concrete. The control concrete mix was designed as per IS 10262 (2019) using OPC, natural surface saturated dry aggregates and water. The effective w/c ratio was 0.36, but meanwhile to maintain the slump in a medium workable range, super plasticizer was used. In rest of the five concrete mixes, OPC was replaced with 3%, 6%, 9%, 12% and 15% micro silica by mass. As the fine particles of micro silica has the tendency of absorbing water during mixing of concrete, the workability was maintained by increasing the super plasticizer content with micro silica without altering the effective w/b ratio (0.36). Super plasticizer (Sika Visco Flow®-3105 NS) has been added in various percentages such 1%, 1.1%, 1.2%, 1.3%, 1.4%, and 1.5% to all the six concrete mixes. The details of materials required for the six concrete mixes are furnished in Table 4.

Production of Fresh Concrete, Specimen Casting and Curing

In the first stage all the solid ingredients were thoroughly mixed in the concrete blender to form a homogenous solid mixture. After that required water was slowly added to the solid mixture and the again mixed thoroughly for 5-6 minutes to form a homogenous wet mix. The super plasticizer was added along with the water in the process of mixing. After the mixing process, the fresh concrete was undergone slump test and its workability was confirmed. After having the workable concrete prepared, it was filled into the different moulds like cubes, cylinders and prisms to prepare the concrete specimens. The fresh concrete was laid in the mould in three layers compacted with required blows by the temping rod. After 24 hr of casting, the specimens were removed from the moulds and put in water for curing up to the desired age.

Testing Procedures

Different types of testing methods has been carried out to find various mechanical properties of the concrete prepared by replacing micro silica with cement such as compressive strength, splitting tensile strength and flexural strength at 28 days of curing by considering relevant IS codes. To calculate the result of compressive strength, 150

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mm cube specimens were tested under 2000 kN compressive strength testing machine at a constant rate of loading of 14 N/mm²/min till the failure as per IS: 516 (1959). To calculate the splitting tensile strength of the specimen after 28 days curing having dimensions 150 mm dia and 300 mm height, the test was conducted by the help of compressive testing machine considering IS: 5816 (1999). To calculate the flexural strength of prism specimens having dimensions 150 mm x 150 mm x 700 mm were tested after 28 days of curing by applying two points load on the specimen considering IS: 516 (1959).

RESULTS AND DISCUSSIONS

The investigation work has been carried out to find different properties of M40 grade concrete mix by replacing micro silica and by adding super plasticizer with a w/c ratio of 0.36 and results were calculated after 28 days of curing. The workability results (slump and compaction factor) of the prepared concrete mixes are represented in Table 5. The workability of the concrete mixes decreases to a lower value by replacing micro silica with cement with the mentioned percentages. That's why super plasticizer has been added in the mixes to enhance the workability to some extent so that the slump can be used for any construction work with a considerable result. In the same way the compaction factor result of the concrete mixes has been kept in between 0.9 to 1.0 by adding super plasticizer which is acceptable to use.

Compressive Strength of Micro Silica Replaced Concrete

The compressive strength of the prepared concrete mixes with M40 grade concrete has been obtained by confirming IS 10262-2019. The compressive strength result of concrete mixes in which micro silica was replaced with OPC and the addition of super plasticizer is shown in Table 6. The compressive strength value for the control mix was calculated as 49.7 MPa and the values increased in a gradual manner of 51.2 MPa, 55.2 MPa, 57.4 MPa, and 57.8 MPa with the concrete mixes RS3, RS6, RS9, and RS12 respectively. The values increased with the replacing percentage due to its pozzolanic nature. But the value decreased suddenly to 55.0 MPa for RS15 i.e. less as comparing to the mix RS12 which is 57.8 MPa. Because the optimum incremental value of micro silica with replacement of cement was up to 12% in this study which was the maximum limit for the hydration process with Ca(OH)₂ present in OPC .

The maximum compressive strength value of concrete mix was found when micro silica were replaced with 12% by OPC. The lower water cement ration was became effective by the addition of super plasticizer which helped to achieve the required workability. The graphical representation of the same compressive strength value at 28 days curing is shown in Fig 1.

Splitting Tensile Strength of Micro Silica Replaced Concrete

The splitting tensile strength for the M40 grade concrete mixes were obtained by considering the testing method according to the standard code IS 5816-1999 for. The test results of the same has been shown both in tabular form in Table 7 and in graphical manner in Fig 2 for a clear view. The values of splitting tensile strength increased initially in a gradual manner with the replacement of micro silica by OPC. The splitting tensile strength results varies from 4.09 MPa to 4.42 MPa with concrete mix ratio from RS0 to RS12 respectively. But the value of value decreased to 4.31 MPa when the replacing percentage increased to 15%.

Flexural Strength of Micro Silica Replaced Concrete

The results of flexural strength for M40 grade concrete mixes were obtained by going through the test procedure as per IS 516-1959. The investigation results for the micro silica replaced concrete mixes are shown in Table 8 in a tabular manner and in Fig3 in a graphical manner for clear view. The flexural strength value increases with the increasing percentage of micro silica in the mix up to 7.6% i.e. 5.52 MPa with the comparison to controlled mix. The maximum value increased at 28 days of curing for M40 grade concrete made with replacement of 12% micro silica is found to be 5.52 MPa as shown in Table 8. The graphical representation for the same results has been shown in Fig 3. The results investigated from the above tests can be concluded as that, the replacing percentage of micro silica



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carried out for the research work to know the various mechanical properties are comparable and are significant to use in case of preparation of concrete to enhance its properties as compare to controlled mix. The result of enhancing properties by using micro silica is due to its ultra-fine particle nature which contains amorphous silica and its pozzolanic nature.

CONCLUSIONS

1. The replacement percentage of cement with micro silica up to 12% at 28 days of curing tends to increase the values of its various mechanical properties such as compressive strength, splitting tensile strength and flexural strength.
2. The compressive strength, splitting tensile strength and flexural strength values increased in a percentage by 16.30%, 8.07%, and 7.60% respectively comparing to controlled mix concrete.
3. The workability of the mixed concrete decreased as the replacing percentage of micro silica increased. Therefore, the consumption of water will be more if the replacing percentage will be higher.
4. The maximum replacing percentage level of micro silica is found to be 12% for M40 grade concrete mix in an effective manner.

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Table 1 (Physical Properties of Binders)

Properties	OPC	Micro Silica
Specific gravity	3.14	2.24
Fineness (m ² /kg)	322	22000
Consistency (%)	32	18
Initial setting time (min)	80	220
Final setting time (min)	340	280
Soundness (mm)	4	10.6
28 days compressive strength of mortar (MPa)	44.45	54





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Table 2 (Chemical Properties of Binders)

Oxides	OPC	Micro Silica
CaO	63.65	0.57
SiO ₂	22.15	91.86
Al ₂ O ₃	5.40	0.76
Fe ₂ O ₃	3.70	1.35
MgO	1.75	-
SO ₃	2.34	0.44
Na ₂ O	0.11	0.39
K ₂ O	0.30	1.45
LOI	0.60	3.08

Table 3 (Properties of aggregates)

Properties	FA	CA
Loose bulk density (kg/m ³)	1420	1511
Compact bulk density (kg/m ³)	1596	1652
Specific gravity	2.46	2.79
Water absorption (%)	1.3	0.28
Free surface moisture (%)	0.07	0.3
Fineness modulus	2.8	6.58
Impact value (%)	-	19.4
Crushing value (%)	-	11.6

Table 4(Quantities of materials required for a cubic meter concrete)

Mix	OPC		Micro Silica		FA	CA	Water	Super plasticizer
	%	kg	%	kg	kg	kg	kg	kg
RS0	100	410	0	0	640	1230	148	4.1
RS3	97	398	3	12	640	1230	148	4.5
RS6	94	385	6	25	640	1230	148	4.9
RS9	91	373	9	37	640	1230	148	5.4
RS12	88	361	12	49	640	1230	148	5.7
RS15	85	348	15	62	640	1230	148	6.2

Table 5 (Workability result of concrete mixes with addition of super plasticizer)

Concrete mix	Slump Value (mm)	Compaction factor
RS0	75	0.95
RS3	75	0.95
RS6	72	0.94
RS9	70	0.94
RS12	68	0.93
RS15	65	0.92

Table 6 (28 days compressive strength of concrete mixes with the addition of super plasticizer)

Concrete mix	Compressive strength (MPa)
RS0	49.7
RS3	51.2
RS6	55.2





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RS9	57.4
RS12	57.8
RS15	55.0

Table 7 (28 days splitting tensile strength of concrete mixes with the addition of super plasticizer)

Concrete mix	Splitting tensile strength (MPa)
RS0	4.09
RS3	4.16
RS6	4.32
RS9	4.40
RS12	4.42
RS15	4.31

Table 8 (28 days flexural strength of concrete mixes with the addition of super plasticizer)

Concrete mix	Flexural strength (MPa)
RS0	5.13
RS3	5.21
RS6	5.40
RS9	5.50
RS12	5.52
RS15	5.38

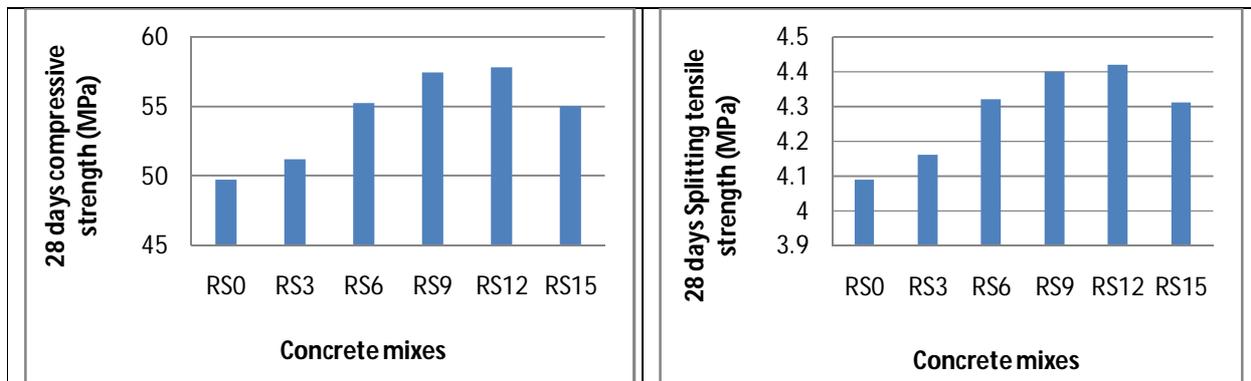


Fig. 1. (28 days compressive strength)

Fig. 2. (28 days splitting tensile strength)

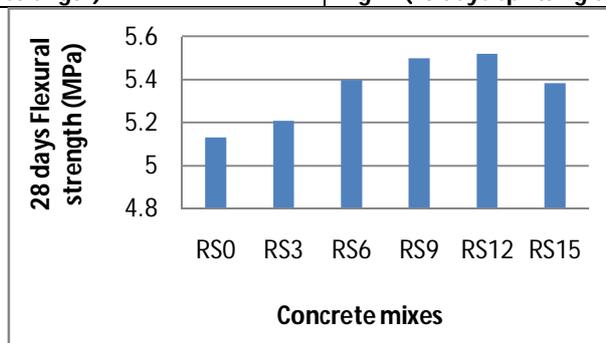


Fig. 3. (28 days flexural strength)





Polymers for Transdermal Drug Delivery System [Degradable and Biodegradable] and Different Advancement in Marketed Formulation of TDDS

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ABSTRACT

Various natural gums and mucilages have been examined as polymers for control and sustained drug release, in the last few decades. Natural polymers remain attractive primarily because they are commercial, readily available, capable of multitude of chemical modifications and potentially degradable and compatible due to their origin [1]. The last few decades have witnessed major academic and industrial efforts aimed at the development and application of polymeric materials for controlled drug delivery. Drug delivery systems can be defined as pharmaceutical dosage forms or formulations which are used to introduce drugs (active entities) into or onto the body. The aim of the delivery system is to transport an active entity to its site of action at a rate and concentration that both minimise side effects, and maximise therapeutic outcome [2]. Polymers from plants have fabulous interest due to their pharmaceutical applications such as diluent, binder, disintegrant in tablets, thickeners in oral liquids, protective colloids in suspensions, gelling agents in gels and bases in suppository and also used in cosmetics, textiles, paints and paper-making [4].

Keywords: TDDS, Polymers, Controlled drug delivery



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INTRODUCTION

Transdermal System

TDDS system lying under the category of controlled delivery in which the aim is to deliver the drugs through the skin in controlled rate [8]. TDDS is, mostly known as one of the most effective, appealing and reliable drug delivery systems. A transdermal system can be defined as a medicated adhesive apply on skin to give a specific dose of drug through the skin with a predetermined rate of drug release to reach into the circulation [7]. Transdermal drug delivery offers many cons over other traditional routes of drug delivery, such as a better control of blood levels, reduce incidence of systemic toxicity, and the absence of hepatic first-pass metabolism[38]. Currently tdds delivery is one of the most promising methods for drug application. It decreases the load that the oral route commonly places on the GIT and liver. It increases patient compliances and reduce harmful side effects of a drug caused from temporary over dose and is convenience in tdds drugs that require only once weakly application. That will improves bioavailability, more consistent plasma levels, longer period of action resulting in a lessening in dosing occurrence, reduced side effects and enhanced therapy due to safeguarding of plasma levels up to the end of the dosing period compared to a decline in plasma level with usual oral dosage forms [15].

Desired Features of TDDS: [12]

- 1) The skin has pH of 4.2 to 5.6, solution which have this pH range are used to keep away from damage to the skin.
- 2) For the healing action of the drug, there is a need of optimum partition coefficient.
- 3) API must have a low melting point (less than 200°C).
- 4) Transdermal system should be less than 40 cm² in dimension.
- 5) Shelf life upto 2 yrs.
- 6) The half-life $t_{1/2}$ of the drug have to be short;

Limitation for a drug substance to be incorporated into a transdermal delivery system are[16, 12]

1. Heavy drug molecules (>500 Da) regularly difficult to penetrate the stratum cornea.
2. Very low or high partition coefficient drug cannot reach circulation.
3. Drugs that are very melting can be given by this route due to their low solubility together in water and fat [16].
4. Some degree of skin permeability.
5. Variation in absorption competence at different sites of skin [12].

Route of delivery system and prospects:

Skin: The skin is the largest organ of the human body which covers a surface area of approximately 2 sq.m. and receives about one third of the blood circulation through the body [14]. The skin layer function is to provide a barrier for allergen, microorganisms, the permeation of ultraviolet (UV) radiation & chemicals, [10]. Skin is a major factor in determining the various drug delivery aspects like permeation and absorption of drug across the dermis. The diffusional resistance of the skin is greatly dependent on its anatomy and ultra structure [15]. The percutaneous absorption facilitates the infusion of diverse but characteristically defined molecular entities across the skin barrier, and any further absorption of the substance gets it into the systemic circulation [36].

Epidermis: The epidermis is the outermost layer of the skin and varies in thickness with approximately 0.8 mm on the palms of the hands and soles of the feet. It consists of multi-layered regions of epithelial cells and the viable epidermis is often referred to as the epidermal layers below the stratum corneum. The cellular content of the epidermis consists predominantly of keratinocytes (approximately 95% of cells), with other cells of the epidermal layers including melanocytes, Langerhans cells and merkel cells. The stratum corneum is the most superficial layer of the epidermis [10]. The stratum corneum is a highly structured lipid-rich region that minimises the ingress and egress of water, oxygen and chemicals. Skin products may target sites like dermis, epidermis and hypodermis. The key target region for the majority of topical products is the viable epidermis and sites targeted here include nerves,





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keratinocytes, melanocytes, Langerhans cells and hair follicles. Transdermal products target the systemic circulation [18].

Dermis: Dermis consists of collagenous (70 %) and elastin fibres and is 0.1-0.5cm thickness. The ground substance that promotes the elasticity of the skin is glycosaminoglycans or acid mucopolysaccharides are linked to peptide chains to form proteoglycans. Fibroblasts are major cells which create the connective tissue components of collagen, laminin, fibronectin and vitronectin; mast cells that are concerned in the immune and inflammatory effect; and melanocytes involved in the manufacture of the pigment melanin. In dermis Nerves, blood vessels and lymphatic vessels are additionally present[44]

Hypodermis: The hypodermis layer is rich in proteoglycans and glycosaminoglycans. It acts as a connecting tissue between skin, muscle and bones. Large quantity of adipose tissue in the hypodermis provides thermal padding to stay the body warm [42].

Principles of Transdermal Permeation

The skin permeation routes include transport across the epidermis and skin appendages, particularly the hair follicles and sweat glands that form an alternative pathway to the intact epidermis. The skin appendages represent only 0.1% of the total surface of the human skin and the contribution of this route for permeation flux of drugs is small [43].

Initially skin was measured as an impermeable protective barrier, but afterwards investigations were carried out which proved use of skin route as systemic delivery. The various steps involved in transport of drug from patch to systemic circulation are as follows [11]:

1. Flow of API from drug pool to the rate controlling membrane.
2. Distribution of drug to stratum corneum through rate limiting membrane.
3. Penetration through epidermis and absorption by stratum corneum.
4. Capillary intake of drugs in the dermal layer.
5. Outcome on target organ.

Types of Transdermal Patches

a) Single layer drug in adhesive: In single layer system drug is available in adhesive lining. It adheres to the skin and is also responsible for drug release for the skin. It is covered with temporary liner and a backing[54].

b) Multi-layer drug in adhesive: It contains more than one layer like immediate drug release and controlled release along with the adhesive layer. The adhesive layer is responsible for the releasing of the API. This patch also has a temporary liner-layer and a stable backing [54].

c) Vapour patch: In this type of patch the role of adhesive layer not only serves to adhere the various layers together but also serves as release vapour. The vapour patches are new to the market, commonly used for releasing of essential oils in decongestion. Various other types of vapor patches are also available in the market which are used to improve the quality of sleep and reduce the cigarette smoking conditions [54].

d) Matrix System: This system is of Two type:

a) Drug-in-Adhesive System: For the formation of drug reservoir, the drug dispersed in an adhesive polymer and then spreading the medicated polymer adhesive by solvent casting or by melting the adhesive (in the case of hot-melt adhesives) on to an impervious backing layer.

b) Matrix System: In matrix dispersion system hydrophilic or lipophilic polymer matrix is used for drug dispersion. The polymer and drug is fixed onto an occlusive base plate in a compartment fabricated from a drug-impermeable backing layer. A strip of adhesive rim is formed in this system along the circumference instead of applying on the face of drug reservoir[55].

The rate of drug release (dQ/dT) from this matrix dispersion system is defined as follows:

$$dQ/dt = \frac{D}{l} \times \sqrt{A} \times C \times \sqrt{2T}$$



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where A is equal to the initial drug loading in the polymer matrix dispersal unit, and C_p and D_p are the solubility and diffusivity of the drug in the polymer, respectively, and T stands for the time [36].

e) Micro-Reservoir Systems: This drug delivery system is a combination of reservoir and matrix-dispersion systems. The drug reservoir is formed by suspending the drug in an aqueous solution of water-soluble polymer and then dispersing the solution homogeneously in a lipophilic polymer to form thousands of un-leachable, microscopic spheres of drug reservoirs. The thermodynamically unstable dispersion is stabilized quickly by immediately cross-linking the polymer in situ [56].

Modern Techniques of Transdermal Drug Delivery System:

Iontophoresis: It involves passing of current (few milli amperes) to skin limited to a certain area using the electrode remains in contact with the formulation which is to be administered. In the diagnosis of cystic fibrosis and Iontophoretic delivery of lidocaine is considered and Pilocarpine delivery is the best example [12].

Electroporation: Electroporation which uses short electrical pulses of high voltage to create transient aqueous pores in the skin [64]. These pores provide pathways for drug penetration that travel straight through the horny layer. This technology has been successfully used to enhance the skin permeability of molecules with differing lipophilicity and size including biopharmaceuticals with molecular weights greater than 7kDA [65].

Ultrasounds: In this method, the low frequency of ultrasound has shown to enhance transdermal transport of various medicaments including macromolecules and it is known as Sonophoresis. It also involves rupturing the lipids that are present in stratum corneum, which allows the drug to deliver through the biological barrier [68].

Sonophoresis: Sonophoresis (which uses low-frequency ultrasonic energy to disrupt the stratum corneum) and thermal energy (which uses heat to make the skin more permeable and to increase the energy of drug molecules) [64].

Magnetophoresis: In this method the function of magnetic field which acts as an external force to increase the diffusion of a diamagnetic solute over the skin. Skin exposure to a magnetic field also induce structural alterations that could provide enhance in the permeability. It is a novel approach in increasing the drug delivery over the biological barrier and benzoic acid, a diamagnetic substance was selected as a drug candidate. The impact of magnet field strength on diffusion flux of drug substance was found to increasing the applied strength [68].

Laser ablation: In this approach, the high energy of the laser creates pores in the skin that permit the transit of drug through the SC for example, from a topically applied patch or gel. There are two optimal wavelengths at which skin ablation can be achieved: a wavelength absorbed by tissue proteins (2940 nm) and one absorbed by tissue water (mid-infrared; 2790 nm). During laser irradiation, the energy is absorbed by the components of the skin in the form of vibrational heating [67].

Skin Abrasion: In this technique, the upper layers of the skin is directly removed or disrupted, so that it easily helps in permeation of topically applied medicaments. There are also some devices that are based on techniques which are employed by dermatologists for superficial skin resurfacing (e.g. micro dermabrasion) that have use in the treatment of acne, scars, hyper pigmentation and other skin blemishes [12].

Polymers in TDDS

Degradable Polymers: Degradable polymers can be categorized as natural and synthetic examples are polyanhydrides, α -hydroxy acids, and natural sugars such as chitosan [22].



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Biodegradable Polymers: Biodegradable polymers degrade after some time and are offer temporary support. With an estimation of 68 million kilograms per year in 2001[5].

Biodegradable polymers are biocompatibility and biodegradability[1]. Biodegradable polymers are natural or synthetic in origin and are degraded in vivo, either enzymatically or non-enzymatically or both to produce biocompatible, toxicologically safe by-products which are further eliminated by the normal metabolic pathways [3]. Herein, a new type of naturally occurring nanoparticles obtained from the sticky exudates on the adventitious roots of English ivy (*Hedera helix*), was explored for its potential biomedical application [20]

Some of the important properties of a biodegradable biomaterial can be summarized as follows [21]:

- The material should not evoke a sustained inflammatory or toxic response upon implantation in the body
- The material should have acceptable shelf life
- The degradation time of the material should match the healing or regeneration process
- The degradation products should be non-toxic, and able to get metabolized and cleared from the body

Polymers In Pharmaceutical Applications

Polysaccharides can be homo-or hetero-polymers and may be obtained from marine and vegetal sources. The common examples from marine sources are chitin and chitosan; while the common examples from vegetal sources are starch, cellulose, and alginic acid (alginate). Proteins are heteropolymers made up of different polar and nonpolar α -amino acids. The biodegradation of proteins is commonly achieved by amine hydrolysis using enzymes such as proteases. Proteins can be obtained from animal or vegetal sources. The common examples of proteins from animal sources for biomedical applications are silk, gelatin, collagen, elastin, albumin, and fibrin. The common examples of proteins from vegetal sources are wheat gluten, soy protein, peanut, and whey protein [2].

Zein: Zein is a protein present in corn in the seeds of maize in large amounts, which has a high content of hydrophobic amino acids (leucine, proline and alanine) [63]. Zein might serve as an inexpensive and most effective substitute for the fast-disintegrating synthetic and semi-synthetic film coatings currently used for the formulation of substrates that allow extrusion coating [9].

Starch: Starch is widely used and in the presence of a plasticizer such as glycerol, starch loses much of its original granular structure and is transformed into a molten plastic state named thermoplastic starch. Unfortunately, thermoplastic starch has two main disadvantages in comparison with most plastics currently in use, namely that it absorbs moisture and exhibits poor mechanical properties. [63].

Starch-Based Polymers: Starch is a natural polymer which possesses many unique properties and some shortcoming simultaneously. Therefore, by combining the individual advantages of starch and other natural polymers, starch-based biodegradable polymers are potential for applications, in the form of microsphere or hydrogel, for drug delivery. Pure starch possesses the characteristic of being able to absorb humidity, and is thus being used for the production of drug capsules in the pharmaceutical sector. Flexibiliser and plasticiser such as sorbitol and glycerine are added so the starch can also be processed thermo-plastically. By varying the amounts of these additives, the characteristic of the material can be tailored to specific needs (also called "thermo-plastical starch") [9].

Gelatin: Gelatin is a natural biopolymer derived from collagen via controlled alkaline, acid, or enzymatic hydrolysis. As a result of its biological origin, it has excellent biodegradability and biocompatibility and because it is widely available, gelatin is a relatively low-cost polymer. Gelatin is a versatile biopolymer that traditionally enabled the design of several different drug carrier systems, such as microparticles, nanoparticles, fibers, and hydrogels [19].



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Rosin: Rosin, a film-forming used as film-coating and microencapsulating materials to achieve sustained/controlled drug release. [9].

Polyisobutylenes (PIBs): PIBs in contrast, are characterized by a low solvent capacity for drugs. PIBs are often used in membrane-controlled systems where the initial burst of drug released from the adhesive layer should be limited. PIB-based adhesives are mixtures of high and low molecular weight polymers, which provide cohesion and tackiness, respectively. By adjusting the composition of the PIB formulation, cold flow and adhesiveness can be customized for each system [70].

Polyamides: Polyamides, where the repeating units are held together by amide groups (CO-NH), may be produced by polymerization of amino or the interaction of an amine (NH₂) group and a carboxyl (CO₂H) group. Polyamides are not generally biodegradable. As a result of the strong hydrogen bonding ability of amide bonds and the biodegradability imparted by the ester bonds, poly(ester-amide)s have been used in various biomedical applications including bio resorbable suture materials, drug-eluting dressings for burn treatment, vascular patches, gene delivery vehicles for transfection purpose, coating materials for metallic drug-eluting stents and wound closure biomaterials. Poly (ester-amide)s have also been used in various drug delivery applications, including anticancer drug delivery [2].

DIFFERENT ADVANCEMENT IN MARKETED FORMULATION OF TDS

The drugs which are available in market and studied widely for the use of TDDS are nifedipine [25], nitroglycerin [26, 27, 40], captopril [28, 29], chlorpheniramine [30], propranolol [31,32], aspirin [33,34], norethindrone[35], hydrocortisone [37, 38], acyclovir [39], fentanyl [40], theophylline [36, 45], nicotine[36, 40], testosterone[40, 46], clonidine [40], lidocaine [35], scopolamine [40], estrogen [48], norelgestromin [49], estradiol [47], triptolide [50], rivastigmine [51, 52], terbinafine [53], primaquine[57], rotigotine [58, 59], methylphenidate [60]and selegiline[61] [24].

Transdermal products currently on the US market

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Table 1: The polymers used in transdermal system [4, 14, 55, 71]

S.No.	Polymers	Examples
01.	Natural Polymers	Zein, gelatin cellulose derivatives, gums, natural rubber, shellac, waxes and chitosan etc.
02.	Synthetic Elastomers	Hydrin rubber, polyisobutylene, polybutadiene, silicon rubber, nitrile, neoprene, butylrubber, acrylonitrile etc.
03.	Synthetic Polymers	Polyvinylchloride, polyethylene, polyvinyl alcohol, polypropylene, polyamide, polyacrylate, polyurea, polyvinylpyrrolidone, polymethylmethacrylate etc.

Table-2: Pros and Cons of Drug:[8,11, 14]

Advantages of Drug	Disadvantages of Drug
keep away from GIT absorption.	Large daily dose is not possible.
Avoid FP hepatic metabolism of drugs.	Limited irritation is major problem.
More enhanced and suitable patient compliance	Drug with extensive half-life cannot be formulated in TDDS
Self-medication is feasible.	Painful to apply.
Reduces occurrence of doses.	May not be reasonable.
Possible for persistent or controlled release drugs.	Barrier of the physiological be different in the functions.
Minimize undesirable side effects.	Transdermal system cannot deliver ionic drugs.
Provide use of drug with short biological half-lives, narrow therapeutic window Inter and intra patient difference.	It cannot attain high drug levels in blood.
Stop of therapy is easy at any point of time.	It cannot transport drugs in a pulsatile fashion.
Provide fittingness for self-administration.	It cannot develop if drug or formulation causes annoyance to skin.
They are non invasive, avoiding the inconvenience of parental therapy.	Possibility of local irritation at site of application

Table2: Numbers of publications, clinical trials and marketed products of advanced pharmaceutical technologies (1980–2017) [23].

Key Drug Delivery Technologies	Number of Global Publications	Number of Global Clinical Trials	Ratio of Clinical Trials to Publications (%)	Number of Clinical Trials in US	Number of Marketed Products in the US	Ratio of Products to Clinical Trials in the US (%)
Transdermal patch	4161	570	13.70	323	54	17.09





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Table3: List of transdermal products currently on the US market [41].

Active ingredients	Type of delivery system	Name	Company	Type of patch	Dose and application	Regulatory status	Uses
Clonidine	Transdermal patch extended release	Catapres TTS	BoehringerIngelheim	Drug in reservoir and in adhesive formulation	3.5–10.5-cm ² patches deliver 0.1–0.3 mg/day for 7 days Applied to hairless skin on the upper outer arm or chest	Rx	Essential hypertension
		Clonidine	Par Pharm	Reservoir type	0.1–0.3 mg/24 h for 7 days		
Estradiol	Transdermal patch extended release	Alora	Watson Laboratories	Adhesive matrix drug reservoir	9–36-cm ² patches deliver 0.025–0.1 mg/day and continuous delivery for twice weekly dosing Applied to lower abdomen	Rx	Menopause, postmenopausal and osteoporosis, in case of lowered estrogen levels
		Climara	Bayer Healthcare	Adhesive matrix containing drug	6.5–25-cm ² patches deliver 0.025–0.1 mg/day for 7 days Applied to lower abdomen or upper quadrant of buttock		
		Estraderm	Novartis	Reservoir type	0.05 or 0.1-mg/day and continuous delivery for twice weekly application		





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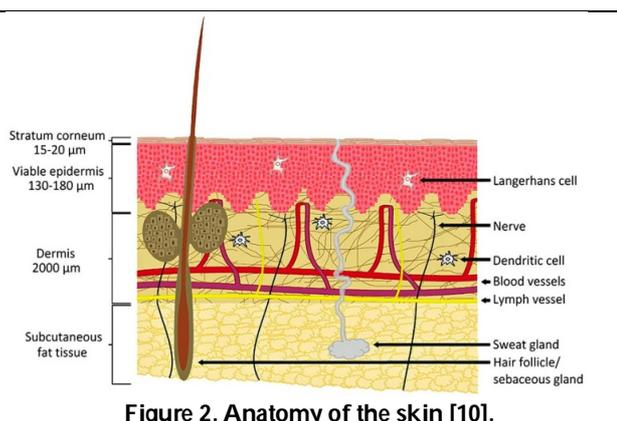
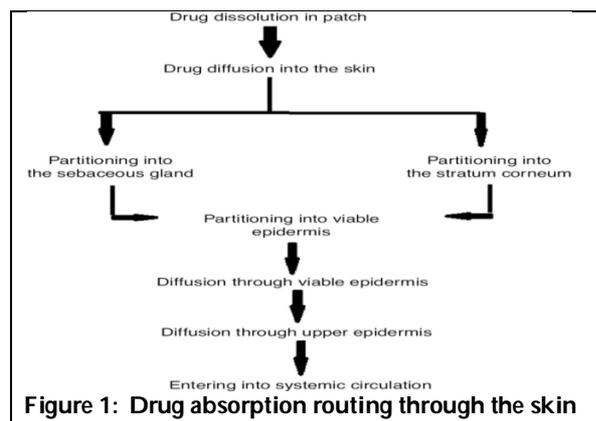
		Estradiol	Mylan Technologies	Adhesive matrix containing drug	0.025–0.1 mg/day continuous delivery once weekly patch		
		Menostar	Bayer Healthcare	Adhesive matrix containing drug	3.25-cm ² delivers 14 µg/day for 7 days Applied near lower abdomen		
		Vivelle/Vivelle-Dot	Novartis/Novogyne	Adhesive formulation contains drug	Patches having active surface area of 2.5–10 cm ² deliver 0.025–0.1 mg/day and twice weekly application Applied to the abdomen		
	Transdermal gel	Divigel	Upsher-Smith Laboratories	0.1% gel	0.25–1 g dose available Applied to a small area (200 cm ²) of the thigh in a thin, quick-drying layer		
		Elestrin	AzurPharma	0.06% gel supplied in a non-aerosol, metered-dose pump container	Applied once daily to the upper arm using a metered-dose pump that delivers 0.87 g of Elestrin [®] gel per actuation		
		Estrogel	Ascend Therapeutics	0.06% estradiol in an absorptive hydroalcoholic gel	1.25 g in a single dose and applied to 750-cm ² area Applied to arm between wrist and shoulder		





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	Transdermal spray	Evamist	KV Pharm/Ther-Rx	Topical application to the skin of a rapidly drying homogeneous solution of 1.7% drug from a metered-dose pump	One, two or three sprays/day (90 µl/spray) to adjacent nonoverlapping 20-cm ² areas on the inner surface of the arm between the elbow and the wrist and allowed to dry	Rx	Menopause, postmenopausal and osteoporosis, in case of lowered estrogen levels
Estradiol and levonorgestrel	Transdermal patch extended release	Climara Pro	Bayer Healthcare Pharmaceuticals	Drug in adhesive layer	22-cm ² Climara Pro™ system contains 4.4 mg estradiol and 1.39 mg levonorgestrel and delivers 0.045 mg estradiol and 0.015 mg levonorgestrel /day for 7 days applied to lower abdomen	Rx	Menopausal symptoms





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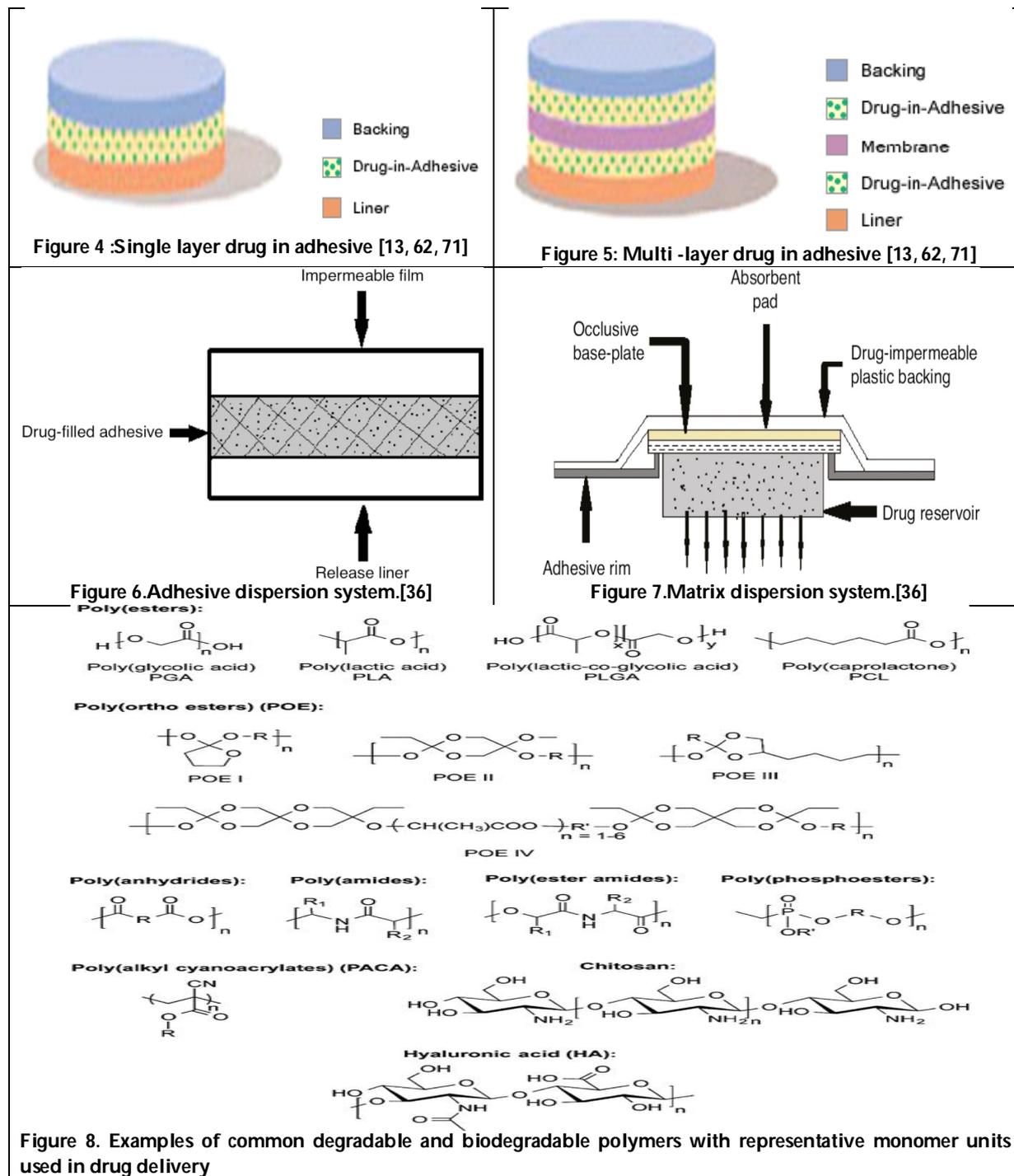


Figure 8. Examples of common degradable and biodegradable polymers with representative monomer units used in drug delivery





Removal of Heavy Metals Such as Nickel, Zinc and Copper from the Chemical Based Combined Effluents

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ABSTRACT

Heavy metals are naturally occurring elements that have a high atomic weight and a density five times greater than that of water. Their various industrial, domestic, agricultural, medical and technological applications have led to their ample circulation in the background; raising concerns over their impending effects on human health and the environment. The investigator have made an attempt to study the removal of Nickel, Zinc and Copper from the Chemical Based Combined effluent by absorption methods. The highest adsorption of Cu, Ni and Zn was noted at the pH value of 5.0. The equilibrium time for the adsorption of Cu, Ni and Zn on the CFA, ASC and 50:50 mixture ranges from 75 to 90 minutes. The percentage (%) removal of Cu, Ni and Zn increases with increase in the adsorbent amount. Desirable amount indicate in this study for various adsorbents ranges from 30 to 50 g/L. The equilibrium experimental data obtained for the adsorption of Cu, Ni and Zn can be described by Freundlich Adsorption Isotherm model. Among the different adsorbents, ASC (Acacia salinarum Carbon) achieved that as a waste material has cost effective and has also been proved to be an efficient alternative to commercial activated carbon.

Keywords: Water Treatment, Adsorption, Isotherm, Heavy Metal, Water Analysis.

INTRODUCTION

Chemical, metal and electroplating industries are responsible for the release of heavy metals into the environment in the form of industrial effluents [1]. The persistence of free heavy metal ions bounds/ completely soluble in wastewater is due to their non-biodegradable and toxicity nature [2]. Biological processes are classified into two broad categories: microbial remediation and phytoremediation [3]. The microbial remediation strategies for heavy



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metal removal in wastewater include bioaugmentation, biosparging and biosorption [4]. The main techniques used to reduce heavy metals pollution in water bodies include, coagulation, chemical precipitation, solvent extraction, ultra filtration, biological systems, electrolytic processes, reverse osmosis, oxidation with hydrogen peroxide /ozone, membrane filtration, ion exchange and photo catalytic degradation [5]. Adsorption technique has advantages over the other methods because it's simple design, low investment and minimum land required, ease of operation, flexibility, simplicity, insensitivity to toxic pollutants and also proper design of the adsorption process [6]. Battery manufacturing, electroplating, metal processing, mining, paint and pigment manufacturing, petroleum refining, pesticides, printing and photographic industries, tanneries, textiles, etc. [7] are the important sources of heavy metal contamination in our environment.

Heavy metal containing aerosols usually accumulate on leaf surfaces in the form of fine particulates and can enter the leaves via stomata [8]. In environments where industrial activities take place, it is indicated that large amount of toxic metals deposits are found in their water, soil, crops and vegetable [9]. The cleaning of process tanks and treatment of wastewater can generate substantial quantities of wet sludge containing high levels of toxic metals [10]. Heavy metals are mostly present in sludge because of their hydrophobic nature as they are attached with the solid portion of the wastewater [11]. The pollution of heavy metals has gained worldwide attention due to their toxicity, difficult degradation, and accumulation in the living organisms [12].

Heavy metals are chemical components with a specific gravity which minimum 5 times the water specific gravity [13]. Excess amount of heavy metals will be harmful to the human body, aquatic life and environment [14]. In recent years, bio-electrochemical systems (BESs) have attracted considerable attention for their innovative features and environmental benefits [15]. Research shows that human body with excess heavy metals can cause health hazard [16]. The presence of any of these metals in excessive quantities will interfere with many beneficial uses of the water [17]. The treatment of aqueous or oily effluents is one of the most serious environmental issues faced by the minerals and metallurgy industries [18]. Membrane separation technology and its applications have been rapidly developed in recent years [19]. Many heavy metals are amphoteric therefore, their solubility reaches a minimum at a specific pH (different for each metal) [20]. Studies like ion exchange, electrochemical precipitation, solvent extraction, reverse osmosis etc. are expensive for large scale treatment of sewage water effluent containing Ni (2⁺), Zn (2⁺) and Cu (2⁺) particularly in budding countries. Adsorption using activated carbon (AC) is a successful method for the treatment of sewage effluents with Ni (2⁺), Zn (2⁺), and Cu (2⁺). The commercial activated carbon is high cost and expensive. This reveals that the cost effective alternate adsorbents for the treatment process of Ni (2⁺), Zn (2⁺) and Cu (2⁺) waste streams are needed at present.

Power plant waste like coal fly ash and indigenous carbon prepared from eco-hate *Acacia salinarum* are used as an adsorbent for the removal of Ni (2⁺), Zn (2⁺) and Cu (2⁺) from waste water. Batch experiments are carried out for kinetic absorption methods on the exclusion of nickel Zinc and copper from aqueous solution. Toxic heavy metal pollution exists in aqueous wastes of various chemical industries. The effects of various parameters such as initial pH, contact time, dose of adsorbent and initial concentration of absorption are studied. The equilibrium isotherm experimental data and kinetic experimental data are tested with various isotherm models and kinetic models.

MATERIALS AND METHODS

VAIGAI RIVER Basin

There are 34 river basins in Tamil Nadu. For hydrological studies, they are grouped into 17 river basins. The Vaigai River basin is one of them. Vaigai river basin covers an area of about 7009.13 sq.km and hilly area extends to 2,101.68 sq.km and located in the Theni, Dindugal, Madurai, Sivaganga, and Ramanathapuram Districts of Tamil Nadu. Vaigai, the main river originating from Varushanadu valley with its tributaries forms a well-defined, compact drainage basin. It has a varied climatic condition resulting often in unreliable rainfall, drought prone, sudden floods,



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etc. This gives rise to unpredictable water resources condition but for the Periyar reservoir water flowing through this basin due to the construction of the Periyar trans-basin scheme which made it possible to divert water from the Periyar basin in the State of Kerala to Tamil Nadu. The index map of Vaigai River Basin is shown in fig. 1.

Location and Extent

Vaigai river basin lies between the geographic co-ordinates Lat. 9o 15' – 10o 20' N and Long. 77o 10' - 79o 15' and falls within the Survey of India toposheets, 58F, 58G, 58J and 58k. The total extent of the area is covered within the administrative boundaries of 20 taluks and 37 blocks. The present study attempts to assess abundance, distribution and seasonal variation of trace metals in surface water of Vaigai River at Madurai, in order to prevent and control water pollution and avoid health risks to human beings in the study region. To observe spatial variation in the metal concentrations, the samples were collected and analyzed from entire course of the rivers. For sampling 8 sampling stations were selected in Madurai. The study period of two (May 2018 to April 2019) in three seasons viz., summer, monsoon and winter have also been followed. All chemicals and double distilled (DD) water free from CO₂ were used to prepare standard solutions. The digested sample was taken for Atomic Absorption Spectrometer (AAS) analysis. The procedure recommended by APHA (2017) was followed during the field and laboratory in Excellence laboratory at Madurai.

Preparation of Adsorbent Fly Ash

The fly ash (MTPS) is collected from Mettur Thermal Power Station-I (MTPS) for the study of treatment process. The fly ash is washed with double distilled water and the activation is carried out by treating it with concentrated H₂SO₄ (95 % w/w) in 1:1 ratio and is kept in an oven maintained at a temperature range of 155°C for 12 hours. Again it is washed with double distilled water to remove the free acid and finally dried at 110°C for 6 hours.

Preparation of Adsorbent (Acacia Salinarum Carbon (ASC)).

The Acacia salinarum wood applied in this study is collected from are of Madurai district. The method of activation is carried out in two different stages. Primary process is the Acacia salinarum wood is renewed into wooden charcoal by carbonization process which is frequently carried out in mud-pits, brick kilns and metallic portable kilns. Secondary process is wood charcoal is activated by treating with conc. H₂SO₄ at temperature of 155 °C for about 12 hours in an oven. The chemical activation takes place at the internal surface area, creating more sites for adsorption.

Characterization of Adsorbents

The Physical and chemical characteristics like moisture content, particle density, ash content and water soluble components of adsorbents such as activated coal fly ash and activated Acacia salinarum Carbon were determined and given in Table 1. The bulk and particle density disturb the adsorption of metal ions. Reduce in the bulk density enhances the adsorption of metal ions. The bulk density value result is less than 1.2 and it indicates the adsorbent materials are of fine nature. When this analysis value falls within the range of 1.2-2.5 the materials are intermediate and the value more than 2 indicates that the materials are small loutish in nature. The particle density value less than 2.2 reveals the materials are finer, the value between 2.2-7 are medium and more than 7 indicates materials are more coarse in nature. In the present study of bulk density and particle density values obtained are closer to fine in nature. Moisture content, though does not disturb the adsorption capacity, dilutes the adsorbents and therefore necessitates the need of additional weight of adsorbents to give the needed weight. Ash content generally gives an idea about inorganic constituents associated with carbon. In any case, the actual amount of individual inorganic matters will vary from one type to another as they are derived from various source of material. The values of matter soluble in water and acid are more knowledgeable for designing the adsorption process.

Other Chemicals

All the various chemicals used are analytical reagent grade and were obtained from Loba / Glaxo / BDH, solution of Buffer is pH equal to 7,7 and 9 for calibration of the pH meter, conc. HNO₃. Individual standard solution for Ni ⁽⁰⁾



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ion, individual standard solution for Cu^(II) ion, individual standard solution for Zn^(II) ion, sodium hydroxide pellets, sodium nitrate and 0.5N Hydrochloric acid

RESULTS AND DISCUSSION**Heavy Metal Analysis**

The analysis methods cover the quantitative and qualitative of dissolved and total recoverable Nickel, Zinc and Copper in water and sewage water by atomic-adsorption spectrophotometry. (AAS). The reason to choose Atomic adsorption spectrophotometer AAS is the results produced are reproducible and accurate and moreover applicable to industrial discharges, which may contain less than 6 mg/l of any toxic heavy metal. In atomic adsorption analyzing sample is aspirated into a flame and atomized. A light beam is directed through the flame into a mono chromator send the beam to detector that measures the amount of light absorbed by the atomized element in the flame. For some metals, atomic absorption exhibits superior sensitivity over flame emission. Because each element has its individual characteristic absorption wavelength, a source lamp composed of that element is used, which is called the Hollow Cathode lamp. It makes the method relatively free from spectral or radiation interference. The amount of energy at the characteristic wavelength absorbed in the flame is proportional to the concentration of the element in the sample over a minimum concentration range. The instrument used in determination of metals and toxic heavy metals is the Atomic Adsorption spectrophotometer(AAS). In the case of Cu^{II} ion, the absorption of the color complex is measured at a wavelength of 253.3 nm, the Zn^{II} ion the adsorption of the color complex measured at a wavelength of 225.5 nm

Batch Experiments

The batch experiments are analysed by in 250 ml (borosil) shaker bottles by shaking a initial weighed amount of the CFA, ASC and 50:50 mixture of CFA, ASC with 100 ml of the aqueous solutions for a pre determined period (found out from kinetic studies) at 30°C with an initial adsorbate concentration of 10g/l. The effect of adsorbent amount is analyzed by varying it in the range of 10-50 g/l with the adsorbate concentration range of 5-25 mg/l at 30°C. The effect of pH of adsorbate on adsorption is analyzed by varying it in the range of acidic 2 to alkaline (basic) 12. Moreover the effect of contact time between adsorbate and adsorbent is studied by different range of 15 to 150 minutes.

The various experimental parameters, which influence the process, are as follows:

- i. Effect of differential concentrations
- ii. Effect of pH differential in solution
- iii. Effect of differential the amount of photo catalyst.
- iv. Effect of differential the contact time.

Effect of Differential Concentrations

The effect of beginning concentration of Cu, Ni then Zn and all on the amount of CFA, ASC and 50:50 mixture was analysed with a particular dose of adsorbent (10 g/l) and constant contact time (60 min) by differential the initial concentration of the above adsorbate. From the analytical results, it is noted that the amount of adsorbate adsorbed exponentially high while the percentage (%) removal reduce with the increase in the beginning concentration of adsorbate. This noted that there exposed a reduction in immediate solute adsorption due to the lack of available active sites required for the high initial concentration of adsorbate. The effect of concentration on the percentage removal of adsorbate is represented. The relative adsorption power of CFA, ASC and 50:50 mixtures also noted that under particular conditions, compared to CAC, the adsorptive capacities of CFA, ASC and 50:50 mixtures are minimum. This may be due to the porous nature of the surface of AC. These low amount adsorbents possess nearly 50% adsorptive capacities compared to that of AC. The percentage(%) reduced of adsorbate by above indicated adsorbent is noted to exponentially reduce with increase in initial concentration of toxic heavy metal, which may be





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due to the lack of available active sites on the surface of the adsorbent. The amount of adsorbate adsorbed on an adsorbent increases with increase in initial concentration of toxic heavy metal. The optimum concentration of metals and toxic heavy metals found to be 15-20 ppm.

Effect of Concentrations Variation

To study the adsorbent dosage on the removal of toxic heavy metal ions, different values have been taken by varying the adsorbent concentration ranging from 10-50 g/l by keeping the volume of the effluent solution constant under optimum temperature and contact time. Graph Cu, Ni and Zn shows the effect of adsorbent dosage on the removal of Nickel, Zinc and Copper by CFA, ASC by 50:50 ratio at optimum temperature of 296 K and time 60 mins. In case of ASC, copper(Cu) removal 76% to 67% was achieved with respect to dose of 10-50 g/l, Nickel(Ni) removal of 72-56% was achieved with respect to dose of 10-50 g/l and Zinc(Zn) removal of 72-60 % is achieved with respect to a dose of 10-50 g/l. In case of CFA, copper(Cu) removal 70%-77% achieved with respect to dose of 10-50 g/l, nickel removal of 36-72% achieved with respect to dose of 10-50g/l and Zinc removal of 36-50% is achieved with respect to dose of 10-50g/l. But in case of 50:50 mixture, copper(Cu) removal of 70-55% achieved with respect to dose of 10-50 g/l, nickel(Ni) removal of 70-50 % achieved with respect to a dose of 10-50 g/l and Zinc(Zn) removal of 70-50% is achieved with respect to dose of 10-50g/l. The observation is made in this examine promotes the extent of removal of toxic heavy metal ions from the electroplating industrial waste increase with increase in adsorbent dosage. This can be explained by the availability of the exchangeable sites or surface area on the adsorbents. In the minimum adsorbent dosage level (10 g/l) there will be low availability of exchangeable sites; Successful removal of metal ions at low adsorbent dosage is minimum. But at the highest adsorbent dosage level (50 g/l) there will be a greater availability of exchangeable sites or surface area, hence the removal of metal ions at highest adsorbent dosage is also maximum. Success removal of toxic heavy metal ions with the effect of adsorbent dosage has been evaluated through the study of the percentage ratio, before and after individual adsorbent dose.

Effect of dose of adsorbent

Characteristic of adsorption isotherm

In this study, as the new adsorbent is developed, it is needed to test the equilibrium experimental data obtained for toxic heavy metal ions removal using activated tamarind seeds with different isotherm models. Freundlich isotherm model is tested with the experimentally obtained equilibrium experimental data.

Freundlich Isotherm

The adsorption given experimental data are fitted with the linearised form of Freundlich adsorption isotherm.

$$\text{Log } (x/m) = \text{logK} + (1/n) \text{logC}_e$$

Where (x/m) is the amount of adsorbate adsorbed per unit mass of the adsorbent, C_e is the equilibrium concentration and K and 1/n are the Freundlich constants, which are the measure of the adsorptive power and adsorption intensity, respectively. The log (x/m) values are found to be linearly correlated to the log C_e values in the case of all the adsorbents. The computed r-values, which are very near to unity, conclude that the Freundlich model is applicable to the analysis experimental data. The noted highest values of (2 -7) of 1/n in the case of all the adsorbents noted that an adsorption mechanism with an intra particle diffusion or mass transfer as the rate limiting step. The higher order of the adsorptive capacities of these adsorbents as indicated by the K values (log k values) for CFA, ASC and 50:50 mixtures.

CONCLUSION

An attempt has been made to the removal of Nickel, Zinc and Copper from the Chemical based combined effluent. The highest adsorption of Cu, Ni and Zn was noted at the pH value of 5.0. The equilibrium time for the adsorption of Cu, Ni and Zn on the CFA, ASC and 50:50 mixture ranges from is 75 to 90 minutes. The percentage (%) removal of



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Cu, Ni and Zn increases with increase in the adsorbent amount. Desirable amount indicate in this study for various adsorbents ranges from 30 to 50 g/L. The equilibrium experimental data obtained for the adsorption of Cu, Ni and Zn can be described by Freundlich Adsorption Isotherm model. Among the different adsorbents, ASC (Acacia salinarum Carbon) achieved that as a waste material has cost effective and has also been proved to be an efficient alternative to commercial activated carbon.

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Table 1 Physical and Chemical Parameters

PARAMETERS	CFA	ASC
pH	7.2	5.8
Bulk density	0.95 (g/cc)	0.67 (g/cc)
Moisture	24%	3 %
Ash	72 %	21%

Table 2. The Percentage (%) Adsorbend Values

Adsorbent	Experimental condition	
	Identical	Optimum
CFA	75	60
ASC	55	70
50:50 (CFA:ASC) mixture	52	67

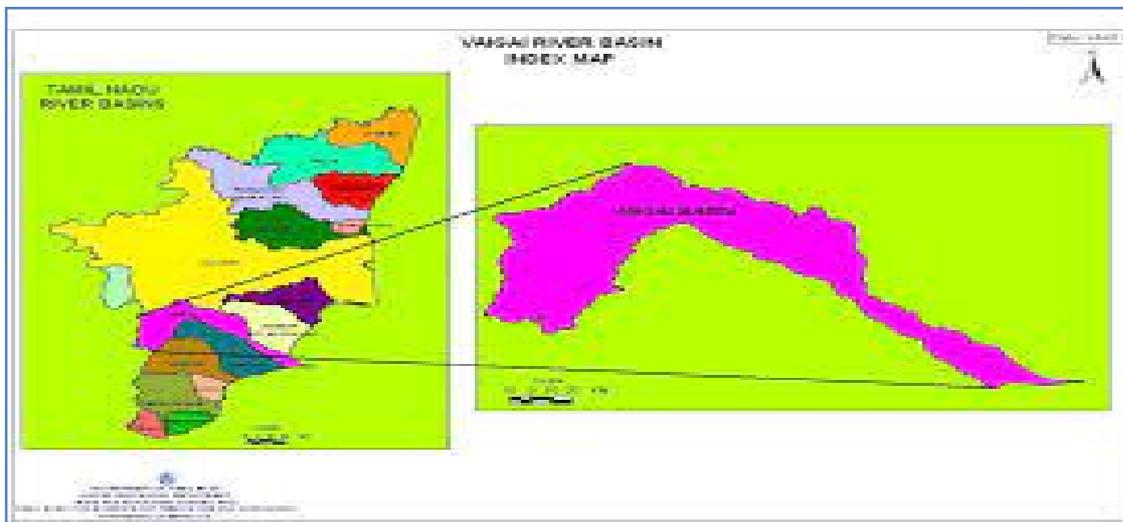


Fig 1. Index Map of Vaigai River Basin





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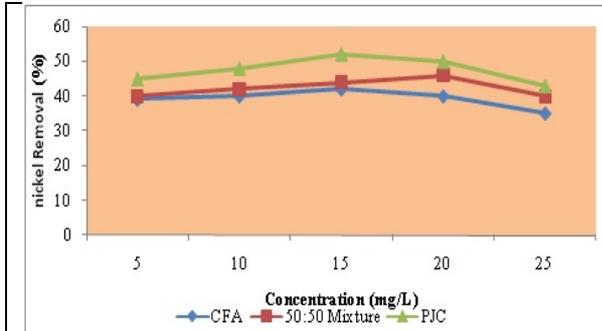


Fig 2.Copper (Cu) scale:x-axis- concentration (mg/l) y-axis : Copper removal (%)

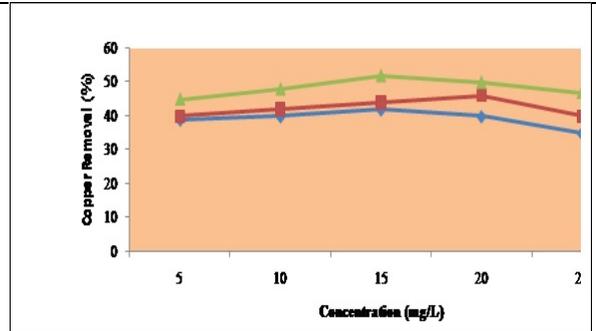


Fig 3.Nickel (Ni) Scale: x-axis: concentration (mg/l); y-axis- Nickel removal (%)

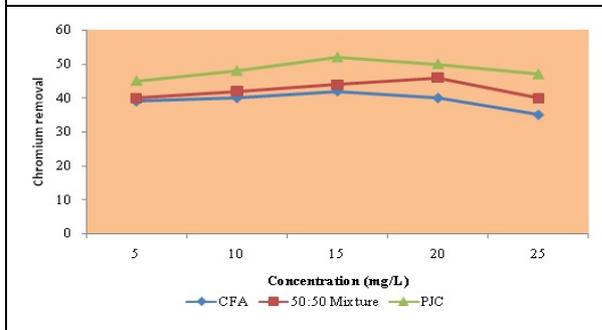


Fig 4. Zinc (Zn) Scale: x-axis: concentration (mg/l); y-axis- Zinc removal (%)

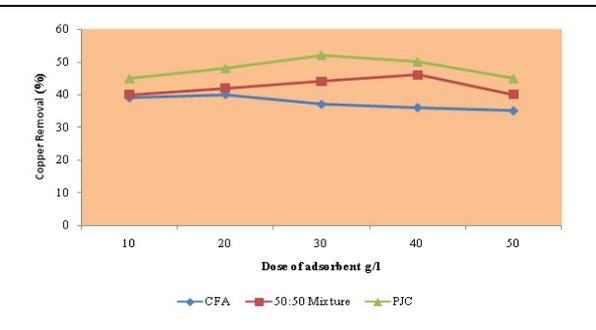


Fig 5.Copper (Cu) Scale: x-axis- dose of adsorbent(g/l); y-axis- copper removal (%)

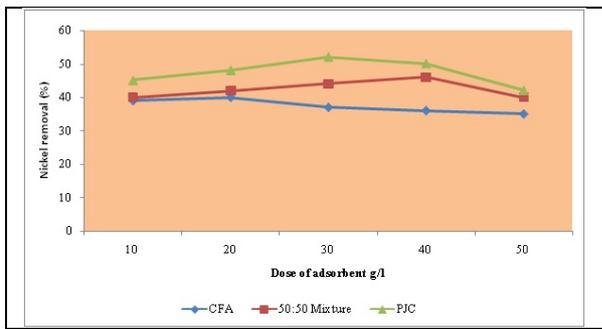


Fig 6. Nickel(Ni) Scale: x-axis: Dose of adsorbent.(g/l); y-axis- nickel removal (%)

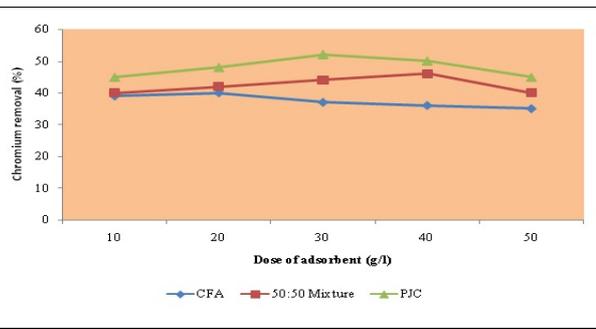


Fig 7. ZINC(Zn) Scale: x-axis- Dose of adsorbent g/l; y-axis: Zn removal (%)





Immune Booster Phytochemicals used in Corona Treatment

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ABSTRACT

The novel coronavirus 2019 currently designated as COVID 2019 is in the limelight since the beginning of New Year 2020. Though human coronaviruses have been recognized for many years, but COVID 2019 was a new strain and its wide global spread sparked panic among the common public. Owing to the lack of immunity to this new strain of coronavirus, a large number of people at large are susceptible to it. People are more concerned to raising their immunity. The coronavirus pandemic of 2020 might have brought medicinal drinks into fresh limelight, but almost every Indian home is familiar with the kadha. Daily consumption of this ayurvedic herbal decoction was recommended by the Indian Ministry of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy (AYUSH) as one of the key methods to boost your immune system. This herbal decoction becomes familiar due to phytochemicals present into it. Phytochemicals have promising potential for maintaining and promoting health, as well as preventing and potentially treating some diseases. This paper aims to summarize the recent progress in Corona infection with natural drugs and use of natural products as medicine as a special focus.

Keywords: Corona, Phytochemicals, Ayurvedic medicine, Decoction.

INTRODUCTION

The novel coronavirus 2019 currently designated as COVID 2019 is in the limelight since the beginning of New Year 2020 (WHO, 2020). Though human coronaviruses have been recognised for many years, but COVID 2019 was a new strain and its wide global spread sparked panic among the common public (CDC, 2020). Owing to the lack of immunity to this new strain of coronavirus, a large number of people are susceptible to it. (Kapil Goyal et al., 2020) and People are more concerned to raising their immunity. Ayurveda, naturopathy and alternative medicine experts have touted the immense benefits of this drink can impart for decades now. While the benefits of this drink are not ignored by western medicine yet, the potential of all the individual ingredients that go into it has been acknowledged by modern science also. Working on your immunity is a lifelong process, and if you're looking for a

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natural way to do it, then including kadha in your everyday routine would be a great start. A kadha is made with dry ingredients that cannot be juiced, hence these ingredients are added to water and boiled to extract the nutrients within. Daily consumption of this ayurvedic herbal decoction was recommended by the Indian Ministry of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy (AYUSH) as one of the key methods to boost your immune system. But much before, many of our ancestors have passed down this recipe to us as part of their traditional knowledge of natural remedies.

The reason why kadha is considered to be such a potent immune booster is because of its many components. According to a 2018, study published in the Journal of Traditional and Complementary Medicine, herbal teas like the kadha are a rich source of natural bioactive compounds or antioxidants like carotenoids, phenolic acids, flavonoids, alkaloids, saponins, terpenoids, polyacetylenes, coumarins and many others. Improving the antioxidant status of the body is a well-known way to reduce the risk of all types of diseases, because all of these antioxidants improve the antibacterial, antiviral, anti-inflammatory, antiallergic, antithrombotic and vasodilatory actions of the immune system. Not only does drinking kadha keep seasonal and chronic diseases at bay, but it also improves the quality of your skin and works as a natural anti-ageing agent.

Herbal medicines, or active compounds derived from natural sources suffer from the same limitations of many other drugs. However, in the case of synthesized drugs, many of these problems can be overcome by preparing derivatives of these drugs that retain some of their activities and at the same time enhancing their physical properties to a more suitable form for pharmaceutical formulations. However, herbal medicines are still the main source of drug and their side effects are much lower than synthetic drugs. Society is also having deep and strong trust in their efficacy to heal or prevent disease. The recipe for decoction preparation recommended by the AYUSH ministry, includes tulsi (Indian basil), cinnamon, black pepper, dry ginger and raisins. The one given by popular Patanjali Ayurved founder, Ramdev, includes mulethi (liquorice) and giloy (heart-leaved moonseed) along with tulsi, cinnamon, ginger, turmeric and black pepper. Some even recommend the addition of cardamom pods to this recipe.

Description about Herbal plants

Tulsi (Indian basil)(*Ocimum sanctum*)

Tulsi (*Ocimum sanctum*), also known as holy basil, is a medicinal herb used in Ayurveda, a form of alternative medicine that originated in India. Closely related to culinary basil, Tulsi is native to India and Southeast Asia. Tulsi is considered an adaptogenic herb. Adaptogens are plants that help to adapt the body to stress and boost energy. Tulsi contains a number of beneficial compounds including:

- Eugenol: a terpene with pain-relieving properties, also found in clove oil
- Ursolic and rosmarinic acid: compounds with antioxidant, anti-inflammatory, and anti-aging properties
- Apigenin: a flavonoid that helps the body removes waste at the cellular level
- Lutein: an antioxidant carotenoid important for eye health
- Ocimumosides A and B: compounds that reduce stress and balances the neurotransmitters serotonin and dopamine. In alternative medicine, tulsi is typically used for asthma, bronchitis, arthritis, colds, and the flu.

Cinnamon (Dalchini) (*Cinnamomum verum*)

Cinnamon, (*Cinnamomum verum*), also called **Ceylon cinnamon**, bushy evergreen tree of the laurel family (Lauraceae) and the spice derived from its bark. It is obtained from the bark and is either rolled into cinnamon sticks (called quills) or ground into a fine powder. Although there are several varieties of cinnamon from countries like India, Sri Lanka, Indonesia, Brazil, Vietnam, and Egypt, Ceylon cinnamon and Cassia cinnamon are the most popular. Ceylon cinnamon, often referred to as true cinnamon, is the most expensive varietal. Beyond its use in cooking, cinnamon is believed to have medicinal properties. Alternative practitioners believe that cinnamon can lower blood sugar, treat superficial fungal infections, and reduce inflammation and pain. In Ayurvedic medicine, cinnamon is used as a remedy for diabetes, indigestion, and colds, and can help balance a person's kapha (physical



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and emotional energies). It is also a common ingredient in chai tea and cinnamon tea, both of which are believed to improve digestion. It is used in the treatment of Diabetes, Hypertension (high blood pressure), Metabolic syndrome, Irritable bowel syndrome (IBS), Yeast infections (candidiasis), Oral infections, Common cold and Hay fever (allergic rhinitis). Cinnamon's characteristic flavor and aroma come from a compound in the essential oil called cinnamaldehyde. Cinnamaldehyde is known to exert antimicrobial and anti-inflammatory properties that may help treat certain metabolic, infectious, digestive, or respiratory disorders.

Black pepper (*Piper nigrum* L.)

Considered as the "King of spices", black pepper (*Piper nigrum* L.) is a widely used spice which adds flavor of its own to dishes, and also enhances the taste of other ingredients and as part of the kingdom of medicinal agents. It is comprising a panoply of bioactive compounds with potential nutraceutical and pharmaceutical applications. The major bioactive compound identified in *P. nigrum* is piperine although other compounds are also present including piperic acid, piperlonguminine, pellitorine, piperolein B, piperamide, piperettine, and (-)-kusunokinin, which also showed biological potency. In ancient Chinese and Indian medicine, black pepper was used as a natural medicinal agent for the treatment and alleviation of pain, chills, rheumatism, influenza, muscular pains, chills, and fevers.

Dry ginger (*Zingiber officinale*)

Zingiber officinale, commonly known as "ginger" or "sunthi (dried ginger)", is a popular spice used in traditional medicines for more than 5000 years. Previously, Indians and the Chinese used it as a tonic for treating migraine, arthritis, high blood pressure, and several other conditions. *Zingiber officinale* is mostly valued for its aromatic and medicinal properties. *Zingiber officinale* is a perennial, herbaceous plant that belongs to the Zingiberaceae family. It originated in Southeast Asia and is widely cultivated in India, China, Nigeria, Australia, Nepal, Thailand, Maluku Islands, and several other regions. The scientific analysis suggested that *Zingiber officinale* have more than 115 chemical components that are responsible for the following health benefits:

- Indigestion: The phenolic compounds present in *Zingiber officinale* extract stimulates gastric enzymes and promote digestion.
- Cold and flu: The warming effect of *Zingiber officinale* helps in treating cold and flu.
- Menstrual pain: The chemical components present in the *Zingiber officinale* relieve menstrual cramps and **pain**.
- Alzheimer's disease: The chemical component of *Zingiber officinale* prevent decline in brain function and also improves memory.
- Osteoarthritis: The chemical component gingerol present in the *Zingiber officinale* extracts has anti-arthritis properties. This results in the inhibition of pain and inflammation of the joints.

It is also used for cancers, bacterial infections, certain heart diseases, diabetes, dizziness, motion sickness, respiratory conditions, insect bites, irritable bowel syndrome, and several other conditions.

Mulethi (licorice) (*Glycyrrhiza glabra*)

From stomach problems to infections like cold and cough and to high sugar and blood pressure, mulethi can be beneficial for all kinds of health issues. Mulethi has anti-diabetic and anti-oxidant properties that help improve metabolic system. It also contains antiseptic properties that can relieve a number of stomach-related problems. The herb is an expectorant and decongestant that can help fight respiratory infections. Consumption of licorice in small amounts can be used to reduce sugar cravings, which may be helpful in managing diabetes, and may also help in regulating blood pressure. Mulethi is grown in various parts of Asia and Europe, and has some profound medicinal properties. Not just this, mulethi is widely used in culinary preparations for its natural sweet flavour, which gives us another reason to include it in our diet. Mulethi, also known as mulethi churna is one such classical ayurvedic remedy that has a centuries-long repute of being the ultimate grandma's remedy for cough and sore throat. This traditional herb exhibits manifold benefits and is extensively used in several folk remedies and classical ayurvedic formulations to treat respiratory problems, obesity, skin infection, liver disorders, gastric problem, hormonal regulation, general debility, joint pain and many more. Benefits of this magic root, come from the buck load of



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nutrients embedded in it. The array of healthful nutrients includes vitamins, potassium, bioactive constituents like glycyrrhizin, anethole, sterols, tannins, flavonoids, biotin, resins, tannins, sucrose, iodine, saponins, niacin, isoflavones, chalcones, volatile oils, etc. Its active constituent glycyrrhizin and its powerful adaptogenic, sedative, alexiteric, synergistic properties, the root powder of licorice provides an absolute answer to almost all health anomalies. It supplements the body with an adequate dose of antioxidants which helps one ward off several skin and scalp infections and flaunt a healthy, radiant skin and gorgeous tane.

Giloy (heart-leaved moonseed) (*Tinospora cordifolia*)

Giloy, which goes by the scientific or Latin name *Tinospora cordifolia* comes from the Menispermaceae family. Also termed as 'Heart-leaved moonseed' in English, the giloy plant is a well-known herbaceous, glabrous climbing vine of deciduous origin. It has elongated twining branches decorated with heart-shaped betel-like leaves and yellow flowers. The succulent herb of this plant is creamy white in colour but gives a yellow tint when cut. The fruits are ovoid, drupe-shaped and generally turns red on ripening. The herb is native to Myanmar, Srilanka and is widely distributed throughout various tropical regions of India. The holistic science of Ayurveda regards giloy as 'Prana', i.e. full of vigour as it is capable to sustain and grow on its own even when it is cut. Although in this formulation, one mainly uses the stem part of the plant, but in its true nature, each and every part, be it roots, leaves or flower is extremely effective and has medicinal values and hence are widely available in the form of churna or powder, vati or tablets and decoction or juice.

Giloy Satva Powder is a potent ayurvedic formulation that is obtained from the maceration of the aqueous extract of the divine giloy plant. Commonly termed as guduchi satva, this magical powder hails immense health benefits towards rectifying all sorts of Pitta aggravating disorders like indigestion, constipation, burning sensation of hands and feet, fever, gout, fatigue, jaundice, diabetes, liver problems, general debility etc. The holistic science of ayurveda popularizes guduchi satva as 'amrita satva', which means 'heavenly elixir' since the formulation claims of granting one with a long and healthy life. Bequeathed with strong antitoxic, anti-pyretic, anti-inflammatory, anti-gout, carminative, immunomodulatory, antioxidant and hematogenic properties, this classical medicine is an ultimate answer to all health anomalies. The abundance of alkaloids, flavonoids, steroids, lignans, carbohydrates and potent active constituents like tinosporin, palmetin, choline, ethanol, isocolumbin, tembetarine, berberine, mangoflorine, aporphine increases the therapeutic efficacy of the herb and truly makes it a class apart.

Turmeric

Turmeric is the golden spice of India. It belongs to the ginger family (zingiberaceae) and is a rhizome, an underground stem. The Turmeric stem turns into orange-yellow shade. India is the leading producer of turmeric and it is the most common culinary spice in Indian cuisine, with a fragrant aroma and slightly bitter taste. Turmeric is a good source of dietary fibre, Vitamin C, Magnesium, Vitamin B6, Iron, Potassium and Manganese. Turmeric is the most comprehensive and powerful herbal ingredient in Ayurvedic treatments and traditional remedies. The active ingredient has been found to be curcumin. It has powerful anti-inflammatory effects and is a very strong antioxidant.

Reduces Arthritis Pain: Turmeric has strong anti-inflammatory properties that help ease inflammation and swelling in people with arthritis. Studies have found that the active compound in turmeric, curcumin is effective in reducing pain in patients with osteoarthritis.

Prevents cancer: It contains antioxidant and anti-inflammatory properties, contributing to cancer prevention. Curcumin is anti-viral, anti-fungal and can help protect against cancer. The National Cancer Institute has recognized curcumin as an effective anti-carcinogenic, or substance that helps prevent cancer.

Boosts the immune system: According to the study published in the journal PLOS ONE (Public Library of Science) curcumin in turmeric is known to have anti-inflammatory properties that help boost immunity. The best way to reap the benefits is to mix turmeric with black pepper to increase the body's absorption greatly.



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Lowers cholesterol: Turmeric is effective in lowering LDL (bad cholesterol) & helps reduce your risk of developing heart disease and stroke. Studies have found that a low dose of curcumin reduces LDL and total cholesterol levels.

Liver Health: Turmeric and its active organic compounds improve liver function and reduces toxicity level in the body. The antioxidant effect of turmeric is an ideal solution for liver ailments.

Cardamom pods (*Elettaria cardamomum*)

Cardamom is one of the world's very ancient spices. It is native to the East originating in the forests of the western ghats in southern India, where it grows wild. Today it also grows in Sri Lanka, Guatemala, Indo China and Tanzania. The ancient Egyptians chewed cardamom seeds as a tooth cleaner; the Greeks and Romans used it as a perfume. Cardamom is an expensive spice, second only to saffron. It is often adulterated and there are many inferior substitutes from cardamom-related plants, such as Siam cardamom, Nepal cardamom, winged Java cardamom, and bastard cardamom. However, it is only *Elettaria cardamomum* which is the true cardamom. Indian cardamom is known in two main varieties: Malabar cardamom and Mysore cardamom. The Mysore variety contains higher levels of cineol and limonene and hence is more aromatic. Cardamom comes from the seeds of a ginger-like plant. The small, brown-black sticky seeds are contained in a pod in three double rows with about six seeds in each row. The pods are between 5-20 mm (1/4"-3/4") long, the larger variety known as 'black', being brown and the smaller being green. It is best to buy the whole pods as ground cardamom quickly loses flavour. A stimulant and carminative, cardamom is not used in Western medicine for its own properties, but forms a flavoring and basis for medicinal preparations for indigestion and flatulence using other substances, entering into a synergetic relationship with them. The Arabs attributed aphrodisiac qualities to it and the ancient Indians regarded it as a cure for obesity. It has been used as a digestive since ancient times.

Laung (clove)

Cloves were probably first used by Chinese emperors to hide bad breath. Over the years, cloves grabbed a prominent place in traditional Chinese medicine and ayurveda to treat nausea, digestive disorders and flu. The clove tree which is native to Indonesia bears dry, aromatic flower buds which are used as a spice. These unopened, pink buds are picked and dried till they turn brown. They can be used whole or ground. When cooked or soaked in water, they tend to become soft and flavourful. Cloves have a long shelf life and this flowering spice will last you almost a year if stored away from light and moisture. Powdered cloves tend to lose their flavour faster. The active component of cloves is the eugenol oil. This oil makes up about 60-90% of each clove and it acts against bacteria, viruses and fungi. The oil is known for its antiseptic, anesthetic, aromatic and astringent properties. Clove oil is one of the richest sources of antioxidants. In aromatherapy, it is used as an antiseptic and pain reliever especially for toothaches and stomach pain. It is often mixed with other oils to treat various disorders. For instance, those who have troubled sleep can apply some warm clove oil along with sesame oil on the forehead to feel calm and relaxed. Since clove essential oil is very potent in nature, it's best to dilute it. In Ayurveda, cloves are said to be *kaphahar* which means that they have the ability to balance the *kapha dosha*. Kapha governs the structure and fluid in the body. Its primary function is protection. Being carminative in nature, it helps in improving digestion. A carminative is any herb or preparation that prevents the formation of gas in the gastrointestinal tract or helps with expulsion. Therefore, it is suggested you add cloves while cooking foods like kidney beans or black gram that tend to cause flatulence.

CONCLUSION

In pandemic caused by various variant of novel corona virus results in havoc for human race. Ancient ayurvedic medicine proved boon for humankind and different decoction made by use of spices help to reduce the initial symptoms caused by the virus. Researches must go on this ancient ayurvedic system and explore new eras and vision for incurable disease.





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Review on Chemotherapeutic Nanoformulations

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ABSTRACT

Cancer is one of the major causes of death in the human population. Cancer is the unconstrained growth of abnormal cells in a body. Various strategies have been implemented to treat this dead-causing disease. Radiation therapy, chemotherapy, immunotherapy, hormone therapy, and surgery are the various cancer treatment strategies. This review deals with the various chemotherapeutic drugs and their nano formulations used for cancer treatment. There are several classes of drugs used as chemotherapeutic agents. These agents had several drawbacks which can be overcome by their nanoformulation. Drug Docetaxel is approved and used for breast cancer. But the drug is associated with systemic toxicities and to overcome this drawback the drug is encapsulated in Poly lactic-co-glycolic acid nanoparticles. Docetaxel-loaded solid self-nano emulsifying drug delivery system also shows enhanced antitumor efficacy. Drug Paclitaxel is a naturally occurring taxane and is a widely used anticancer agent. The nanoformulation of the drug shows enhanced stability and prolonged blood circulation time. Nanoformulation of the drug doxorubicin had reduced toxicity and increased therapeutic efficacy. Drug Teriflunomide is a potent anticancer agent with a high risk of hepatotoxicity, and the microemulsion of the drug is capable of overcoming this problem. The drug Rapamycin-loaded polymeric Poly lactic-co-glycolic acid nanoparticles shows high efficacy in breast cancer therapy. Nanoformulation of drugs Irinotecan and Methotrexate also show enhanced anticancer activity. Many molecules and formulations are developing to conquer this dead-causing disease and with the help of new technologies, we can overcome this disease and save human population.

Keywords; micelle, fullerenes, Glioblastoma multiforme, microemulsion.



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INTRODUCTION

In the world, cancer remains the most dominant cause of death [1]. Cancer is believed to be one of the most daring diseases, which cause the death of millions of people each year [2]. The use of anticancer medicaments is suboptimal because of their low efficacy and higher prevalence of adverse reactions. Following systemic administration, only a small amount reaches the solid tumor and even a little fraction reaches the target cell [3]. Now a day multi-targeted chemotherapeutic combinations have gained substantial recognition in solid tumor chemotherapy [4]. Chemotherapy is the most effective way of cancer treatment by chemicals or small molecule antineoplastic drugs. However, this is a misunderstanding [5]. Researchers are carried out for improving chemotherapy using various approaches based on polymer chemistry and nanotechnology [6]. This review deals with chemotherapeutic drug formulations developed based on Nanotechnology and polymer chemistry

Chemotherapeutic Agents and Formulations

The serious drawback of chemotherapy includes rapid metabolism of the drug, small ductile exposure, limited bioavailability, increased elimination rate, undeserved side effects and the high dose of the drug. Several advanced formulations are developed to overcome these drawbacks [7].

Nano formulations of drug Docetaxel

Docetaxel is a cytotoxic anti-microtubule agent. The drug had been approved and used for the treatment of breast cancer. But the drug has dose-limiting toxicities associated with systemic drug delivery [8]. Severe systemic toxicities including bone marrow suppression, cardiac toxicity, neutropenia, anemia, febrile neutropenia, hypersensitivity, thrombocytopenia and neuropathy are the major obstructions to successful treatment [9]. So to overcome this drawback the drug is encapsulated in Poly lactic-co-glycolic acid (PLGA) nanoparticles (NPs) via the Particle replication in nonwetting template (PRINT) process. The PRINT process is a platform that simplifies fabrication and particle design with the ability to control the size and shape of the particle [8]. This technique permits the design and synthesis of promptly defined micro and nanoparticles (NPs). PRINT permit researchers to have unparalleled control over the chemical composition, modulus, cargo, and surface properties of NPs [10]. The PRINT process allows high encapsulation of drug and controlled drug release. The docetaxel molecules released from the PLGA particle are delivered to the desired cellular location. 10% and 20% drug-loaded PLGA NPs via PRINT technique shows less toxicity when compared with marketed docetaxel formulation [8].

Docetaxel is effective against breast cancer, lung cancer, and ovarian cancer. Due to its systemic toxicity efforts are focused on the development of oral route as a viable route in drug delivery. But the major drawback of oral delivery is the poor bioavailability due to its high hepatic metabolism. Several formulations are developed to overcome this drawback. Docetaxel-loaded solid self-nano emulsifying drug delivery system (SNEDDS) shows improved bioavailability and enhanced anti-tumor efficacy. SNEDDS improve the bioavailability by circumventing the hepatic portal route and protect the drug from degradation in the harsh gastrointestinal tract. It also facilitates lymphatic transport of the drug [11].

Micelles are the nanocarriers mostly used because of their promising performance and technical simplicity. Micelles are colloids of amphiphilic molecules. They form spontaneously above their critical concentration with hydrophilic fragments forming the shell and hydrophobic fragments forming the core. Polyethylene glycol-b-PLGA (PEG-b-PLGA) copolymer micelles with the combination of chloroquine as an autophagy inhibitor and docetaxel as an anti-cancer drug show significant enhancement in the therapeutic effect of the drug. Micelles have a small particle size which is suitable to achieve high cellular uptake and facilitate passive targeting and thus provide enhanced permeability and retention effect. Docetaxel-loaded PEG-b-PLGA copolymer micelles are developed by membrane dialysis method. The micelle had 7.1% drug loading and 72.8% drug encapsulation efficiency. The co-administration of the micellar formulation with chloroquine as an autophagy inhibitor shows 12 fold more efficient treatment [12].



**Ammu Soman and Dhanish Joseph****Nano formulations of drug Paclitaxel**

Paclitaxel (PTX) is a naturally occurring taxane and is widely used for treating metastatic breast cancer ovarian cancer and several other malignancies [13]. Anticancer agent paclitaxel-loaded PLGA NPs were formulated by solvent evaporation technique with vitamin E d- α -tocopheryl polyethylene glycol (ETPGS) as an emulsifier. Here nanoparticles of biodegradable polymers are used and thus toxic adjuvant is avoided. And this formulation shows high drug encapsulation efficiency, high NPs uptake, and sustained drug release [14]. For lung cancer therapy, liposome aerosol delivery has been prosperously used. But this delivery route has certain drawbacks such as rapid clearance of the drug from lungs after cessation of aerosol delivery. Fullerenes have the potential to overcome these drawbacks. Fullerenes are biologically stable three-dimensional scaffolding for covalent attachment of multiple drugs to create a single dose. Fullerenes loaded with PTX could produce such an ideal lipophilic slow-release system because it is biologically stable [15].

Photothermal therapy (PTT) using near-infrared (NIR) light-absorbing nano agents to kill cancer cells has a great role in chemotherapy. The formulation composed of paclitaxel, human serum albumin, and indocyanine green which is an FDA-approved NIR dye, is used for the treatment of breast cancer and lung cancer. This formulation shows enhanced stability and prolonged blood circulation time [16]. Worm-like Filo Micelles loaded with anti-cancer drug PTX show that worm-like micelles load and solubilize twice as much drug as spherical micelles. These formulations are far less toxic and show fivefold higher anticancer efficacy on human lung cancer cells. Worm-like micelles loaded with the drug had a long retention time in blood and the formulation is much less toxic compared to Cremophor EL [17].

Nano formulation of drug Doxorubicin

Doxorubicin (DOX) is a drug approved by the FDA for the treatment of ovarian cancer and multiple myeloma. Doxil is the liposomal formulation of DOX, which is designed to retain the drug in circulation, minimizes the clearance of the drug and its uptake by healthy tissues. PEGylation of liposomes results in a long-circulating half-life, very small distribution volume, low clearance rate, and high area under the curve. And also Doxil could load 10,000-15,000 drug molecules [18]. DOX is associated with various side effects such as cumulative and irreversible cardiotoxicity. To overcome these drawbacks a drug delivery system with improved pharmacological properties was formulated. PLGA drug delivery system with simultaneous incorporation of chemotherapeutic agent DOX and thermo-optical agents showed biphasic drug release pattern and high drug entrapment efficiency. Also, it was a biodegradable and biocompatible polymer. Studies show that incorporation of DOX into PLGA NPs reduces cytotoxicity and decreases the undesirable side effects such as impaired cardiac function [19].

This drug had severe gastrointestinal toxicity and cardiac toxicity. So the drug is encapsulated in carbon nanotubes. Carbon nanotubes are used as novel delivery vehicles. Carbon nanotubes have great mechanical, optical, and chemical properties. Incorporation of doxorubicin on carbon nanotubes shows significantly enhanced therapeutic efficacy and great reduction in toxicity when compared with normal formulation [20]. NPs loaded with chemotherapeutic agents such as liposomes, polymer NPs and lipid NPs can overcome drug resistance, solubility, and stability problems which are the biggest challenges in chemotherapy. The size range of NPs is defined as 10-100nm. They had a small particle size and vast surface area and have unique mechanical, electronic, photonic, and magnetic properties. Targeted drug delivery to a tumor cell is another advantage of drug-loaded NPs. Doxil is the first nano-drug used to treat metastatic ovarian cancer. The formulation had high therapeutic efficacy. It allows the drug to stay longer in the bloodstream so that more of the drug reaches the cancer cells [21]. Iron oxide NPs loaded with Doxorubicin hydrochloride are a good drug delivery vehicle for targeting brain tumors. The accretion of iron oxide NPs in gliosarcomas is substantially increased by magnetic targeting and successfully measured by magnetic resonance imaging (MRI). And for glioma-targeted drug delivery, these NPs seem to be a better drug delivery vehicle. The formulation demonstrated sustained intracellular retention and dose-dependent anti-proliferative activity. [22,23].



**Ammu Soman and Dhanish Joseph****Nano formulation of drug Teriflunomide**

Glioblastoma multiforme (GBM) is regarded to be the highest degree lethal primary brain tumor. Teriflunomide (TFM) is a potent tyrosine kinase and dihydroorotate dehydrogenase kinase inhibitor. It is one of the potent anticancer agents in the treatment of GBM. But this drug has a high risk of hepatotoxicity, so the drug is advocated to deliver directly to the site of action. For the delivery of therapeutic agents directly to the CNS, the Nose-to brain pathway is considered the safest and effective way. Intranasal teriflunomide microemulsion is an improved chemotherapeutic approach in GBM [24]. A microemulsion is a lipid-based nanocarrier which is a promising approach for improving solubility and permeability of poorly soluble drugs [25]. This formulation displays high drug entrapment efficiency and direct brain transport of drugs [24].

Nano formulation of drug Rapamycin

Rapamycin is an effective drug that uses an alternative mechanism to inhibit the growth of breast cancer cells. But the drug had no solubility in water, no tumor tissue specificity, and low bioavailability. Rapamycin-loaded polymeric PLGA nanoparticles show high efficacy in breast cancer therapy. These NPs are surface conjugated with antibodies to epidermal growth factor receptor (EGFR) using 1-ethyl-3-(3-dimethyl aminopropyl) carbodiimide hydrochloride. EGFR is expressed about 14-91% in breast cancer. By using tumor-specific antigen or antibody as a targeting moiety, chemotherapeutic agents are selectively delivered to cancer cells. The formulation has high drug loading capacity and high intercellular uptake and is selectively delivered to tumor cells [26].

Nano formulations of drug Methotrexate

Methotrexate is a hydrophilic anti-cancer agent used to treat various tumors. But this drug is highly cytotoxic. It administers the cytotoxic activity not only in cancerous cells but also in normal cells. So for targeted drug delivery, an effective carrier system was required. Thus Methotrexate-loaded solid lipid NPs were formulated and the formulation displays major drug accumulation in neoplastic tissues when compared with the drug solution alone [27]. Magnetic NPs conjugates were formulated as an enhancement agent in MRI and as a drug-carrying vehicle in controlled drug delivery. The conjugate was made of iron oxide NPs covalently bound with Methotrexate. The drug binds covalently to NPs is highly stable. Methotrexate incorporated super paramagnetic NPs can be used to target many cancer cells. Drug- NPs conjugate was formulated by grafting the drug into the nanoparticle surface. Hereby covalently modified the surface of iron oxide NPs via a peptide bond, cleavage of the bond occurs only under conditions present in lysosomal compartment, a typical environment inside the target cell. So these NPs provide controlled and targeted drug release to cancer cells [28].

Nanoformulation of drug irinotecan

Lung cancer is one of the main causes of death in the world. A great invention in cancer therapy is the development of magnetic NPs formulation of chemotherapeutic irinotecan to lungs. The major drawbacks of cytotoxic agents are the limited entry into the lung selectively, thus resulting in collateral damage to other tissues. This problem can be over helmed by the development of new magnetic irinotecan containing NPs which targets the lung over other tissues by over 5-fold. Selective targeting into lungs is attained by incorporating a facilitated transport mechanism into NPs. By using an external magnet the drug can be retained in the lungs. Studies display that this method of treatment is a cost-effective and efficacious therapy for lung cancer [29].

Nanoformulation of drug Sulforaphane

Targeted drug delivery by using biodegradable microspheres is a promising approach in cancer therapy. A magnetic targeted delivery system is an approach that can deliver therapeutic agents to a targeted site using an external magnetic field. Using an effective external magnet it is possible to target the microspheres injected in blood circulation to the disease site. Also, these particles are nontoxic and biocompatible. Sulforaphane, a histone deacetylase inhibitor loaded with targeted magnetic microspheres is developed by a spray-drying method. This formulation shows high efficacy in cancer therapy. Microspheres deliver a high concentration of drugs in the target site when compared with free drugs [30].



**Ammu Soman and Dhanish Joseph****Nano formulations containing a combination of multiple chemotherapeutic agents**

A synergistic combination of multiple chemotherapeutic agents in high-capacity poly (2-oxazoline) micelles is another promising step in cancer treatment. Paclitaxel, docetaxel, 17-allylamino-17-demethoxygeldanamycin, and etoposide were used. The micelles show high drug loading capacity. And multi-drug loaded poly (2-oxazoline) micelles displayed improved stability in comparison with single-drug loaded micelles [31]. A rational design of drug synergy-based design is required to increase chemotherapeutic effect while decreasing the toxicity effect of anti-cancer agents. Novel doxorubicin-mitomycin C co-encapsulated NPs formulation discloses anti-cancer synergistic effect in multidrug-resistant human breast cancer cells. This formulation display improved drug efficacy with reduced systemic toxicity [32]. Chemotherapeutic drugs PTX and Rapamycin had non-specificity and potential side effects to the healthy tissues. To overcome these problems, drug-loaded in multifunctional magnetic NPs are formulated. The development of glycol monooleate coated magnetic NPs loaded with PTX and Rapamycin shows high biocompatibility and high drug entrapment efficiency. Sustained drug release to target cells is also achieved. And also glycol monooleate coated magnetic NPs are devoid of any surfactants and are capable of carrying high drug load [33]. N-(2-hydroxy propyl) methacrylamide (HPMA) copolymers had been formulated as targeted drug carriers during recent years. HPMA is a synthetic soluble polymer and is internalized by cells by pinocytosis. They provide controlled intracellular delivery of anti-cancer agents. Anticancer agents like Daunomycin and Puromycin coupled to this copolymer provide controlled drug delivery [34].

CONCLUSION

Cancer is a leading death-causing disease in the world. Now a day many inventions are taking place in cancer therapy. Many molecules with anticancer properties were invented and various drug formulations were developed to conquer this dead-causing disease. Many new molecules with anticancer properties and new formulations are developing for saving human population from this death-causing disease. The nanoformulations of chemotherapeutic agents improve the therapeutic efficiency. Nanoformulations provide high drug entrapment efficiency and improved stability. They also provide a reduction in the toxicity level. These formulations facilitate a high concentration of drug delivery in the target site and controlled drug release when compared with free drugs. The major concern of antineoplastic agents is that they produce a cytotoxic effect not only in cancerous cells but also in normal healthy cells. The drugs encapsulated in nanoparticles facilitate targeted drug delivery and provide protection to healthy cells. Studies proved that nanoformulations allow the drug to stay longer in the bloodstream. Like this, the major drawbacks of anticancer agents can be overcome by developing their nanoformulations and the therapeutic efficacy also gets improved. Of course with the help of new technologies, we can overcome this dangerous disease and save our humanity.

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***In-vitro* and *In-vivo* Antioxidant Activity of *Portulaca pilosa* Linn. A Crop Field Weed Containing Phenolic Compounds**

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ABSTRACT

Antioxidants play an essential role in protecting oxidative stress (OS) induced damage. Such antioxidant properties are extensively found in plants with phenolic contents. The current investigation was designed to determine the statistical relationship between the antioxidant potential and content of all types of phenolic compounds existing in the methanol and petroleum ether extracts of the whole plant of *Portulaca pilosa* Linn. The spectrophotometric method revealed the antioxidant potential and phenolic contents of both extracts. Upon evaluation by several established procedures, the highest activity was observed for the methanolic extract. With IC₅₀ values of 17.94 and 56.48 µg/mL, the methanol extract was superior to ether extract (27.48 and 47.23 µg/mL) for the scavenging activity of DPPH and hydroxyl radicals, respectively. Also, the IC₅₀ value of 24.53µg/mL established a potent lipid peroxidation inhibition of the methanol extract. Furthermore, the reducing capacity on ferrous ion was in the following order: PPM > PPP. Overall, the methanol extract had the highest levels of phenols, flavonoids, flavonols, and proanthocyanidins compared to others. Hence, with further investigations for its aptness as a medicinal agent, *Portulaca pilosa* can be an efficient option due to its efficient scavenging effects.

Keywords: *Portulaca pilosa*, Portulacaceae, Oxidative stress, Antioxidant, Weed.

INTRODUCTION

An imbalance in the cell's ability to scavenge the reactive oxygen species (ROS) is the causative reason behind oxidative stress (OS). It is needless to say that diabetes, heart disease, cancer, etc., are the final pathogenic outcome of OS [1]. Most of the cellular components like proteins, lipids, and their associated organelle get damaged due to cell



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death by ROS [2]. Weak antioxidant-driven defense systems lead to a greater level of damage in the body. Regular dietary consumption of antioxidant-rich fruits and vegetables can strengthen this mechanism and lower the risks of cancer, cardiovascular diseases, and stroke caused by OS [3]. To name a few, polyphenols, carotenoids, and vitamin C and E are the critical antioxidants for this purpose [4]. Both plant and animal-based edible and non edible sources are enriched with phenolic compounds [5,6]. However, its content in weeds is limited to specific geographical regions and the surrounding population only. Hence it is necessary to assess such properties to find new natural antioxidant-rich sources for functional foods along with nutraceuticals [6,7].

A warm climate herbaceous succulent annual plant *Portulaca pilosa* Linn., belonging to the family Portulacaceae, is commonly known as Balibalua in Odia, Lunia in Hindi, Nunia sag in Bengali, Peddapavilikari in Telugu, and kiss me quick in English. For years the Mediterranean and tropical Asian countries use it as folk medicine and in soups and salads. The flavonoids, alkaloids, polysaccharides, fatty acids, terpenoids, sterols, proteins, vitamins, minerals, etc., are reportedly isolated from *Portulaca pilosa*. Further, several pharmacological actions are viz. antibacterial, anti-ulcerogenic, anti-inflammatory, antioxidant, diuretics, analgesic, and wound-healing, are noticed by using this plant. In the present study, the leaves of this medicinal weed are explored with systematized scientific studies to assess the possibility for inclusion for therapeutic use [8-14]. The study is focused on a comparative statistical assessment of phenolic content and antioxidant activity of ether and methanol extracts of this weed.

METHODS

Plant collection

Portulaca pilosa (PP) plant was collected from Durgapur forest region in Dhenkanal district, Odisha, in the month of October – November and authenticated by Dr. K. B. Satapathy, P.G. Department of Botany, Utkal University, Bhubaneswar, Odisha, India. A voucher specimen was deposited to the herbarium in the Department of Botany, Utkal University. Dirt particles were removed by separate water washing of the plant materials and dried in the shade for days with intermittent sun drying. Finally, before storing at room temperature, the authors ground the dried plants to a coarse powder by a grinder.

Extract preparation

According to our primary evaluation, we noticed petroleum ether and methanol as the most suitable solvent for the extraction of *Portulaca pilosa*. Based on the TLC behavior and amount of extract obtained/gm of material, the petroleum ether and methanol were chosen for extraction compared to dichloromethane and ethyl acetate. The extraction was performed according to Alam *et al.* [15]. About 500 gm of each powdered plant materials were taken in four amber colored reagent bottles and soaked the materials with 1.5 liter of pet. ether and methanol separately. The sealed bottles were kept for 15 days with occasional shaking and stirring. Finally the extracts were filtered separately through cotton and then Whatman No.1 filter papers and was concentrated with a rotary evaporator under reduced pressure at 50°C to afford 25 and 40 gm extract of from the whole plant of PP in pet. ether and methanol respectively .

Chemicals

All the chemicals used in this study are of analytical grade 1,1-diphenyl-2-picrylhydrazyl (DPPH), potassium ferricyanide, catechin (CA), ferrous ammonium sulphate, butylated hydroxytoluene (BHT), gallic acid (GA), ascorbic acid (AA), $AlCl_3$, trichloro acetic acid (TCA), sodium phosphate, ammonium molybdate, tannic acid, quercetin, DMSO, EDTA, acetyl acetone and $FeCl_3$ were purchased from Sigma Chemical Co. (St. Louis, MO, USA); potassium acetate, phosphate buffer, thiobarbituric acid were purchased from Sigma-Aldrich, USA; vanillin was obtained from BDH; folin-ciocalteus's phenol reagent and sodium carbonate were obtained from Merck (Damstadt, Germany).



**Suman Kumar Mekap et al.****Determination of total phenolics**

Total phenolic contents in the extracts were determined by the modified Folin-Ciocalteu method described by Wolfe et al., 2003 [16]. An aliquot of the extracts was mixed with 2 ml Folin-Ciocalteu reagent (previously diluted with water 1:10 v/v) and 2 ml (75 g/l) of sodium carbonate. The tubes were vortexed for 15 second and allowed to stand for 20 min at 25°C for development of color. Absorbance was then measured at 760 nm UV spectrophotometer (Shimadzu, USA). Samples of extract were evaluated at a final concentration of 0.1 mg/mL. Total phenolic contents were expressed in terms of galic acid equivalent, GAE (standard curve equation: $y = 0.0086x + 0.0105$, $R^2 = 0.9997$), mg of GA/g of dry extract.

Determination of total flavonoids

Total flavonoids were estimated using method described by Ordon ez *et al.* [17]. To 0.5 ml of sample, 1.5 ml of methanol, 100 µl of 10% aluminum chloride, 100 µl of 1 M potassium acetate solution and 2.8 ml of distilled water was added. After one hour 30 minutes of incubation at room temperature (RT), the absorbance was measured at 420 nm. Extract samples were evaluated at a final concentration of 0.1 mg/mL. Total flavonoids content was expressed in terms of catechin equivalent, CAE (standard curve equation: $y = 0.0135x + 0.0085$, $R^2 = 0.9984$), mg of CA/g of dry extract.

Determination of total flavonols

Total flavonols in the plant extracts were estimated using the method of Kumaran and Karunakaran [18]. To 2.0 ml of sample (standard), 2.0 ml of 2% $AlCl_3$ in ethanol and 3.0 ml sodium acetate (50 g/L) solutions were added. The absorption at 440 nm was read after 2.5 hours at 20°C. Extract samples were evaluated at a final concentration of 0.1 mg/mL. Total content of flavonols was expressed in terms of quercetin equivalent, QUE (standard curve equation: $y = 0.0255x + 0.0069$, $R^2 = 0.9995$), mg of QU/g of dry extract.

Determination of total proanthocyanidins

Determination of proanthocyanidins was based on the procedure reported by Sun *et al.* [19]. A volume of 0.5 ml of 0.1 mg/mL extract solution was mixed with 3 ml of 4% vanillin-methanol solution and 1.5 ml hydrochloric acid; the mixture was allowed to stand for 15 minutes. The absorbance was measured at 500 nm. Extract samples were evaluated at a final concentration of 0.1 mg/mL. Total content of proanthocyanidin was expressed in terms of catechin equivalent, CAE (standard curve equation: $y = 0.567x - 0.024$, $R^2 = 0.9801$), mg of CA/g of dry extract.

Determination of total antioxidant capacity

Total antioxidant capacity (TAC) of samples was determined by the method reported by Prieto *et al.* [20] with some modifications. 0.5 ml of samples/standard at different concentrations was mixed with 3 ml of reaction mixture containing 0.6 M sulphuric acid, 28 mM sodium phosphate and 1% ammonium molybdate into the test tubes. The test tubes were incubated at 95°C for 10 minutes to complete the reaction. The absorbance was measured at 695 nm using a spectrophotometer against blank after cooling at room temperature. Catechin was used as standard. A typical blank solution contained 3 ml of reaction mixture and the appropriate volume of the same solvent used for the samples/standard was incubated at 95°C for 10 minutes and the absorbance was measured at 695 nm. Increased absorbance of the reaction mixture indicated increase total antioxidant capacity.

Ferrous reducing antioxidant capacity assay

The ferrous reducing antioxidant capacity (FRAC) of samples was evaluated by the method of Oyaizu [21]. 0.25 ml samples/standard solution at different concentration, 0.625 ml of potassium buffer (0.2 M) and 0.625 ml of 1% potassium ferricyanide, $[K_3Fe(CN)_6]$ solution were added into the test tubes. The reaction mixture was incubated for 20 minutes at 50°C to complete the reaction. Then 0.625 ml of 10% trichloro acetic acid, TCA solution was added into the test tubes. The total mixture was centrifuged at 3000 rpm for 10 minutes. After which, 1.8 ml supernatant was withdrawn from the test tubes and was mixed with 1.8 ml of distilled water and 0.36 ml of 0.1% ferric chloride ($FeCl_3$) solution. The absorbance of the solution was measured at 700 nm using a spectrophotometric measurement



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against a reagent blank (same reagent mixture without extract/standard) was performed at 700nm. A separate absorbance of blank was also determined, for which upon comparison revealed increased absorbance of the reaction mixture suggesting higher reducing capacity.

DPPH radical scavenging assay

A DPPH radical scavenging assay (DRSA) was employed for this purpose, as reported by Choi *et al.* [22] and Desmarchelier *et al.* [23]. A solution of 0.1 mM DPPH in methanol was prepared, and 2.4 ml of this solution was mixed with 1.6 ml of extract in methanol at different concentrations. The reaction mixture was vortexed thoroughly and left in the dark at RT for 30 minutes. The mixture was subjected to spectrophotometric measurement at 517 nm using BHT as a reagent blank. The following equation calculated percentage DPPH radical scavenging activity (% DRSA), (% DRSA) = $\{(A_0 - A_1) / A_0\} \times 100$

Where A_0 is the absorbance of the control, and A_1 is the absorbance of the extractives/standard. Then % of inhibition was plotted against concentration, and from the graph IC_{50} was calculated.

Hydroxyl radical scavenging activity

Hydroxyl radical scavenging activity (HRSA) of the extractives was determined by the method of Klein *et al.* [24] with a slight modification. 0.5 ml of extractives/ standard at different concentration was taken in test tubes. 1 ml of Fe-EDTA solution (0.13% ferrous ammonium sulphate and 0.26% EDTA), 0.5 ml of 0.018% EDTA solution, 1 ml of 0.85% DMSO solution and 0.5 ml of 22% ascorbic acid were added into the test tubes. The test tubes were capped tightly and warm at 85°C for 15 minutes into the water bath. After incubation, the test tubes were uncapped and 0.5 ml ice cold TCA (17.5%) was added to each of test tubes immediately. 3 ml of nash reagent (7.5 gm of ammonium acetate, 300 μ l glacial acetic acid and 200 μ l acetyl acetone were mixed and made up to 100 ml) was added to all the tubes and incubated at RT for 15 minutes. Absorbance was taken in UV-spectrophotometer at 412 nm wave length. Percentage hydroxyl radical scavenging (% HRSA) activity was calculated using the following equation, (% HRSA) = $\{(A_0 - A_1) / A_0\} \times 100$

Where A_0 is the absorbance of the control, and A_1 is the absorbance of the extractives/standard. Then % of inhibition was plotted against concentration, and from the graph IC_{50} was calculated.

Lipid peroxidation inhibition assay

The lipid peroxidation inhibition assay (LPI) was determined according to the method described by Liu *et al.* [25] with a slight modification. Excised rat liver was homogenized in buffer and then centrifuged to obtain liposome. 0.5 ml of supernatant, 100 μ l 10 mM $FeSO_4$, 100 μ l 0.1 mM AA and 0.3 ml of extractives or standard at different concentration were mixed to make the final volume 1 ml. The reaction mixture was incubated at 37°C for 20 minutes. 1 ml of (28%) TCA and 1.5 ml of (1%) TBA was added immediately after heating. Finally, the reaction mixture was again heated at 100°C for 15 minutes and cool at room temperature. After cooling, the absorbance was taken at 532 nm. Percentage inhibition of lipid peroxidation (% LPI) was calculated by the following equation, (% LPI) = $\{(A_0 - A_1) / A_0\} \times 100$

Where A_0 is the absorbance of the control, and A_1 is the absorbance of the extractives/standard. Then % of inhibition was plotted against concentration, and from the graph IC_{50} was calculated.

Statistical analysis

All analyses were carried out in triplicates. Data were presented as mean \pm SD. To evaluate significant relationships between experimental parameters by correlation and regression analysis, the F- and t-tests (p-value <0.001) were used. Free R-software version 2.15.1 and Microsoft Excel 2007 (Roselle, IL, USA) were used for the statistical and graphical evaluations.





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RESULTS

DPPH radical scavenging activity

Figure 1 shows the dose–response curve of DPPH radical scavenging activity of the pet. ether and methanol extracts of *P. pilosa*, compared with BHT. It was observed that the methanol extract of *P. pilosa* had higher activity than that of the petroleum ether extract. At 100 µg/mL concentration the scavenging activity of the methanol and pet. ether extracts reached 78.26 and 74.91 %, while at the same concentration, that of the BHT was 96.354%. The IC₅₀ of methanol and pet. ether were 17.94 and 27.48 µg/ml, respectively. The IC₅₀ of BHT (standard) was 8.08 µg/mL.

Determination of TAC and FRAC

The TAC as well as FRAC of methanol and pet. ether extracts of *P. pilosa* were shown in Table 3. Both the extracts of *P. pilosa* plant showed considerable antioxidant activity compared to CA (standard). At the concentration of 100 µg/mL, the absorbance of methanol and pet. ether extract of *P. pilosa* and (+)-catechin were 0.410, 0.148 and 1.81, respectively; while at 400 µg/mL, the absorbance of methanol, pet. ether extracts and (+)-catechin were 0.916, 0.532 and 3.875. The extractives were found to increase the total antioxidant activity with the increasing concentration of the extracts (Table 3).

The methanol and pet. ether extracts of *P. pilosa* showed reducing activity, although less than that of ascorbic acid, a reference antioxidant, the extractives increased the reducing activity with the increased concentration of the extracts. At 100 µg/mL, the absorbance of methanol, pet. ether extracts of *P. pilosa* and ascorbic acid were 0.088, 0.516 and 2.47 respectively, while at 400 µg/mL, the absorbance of methanol, pet. ether extracts of *P. pilosa* and AA were 1.152, 0.355 and 3.04, respectively. A higher absorbance indicates a higher reducing power. These results demonstrated that the methanol extracts of *P. pilosa* had considerable iron reducing capacity as compared to petroleum ether extract.

Hydroxyl radical scavenging activity

The hydroxyl radical scavenging activity of the methanol and pet. ether extract of the *P. pilosa* possess dose–response curve, compared with CA. It was observed that methanol extract of *P. pilosa* had higher activity than that of the petroleum ether extract. At a concentration of 200 µg/mL, the scavenging activity of *P. pilosa* methanol extract reached 81.10 % while at the same concentration, that of the PPP was 56.48%. The hydroxyl radical scavenging activity of PPM was closely resembled to that of CA. The IC₅₀ of methanol and pet. ether extracts of *P. pilosa* were 57.25 and 116.00 µg/mL, respectively. The IC₅₀ of CA (standard) was found to be 27.5 µg/mL .

Lipid peroxidation inhibition assay

The lipid peroxidation inhibition activity of the methanol and pet. ether extract of the *P. pilosa* was compared with CA. The methanol extract of *P. pilosa* had higher activity than that of the pet. ether extract. At a concentration of 100 µg/mL, the scavenging activity of the PPM and PPP reached 63.05 and 61.01% respectively while at the same concentration, that of the catechin was 75.54%. The IC₅₀ of methanolic and pet. ether extracts was found to be 47.17 and 24.53 µg/mL. respectively. The IC₅₀ of catechin (standard) was 56.5 µg/mL.

Total phenolic, flavonoids, flavonol and proanthocyanidin contents Table 4 shows the total polyphenols in the methanol and petroleum ether extract of *P. pilosa*. Correlation of total phenolic contents of the extractives with free radical (DPPH• and •OH) scavenging efficiencies and %LPI.

DISCUSSION

The authors assessed the scavenging potency of the various extracts of *P. pilosa* from the corresponding ability to lessen the reduction of Mo (VI) to Mo (V) by the antioxidants and while subsequently forming a green phosphate/Mo (V) complex in an acidic environment. The reducing ability of the extractives was in the range of 0.916 ± 0.016– 0.532





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$\pm 0.011 \mu\text{m}$ green phosphate/ Mo (V). The study unearthed a proportionate increase in antioxidant activity with increasing levels of polyphenols content was observed. Many plant species have shown a good correlation between total phenols and antioxidant activity[26]. Both the extracts of *P. pilosa* reduced the Fe^{3+} -ferricyanide complex to the ferrous, indicating their iron-reducing capacity. The reduction potential of the whole plant extracts was in the range of $1.152 \pm 0.039 - 0.355 \pm 0.013 \mu\text{m Fe (II)/g}$. The present investigation is well consistent with a previously published report on iron-reducing antioxidant capacity, suggesting increased capacity with the high phenolic contents[27].

DPPH radical scavenging activity

The effect of antioxidants on DPPH is because of their hydrogen donating nature [28]. The knowledge on inhibition of lipid peroxidation and rapid analysis is the critical advantage of DPPH based free radical scavenging for diseases like cancer. The present leaf extracts postulated parallel scavenging activity as that of standard BHT. This confirms the proton donating capability of the extracts and can act as primary antioxidants. Further, this study adequately demonstrated the correlation between polyphenolic contents of the extracts and related antioxidant nature, suggesting suitability as a health care supplement [29].

Hydroxyl radical scavenging activity

Most cancers are formed due to the mutagenic action of free radicals by interacting with the DNA[30]. SO radicals produce such hydroxyl radicals. The superoxide dismutase enzyme converts to hydrogen peroxide, which later generates hydroxy radicals of higher interactive properties. The present study results demonstrate good hydroxyl radical scavenging activity of both extracts in comparison to standard catechin. This vouches for a possible anticancer activity and can effectively quench lipid peroxidation due to hydroxyl radicals..

Lipid peroxidation inhibition assay

The lipid peroxidation of polyunsaturated fatty acids is due to ROS, damaging the cell membrane[31]. The sequence of chain reaction initiates rapidly and generates a secondary radical, which later reacts with a second macromolecule to sustain the chain reaction. In this study, the ferric ion and ascorbic acid-induced lipid peroxidation of rat liver homogenates was investigated. The inhibition activity of the methanol extract was superior to that of pet. ether extract. This result correlated to the plant's capability to treat diabetes and liver disease.

Total phenolic, flavonoids, flavonols and proanthocyanidin contents

Total phenolic contents of the extractives showed a significant and robust positive correlation ($p\text{-value} < 0.001$) with free radical (DPPH• and •OH) scavenging efficiencies and %LPI. These results explain the probable free radical neutralization and lipid peroxidation activity of the extractives due to their polyphenolic constituents. This infers that the extractives' differential lipid peroxidation inhibition ability can be attributed to their differing levels of free radical quenching potential.

CONCLUSION

Different extracts of *P. pilosa* are reportedly used to treat various diseases in folk medicine of tribal belts of Odisha. Minuscule information is available on antioxidant activities of *P. pilosa* compared to the effects of the whole plant for various diseases. In this regard, our study results confirm the potent hydroxyl and DPPH radical scavenging activities by the methanol extract of *P. pilosa*. Also, the methanol extract superior activity on reduction of ferrous ion than that of ether extracts. Moreover, the higher polyphenolic content assured the potent antioxidative activity of *P. pilosa*. Overall, the methanol extract from *P. pilosa* whole plant can effectively serve the patients as food supplements and pharmaceuticals.



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Table 1: DPPH radical scavenging activity of methanol extracts of *P. pilosa* at different concentration

Test extract	Concentration(µg/ml)	Absorbance	Inhibition (%)	IC ₅₀
Methanol extract	12.5	0.449±0.067	48.09±1.87	17.94
	25	0.407±0.098	52.94±1.65	
	50	0.341±0.006	60.57±1.22	
	75	0.274±0.051	68.32±1.87	
	100	0.188±0.066	78.26±2.01	

Table 2: DPPH radical scavenging activity of pet. ether extracts of *P. pilosa* at different concentration

Test extract	Concentration(µg/ml)	Absorbance	Inhibition (%)	IC ₅₀
Pet. ether extract	12.5	0.481 ± 0.051	44.39 ± 2.05	27.48
	25	0.429 ± 0.069	50.40 ± 1.89	
	50	0.376 ± 0.008	56.53 ± 1.07	
	75	0.289 ± 0.023	66.58 ± 2.03	
	100	0.217 ± 0.036	74.91 ± 1.98	

Table 3: Absorbance of TAC and FRAC of methanol and pet. ether extracts of *P. pilosa* at different concentration

Extracts	TAC		FRAC	
	100µg/mL	400µg/mL	100µg/mL	400µg/mL
PPM	0.410 ± 0.019	0.916 ± 0.016	0.088 ± 0.009	1.152 ± 0.039
PPP	0.148 ± 0.011	0.532 ± 0.011	0.516 ± 0.027	0.355 ± 0.013
AA	-----	-----	2.47 ± 0.008	3.04 ± 0.163
CA	1.81 ± 0.041	3.875 ± 0.081	-----	-----

PPM: *Portulaca pilosa* Methanol extract, PPP: *Portulaca pilosa* Pet. ether extract AA = Ascorbic acid and CA = Catechin





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Table 4: Polyphenols content of methanol and pet. ether extracts of *P. pilosa*

Polyphenols	PPM	PPP
Phenolics ^a	103.68 ± 17.47	52.71 ± 3.17
Flavonoids ^b	6.667 ± 2.45	4.198 ± 2.26
Flavonols ^c	185.48 ± 1.19	149.01 ± 2.78
Proanthocyanidins ^b	2.36 ± 0.04	1.94 ± 0.25

Each value is the average of three analyses ± standard deviation. a, b and c expressed in terms of GAE, CAE and QUE, respectively (mg of GA, CA and QU/g of dry extract, respectively). PPM: *P. pilosa* Methanol extract, PPP: *P. pilosa* Pet. ether extract.

Table 5. Lipid Peroxidation activity of Methanol extract of *P. pilosa*

Test extract	Concentration (µg/ml)	Absorbance	Inhibition(%)	IC ₅₀
Methanol extract	12.5	0.521 ± 0.085	36.84 ± 1.45	47.17
	25	0.454 ± 0.031	44.96 ± 1.26	
	50	0.382 ± 0.043	53.69 ± 2.05	
	75	0.336 ± 0.072	59.27 ± 0.089	
	100	0.305 ± 0.018	63.05 ± 1.01	

Table 6. Lipid Peroxidation activity of Pet. ether extract of *P. pilosa*

Test extract	Concentration(µg/ml)	Absorbance	Inhibition(%)	IC ₅₀
Pet. ether extract	12.5	0.496 ± 0.088	39.87 ± 0.079	24.53
	25	0.387 ± 0.057	53.09 ± 1.28	
	50	0.328 ± 0.082	57.24 ± 0.098	
	75	0.291 ± 0.023	59.72 ± 1.66	
	100	0.264 ± 0.009	61.01 ± 1.28	

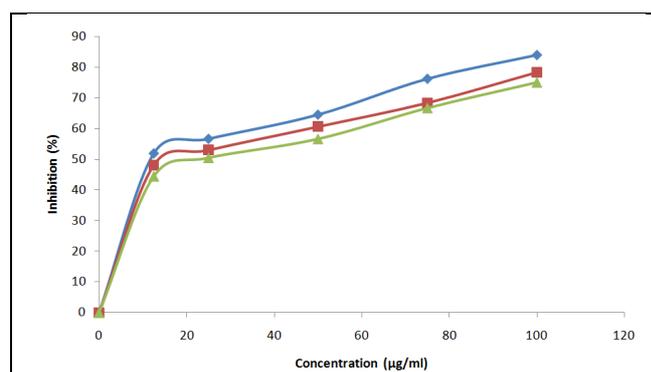


Fig. 1: The % inhibition of DPPH radical by BHT, Methanol and Petroleum ether extracts of *P. pilosa*

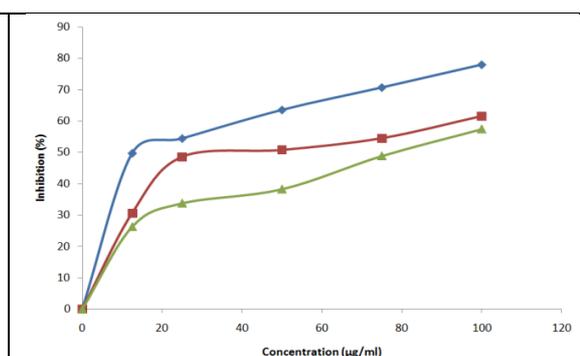


Fig. 2: The % inhibition of Lipid Peroxidation by Catechin, Methanol and Pet. ether extracts of *P. pilosa*





Evolution of Gothic Genre in France and America

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ABSTRACT

This research paper addresses to the evolution and also the contribution of Gothic genre from 18th and 19th century. This research paper will show the modernization of Gothic literature from 18th and 19th century specially targeting the countries of France and America, it will also prove that no matter if it is considered to be an obsolete genre but still it is really very popular in today's time and most of the novel's, poetries have been fictionalized and converted into films and movies in 21st century.

Keywords Gothic literature, horror, fantasy, culture, symbolism, color scheme, fantasy.

INTRODUCTION

Gothic genre is being considered as obsolete and also not productive but at the same time it is the only genre which we can see in today's times growing and becoming very popular, it is also changing its forms in according to horror, fantasy, ghastly elements, psychoanalytic, supernatural powers, mysterious settings. From the time of mediaeval culture to the modern culture, it has outshined every single way in terms of films, in terms of representations, series. we can say there is a new trend which is coming because of Gothic genre that has been generated in 17th and 18th century. There is no single definition of Gothic genre but it is revolutionary because of its morality and believes this was being questioned not only in 18th century but also at every century. Sometimes it is being considered to be the cause of social problems and also for political and religious crisis because of the fear, anxiety, terror, elements of grotesque and decline of moral and social tradition.

In French we call it "fin de millénaire"

The gothic as whole will be considered to be scary which is connecting to the crisis and also the terror and gruesome and horrifying scenes of the past which is coming in the present scenario. it is being described in very different terms





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and also being a cause of rejection of barbarity superstition and irony. The origin of Gothic has put it into a situation where the new categories have been established one by one on the other hand there are many critics such as Robert Mayo, Devendra Verma, Edgar Allan Poe, Mary Shelley, Emily Bronte. We have assigned a concrete and point to all the Gothic literature and also it has created and adapted different realities from their opinion if we talk about "Frankenstein, Fall of the House of Usher, Wuthering Heights, The Picture of Dorian Grey, Dr Jekyll and Mr Hyde." We can only say that the literature and the ethics of this genre has grown from the past ages till now. Specially if we see in French culture and the modern inaction the historical preferences and also the monuments have been of a major and a great significance.

The setting of the Gothic literature was always been into haunted castle, cave, monastery, Church Chapel, places graveyards churches. It was from that time the Gothic features were really influenced by the ideas of death progress as we can see in Darwin theory of evolution that the text seems more realistic and also the interest of people and the general public started increasing with the novels like Frankenstein, strange case of Dr Jekyll and Mr. Hyde. With that at the beginning of the 20th century became very fashionable to adopt the science fiction and also consider a number of detective fiction at that age during the golden age they have a number of writers who emerged as very popular including Agatha Christie, Mariya Allingham, Ian Rankin etc. In contrary the modern is considered these Gothic novels as inferior and also the theory of bhaktin, but if we closely look at the elements of modernity it has acknowledged and also adapted many characteristics of Gothic literature including the gloomy cities the corrupted priest and also the class trophic environment if it is like the cannibal threads in heart of darkness or walking dead with tarot card readers you could register that the 20th century Gothic literature not only survived but also have improved and the tradition have been continued in these years so in spite of the modernist rejecting Gothic literature they have still adapted in different form.

Main argument

The new Gothic romance has another sub-genre that has which has reinforced main traits the most popular in 20th and 21st century has been where was vampires' zombies and other characters starting from Harry Potter series to the Twilight saga. Also talking about the French literature, the Phantom of the Opera has been casted in many films and also have been adapted by different series.

Talking about Gothic fiction Gothic genre has its roots starting from the tales superstition mysteries experiments and also in past the settings which have been there in Gothic romances including castle, haunted places, churches. While the 18th century was more concerned with superstitious and mystery the 19th century was being considered to be concerned with monologue psychological analytics and also psyche and terror of the protagonist. It considered and also pay emphasis on the darkness of human soul inside and out that is the reason Dr Jekyll and Mr. Hyde Frankenstein has been fight between the human soul and the human body. The zeal to achieve the power to the extent and also to become a god which is really not possible is what is explained to be main theme. The feeling of admiration and along with the feeling of horror can be very well find in the works of writers like Ann Radcliff in the "mysteries of Udolpho." Gothic novels are relying heavily on the atmosphere and the setting which includes remote areas and familiar settings and could be represented by the king building monastery other than that to represent Catholicism. The Gothic cusp is an anachronism, which is very important to understand because it was a setting between the history and also the modernity of the protagonist so that is the term which is being invented.

The incredible style of architecture started in 1140 in France it was also been called as mid 16th century there were enormous architectural innovation including cathedral glass windows which was called as French style work. Some of the old churches were reconstructed and modified and also there were some churches which were still having their original and remarkable innovation it was being constructed in four levels. More than being superstitious having a connectivity to horror, fantasy the kingdom, churchyard & graveyards.



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In France it was a style which have spread to other cities including Northern France. The major characteristics of Gothic elements specially in France and other European countries were the cathedral which were made very wider taller and also full of lights so that it could be reflected and it was being indicated as the elimination of darkness.

The next period of Gothic architecture started from the second half of the 13th century the most popular and most celebrated example was the chapel of Saint Chapelle. Gothic style is really not limited to only the specific things but also to ornate architecture and the portion including the windows the delicate framework and also the space between the pillars everything holds a very large value and also authentication. Similar style was adapted in American literature as well when the novels were adapted into films and also in television series

In brief it was been divided into "Norman Gothic"

"Maine Gothic"

"Burgundian Gothic"

In total Gothic has been an undeniable fact of the world there can be many Gothic elements and also whole history based on the little facts it has become highly significant and has also inspired many people the primary concepts have become very popular from the the era of renaissance to Anno Domini era The writers of the Gothic genre use their incredible vocabulary to create a disturbing on net and dynamic world so it goes from the mysterious world to the possibilities of strangeness mystery fear. The common people started believing in death, decay and also the setting. American literature has also proven that the fiction begins only with the Gothic mod Edgar Allan Poe, Carol Oates. Female and male protagonist have been the evil characters in the story with ghost vampires' witches' monsters are fantastic and symbolic elements. Talking about the main elements including the male and the female hero, the protagonist and also the villain dichotomy and the hardship and an exciting rigid Catholics, non-conformist and the evil monster which are being considered to be the main elements of Gothic literature including the supernatural forces.

The masque of the red death is a popular and widely short stories which has offered the failed attempts to avoid the death there are many events which took place in the castle only and also the seven rooms which depicted the colors show the color scheme is the main Idea behind the setting of Gothic literature including blue purple green orange and violet also the scheme of number 7 is being very important over there because it is being considered as a deep blood coated room again a metaphor of death. It is the motive which is related to life and death. this particular genre has crossed the boundaries between the living the dead or the undead. these are the three main elements which have been used invariably connecting with ghost, Phantom and also, it is a reason for the desperation to believe that it is not final and other reason could be that an everlasting life would narrate as a curse or a blessing. it is being represented and many of the Gothic novels that the transaction lines in between the men women and different social class from 18 century.

It also tells the relation between the evolution of different genders and also why women were being expressed in all the Gothic novel and the supreme leader was always a male character. The female is being considered as fatal and always been a victim of the circumstances. Do the protagonist and the villain were really superior because they hold a significantly more tyrannical behavior that is the male aggression. Another important theme was of aristocracy which we can see in the Phantom of the Opera and the masque of the red death where the pigeon tree was always been impressed by the hands of the superior authority, while the superior authority was enjoying their powers and relishing their values all the devils curbing the powers of the peasants. While they were having a ball masquerade at the party the whole peasantry was suffering from disease, illness and death.

Even in Bram stoker's Dracula it has been represented that in spite of the attempts to kill him he comes back as an undead provoking fear in the hands of old aristocracy. the culture of myth, knowledge, good and evil is historically represented everywhere as Christianity is only God to allow to bring the dead to life. This example is being depicted in terms of science and technology everywhere for example Frankenstein where set was more than a promise



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configure rebelling against orati the second was paradise lost where Satan was a villain but also considered to be a hero and he also fought against authorities the symbol of catholic Church is always releasing the hero is and rebellion representation. All the critics always targeted the loneliness and the and excited behind the Gothic novels and this is a reason that it was considered to be the worse form. In spite of all the allegation it became tremendously popular after 1794.

CONCLUSION

The story and the portrayal of death, supernatural powers, symbolism, color scheme and also the fear inside the human soul. From the past 18 century it is being considered that the Gothic is all about all these characteristics but at the same time when it evolved in 19th century and 20th century it became more of a fight between the human soul and the human body to create the powers to crave the eternity and to be a figure just like God achieving all the powers and controlling the world. Because of the endless expectation from the human soul to achieve the powers of eternity. As we can see in "doctor Faustus" and "Frankenstein" and other Gothic novels that they wanted to fight against God just as Satan did in order to become the most reliant figure of this world you have to beat Christianity, which will put you into "doom" or "hell".

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Ensemble learning Based Analysis of Healthcare Data

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ABSTRACT

This paper provides data classification, data mining techniques in healthcare sector using ensemble learning. Data Mining is the iterative and interactive technique of discovering valid, novel, useful, and understandable models or patterns in massive databases. Machine Learning techniques are applied to recognize relationships among a set of items in a database. Data mining plays a very important role in knowledge discovery. Machine Learning is being used as the vital tool in this area. Bagging and boosting are the main ensemble learning techniques in data mining. Ensemble learning based data mining technique is a comparatively new and emerging in many disciplines. It is becoming more popular as technology development and the need for efficient data analysis is required. The aim of ensemble learning itself is not to give strict rules by analyzing the full data set. Data mining is used to predict with some certainty while only studying a small portion of the data. In recent years, ensemble learning data mining has been studied widely. A number of algorithmic techniques have been developed for ensemble learning. Ensemble learning in health Informatics is an emerging field of research at the intersection of information science, computer science, and health care. Healthcare informatics and analytics is a new era that brings tremendous opportunities and challenges due to easily available plenty of biomedical data for further analysis. In this paper, we present a review of the state-of-the-art methods for ensemble learning based healthcare data analysis.

Keywords: Machine Learning, bagging, boosting, health informatics, ensemble learning.

INTRODUCTION

Data mining refers to extracting or mining the knowledge from huge amount of data. The term data mining is suitably named as "Knowledge mining from data" or "knowledge mining". Data mining is a kind of knowledge discovery necessary for solving problems in a specific domain. Soft computing methodologies (involving fuzzy sets, neural networks, genetic algorithms, and rough sets) are most widely used in the data mining step of the overall KDD process [1]. Fuzzy sets give a natural framework for the process in dealing with uncertainty. Rough sets and

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neural networks are widely used for classification and rule generation [2]. Genetic algorithms (GAs) are concerned in various optimization and search processes, like query optimization and template selection. Other approaches like case based reasoning and decision trees are also widely applied to solve data mining problems. The term data mining refers to the non trivial extraction of valid, implicit, potentially useful and ultimately reasonable information in large databases with the help of the modern computing devices. In the last few decades, many successful applications in data mining have been accounted from varied divisions such as finance, marketing, medical diagnosis, banking, manufacturing and telecommunication. Apart from the benefits of using data per sec (e.g. keeping up to date profiles of the customers and their purchases, maintaining a list of available products, their quantities and prices etc.), the mining of these datasets with the existing data mining tools can reveal invaluable knowledge that was unknown to the data holder. Therefore, there might be privacy intrusion. Hence, the true difficulty does not lie with data mining, but with the way data mining is done. The objective of preserving privacy in data mining is to lower the risk of misuse of data and at the same time generate results same as that produced in the absence of such privacy preserving techniques. There exist several methods to do decision analysis. Each method has its own advantages and disadvantages. In machine learning, decision tree learning is one of the most accepted techniques for making classifications, decisions in pattern recognition. The approach of decision tree is applied in many areas because it has lots of advantages. The aim of healthcare informatics is to ensure the high-quality, efficient healthcare, better treatment and quality of life by efficiently analyzing of abundant biomedical, and healthcare data including patient's data, electronic health records (EHRs) and lifestyle [3, 4]. Earlier, it was common requirement to have a domain expert to develop a model for biomedical or healthcare; however, recent advancements in representation learning algorithms allow to automatically learning the pattern and representation of the given data for the development of such model. Biomedical Image Mining, a novel research area, due to its large amount of biomedical images are increasingly generated and stored digitally [5].

Data Mining allows efficient discovery of valid, non-obvious information in huge collections of data, and it is applied in information management and decision making, enabling a boost in business opportunities. In spite of the augmentation of computer processing power, many more attention is given to make the data mining process faster. Mainly, efficient approaches can be either (i) data-oriented or (ii) algorithm-oriented. In (i) the dataset is computed and the learning instances space is decremented by discretization, attribute selection or sampling. In (ii) new search strategies are calculated or data are processed in a distributed or parallel fashion. The most important step is feature selection using data preprocessing in many fields, such as pattern recognition, data mining and machine learning [6]. For a huge amount of datasets, it is a method to select a very less amount of optimal feature subsets to increase the output of a specific model. Generally, one efficient solution to decrease data dimensionality for feature selection is to eliminate irrelevant and redundant features. In the supervised feature selection, it can be classified into three groups as follows: filters, wrappers, and embedded methods. Filter methods estimate the performance of features by using the training data, which are independent of any learning algorithm.

The feature criteria for evaluation can be categorized into four types, namely, information, dependency, distance, and consistency. Wrapper methods are generally used a specific learning algorithm to estimate the features. And the embedded methods present feature assessment by using internal properties of the classification model. Due to the growth of feature selection techniques, various learning algorithms are proposed to obtain a good performance in the domain of feature selection. In the process of feature selection, different algorithms will choose different subsets and then produce different results. Estimated with utmost spaces methods, decision tree is the best, especially under the condition that the concept space is big. In addition, it is easy to do the data preparation and to understand for non-technical people. Another benefit is that it can categorize both numerical and categorical data. These techniques are frequently considered numerical methods and so lend fit to software implementation. Specific groups of algorithms including C4.5 and ID3 algorithms are developed. A simulation of neural network algorithms can be checked in the neural network toolbox for MATLAB. This toolbox includes several methods to the neural network method. Newly developed swarm intelligence is a newly exposed research area that studies the behavior of social insects and uses their predictive models to explain real-world problems. Swarm based systems are constituted with population



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of general agents that interact with each other and their surroundings whose elements follow simple and fixed rules[7]. Although every particle is ignorant of their nature, the entire set behavior guides to an intelligent global behavior. Swarm intelligence based optimization problems have features like decentralized control, self-organization, derivative free and easier execution which guide to an evolving behavior overcoming the limitations of conventional techniques. Real world optimization problems falls in the category of hard problems whose key objective is to get the minimum or the maximum of the D dimensional objective function where D shows the number of variables to be optimized.

In contradiction of the centralized model, the Distributed Data Mining (DDM) model believes that the data sources are distributed across many sites. Algorithms developed within this field address the problem of efficiently getting the mining results from all the data. Easy approaches to data mining over multiple sources that will not share data is to run existing data mining tools at each site independently and combine the results. Though, this will often fail to give globally suitable results. Issues that cause a disparity between local and global results include:

- i. Values for a single entity may be divided across sources. Data mining at individual sites will not be capable to detect cross-site correlations.
- ii. The exact item may be duplicated at different sites, and will be over-weighted in the results.
- iii. (iii)At a single site, it is probable to be from a homogeneous population. Important geographic or demographic distinctions between that population and others cannot be seen on a single site. PPDM tends to convert the original data so that the result of data mining task should not defy privacy constraints.

Following is the list of measurements on the basis of which different PPDM Techniques can be classified

Data Distribution

The first dimension refers to the distribution of data. Some of the privacy preserving approaches have been developed for centralized data and others refer to a distributed data scenario. Distributed datasets scenarios can also be classified as horizontal data distribution and vertical data distribution. Horizontal distribution refers to these cases where different database records reside in different places.

Data Modification

The second aspect refers to the modification scheme of the data. Data modification is typically used in order to change the original values of a database that needs to be released to the public and also to ensure high protection of the privacy data. It is significant that a data modification technique should be in concern with the privacy policy adopted by an organization. Methods of data modification include:

Perturbation, which is accomplished by the alteration of an attribute value with a new value (i.e., changing a 1-value of a 0-value, or adding noise).

Blocking is the substitute of an existing attribute value with an aggregation or merging which is the combination of several values.

Swapping that points to interchanging values of individual records

Sampling, which is referred to send the data for only a sample of a population

Data Mining Algorithm

The third aspect refers to the data mining algorithm, for which the data alteration is also placed here. It has included the problem of hiding data from a combination of data mining algorithms. For the time being, various data mining techniques have been considered in isolation of each other. Among them, the most significant ideas have been developed for classification data mining algorithms, such as decision tree inducers, clustering algorithms, rough sets and Bayesian networks, association rule mining algorithms [8, 9, 10].



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The fourth aspect refers to hiding the rule or the data. The complexity of hiding combined data in the form of rules is of course higher, and for this reason, most heuristics have been developed. The data miner to generate weaker inference rules that will not allow the inference of confidential values. This process is also known as "rule confusion".

Literature Survey

Knowledge Discovery Database (KDD) has evolved in the recent past as a result of the notable improvement of the technology for information storage, access, and analysis. The ability of various organizations to store, collect and retrieve huge amounts of data has necessitated the discovery of algorithms that can retrieve useful and essential information from these databases. KDD focuses this issue. Now a day Machine learning (ML) is gaining huge magnitude and is becoming a major technology as the speedy growth of quality of medical data and information. But the early and exact detection of disease is also a challenge due to the complex, incomplete and multidimensional healthcare data. Data preprocessing is a vital tool of ML whose primary objective is to give processed data to develop the prediction accuracy. Misra, Puneet and Yadav et al. 2019 [11] proposed classification problem using diabetes dataset. Type II diabetes mellitus (T2DM) is a major disease with high entrance in human around the world and still rising. This may cause other serious complications like kidney failure, heart failure, blindness etc. The early detection and diagnosis help to identify and may avoid these complications. Several classification algorithms exist but selecting the best classifier surely improves the accuracy of the predictions. The preprocessing methods selected in this study are Multiple Imputation, k-means for missing values treatment, Discretization to change in discrete values, Standard scalar, Min-Max scalar for feature scaling and, Random Forest (RF) for feature selection. For the classification Logistic Regression (LR), Artificial Neural Network (ANN), Support Vector Machine (SVM) and Random Forest (RF) are used.

Chronic Disease Prediction plays a pivotal role in healthcare informatics. It is crucial to diagnose the disease at an early stage. Divya Jain, Vijender Singh 2018[12] presents a survey on the utilization of feature selection and classification techniques for the diagnosis and prediction of chronic diseases. Adequate selection of features plays a significant role for enhancing accuracy of classification systems. Dimensionality reduction helps in improving overall performance of machine learning algorithm. The application of classification algorithms on disease datasets yields promising results by developing adaptive, automated and intelligent diagnostic systems for chronic diseases. Parallel classification systems can be used to expedite the process and to enhance the computational efficiency of results. Respiratory diseases in children are a common reason for physician visits. A diagnostic difficulty arises when parents hear wheezing that is no longer present during the medical consultation used by P. Bokov, B. Mahut et al., 2016[13]. Thus, an outpatient objective tool for recognition of wheezing is of clinical value. Hybrid methods also developed in which use combinations of filter and wrapper techniques are also investigated. Many filter methods are found to give no increase in accuracy for the classifier. The most effective method is found to be a hybrid method which is called 'Ranked Forward Search'. This gives an increase in accuracy for the classifier when using only a small subset of the possible features.

Wireless capsule endoscopy (WCE) is a novel imaging technique that can travel through human body and image the small bowel entirely used by G. Liu, G. Yan et al., 2016[14]. Therefore, it has been gradually adopted compared with traditional endoscopies for gastrointestinal diseases. However, the big number of the produced images by a WCE test makes their review exhaustive for the physicians. It is helpful for clinicians if we can develop a computer-aided diagnosis system for the task of identifying the images with potential problems. They discussed to automate the process of WCE images abnormalities detection by presenting a new texture extraction scheme for pathological inflammation, polyp, and bleeding regions discrimination in WCE images. A new approach based on local binary pattern variance and discrete wavelet transform is proposed. The new textural features scheme has many advantages, e.g., it detects multi-directional characteristics and overcomes the illuminations changes in WCE images. Intensive experiments are conducted on two datasets constructed from several WCE exams.



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Purusothama et al. (2015) [15] applied various classification algorithms for disease prediction model in diagnosing the HD. The two types of models were used and compared i.e primary model is single model and secondary model is the combined model which is called as hybrid model and the both models are used to train the data. Data analysis was done using these two models. For both the single model and combined model, authors have considered the classification techniques only. The following are the results attained by comparing the algorithms such as decision method, association rule, KNN, ANN, Naive Bayes, hybrid approach with the accuracy of 76%, 58%, 86%, 69% and 96% respectively. The author recommended that hybrid data mining algorithms performs well and promising accuracy results were attained in heart disease diagnosis.

Kathleen Miao et al. (2016)[16]analyzed learning classification and prediction models and applied to four different data sets that are Cleveland Clinic Foundation CCF, Hungarian Institute of Cardiology-HIC, Long Beach Medical Centre-LBMC, and Switzerland University Hospital-SUH for coronary disease diagnosis. This model achieved the accuracies of 80.14% using CCF, obtained accuracy 89.12% using HIC, 77.78% obtained using LBMC, and 96.72% results produced using SUH.

Rovina Dbritto et al. (2016)[17] developed an effective intelligent medical decision support system based on data mining techniques. The authors considered to emphasize on finding the appropriate classifier that has the potential to give better accuracy by applying data mining algorithms viz. Naïve Bayes, Support Vector machine and Logistic Regression and the accuracy with 75%, 80% and 79% respectively. Some natural selection algorithm based trained neural networks for detecting the occurrence of heart diseases. The authors used totally 297 instances of patient data. Among these 252 were used for training and 45 of them were chosen for testing. The authors compared this RFNN approach with ANN-Fuzzy-AHP approach. Meta-heuristic approach with trained fuzzy neural networks approach is used for training the data set. The prediction of coronary disease can be done with Map reduce algorithm.

“Association rules in parallel data mining , by Park et al(1995)[18]is one of the most primitive efforts on parallel data mining that targets at efficient identification of hugeitem sets by a hashing technique that gathers the count information relevant to item sets within a partition. Additional attempts on bringing parallelism in association rule mining and frequent item set mining was discussed in “Hash-based Parallel Algorithms for Mining Association Rules” by Shintani et al. (1996)[19]. In the current report, the authors proposed four different algorithms: SPA (Simply Partitioned Apriori), NPA (Non-Partitioned Apriori) HPA (Hash-Partitioned Apriori) and HPA-ELD (HPA with Extremely Large item set Duplication). Their research explained that HPA and HPA-ELD are effective in handling very huge data sets and also effectively handled the data skew problem. All these techniques were implemented in a share nothing environment.

The healthcare sectors has also promoted significantly from recent development in text and data mining for biomedical innovation. Related technologies studies the genetic basis of every drug retrieves by discovering the relationship between drugs, genes and diseases and analyzing required pathways. The important information is typically derived through the manual curation of data and stored in the freely accessible database. On the other hand, the considerable level of improvement in the field of gene detection, drug detection and disease detection along with the improved efficacy of methods for the retrieval of relations between drugs, genes and diseases has now easy to use automated systems to assist with this curation process.

Recent years have also witnessed extensive research in the field of privacy preserving data mining techniques. Privacy preserving data mining received considerable attention and many researchers performed a good number of studies in this area. Since its beginning in 2000 with the pioneering work, privacy preserving data mining has rapidly increasing popularity in data mining research community. PPDM has become an important issue among data mining researchers. As a result, a whole new set of methods were introduced to allow mining of data, while at the same time prohibiting the leakage of any private and sensitive information. The majority of the existing techniques can be classified into two broad categories.



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The first category refers to the methodologies that use perturbation, sampling, generalization / suppression, transformation, etc. techniques to the original datasets in order to produce their sanitized counterparts that can be safely reveal to untrustworthy parties. The aim of this category of approaches is to enable the data miner to get accurate data mining results when it is not given with the real data. Secure Multi party Computation methodologies that have been proposed to enable a number of data holders to collectively mine their data without having to reveal their datasets to each other. The second category deals with techniques that excludes the disclosure sensitive knowledge patterns derived through the application of data mining algorithms as well as techniques for downgrading the effectiveness of classifiers in classification tasks, such that they do not disclose sensitive knowledge.

A related endeavor on parallel data mining on a share-nothing multiprocessor by Agarwal et al. (1996)[20], allowed "Parallel Mining of Association Rules" planned three algorithms, namely, Data Distribution algorithm, Count Distribution algorithm and candidate. Distribution algorithm which aims on minimizing communication. These techniques were customized Apriori algorithms projected by the same authors in 1993 to outfit the parallel data mining context. Additionally other authors offered an encoding scheme that assisted the fast finding of association rule mining. The count distribution algorithm attains this at the cost of carrying out surplus computations in parallel, whereas the count distribution algorithm efficiently operated the main memory and the candidate distribution algorithm utilizes the semantics of the difficulty to lessen synchronization and load balancing problems. It is costly to broadcast messages across the different sites in a distributed environment.

Cheung et al.(1996) [21] presents "A Fast Distributed Algorithm for Mining Association Rules" that applies local and global pruning techniques to decrease the number of candidate item sets. It discusses an technique that decreases the time complexity of message support. Zaki et al. (1996)[22], describes a parallel method in "Parallel Data mining for Association Rules on Shared Memory Multiprocessors" on shared memory multiprocessors, which is considered as another hash-based approach. The achievement of the present description included optimization of pruning, joining, balancing of hash trees and accomplished on considerable performance gains. Han et al. (1997) [23]presents next set of parallel data mining algorithms as an development on the data distribution techniques in "Scalable Parallel Distribution Algorithm" ,namely the "hybrid distribution algorithm" and "intelligent data distribution algorithm". The algorithm predicts the concerns regarding communication, memory overhead and redundant communication. Cheung et al. (1998)[24]planned FPM (Fast Parallel Mining) for mining association rules on a shared nothing platform in their research titled "Effect of Data Skewness in Parallel Mining of Association Rules" in 1998. The FPM utilizes the count distribution algorithm acceptance with two new candidate pruning techniques called the global pruning and distributed pruning. They have generally developed the new approach to data skew issues and established that the distributed pruning is very efficient in managing a high degree of skewness in data whereas the global pruning technique is very efficient when mild skewness is experimented.

Exactitude medicine is formative prevention and treatment plan based on an everybody's inclination in an attempt to give more targeted and therefore efficient treatments .This part is poised for strong growth based on the ease of getting patient data and the advancement of computational methods with which to investigate this personalized data. While exactness medicine is a budding field, there have much more advancements in the personalized management of cancer. A number of hospitals are already applying genetic data to treat directly cancer patients. On the medical side of translational research, the required for accurate knowledge has the importance of life it self. It is obvious from the above discussions that individual algorithms in its own way can manage this problem.

Machine Learning & Data Mining Ensemble Methods**Bayesian networks**

Bayesian networks extract very needful information about the mutual dependencies between the features in the various application domains. Such useful information can be applied for gaining a better outcome about the dynamics of the procedure under observation. Health care data analysis, financial data analysis, and manufacturing



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process monitoring, sensor data analysis, and web mining are only some examples where mining Bayesian networks has been pretty helpful. Bayesian methods will also be helpful for mining distributed data [25]. Due to the advancements in computing and communication over wired and wireless networks that resulted in many pervasive distributed computing environments. Local area networks, the internet, intranets and ad hoc wireless networks are some examples. Lots of these environments have various distributed sources of huge data and many compute nodes. Bayesian networks with their related techniques are especially matched for reasoning and capturing with uncertainty. They have been around in health-care and biomedicine for more than a decade now and becoming popular for managing the uncertain knowledge implicated in establishing selecting optimal treatment alternatives, diagnoses of disease and predicting treatment result in various different areas. Bayesian networks are also gradually more developed in areas of health-care that are indirectly related to the management of disease in individual patients. The application of Bayesian networks in clinical epidemiology for the building of disease models and within bioinformatics for the interpretation of microarray gene expression data are the examples

Decision Trees

Decision trees are prominent models, because they are simple to understand and generate easy decision rules. Decision tree techniques such as ID3 and C4.5 are also accurate and fast on many data sets[26]. Decision trees can be used when choices or results of treatment are uncertain, and when such choices and results are important (sickness, wellness or death). Once the decision tree has been plotted out with its matching outcomes, values (utilities) and probabilities, the greatest healthcare choice requires to be identified. Still this method allows practitioner and doctor for better identify the most constructive option for patients.

Distributed clustering with Distributed PCA

Clustering is one of the major data-mining techniques for large data sets. The accomplishment of a clustering application usually based on the representation of the data. Clustering without correct feature selection and feature structure may not generate desirable data clusters. Furthermore, this is significant for the scalability of the clustering algorithms [27,28,29]. Principal component analysis (PCA) is a widely used technique to build a representation of the data that get maximally variant dimensions of the data. It calculates a representation with a group of basis vectors that are the leading eigenvectors of the covariance matrix produced by the data. Clustering techniques prepared with PCA-based representation are very helpful in many applications including knowledge discovery from databases (KDD).

Bagging

Many times training sets are not fine enough to explain a given problem. In such case, the obtainable data signify a partial view of the whole problem. As a result, a learning algorithm may not generate a good classifier because it depends on a local model. For better performance of any algorithm we need to combine multiple classifiers: bagging[30]. Bagging resolves the problem of local models by choosing equal sized samples of training subsets and producing classifiers for such subsets according to a learning algorithm [31]. Every training subset is consists of instances chosen randomly but with replacement. This presents a given instance may frequently appear or not at all in any training subset. Lastly, the classification of a test instance is specified by a vote strategy.

Boosting

In the previous paragraph that bagging usually works for unstable learning algorithms. This occurs because learning algorithms produce very dissimilar models that are probably complementary, even for related inputs [32]. Therefore, the more dissimilar data models, the bigger the covered region of training instances are. However, with bagging, we do not promise complementary models because the instances are chosen randomly. Boosting utilizes this problem by providing a hill climbing-like algorithm, undertaking the models to be as complementary as possible [33]. There are lots of versions of boosting. To guide the invention of models, at first, instances are weighed with an initial value. The weights are utilized for the classifier error estimation. The error is specified by the sum of the weights of the



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misclassified instances alienated by the sum of the weight of all instances. The weighing policy forces the technique to pay more attention to misclassified instances (high weight). First, an equivalent error is assigned to all training instances. Then the learning algorithm produces the classifier and weights in all training instances are updated, rising the weights of misclassified instances and lessening the weights of well-classified instances. The global error of the classifier is also calculated and stored. The process is recurred interactively until the production of a small error. This process produces the classifiers and the weight of the training instances, where the weights signify the frequency the instances have been misclassified by the classifiers [34]. To classify a fresh instance, the decision of a classifier is considered into account by assigning the weight of the classifier to the predicted class. Lastly, the class with the biggest weight (sum of the weights) is returned.

Distributed Association Rule mining algorithm

Due to the inevitability of speedily growing distributed computing environment, distributed mining techniques become popular in the market. Distributed data mining technique is also essential to ensure security and privacy in lots of other circumstances [35]. A parallel and distributed association rule mining technique also identified as Count Distribution (CD). Main point of CD is to diminish the communication overhead with the cost of surplus computation in all sites. This distributed model is appropriate for a system for which the computational capability controls the communicational capability. An additional algorithm, Fast Distribution Algorithm (FDM) is to decrease the number of candidate sets produced in local sites, as a result to reduce the communication overhead.

CONCLUSION

In this paper, we discussed an overview and a bibliography of machine learning and ensemble methods in healthcare sector. In spite of our efforts, we are confident that we missed significant research works and maybe vital research areas, since this field of machine learning is constantly growing, and novel methods and innovative applications able to excite the development of novel ensemble techniques are object of intensive research. Our overview focused on ensemble methods, since historically these were the primary to be studied and applied to several application domains. More precisely, in this paper a general categorization, distinguishing between distributed and parallel ensemble methods, has been discussed, considering the diverse ways supervised base learners can be produced or merged together. However ensemble methods have been also proposed in the context of semi-supervised and unsupervised ensemble methods, as seen by recent research works on the unsupervised investigative analysis of data. Several significant issues have not been discussed in this paper.

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An Economic Analysis of Agriculture Crop Production in India with Special Reference to Tamil Nadu

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ABSTRACT

Agricultural production is influenced by a number of things. Agricultural inputs such as land, water, seeds, and fertilizers, as well as access to agricultural financing and crop insurance, assurance of remunerative pricing for agricultural products, and storage and marketing facilities, are among them. This study gives an overview of India's agricultural situation. It covers aspects relating to agricultural production and post-harvest operations.

Keywords: Agriculture, Crops, Land, Seeds, Marketing, Products.

INTRODUCTION

Over the last three decades, India has achieved significant progress in the agriculture sector. The millions of small farming families who constitute the backbone of Indian agriculture and the Indian economy deserve a lot of credit for this achievement. Policy support, production techniques, public infrastructure investment, crop, livestock, and fisheries research and extension have all aided in boosting agricultural productivity, food production, and availability. Despite these accomplishments, increasing food production with limited land and providing economic access to food at the home level to ensure food security will remain a key issue for the country. Since the start of the Green Revolution, India's crop mix, yield, and output have changed dramatically. During the Green Revolution, there was a significant increase in yield per unit of input. In the recent period of growth, India's agriculture industry is undergoing a dynamic phase. It offers 65 percent of India's working population with employment possibilities. Since the post-independence period, the Indian government has been developing a policy framework for agricultural structural, technical, and institutional reforms.



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The specific emphasis for the agriculture sector during the first five-year plan (1951-56) was to deal with the food crisis. Since then, the proportion of GDP derived from agriculture and related sectors has been steadily decreasing. . In response to concerns about an agricultural crisis and reduced productivity, the 11th five-year plan (2007-08 to 2011-12) set a goal of reversing the decline in agriculture growth and productivity.

The focus of the 12th five-year plan is on agriculture's rapid and inclusive expansion. Since 2008-09, the world economy has been experiencing poor development, which has led in sluggish growth in all of India's industries. Despite the fact that agricultural production is poor in comparison to other industrialized nations, certain developmental initiatives have resulted in modest gains. These include technical advancements, seed acceptance of (High yielding Varieties) HYVs, increased fertiliser, insecticide, and pesticide quality, new cropping patterns, new irrigation infrastructure, agricultural research, and management techniques. In the next 20 years, India's already huge population will exceed Japan's to become the world's third biggest, while its economy will shortly overtake Japan's to become the world's third largest. Higher agricultural productivity or increased food imports will be required to meet the resultant rise in food demand. Productivity, water management, government policies and initiatives, and food distribution and storage are some of the main areas of development and problems for India's agricultural industry discussed in this article. Increased output of numerous agricultural goods is insufficient to propel this country's economic development. It also necessitates a structured and scientific marketing strategy for the sale of agricultural goods both domestically and internationally. A range of actions involved in the transfer of agricultural goods from the site of production to the point of consumption is referred to as agricultural product marketing. Agricultural marketing, according to Thomsen, encompasses all operations, as well as the organisations that carry them out, that are engaged in the transportation of farm-produced goods, raw materials, and derivatives.

The Study's Objectives

The study's goals are as follows:

1. Research Agriculture Production and Economic Development.
2. To determine trends in India's food grain output.
3. To determine the factors that influence changing area under various crops, production, productivity, and product price patterns, as well as their relative importance.
4. To identify the key agricultural production challenges in Tamil Nadu.
5. To identify trends in Tamil Nadu's food grain output.
6. To emphasise the government's participation in agriculture marketing growth.
7. Make recommendations for resolving the agriculture crop production challenge.

The study's methodology

The research is based on secondary data gathered from a variety of published sources. The Directorate of Economics and Statistics provided data on area, output, and yield. The Ministry of Agriculture's guidebook is available on the RBI's website. From 2001-2002 to 2019-2020, data was collected for 17 main Indian states for a variety of food crops. The entire time span is divided into two decades: 2001-2011 and 2011-2019. Data on the value of agricultural output was gathered from the Central Statistics Office of the Government of India, and compound annual growth rates were computed.

A Literature Review

Any research should include a review of relevant studies. It assists the researcher in identifying areas where previous studies have been done and focusing on fresh areas and elements that have not been addressed. According to Arhad Ali (2001), the world's population would rise to more than 8 billion people by 2025. The consequences for underdeveloped nations are extremely concerning. Because area growth is not conceivable due to land and water scarcity, future increases in food supply must come from increasing biological yields. Because area growth is not possible with the output of 82.2 million tonnes, the rice crop is planted on roughly 4.2 million hectares. However, rice productivity is significantly lower, at just 2811 kg/ha compared to 7,444 kg/ha in Ukraine. Rice yields have grown by



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170 percent in recent years. Existing technologies and types cannot solve the genuine challenge of meeting the additional demand of 101,886 (1000 tonnes) in 2015. As a result, several techniques are required to boost output. According to Kavitha (2001), the advent of monsoon and the pattern of rainfall, which is typically capricious in its occurrence and unpredictable in its volume, is the main reason why irrigation has become important for agricultural growth in India. Rainfall is concentrated in only a few months of the year, posing a major issue for rice farming. According to Satapathy and Tripathy (2001), the borrowers employed more key inputs than their competitors, allowing them to achieve greater per hectare rice yields. Rice production may be done using both borrowed and owned cash. In terms of resource optimization, loan receivers might earn the most profit from rice production by making the best use of credit-financed inputs.

Non borrower farmers can also better utilise their resources by investing more of their own money and increasing their non-farm income. Suu and Kombairaju (2001) discovered that the exponential function was used to calculate compound growth rates for rice acreage, production, and productivity for three periods (pre-green revolution (1949–1955), post-green revolution (1966–1998), and the entire time under review) (1949 to 1998). According to the findings, there is an upward trend in output and productivity. Prior to the green revolution, the state's rice output increased primarily as the state's rice acreage grew. Productivity increased significantly and positively after the green revolution. In a study done at the zonal agricultural research station Chhindwara, N. S. Thakur (2003) discovered that cropping patterns had a substantial impact on total productivity in terms of maize grain equivalent yield. Soyabean had the highest maize equivalent yield among rainy season crops, followed by maize and blackgram. During the winter, chickpea produced a substantially greater maize equivalent yield (113.37 qu/ha) than mustard. The Soyabean-chickpea cropping system produced the greatest Maize equivalent yield, which was substantially greater than the other farming systems. The maize, soyabean, and chickpea system came in second place, with a substantially greater maize equivalent yield (109.79qu/ha) than the other cropping systems. The most productive cropping system was Soyabean-Chickpea, followed by Maize + Soyabean Chickpea (Tomar et al 19964 ; Raskar et al 2000)5. The greater production of maize equivalent yield under the Soyabean chickpea cropping system was due to the strong potential yield and fair market price of a Soyabean and chickpea. Sesame-mustard had the lowest maize equivalent yield, with 67.86 q/ha less than the Soyabean-chickpea cropping scheme.

Background Information The Research

The worth of the researcher's research effort is determined by his or her theoretical foundation. The cause and effect relationship between variables is explained by theory. The study of economics is concerned with the explanation and prediction of specific events. Only when things are produced using theories can predictions and explanations be provided. Economic models are founded on theories, and each theory has its own set of assumptions. Predictions are made by formulating and testing hypotheses.

Agriculture's History

Agriculture has been the primary activity of every culture and civilisation throughout the history of mankind from its conception and beginnings. Agricultural methods ensured a steady supply of food. It also led in the formation of farming communities, which developed into villages, towns, cities, states, nations, and empires throughout time. Agriculture's history may be split into four periods, each with a different start and end date depending on the location.

DISCUSSION AND ANALYSIS**The Beginning**

The idea of productivity is a relative one that cannot be applied universally throughout the world. Some people define productivity as the total efficacy of a productive unit, while others define productivity as the ratio of output to matching labour input. However, all of these seemingly contradictory meanings have one thing in common:



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productivity refers to a person's capacity to create more cheaply and efficiently. As a result, agricultural productivity may be defined as the output-to-input ratio in respect to the amount of land, capital, and other resources used in agriculture. The efficiency of various inputs utilised in productive processes is characterised as agricultural productivity. With the difference in numerous physical, technical, and institutional variables functioning in the region, productivity is going to vary from region to region. We refer to the changing link between agricultural production and one of the primary inputs, such as land, as agricultural productivity. The average yield per hectare of land is the most often used word to describe agricultural production. In India, yield per hectare of all crops has increased dramatically with the advent of modern agricultural techniques, including the acceptance of hybrid seeds, the expansion of irrigation systems, and the use of intensive farming methods.

Rice Production in India from 2001-2002 to 2019-2020 is examined in Table 2. Production grew from 933.4 tonnes in 2001-2002 to 966.9 tonnes in 2007-2008, then 1044.1 lakh tonnes in 2015-2016, and ultimately 1184.3 tonnes in 2019-2020. Rice production averages 993.34 lakh tonnes. During the research period 2019-2020, the highest level of output was seen. Rice output growth has reduced from -29.96 percent in 2002-2003 to 18.87 percent in 2003-2004, then back to negative growth of -6.50 percent in 2005-2006. The growth rate had a favourable trend from 2008 to 2009, but then reverted to a negative trend in 2009-2010. (-11.33%) and 1.65%, respectively. The highest rate of increase was 18.87 percent in 2003-2004, while the average growth rate was 0.87 percent. Throughout the research period, the percentage change in total output showed a growing and declining tendency.

From 43.85% in 2001-2002 to 41.09 percent in 2002-2002, the percentage share has fallen by 41.09 percent. From 2002-2003 to 2009-2010, rice production accounted for approximately 40% of total production. In terms of overall grain output, there has been a changing tendency throughout the research period. It rose 2307.8% in 2007-2008, from 2128.5 lakh tone in 2001-2002 to 1747.8 lakh tone in 2002-2003, and finally stood at 2966.5 and average total production 2410.49 tonne correspondingly. Rice output and overall production have annual compound growth rates of 1.26 percent and 1.76 percent, respectively. which fell by 111.3 tonnes in 2003-2004, then fell by 131.3 tonnes again in 2004-2005, before skyrocketing to 182.2 tonnes in 2010-2010 and eventually reaching 231.5 tonnes in 2019-2020. Pulses output averages 170.68 tonnes per year, with a compound annual growth rate of 2.93 percent, which is greater than overall crop production. The growth rate likewise dropped from -20.13 percent in 2002-2003 to -13.35 percent in 2004-2005, then to -6.73 percent in 2011-2013, then to -15.13 percent in 2014-2015, until finally returning to a positive trend with 4.62 percent in 2019-2020. The average annual growth rate is 2.08%, with a maximum of 29.31%. During the whole research period, the percentage share of total output likewise showed a changing pattern.

Discoveries, Recommendations, and Conclusions**The study's findings**

Production grew from 933.4 tonnes in 2001-2002 to 966.9 tonnes in 2007-2008, then 1044.1 lakh tonnes in 2015-2016, and ultimately 1184.3 tonnes in 2019-2020. Rice production averages 993.34 lakh tonnes. During the research period 2019-2020, the highest level of output was seen. Rice output growth has reduced from -29.96 percent in 2002-2003 to 18.87 percent in 2003-2004, then back to negative growth of -6.50 percent in 2005-2006. The growth rate showed a favourable trend from 2008 to 2009, then a negative trend from 2009 to 2010 (-11.33%), and ultimately 1.65 percent. The greatest rice production growth rate of 18.87 percent was recorded in 2003-2004, with an average growth rate of 0.87 percent. Throughout the research period, the percentage change in total output showed a growing and declining tendency. Rice output as a proportion of total production fell from 43.85% in 2001-2002 to 41.09 percent in 2002-2002. From 2002-2003 to 2009-2010, rice production accounted for approximately 40% of total production.

CONCLUSION

The results of the preceding data analysis research show that, while India is one of the world's greatest producers of wheat, it is not a significant exporter. In addition, extensive assessment studies on initiatives aimed particularly at



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shaping the tobacco and food supply are required. To far, there hasn't been much study done in this area. In India, the cropping pattern has shifted dramatically from the production of food grains to the growth of commercial crops. Although its proportion of the economy has declined over the last 50 years, India's agriculture industry remains vital to the Indian economy. In recent decades, India has achieved tremendous strides in agricultural output, including the introduction of high-yield seed types, greater fertiliser use, and better water management systems. Land reforms, water management reforms, and food distribution system reforms would boost production and enable India fulfil its rising food demand. Farmers in India are confronted with a variety of issues, both natural and man-made. Solving their difficulties will take a long time. Every year in the budget, the government appropriates large sums of money and develops numerous policies and initiatives aimed at improving India's agriculture industry. In order to decrease price volatility in perishable agricultural commodities, the government has created a Rs.500 crore Price Stabilisation Fund for Cereals and Vegetables (onions, potatoes & tomatoes etc.). With the establishment of this Price Stabilization Mechanism Farmers will be able to obtain a fair price for their food, and consumers will be able to buy it at a reasonable price thanks to the fund.

As a first step toward the development of a national market, an agri-tech infrastructure fund has been suggested to create a single emarketing platform for agri-commodities in the Agriculture Produce Marketing Committees (APMCs) throughout the State. On the other side, the government is working on an insurance product that would protect farmers against both crop loss and price volatility. As a result, improved soil and water management, lucrative crop rotation, creative marketing, genetic engineering, and investments in farm education and rural infrastructure have the potential to boost major crop yields. Existing knowledge of successful interventions aimed at agricultural productivity and farm-level economic variables must be put to use. According to research, certain forms of treatments are more beneficial than others.

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Table 1. International production of Wheat in MT

Country	2010	2011	2012	2013	2015
China P Rp	112464292	115115364	115181303	117410300	120580000
India	78570200	80680000	80800000	86874000	94880000
United States	0	0	0	54413300	61755240
France	39006400	38332200	40787000	38037000	40300800
Russia	63765100	61739800	41507600	56240000	37719640
Australia	21420200	21656000	22138000	27410100	29905009
Canada	28611100	26847600	23166800	25261400	27012900
Pakistan	20958800	24033000	23310800	25213800	23473000
Germany	25988600	25192400	24106700	22800000	22432000
Turkey	0	0	0	21800000	20100000

Source: Food & Agricultural Organization (FAO).





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Table 2. Rice Production in India from 2001-2002 to 2019-2020 (In Lakh Tonne)

Year	Rice	Growth rate	% of Change in Total Production	Total Food Grains	Growth Rate
2001-02	933.4		43.85	2128.5	
2002-03	718.2	-29.96	41.09	1747.8	-21.78
2003-04	885.3	18.87	41.53	2131.9	18.02
2004-05	831.3	-6.50	41.91	1983.6	-7.48
2005-06	917.9	9.43	44.00	2086	4.91
2006-07	933.6	1.68	42.97	2172.8	3.99
2007-08	966.9	3.44	41.90	2307.8	5.85
2008-09	991.8	2.51	42.30	2344.7	1.57
2009-10	890.9	-11.33	40.85	2181.1	-7.50
2010-11	959.8	7.18	39.26	2444.9	10.79
2011-12	1053	8.85	40.61	2592.9	5.71
2012-13	1052.4	-0.06	40.93	2571.3	-0.84
2013-14	1066.5	1.32	40.24	2650.4	2.98
2014-15	1054.8	-1.11	41.85	2520.2	-5.17
2015-16	1044.1	-1.02	41.50	2515.7	-0.18
2016-17	1097	4.82	39.87	2751.1	8.56
2017-18	1127.6	2.71	39.56	2850.1	3.47
2018-19	1164.8	3.19	40.84	2852.1	0.07
2019-20	1184.3	1.65	39.92	2966.5	3.86
Average	993.34	0.87	41.31	2410.49	1.49
CAGR	1.26			1.76	

Source: Ministry of Agriculture, Government of India.

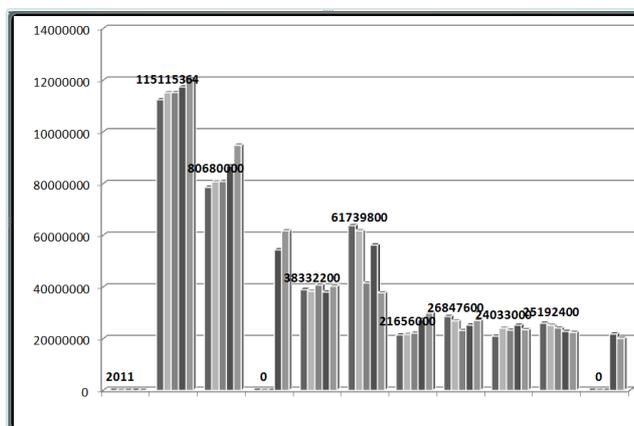


Fig. 1. International production of Wheat in MT-Barchart





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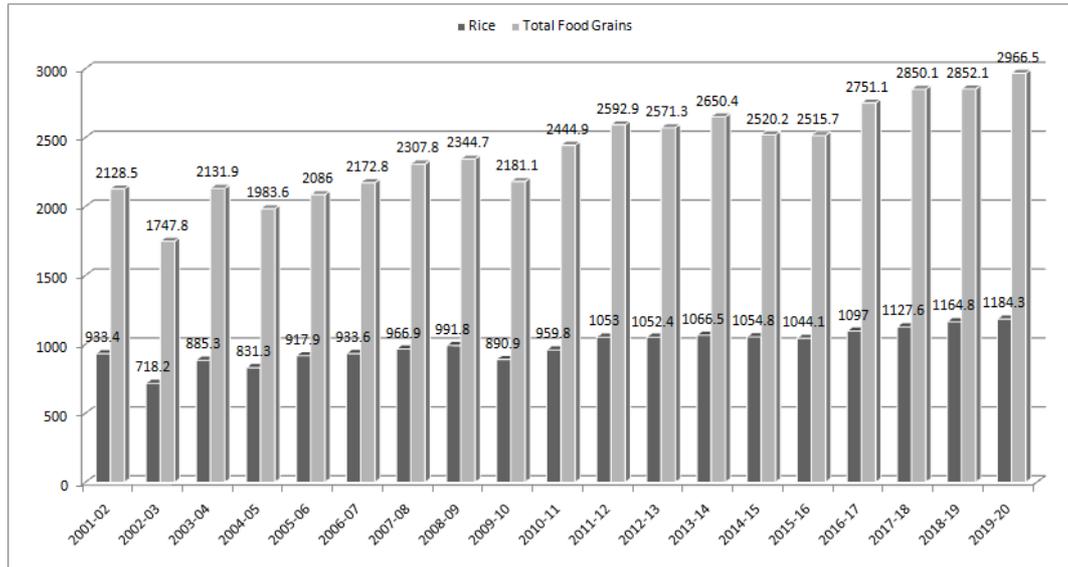


Fig. 2. Rice Production in India from 2001-2002 to 2019-2020





Study to Determine Impact of Traditional Class Room Learning Versus Live E- Learning of Low Back Pain for Final Year Physiotherapy Students of Madhav University: A Cross Sectional Survey

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ABSTRACT

India has more than 250 Physiotherapy Colleges that offer a bachelor of physiotherapy courses. All college campus offers a higher level of learning to students. But due to the covid-19 outbreak, most physiotherapy colleges shifted their teaching style with immediate effect from offline classroom learning to online e-learning mode. This immediate shift of learning patterns raised concerns about the quality of education among students and faculties. Here there was a survey conducted on 30 final-year undergraduate physiotherapy students which intended to check whether e-learning of low back pain is better or traditional classroom learning so based on the survey future modification can be done to improve education quality from the students perspective. Survey results confirmed that the present method of e-learning can't replace traditional classroom learning particularly in branch-like physiotherapy which has a major focus on hands-on training. But we can't ignore digitalization so we recommend various improvements in the present mode of e-learning like the use of animation, virtual 3D models, more user-friendly platforms with proper training to use, along with a hybrid model of learning which can overcome the present need of e-learning without hampering education quality.

Keywords: Live e-learning, Low back pain, Madhav University, Physiotherapy, Traditional classroom learning

INTRODUCTION

From ancient times India is famous for its high standard education system and Nalanda, Takshashila was the best example of this. After the phase of Vedic civilization, India adopted a modern education system set by the British which consist of classroom and board learning. (Pandya et al 2014). Since the independence of India, most students

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are only dependent on classroom learning and there's no such change in teaching pattern for many decades. The current era is of smartphones and high-speed internet where everything at just one click away from you. So these digital revolutions started to change the current education system by including PowerPoint presentations, online teaching material, videos, etc. but the process of change was very slow and limited. Digitalization in the education system of India is not at the level of any developed countries because India is having many hurdles to adopt digitalization fully. Particularly it is more difficult to adopt for practically oriented courses like physiotherapy. Even physiotherapy teaching also accepted and adopted many teaching changes and moved up to some extent of digitalization. Many physiotherapy lectures/notes/slides or practical demonstration videos is now available online. All these online materials are used by many physiotherapy students to explore and gain knowledge of a particular topic in depth. These online features are advantageous to students as their knowledge is not bound to book learning. In the growing phase of technology, India is facing Covid 19 outbreak along with the whole world (Boa, W. 2020). so due to the lockdown imposed by the government of India, all the physiotherapy colleges have stopped classroom learning activity and suddenly shifted to an alternative mode of e-learning. A learning system based on formalized teaching but with the help of electronic resources is known as E-learning. E-learning can also be termed as a network-enabled transfer of skills and knowledge, and the delivery of education is made to a large number of recipients at the same or different times. Earlier, it was not accepted wholeheartedly as it was assumed that this system lacked the human element required in learning. (The Economic Times 2021 May 3). E-learning includes most of the time live and sometimes pre-recorded lectures which deliver study materials by PowerPoint presentation, video tutorials and showing images or graphs, etc. by using various platforms available on the internet. Colleges are using many online free or paid platforms like zoom, google classroom, etc. for online live teaching where they took theory and practical demonstration. (Devi et al 2020)

The Study

There are many complaints from students about e-learning like network issues, lack of concentration, difficulty to use gadgets and software for e-learning, etc. but the most common complaint is lack of face-to-face interaction and poor understanding of practical aspects. So authors decided to give a statistical frame to a student's mindset by conducting a scientific survey which helps for future modification in teaching patterns for the betterment of education quality. To maintain homogeneity of the population, the study is limited only to final year physiotherapy students of Madhav University, Rajasthan. With the focus i.e. low back pain for both the mode of learning with same timing of classes and same faculty for both mode of classes to minimize variable which can contaminate study results.

Methodology

30 final-year students who were studying a bachelor of physiotherapy at Madhav University were taken into the survey. All 30 students have attended a class on low back pain by both e-learning mode and traditional classroom mode from the same faculty with the same content. Live Online classes were conducted on zoom cloud meeting app platform for two days (13/05/20-14/05/20) in morning session i.e. 9:30 am to 12:30 pm and offline traditional classroom teaching on the same topic with the same content were done at Madhav physiotherapy college for two days (04/03/20-05/03/20) in the morning session with same time slot which opted for live online classes. Zoom cloud meeting app: Zoom is a cloud-based video conferencing platform that can be used for face-to-face video conferencing, audio conferencing, webinars, meeting recordings, and live chat. The free version allows a maximum 100 number of participants. We have found that it consumes little amount of data. Also, there is the option of screen sharing, whiteboard sharing, and recording the whole meeting, maintaining thereby a cloud backup. (D Das et al 2021). Questionnaires were given to all the students who were part of the survey. The core of the questionnaire (table 1) were student-specific questions that determine their perspective of learning. The questionnaire was evaluated by a team of senior physiotherapists for its construct and content validity. Questionnaires consist of 6 compulsory closed-ended questions which are printed on paper and that have to be filled within 10 minutes of the given time. Before answering the questions related to the survey informed consent was taken from all the participants. Students have to give their feedback on all

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compulsory questions with the help of the Slider Scale (Figure 1) of satisfaction and data has to be analyzed statistically to find the result. The use of a slider scale makes rating easy for students as this scale is very easy to understand.

Data Analysis

Data were managed and analyzed into an excel spreadsheet.

Finding

A total of 30 student's responses were recorded via questionnaires. All 30 students have attended both the mode of learning and filled questionnaire properly. There were no dropout or rejection of any responses. Characteristics of all students are shown in table 2. Table 3 clear cut showing that the mean *comfort level* of traditional classroom learning is 89.33% which is much higher than 32.33% which is for e-learning. Similarly *concentration level in the class* is also more 90.33% in classroom learning than e-learning which 33.33%. This difference is mainly because of physical issues and psychological issues related to e-learning.

Physical issues

Lissak et al. 2018 have proven in research that studying long via digital media is causing a lot of eye strain to students, most of them are suffering from eye redness, excessive watering of eyes, sensitivity to light, insomnia, etc. Eyes are most affected by the use of smartphones because the blue light emitted by the screens is responsible for disturbing the sleep cycle. 75% of the audience was concerned about the increasing eye issues amongst children. Online-based education also raises some health-related issues connected predominantly to spending long periods working with computers. Excessive screen usage was linked with high blood pressure, diabetes, vision problem, and joints issues in children and adolescents. Backbone too gets negatively impacted because of the poor posture and 83% of the audience had complaints about backaches. 54% of the participants confirmed that sitting on computers, laptops and watching mobiles for hours makes students lethargic. Whether the learning is offline or online, the main objective of efforts is to impart knowledge along with minimizing health issues in both learnings before implementing it on a mass scale.

Psychological issues

Singh, S. et al 2012 found that the presence of physical issues will also not allow the mind to concentrate or focus on e-learning. There are various distractions too when a student is not supervised in e-learning. Electronic gadget addiction is yet another major problem and seventy-one percent of respondents confirmed it. Also, surveys suggesting more *interference/disturbance* in e-learning (65.66%) than traditional classroom learning (35.66%). Internet connectivity is a major hurdle in the learning system which leads to recurrent pause of video or poor sound clarity. Also, some technical errors may prevent students from joining e-learning platforms. Also when students are at home the social interference disturbs them. Also, surveys showed high *Presentation Clarity of the teacher's theory* material in classroom learning (88.00%) while 34.66 % for e-learning. Same way for *Presentation Clarity of hands-on practice* of classroom learning is 89.33% efficient for understanding while e-learning is just 20.66% efficient. This happens mostly because e-learning lacks face-to-face personal interaction with the use of various e platforms and its interference is quite difficult for teachers and students which overall reduces the experience with e-learning. (Naman, W.et al 2020) Also, students' mindset is used too with traditional classroom learning methods so this paradigm shift toward e-Learning will take some time. (Sun, A. et al 2020) In this survey *overall learning experience* to e-learning is 34.00% while for classroom learning is 92.00% which clearly can be understood due to the physical and psychological impact of e-learning.

Study Limitations

- A limited number of participant
- Use of single platform i.e. Zoom could meeting app





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CONCLUSIONS AND CLINICAL RELEVANCE

Pros and cons of live e-learning

Pros

- Students can attain classes irrespective of the place
- can record lecture if allowed which help for revision

Cons

- Difficult face to face interaction
- Poor network issues
- Difficult to understand practical knowledge
- Environmental issues
- The teacher cannot ensure whether the student is attentive or not

In a study, it was observed that students who were taught through a blended model of education i.e. combination of offline and online mode had significantly better results than students who were solely taught in classrooms by traditional methods. (Setyawan et al 2019). Traditional classroom learning is found best as it involves one-to-one interaction and the teacher and students both feel that they are connected so they can deliver lectures very well particularly in branches like physiotherapy where hands-on skill or lab work training is a major portion of learning. Though authors found an impact of e-learning on the lower side we can't exclude it totally as it has its benefits. So the future focus should be on new techniques like virtual 3D models and various animations which can justify-content in a better way. So the future can be expected with the hybrid mode of learning.

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Table 1: Questionnaire Form

Class Learning Vs E-Learning of Low Back Pain for 4 th -year Physiotherapy Students of Madhav University			
Sr.No	Questions to be answered	Class Room Learning	E-Learning
1	Comfort level of class	-	-
2	Concentration level on the class	-	-
3	Interference of the external environment/Disturbance on the class	-	-
4	Presentation Clarity of the teacher's theory material	-	-
5	Presentation Clarity of the Hands-on / practical Learning	-	-
6	Overall learning experience	-	-

Table 2: Characteristics of students

Gender	Male	10
	Female	20
Age range	21 years – 23 years	
Gadgets	Mobile / Tablets	18
	Computer / Laptop	12

Table 3: Students Mean response in percentage

Class Learning Vs E-Learning of Low Back Pain for 4 th -year Physiotherapy Students of Madhav University			
Sr.No	Questions to be answered	Class Room Learning	E Learning
1	Comfort level of class	89.33%	32.33%
2	Concentration level on the class	90.33%	33.33%
3	Interference of the external environment/Disturbance on the class	35.66%	65.66%
4	Presentation Clarity of the teacher's theory material	88.00%	34.66%
5	Presentation Clarity of the Hands on / practical Learning	89.33%	20.66%
6	Overall learning experience	92.00%	34.00%

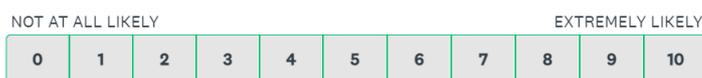


Figure: 1 Slider Scale of satisfaction (Bosch, O. J. et al 2018)





Effect of Doping on Magnetic Nature of Tin Oxide Nanoparticles

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ABSTRACT

The thrust to develop eco-friendly procedures for the production of nanoparticles arises from the extremely recent nanotechnology research. SnO₂ nanoparticles were synthesized by sol-gel method. The size, structure and morphology of SnO₂ nanoparticles were characterized by X-Ray diffraction (XRD), Scanning Electron Microscope with EDS (SEM-EDS) and Vibrating Sample magnetometer (VSM) techniques. The average particle size of Tin oxide nanoparticles was calculated from the XRD study. The average particle size of SnO₂ nanoparticles was 25-30 nm. The VSM used to measure the magnetic nature of the particle. SnO₂ nanoparticles thus synthesized have large number of potential applications in the field of pharmaceutical industries, sensors piezoelectric crystals, fuel cell electrodes and catalysis etc.

Key words: Magnetic nano particles, Tin oxide, XRD, VSM.

INTRODUCTION

Nanostructure material have small crystal size. As compared to bulk materials nanostructure materials have large surface area. The nanostructure metal oxides are of great scientific interest and have enhanced properties due to decrease in size. SnO₂ is commonly used in transparent conductive electrodes, gas sensors, electro chromic devices, anode materials for batteries, etc. So far, various strategies have been applied to tailoring the shape and size of SnO₂ nanoparticles, and the findings here will provide a meaningful contribution in this fields (Yong Joo Kim *et al.*). Nano structured Tin oxide have high electrical conductivity, with optical transparency and it is also an interesting semiconducting material. Because of its less energy consumption to move valance band, it's used in magnetic data storage and magnetic resource imaging (MRI). It also used as catalyst in energy saving coatings and anti-static coating. Moreover it's used in gas sensors, anti-reflecting coating, solar cells, etc.

Intense experimental and theoretical efforts have been dedicated to understanding the mechanism of nano magnetism and to form unique magnetic nanostructures. This is due to their huge potential for technological



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applications in information technology [1, 2] and in other disciplines such as biology and medicine [3]. In last five year, the engineering of layered structures has become more and more important, since the crystallography, electron structure, and physicochemical properties, especially the magnetic properties. Vibrational spectroscopy such as Raman scattering (RS) and Fourier transform infrared (FTIR) have proved as valuable means for the structural characterization of oxides used as electrode materials in rechargeable lithium batteries [6-8]. Geometrically frustrated systems often exhibit unusual magnetic properties. The alteration in the geometrical structure leads to change in magnetism (my paper). We focus on the formation mechanism of these nanostructures and the relationship between the structures and the unusual magnetic properties (including abnormal magnetization loop horizontal shift (HHS) phenomena) by employing systematic microstructure and magnetic measurements and analysis (my paper).

RESULTS AND DISCUSSION**Preparation of Pure Tin Oxide Nanoparticle**

To prepare pure sample (1M) 11.28gm of tin chloride is dissolved in 50 ml of double distilled water stirred it about one and half hours, while stirring aqueous ammonia (3M) 15 ml added drop wise after one hour of completely add the ammonia solution the mixture become gel. After that the solution is heated to evaporate the water molecule then dry in hot air oven for about one hour in 80°C. Sample is calcinated in 400°C to obtained pure sample. Sample is stored for analysis and doping.

Preparation of Mn Doped Material

Previously prepared Tin oxide sample is mixed with 0.1M, 0.2M, and 0.3MMnSO₄ with polyethylene glycol (PEG 600). The same procedure is followed to dry and purify the sample.

X-Ray Diffraction

XRD is used as a fingerprint region for inorganic material used (crystal impact match 2 and diamond 3) SnO₂ pure software to draw structure. The blue line shows the observed data the red line shows matched data the colors represent for each match in the doped sample. From the table- we confirm the cell parameter of SnO₂ is 3.7730 Å. The tetragonal structure of SnO₂ was usually found to be the most stable configuration. (Lin Tan *et. al.*). The lattice arrangement of pure SnO₂ shows the tetragonal size of the particles and the P 42/m n m space group and the atomic distance at 2.0537Å for the Sn-Sn band and 2.0601Å at Sn-O band. The XRD shows the high intensity each and d-value at 3.3556Å this shows the sample is high purity. These two peaks perfectly match with reference data 96-153-4786. The atomic distance shows the practice is arranged in the perfect grain size and shape the list shows in the table. The hkl value of the high-intensity peak with d-value as 2.8141 (100) and second high-intensity peak with have d-value as 1.6236, and hkl value as (110) the two hkl value shows the samples are in 99% purity and perfect arranged size according to the grain size the sample are formed less than 100nm that shows the in SEM report. The size of the unit cell is complete match with reference data which shows. For doped sample it shows trigonal (rhombohedral axes) structure with R-3C and R-3 space group respectively for 0.1M, 0.2M and cubic structure with FD-3M space group for 0.3M doped sample. The hkl values are changed due to doping this explained with the help of XRD as follows sample with 0.1M Mn doped shows high intensity peak d-value at 2.8005Å (211) and 2.8720 Å (10-1). For 0.2M Mn doped sample shows d-value at 2.8573Å (121), and 2.6793Å (10-1). And finally 0.3M shows d-value as 5.1263Å (111) and 2.2197Å (004). The change in hkl value shows doping exists in the sample (my paper). When the doping takes place the impurity added to the parent material due to the impurity the lattice arrangement of the parent material changed. When we add a known impurity to parent material the lattice disorder take place on it due to lattice disorder the morphology of the parent material was changed (my paper).

SEM with EDS

The scanning electron microscope is used to find the shape and size of the nano particle most important morphology of the sample is studied using SEM. EDS used to identify the percentage of doping and purity of the particular



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sample. The report shows all samples are arranged with in 100nm range. EDS report shows 0.1M doped sample have 55% of oxygen 9% Mn and 34% Tin. The same report confirmed by computational study of XRD report that mention in fig- . This sample shows trigonal (rhombohedral axes) structure in XRD this morphological comes from the Mn atom doping. Same time 0.2M doped sample have 66% of oxygen 18.5% Mn and 15% Tin. This sample also shows trigonal (rhombohedral axes) structure in XRD this morphological comes from the Mn atom doping, but the percentage of Mn atom is greater than Tin atom. This is because of Mn atom radius is lesser than Tin atom, when the concentration is increase affect the oxygen atom in tin oxide and make MnO and form a co-ordination mixture. But 0.3M doped sample have 60% of oxygen 30% Mn and 9% Tin. In this sample due to over concentration the amount of Mn atom is higher than Tin atom and the compound is completely collapsed. The same report confirmed by computational study of XRD report that mention in fig-2, 4, and 6.

VSM

The VSM of the samples are shown in the figure from the image we come to the conclusion that pure SnO₂ doesn't have any magnetic nature. Ferro magnetic nature for doped material. Coercivity of 0.1M doped sample is 33.331G and Ms = 2.088E⁻³emu and Mr = 10.655E⁻⁶emu this shows the material become ferromagnetic nature. Coercivity of 0.2M doped sample is 8.8850G and Ms = 3.7044E⁻³emu and Mr = 5.4720E⁻⁶emu from this report material become ferromagnetic nature. But the magnetic saturation and magnetic resonance are very low compared to 0.1M Mn doped material. Coercivity of 0.3M doped sample is 10.147G and Ms = 6.7411E⁻³emu and Mr = 3.5988E⁻⁶emu, this sample have more magnetic nature than sample 0.2M Mn doped material, this is because of increasing the concentration on Mn atoms. γ -MnO₂ have ferromagnetic nature (my paper). That is the reason for increasing in Coercivity of 0.3M Mn doped material.

Fourier Transform Infrared Spectroscopy (FTIR)

FTIR is used to identify the functional group of the prepared Nanoparticle. The sample shows absorption at 3390 cm⁻¹, 3376.03 cm⁻¹, 645 cm⁻¹, 639.05 cm⁻¹, 528 cm⁻¹, 444 cm⁻¹, 422.28 cm⁻¹, 420 cm⁻¹, 408.10 cm⁻¹. Normally adsorption shows in 2800 -3600 cm⁻¹ is due to the removal of OH molecule. 645cm⁻¹, 528 cm⁻¹, 444 cm⁻¹ was assigned SnO microcrystals and the position the peaks is dependent on the axial ratio of the crystal. 3376 cm⁻¹ and 3390 cm⁻¹ OH in alcohol, 645 cm⁻¹ was assigned for Sn-O Stretching and deformation vibration, 444 cm⁻¹ was assigned for E2 mode Sn-O trigonal (rhombohedral) bond, these peaks confirm the presence of PEG in the sample which is used as a capping agent or surfactant, the doped material for the following peaks are assigned and confirmed the doping of Mn. The peak 560 cm⁻¹ was assigned for Mn-O Lo phonon mode of MnO lattice, 444 cm⁻¹ was assigned for E2 mode of morphed SnO and the Vibration of Mn-O also. The SEM of this sample shows the morphology change of SnO nanoparticle.

CONCLUSION

The SnO₂ nano particle was successfully prepared by sol-gel method and doped with Mn in various concentration. Characterized by various instrument. From the reports we get clear view about doping materials, magnetic property and effect of doping in it. Optimum doping make particles high coercivity (Oe) and magnetization (Ms). But doping makes both particle moves to diamagnetic nature to ferromagnetic nature. Wet method is more commercial and successful method to prepare Nano particles. Sol-gel method Give the best result in formation of Nano particle. Nano particles are formed less than 100nm. Due to structural defects such as particles of non-magnetic phase or voids in the magnetic material tend to restrict the motion of domain wall and thus increase coercivity. When the non-magnetic void in to add to the parent material its lattice arrangement disturbed by the doped material this is due to the atomic radius. The atomic radius of Sn is higher than Mn atoms radius, so the interaction of Mn atom makes a change in arrangement of a lattice of SnO₂, this change in lattice gives notable change in the domain wall of the SnO₂ so the particle moves from non-magnetic nature to soft magnetic nature.





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Table-Cell parameter for SnO₂

Cell parameter	Å
A	4.74560
B	4.74560
C	3.19300

Table-Cell parameter for 0.1M doped SnO₂

Cell parameter	Å/(pure SnO ₂)	Å (0.1M doped SnO ₂)
A	4.74560	5.61100
B	4.74560	5.61100
C	3.19300	5.61100

Table-Cell parameter for 0.2M doped SnO₂

Cell parameter	Å/(pure SnO ₂)	Å (0.2M doped SnO ₂)
A	4.74560	5.74000
B	4.74560	5.74000
C	3.19300	5.74000

Table-Cell parameter for 0.3M doped SnO₂

Cell parameter	Å/(pure SnO ₂)	Å (0.3M doped SnO ₂)
A	4.74560	8.87900
B	4.74560	8.87900
C	3.19300	8.87900





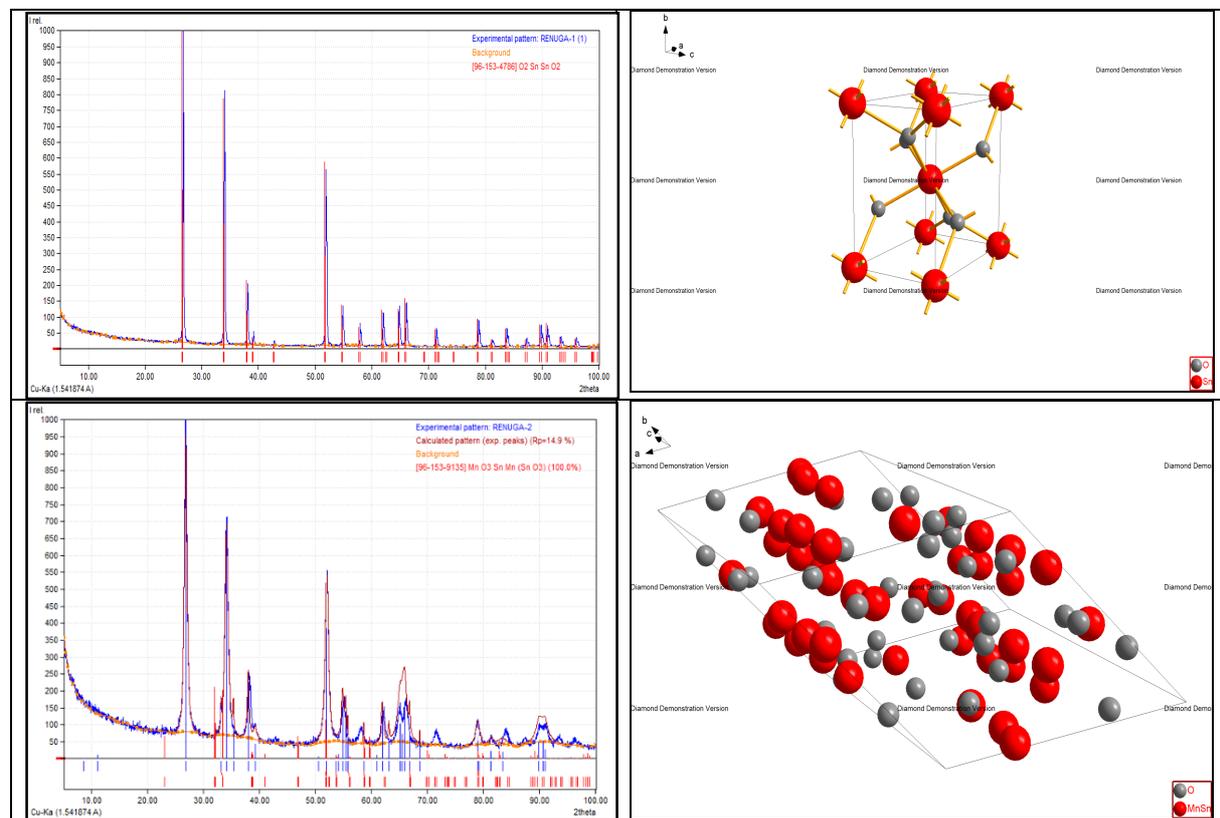
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Table- 12 Assigned Peak List for Pure SnO₂

Wavelength	Functional group
3376.03 cm ⁻¹	OH Stretching for alcohol
639.05 cm ⁻¹	O-Sn-O Stretching and deformation vibration
408.10 cm ⁻¹ , 422.28 cm ⁻¹	C-Halogen stretching mode

Table -13 Assigned Peak List For Doped with Mn

Wavelength	Functional group
3390 cm ⁻¹	OH Stretching for alcohol
645 cm ⁻¹	O-Sn-O Stretching and deformation vibration
560 cm ⁻¹	Mn-O Lo phonon mode of MnO lattice
528 cm ⁻¹	-Mn-O stretching bond
420 cm ⁻¹	C-Halogen stretching mode
444 cm ⁻¹	E ₂ mode of trigonal (rhombohedral)





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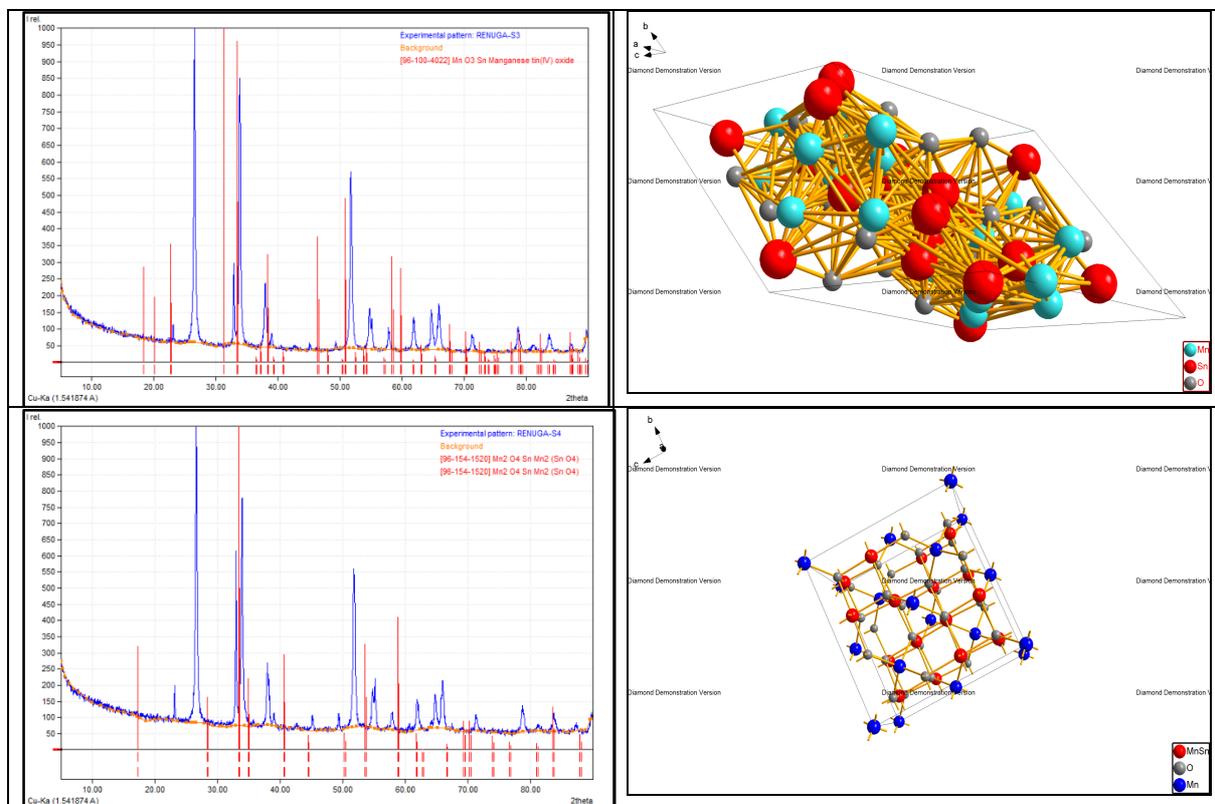


Fig.1. Atomic distance of pure sample

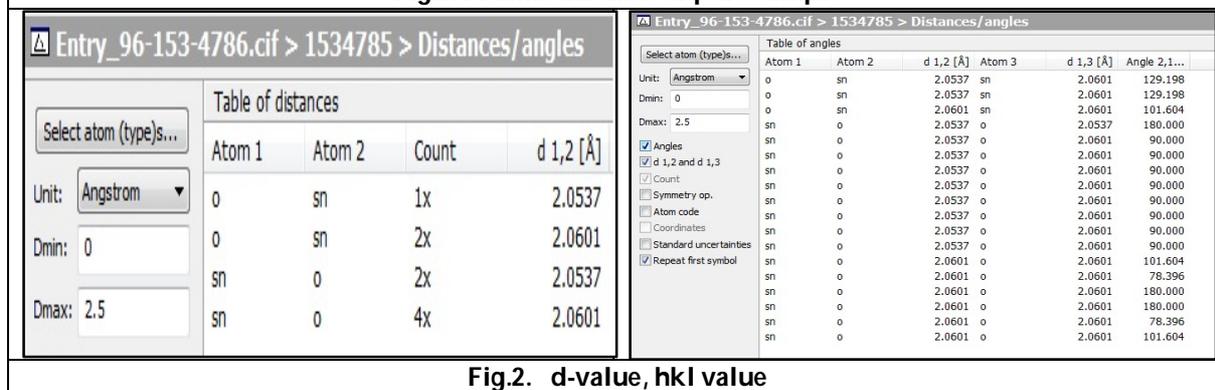


Fig.2. d-value, hkl value





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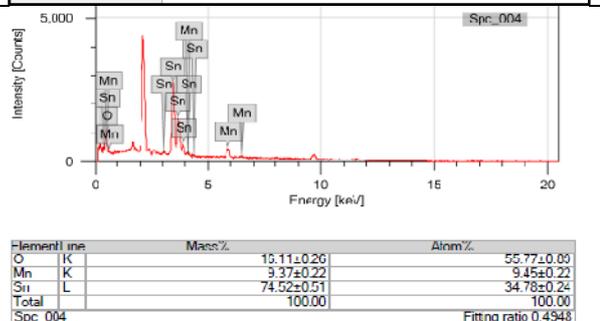
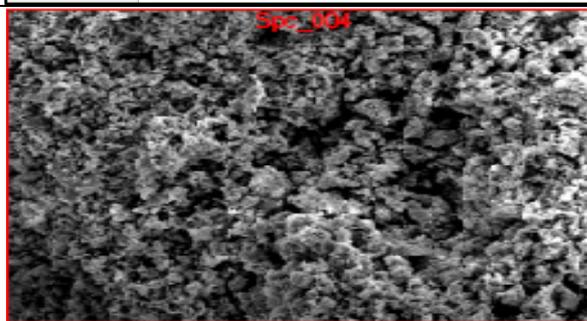
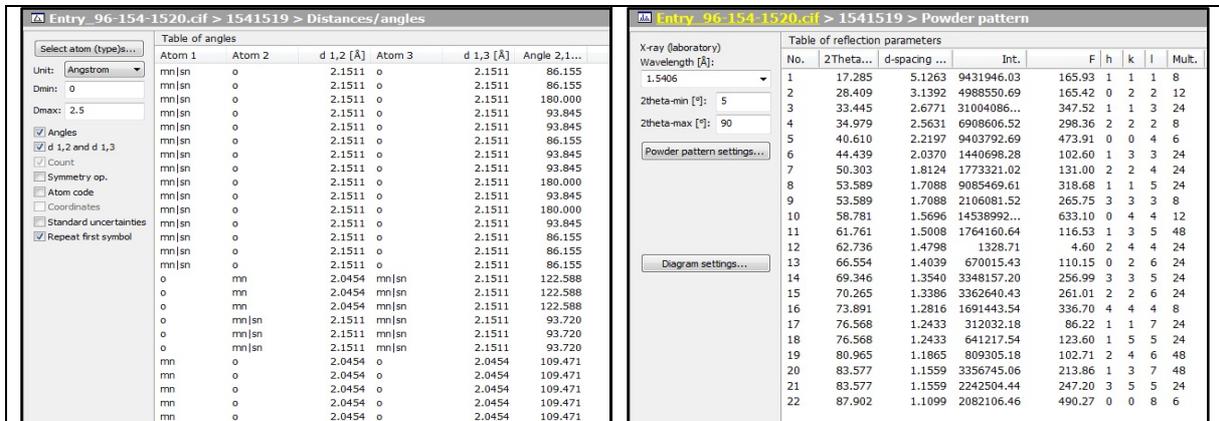


Fig.3. SEM EDS of 0.1M doped sample

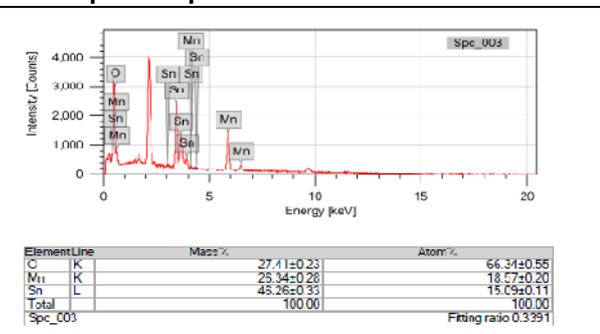
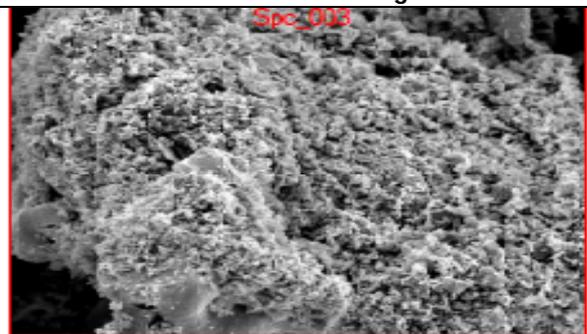


Fig.4. SEM EDS of 0.2M doped sample

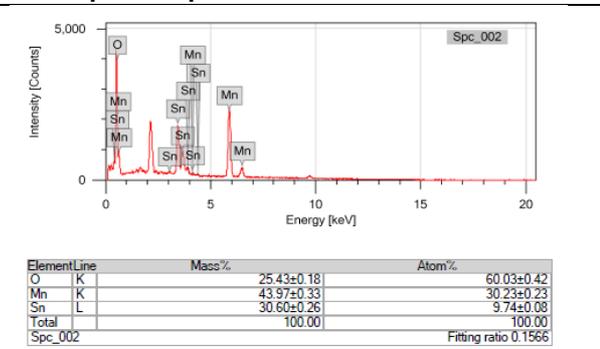
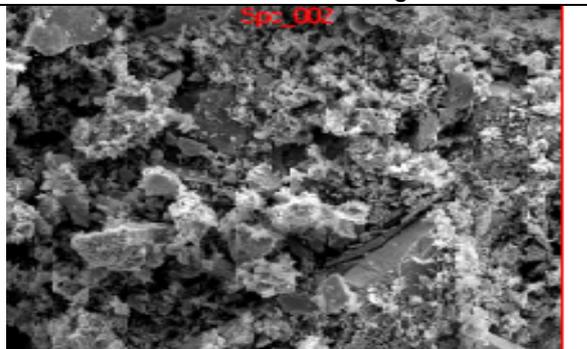


Fig.5. SEM EDS of 0.2M doped sample





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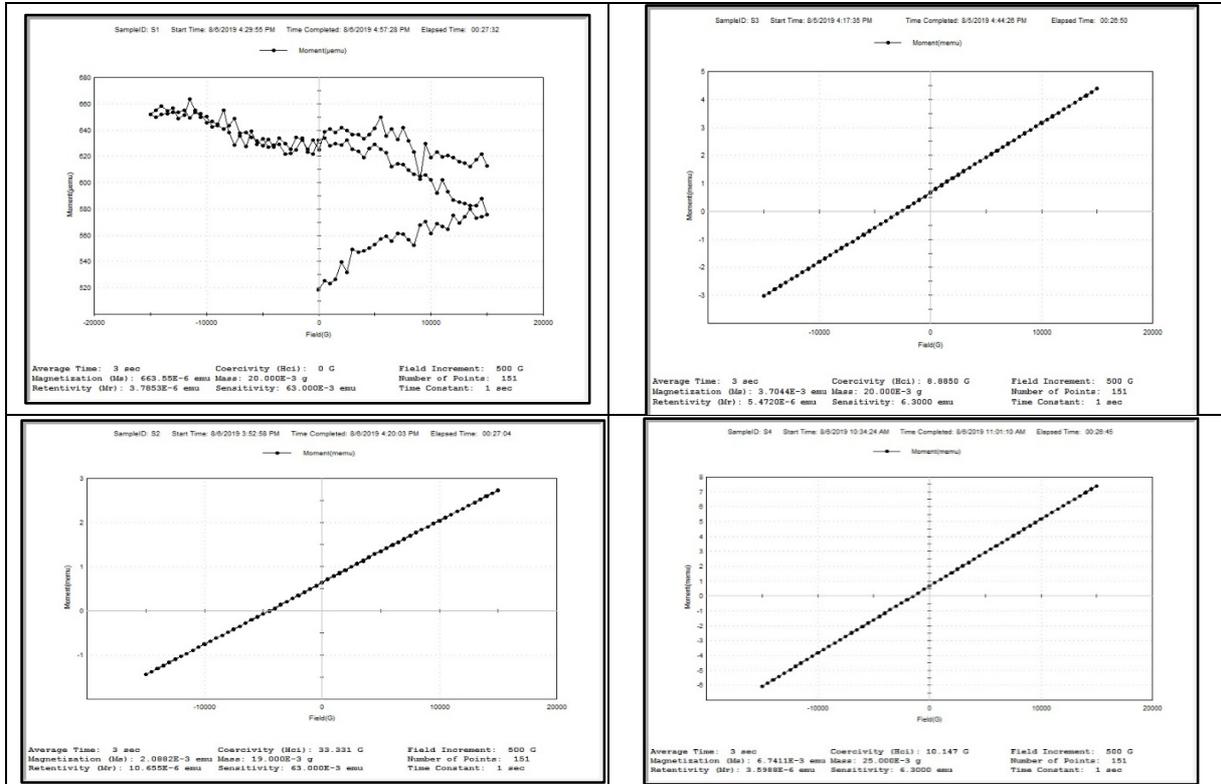
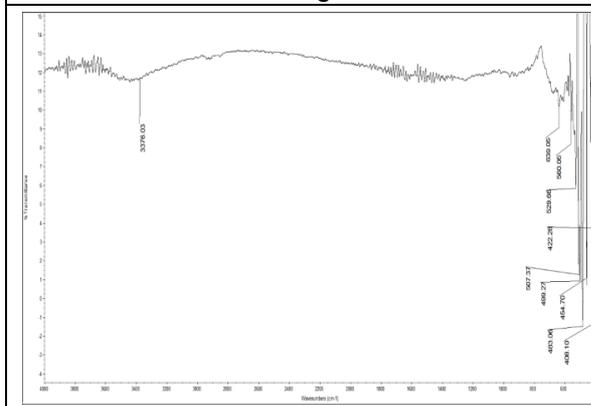


Fig.6. Fourier Transform Infrared Spectroscopy (FTIR)





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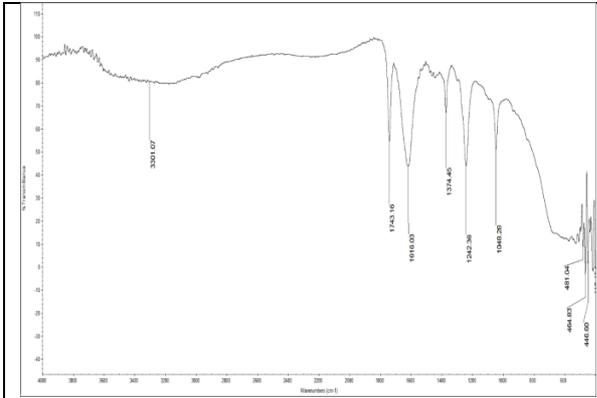


Fig.9. FTIR Spectrum of Doped Sample

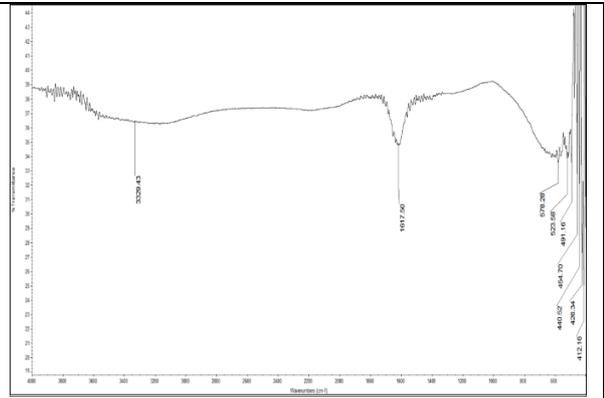


Fig.10. FTIR Spectrum of Doped Sample





Dietary Calcium and Osteoporotic Fracture Risk – A Factual Concern

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ABSTRACT

Studies have shown that adequate dietary calcium intake if sustained for long term prevents osteoporosis. Thus, the investigator aimed to analyze the dietary calcium intake of adults in Chennai, South India and its influence on osteoporotic fracture risk. Daily dietary calcium intake was estimated using a validated quantitative food frequency questionnaire and FRAX tool to assess the osteoporotic fracture risk. The mean dietary calcium intake of 800 subjects was found to be 451.29 ± 313.55 mg/day among male and 462.23 ± 29.00 mg/day among females. Forty-five percentage of male and 47% of female were found to be at risk of major osteoporotic fracture. The dietary calcium intake and major osteoporotic fracture risk showed a low inverse correlation ($R^2=0.11$). Inadequate dietary calcium intake need not be the single rationale for osteoporotic fracture risk. Insight and awareness on the bone remodeling and significance on the combined role of bone sparing nutrients has to be imparted in early ages for better prevention of osteoporosis or bone related disorders.

Keywords: Calcium, Osteoporosis, Questionnaire, FRAX tool, Fracture risk.

INTRODUCTION

Osteoporosis is defined as a metabolic bone disorder with low bone mass and diminished bone quality, which builds the danger of fracture, especially during oldage [1]. Osteoporotic fractures cause discomfort and decrease mobility, thus decreasing the quality of life and increasing both men and women 's risk of mortality [2]. Hence, it is important to prevent osteoporosis and avoid fractures associated with osteoporosis. Bone mineral density (BMD) can be both influenced by biological selection and multiple epigenetic factors; dietary consumption is an important component linked to BMD [3]. Calcium is an important mineral for skeletal health, and there has been comprehensive study of therelationship between calcium intake and bone density or bone strength [4,5]. For Indians, the RDA 2010



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recommends a calcium intake of 600mg/day for adults. Whereas the actual consumption from the dietary sources was found to be approximately 400 - 450 mg/day intake of calcium which was analysed using dietary recalls, quantitative questionnaires [6,7] and 400 – 500 mg/day using laboratory analysis of actual food samples [8]. Most studies has been performed in Western populations investigating the impact of dietary calcium on skeletal health and the evidences lacks for Asians, especially south Indians who have lesser intakes of dairy and other calcium rich foods. Hence this study was postulated to analyze the influence of calcium intake through dietary sources on the osteoporotic fracture risk among the people residing in Chennai, South India.

The participants consisted of general population with moderate to sedentary work, who visited the out patient department of the multi speciality hospital from 2016-2017 for any general health related problems. The participants included were aged between 40-60 year, living in suburban areas of Chennai. Informed consent was obtained and the participation was voluntary. Detailed assessment on the dietary calcium intake was obtained using a validated quantitative food frequency calcium questionnaire [6]. Osteoporotic fracture risk was evaluated using FRAX tool for India developed by World Health Organization. This research was performed in compliance with the principles set out in the Declaration of Helsinki and the Institutional Ethics Committee of Sri Ramachandra Institute of Higher Education and Research (Deemed to be University) approved all procedures involving human subjects/patients (Ref: IEC/15/FEB/114/02).

To calculate body mass index (BMI, kg/m²), weight was analyzed to the nearest kg barefoot, and height was estimated to the closest centimeter. The self-report (yes/no) determined the current smoking status, consumption of more than 3 alcoholic drinks per day, and glucocorticoid use. Glucocorticoid usage to a minimum of 5 mg of 54 oral prednisolone or equivalent for more than 3 months is considered to be a risk factor by the FRAX tool. Self reporting was done to ascertain the parental history of hip fracture among offspring participants only and adult fracture at any skeletal site like finger, wrist, vertebrae, ankle. Medical records were examined for hip fractures. The scores were analyzed using graphs with three colors. Green implies (not at risk) that risk of the individual is below the intervention threshold i.e. care plan is not advised. Red implies(severe risk) that probability of the fracture is consistently above the upper assessment threshold, regardless of the combination of clinical risk factors, and hence care plan can be strongly recommended. The mid category (orange) denotes (moderate risk) that odds lie between these limits and that care plan might be suggested for those with the higher risk factors.

Diet history comprises quantitative assessment using a validated food frequency calcium questionnaire. Nutritive value of Indian foods, ICMR, Hyderabad was used to list the foods and develop the calcium questionnaire. The questionnaire included those foods of all groups that have more than 30 mg of calcium per 100 g. Calcium supplements, calcium fortified foods, and soft drinks were not included. Servings were defined as small, medium, large along with the quantity. The portion sizes were divided as follows: small = 0.5 × standard/medium portion size; medium = 1.0 × standard/medium portion size; and large = 1.5 × standard/ medium portion size⁶. The questionnaire was subjected to the participants of the study. The data obtained was analysed using IBM.SPSS statistics software 23.0 Version. Descriptive statistics like frequency analysis and mean ± S.D were used for categorical variables and continuous variables respectively. Pearson correlation was used to analyze the significant relationship. The probability value ≤ 0.05 was considered to be significant in the above statistics.

A total of 830 participants were interviewed based on the inclusion criteria out of which 800 subjects completed the assessment. Table 1 shows the characteristic profile of the selected subjects. The mean age was 50.28 ± 5.95 year for male and 50.29 ± 5.95 year for female and the dietary calcium intake was found to be inadequate when compared with the RDA of Indians. The major contribution of the calcium intake was from the food group - milk and its products.



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Fig 1 depicts the prevalence of osteoporotic fracture risk, which was found to be similar between the gender (45%) among male and (47%) among female. Table 2 shows the mean osteoporotic fracture risk scores and the average dietary calcium intake of the subjects. Both male and female did not meet the recommended daily allowances of calcium and were at moderate risk of osteoporosis. Fig 2 shows the correlation between the fracture risk and dietary calcium. There was a low inverse correlation of dietary calcium and fracture risk ($R^2=0.11$). Both the variables assessed are independent to one another and hence it can be concluded from the present study that dietary calcium intake is not associated with osteoporotic major fracture risk. The mean daily intake of calcium around 400mg/day is considered as lower intake as per the Recommended Dietary Allowance (RDA) for adults. The mean intake of the study subjects was found to be meeting only 75 - 77% of the RDA. Similar findings were reported by Raj *et al.* [10] in the year 2015 using the same validated questionnaire were the women in Tamil Nadu met 74.5% of the RDA. Harinarayan *et al.* [11] reported an intake of 328 mg/day and 271 mg/day among urban and rural men and 306 mg/day and 262 mg/day among urban and rural women respectively.

Though there was a decreased intake of dietary calcium among the subjects only 47% of them were under risk of osteoporotic fracture. In a Meta analysis Bolland *et al.* [12] observed that assessment of the relation between fracture, milk or dairy intake and dietary calcium intake was done in 42 cohort studies. There was no association seen in most of the analyses ($\geq 75\%$) and those observational studies that proved an association showed weak relative risks between 0.5 and 2.0. Majority of the studies did not conclude lower levels of calcium intake with higher risk of fracture. Thus, the hypotheses "dietary calcium deficiency increases fracture risk" is not supported by observational studies. Our analysis also shows a similar result with no association of dietary calcium intake and osteoporotic fracture risk. The present study may reflect a situation of reduced dietary calcium intake combined with adequate intake of other bone sparing nutrients. We did not assess the dietary intake of other nutrients, which remains as a possible limitation. Hence the study suggests conducting randomized controlled trials by supplementing the bone sparing nutrients especially vitamin D and calcium from the available dietary sources, also considering the region and dietary practices of the individuals and assessing the bone mineral density or the bone turnover markers will provide a better clarity in understanding the importance of nutrition. The long-term effect of bone deprivation and osteoporosis especially in elderly is more prevalent. To understand this severity, appropriate education and awareness from early life especially adolescence on the bone health, remodeling, adequacy of dietary intake especially the bone nutrients like vitamin D, calcium, phosphorous, magnesium, vitamin C, zinc, protein, other contributing factors of bone deprivation like physical activity is essential to prevent bone loss and osteoporosis.

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Nil

Conflict of Interest:

None

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Table 1 Baseline Characteristics Of The Subjects (N=800)

Parameters	Male (n=400)	Female (n=400)
Age (year)	50.28 ± 5.95	50.29 ± 5.95
BMI (Kg/m ²)	31.62 ± 5.99	32.63 ± 6.03
Dietary calcium intake	451.29 ± 313.55	462.23 ± 29.00

Table 2 Dietary Calcium Intake And Fracture Risk Scores

Age (year)	Male (n=400)		Female (n=400)	
	Dietary calcium intake (mg/day)	Major Fracture risk*	Dietary calcium intake (mg/day)	Major Fracture risk*
40-45 (n=100)	439.79 ± 52.26	5.22 ± 2.14	462.24 ± 30.99	5.15 ± 2.41
46-50 (n=100)	439.57 ± 67.19	5.20 ± 2.22	463.50 ± 31.66	5.15 ± 2.29
51-55 (n=100)	420.37 ± 29.20	5.03 ± 2.14	420.37 ± 29.20	5.03 ± 2.14
56-60 (n=100)	431.54 ± 55.18	5.46 ± 2.23	459.83 ± 25.34	6.12 ± 3.32

*Ten year fracture probability





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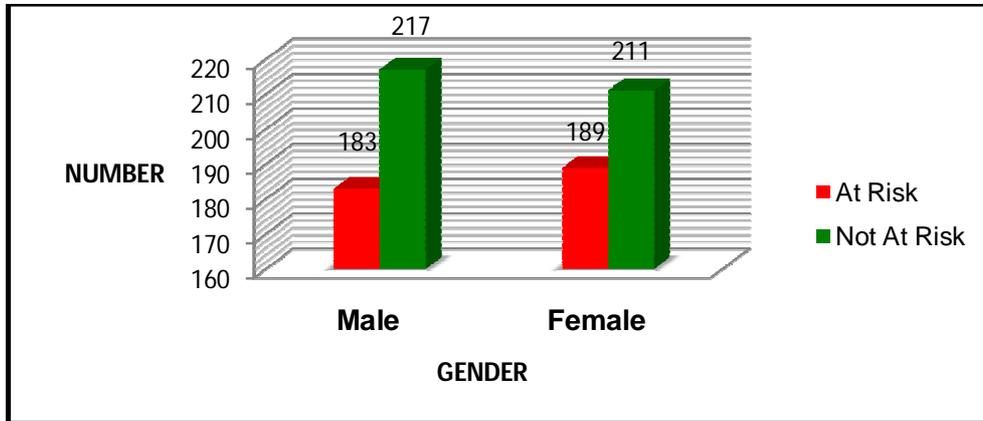


Fig. 1. Correlation Between Fracture Risk Scores And Dietary Calcium Intake

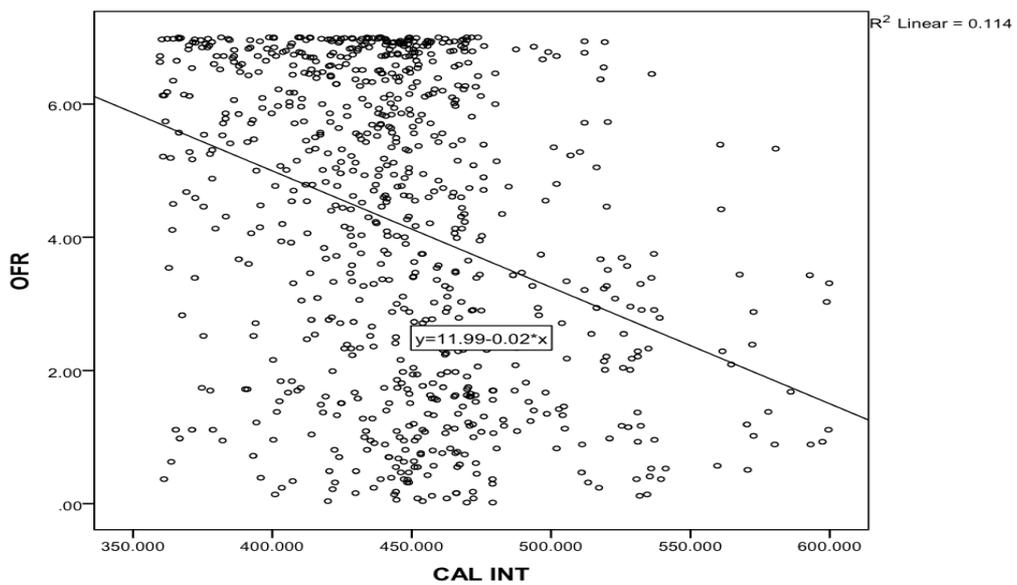


Fig. 2. Correlation Between Fracture Risk Scores And Dietary Calcium Intake





Evaluation of Antioxidant Activity and Polyphenols Contents of *Melilotus indicus* Extracts

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ABSTRACT

Melilotus indicus is a medicinal plant, is known for its ethno-medicinal activities such as antibacterial, anticoagulant, antispasmodic, emollient, laxative and narcotic. The objective of this study is to evaluate the antioxidant activity of aqueous extract (AqE) and the ethanolic extract (EE) of *Melilotus indicus*. The antioxidant activity was evaluated using DPPH (2, 2'-diphenyl- 1- picrylhydrazyl) and bleaching of β -carotene tests. Results showed that the total polyphenols content of the ethanolic extract was 120.067 μ g GAE/ mg extract and flavonoids was 26.375 μ g QE/mg. The total polyphenols content of the aqueous extract was 144.382 μ g GAE/ mg extract and flavonoids was 25.65 μ g QE/ mg. Aqueous extract has the higher scavenging capacity with IC₅₀ (0.09 \pm 0.002 mg / ml) than the ethanolic extract IC₅₀ (0.28 \pm 0.037 mg / ml), the inhibitory activity of the tow extracts in the β -carotene/linoleic acid assay was (70.983 \pm 4.22%) for the aqueous extract and (66.169 \pm 3.445%) for the ethanolic extract.

Keywords: *Melilotus indicus*, antioxidant activity, polyphenols, DPPH scavenging, β -carotene.

INTRODUCTION

Oxidative metabolism is essential for normal biological activities of cell. However, it also accompanies the production of reactive oxygen species (ROS). Oxidative modification of DNA, proteins, lipids, and small cellular molecules by excess of ROS plays a role in a wide range of common diseases such as cardiovascular diseases, neurodegenerative disorders, cancer, and aging [1]. Antioxidants are vital substances which possess the ability to protect the body from damage caused by free radical induced oxidative stress [2]. The body produces endogenous antioxidants that interact with and neutralize the free radicals. The endogenous antioxidants are not sufficient to



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counteract all the free radicals, as such, the body requires external (exogenous) antioxidants. Exogenous antioxidants can be natural (sourced from herbs, fruits and/or vegetables) or man-made [3]. The antioxidative phytochemicals especially phenolic compounds found in vegetables, fruits, and medicinal plants have received increasing attention, for their potential role in prevention of human diseases [2]. *Melilotus* (Family Fabaceae), also known as sweet clover or melilot, is one of flowering plants genera including around twenty five species that are distributed worldwide. Traditionally, the popularity of sweet clover back many centuries; Ancient Egyptians used it as a herbal tea to treat earache and intestinal worms. The Greek physician "Galen" recommended an infusion containing *Melilotus* in a wrapping for swollen joints and inflammations. Also, the *Melilotus* genus has earned a reputation for preserving eyesight, in Anglo-Saxon England [4].

Melilotus indicus is a plant that belongs to the family Fabaceae and is widely distributed in many parts of the world including Indo-Pakistan Subcontinent, Mediterranean region, central Asia, Europe and Africa [5]. *Melilotus Indicus* is a small annual plant of up to 50 cm in height having pale yellow flowers. Traditionally, *Melilotus indicus* is used as an analgesic, antioxidant, insecticide, emollient and astringent agent. Various ailments such as gastritis, inflammatory disorders, psoriasis, genital organ diseases, and wounds were also treated using different parts of *Melilotus Indicus* plant [6].

MATERIALS AND METHODS

Chemicals

Folin-Ciocalteu, aluminum chloride (AlCl₃), gallic acid, quercetin, 2,2-diphenyl-1-picrylhydrazyl hydrate (DPPH), gallic acid and tween 40 were purchased from Sigma Chemical Co. (St. Louis, MO). Linoleic acid, β-carotene and butylated hydroxytoluene (BHT) were obtained from Fluka Chemical Co. (Buchs, Switzerland).

Plant material

Melilotus Indicus was collected in March, from Hidhab region, Wilaya of Sétif in Northeast of Algeria.

Preparation of plant extract

Aqueous extract

The aerial parts of plant material were cleaned with tap water, dried in the shade at room temperature for 2 weeks and ground into powder using an electric grinder. The aqueous extract was prepared by boiling 100g of *Melilotus Indicus* powder in distilled water for 15 minutes, The resulting mixture was filtered using Wattman filter paper and then evaporated in rotary vacuum evaporator at 45°C.

Ethanollic extract

The ethanollic extract was obtained by maceration in water/ethanol mixture (20:80) for 24 h. The resultant extract was filtered through Wattman paper and the solvent was removed by rotary evaporator under reduced pressure at 45°C.

Determination of total polyphenol content

Total phenolic content was determined using Folin-Ciocalteu method, according to Li and al, [7] with slight modifications. A volume of 100 µl of the extract was mixed with 500 µl of Folin-Ciocalteu (diluted 10% in distilled water). After 4 min, 400 µl of sodium carbonate solution Na₂CO₃ (75 g/l) was added to the mixture, the reaction mixture was incubated at room temperature for 1h 30 min and the absorbance of the mixture was measured at 760 nm, Gallic acid (20-140 mg/l) was used as standard for the calibration curve. The total polyphenols content was expressed as micrograms of gallic acid equivalents (GAE) per milligram of extract. All samples were analyzed in three replications.



**Mounira Merghem et al.****Determination of total flavonoids contents**

The total flavonoids in plant extracts were determined using the aluminum trichloride (AlCl₃) method [8]. Briefly, 1 ml of 2% AlCl₃ in methanol was mixed with 1 ml of the extract. After incubation in dark at room temperature for 10 min, the absorbance of the reaction mixture was measured at 430 nm. Quercetin (1-40 mg/l) were used as standards for calibration curve and the total flavonoids content was expressed as micrograms quercetin equivalents (QE) per milligram of extract.

Evaluation of antioxidant activity**DPPH free radical-scavenging assay**

The free radical scavenging activity of the extracts was measured by 2,2- diphenyl-1-picrylhydrazyl(DPPH) assay [9]. After dissolving the aqueous extract in distilled water, the ethanolic extract in ethanol, the solution of DPPH in methanol (0.04mg/ mL) was prepared and 1250 µL of this solution was added to 50µL of extracts solution at different concentration. The mixture was shaken vigorously and then kept in the dark for 30 minutes at room temperature. Then, the absorbance was measured at 517nm. BHT and gallic acid were used as standards. All tests were performed in triplicate.

Radical-scavenging activity was calculated using the following equation:

$$\text{radical scavenging activity (\%)} = (A_{\text{blank}} - A_{\text{sample}} / A_{\text{blank}}) \times 100$$

A_{blank}: Absorbance of the control.

A_{sample}: Absorbance of the reagent with extract.

β-carotene/linoleic acid assay

In this test, the antioxidant capacity of the extracts was determined by measuring the inhibition of the oxidative degradation of β-carotene (discoloration or bleaching) by the oxidation products of the acid linoleic [10]. The β-carotene solution was prepared by dissolving 0.5 mg β-carotene in 1 mL of chloroform. One milliliter of this solution was pipetted to a flask covered with aluminum foil. Then 25 µL of linoleic acid and 200 mg of tween 40 were added. The chloroform was evaporated using evaporator at 45°C. Then 100 mL of distilled water saturated with oxygen was added. 2.5 mL of this prepared β-carotene solution were transferred to test tubes, and 350 µL of the extracts (2mg/mL methanol) were added before incubation for 48h at room temperature. The same procedure was repeated with butylated hydroxyl toluene (BHT) as a positive control and with distilled water and methanol as a negative control. The absorbance was reading at 490 nm after 1h, 2h, 6h, 24h and 48h.

The antioxidant activity of extracts was calculated using the following equation:

$$AA\% = A_{\text{sample}} / A_{\text{BHT}} \times 100.$$

A_{sample}: Absorbance in the presence of the Extract; A_{BHT}: Absorbance in the presence of positive control BHT.

Statistical Analyses

The results are expressed as the mean ± standard deviation. One-way analysis of variance (ANOVA) was performed to assess differences between groups.

RESULTS AND DISCUSSION**Total polyphenols and flavonoids contents**

Total phenolic content is considered an important indicator of the antioxidant potential of plant extracts [11]. Which function as free radical scavengers, and absorb oxygen radicals, because of their ability to transfer electrons and characteristic benzene rings [12]. The contents of total polyphenols and flavonoids in extracts are shown in Table 1. The results showed that AqE contain a total phenolic compounds (144.382 µg GAE/mg), and flavonoids (25.65 µg QE/mg) followed by EE (120.067µg GAE/mg) and (26.375 µg QE/mg).





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Antioxidant activity evaluation

DPPH radical scavenging activity

The DPPH assay is a popular method to establish the free radical scavenging potential of a sample. DPPH is a stable free radical which is scavenged (reduced) by antioxidants present in a sample. As a result, its color change from violet to pale yellow is monitored through spectrophotometer at 517 nm [13]. The scavenging ability of the extracts was expressed as IC₅₀ value, which is the concentration of substrate that causes 50% loss of DPPH activity (color) [14]. Low IC₅₀ value indicates strong ability of the extract to act as DPPH scavenger. Results of DPPH scavenging activity of *Melilotus indicus* extracts are given in Table 2. AqE exhibited the highest activity toward DPPH scavenging (IC₅₀ = 0.09 ± 0.002 mg/ml) followed by EE with (IC₅₀ = 0.28 ± 0.037 mg/ml). The interaction of an antioxidant with DPPH depends not only on the concentration but also on the structure and nature of the antioxidants. Some compounds react very quickly with the DPPH radical [15]. According to Turkmen et al., the polyphenols appear to be effective donors of hydrogen to the DPPH radical because of their ideal structural chemistry [16]. They have high reactivity as hydrogen or electron donors and also they are capable of chelating metal ions. In addition, the synergism between the individual phenolic compounds in the mixture makes the antioxidant activity not only dependant on the concentration, but also on the structure and the interaction between the compounds [17].

β-carotene/linoleic acid bleaching assay

AqE exhibited the highest antioxidant activity (70.983 ± 4.22%), following by EE with an antioxidant activity (66.169 ± 3.445 %). *Melilotus indicus*, is known for its ethnomedicinal activities such as antibacterial, anticoagulant, astringent, emollient, laxative and narcotic [5]. *Melilotus indicus* include different kinds of metabolites with free radical scavenging [18; 19; 20; 21]. Studies showed that extract of *Melilotus indicus* is rich in coumarin, herniarin, β-sitosterol, triterpenes, choline and scopoletin [6]. flavonoid glycosides, and steroids [5].

CONCLUSION

The present study was carried out to evaluate the antioxidant activity of aqueous and ethanolic extracts of *Melilotus indicus*, The results showed that *Melilotus indicus*. has an important antioxidant activity achieved by DPPH (2,2-diphenyl-1-picrylhydrazyl), β-carotene /linoleic acid bleaching tests.

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Table 1. Total polyphenols and flavonoids content of *Melilotus indicus* extracts.

Extract	Polyphenols µg GAE/mg extract	Flavonoids µg QE/mg extract
AqE	144.382	25.65
EE	120.067	26.375

AqE : aqueous extract, EE : ethanolic extract, GAE: gallic acid equivalent, QE: quercetin equivalent. Each value represents the mean ± SD (n = 3).



**Mounira Merghem et al.****Table 2: DPPH scavenging activity of *Melilotus indicus* extracts and standards.**

Extracts	IC ₅₀ (mg/mL)
AqE	0.09 ± 0.002
EE	0.28 ± 0.037
Gallic acid	0.001 ± 0.000 [#]
BHT	0.043 ± 0.003 [#]

[#]: µg/ml. Each value represents the mean ± SD (n = 3).

Table 3. Antioxidant activities of *Melilotus indicus* extracts at 24 hours of incubation measured by β-carotene bleaching method.

Extracts	Inhibition %
AqE	70.983 ± 4.22
EE	66.169 ± 3.445
BHT	100 ± 3.972
H ₂ O	30.91 ± 3.864

Each value represents the mean ± SD (n = 3).





Efficacy of Tea Tree Oil and Garlic Mouthwashes against *Candida albicans* – an *in vivo* Study

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ABSTRACT

Oral diseases continue to be a major health problem worldwide. *Candida* species are responsible for a wide range of systemic as well as superficial opportunistic infections (Candidiasis) occurring most frequently in the vaginal or oral mucosa. Studies also indicate the role of *Candida albicans* in dental caries. The impact of antifungal resistance has shifted the research focus to ethnopharmacology and ethnomedicine. The present study was conducted to evaluate the effect of mouthwashes containing garlic extract (GE), tea tree oil (TTO), and chlorhexidine (CHX) on *Candida albicans*. An *In-vivo*, with a parallel study design, was conducted among ninety 18-25- year-old subjects. GE (2.5%) and TTO (0.2%) mouthwash were prepared for use in the study. Commercially available CHX mouthwash (0.12%) was used as a positive control. The study was conducted over 5 weeks. The subjects were randomly assigned into three groups (30 subjects in each group). To assess the residual effects following discontinuation of

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mouthwashes, saliva samples were collected on the 18th and 24th days. One-way ANOVA was used to assess the mean colony difference. At baseline and on the 6th day, no statistically significant difference was observed for *Candida albicans* counts in saliva in between the three mouthwash groups. On the 12th day, 18th day, and 24th day, a statistically significant difference ($p < 0.001$) was observed between the three mouthwash groups. The least colony-forming unit (CFU) count was observed in the TTO group, followed by the CHX group on the 12th, 18th, and 24th day. The mean colony counts of *Candida albicans* in all the three groups at baseline showed significantly higher counts followed by that in the 24th day, 18th day, and 12th day respectively when compared at different intervals. Both GE and TTO mouthwashes demonstrated significant antifungal activity against *Candida albicans* in-vivo, with TTO demonstrating the greatest effect.

Keywords: Garlic, tea tree oil, *Candida albicans*, Chlorhexidine, antifungal.

INTRODUCTION

Candida species are normal commensals and are isolated intra-orally in 17% to 75% of healthy individuals and all debilitated people.[1] When an imbalance in the normal flora occurs, these fungi overgrow and cause a wide range of systemic and superficial opportunistic infections called candidiasis. [2] Along with these, *Candida* species colonize hard tooth surfaces, invade the dentinal tubules, and result in demineralization of the dental enamel and dissolution of apatite, and the development of active carious lesions.[3,4] The emergence of *Candida* strains that are resistant to the currently used antifungal agents [5], shifted the research focus to ethnopharmacology using natural medicines that are safer than synthetic alternatives, offering profound therapeutic benefits and more affordable treatment.[6,7] Garlic (*Allium sativum*) is believed to have originated in Central Asia and belongs to the *Alliaceae* family. It has been used as a medicine since ancient times because of its antimicrobial effect due to allicin, an oxygenated sulphur compound, which releases when garlic is crushed [8,9]. The tea tree oil (TTO) is essential, steam-distilled from the Australian plant, *Melaleuca alternifolia*. It is effective against a high number of gram-positive and gram-negative bacteria [10,11]. Few in-vitro studies have proven the antifungal effect of *Melaleuca alternifolia* on *candida albicans*. [12,13] The present in-vivo study was conducted to evaluate the effect of mouthwashes containing garlic extract (GE), and TTO on *Candida albicans*.

MATERIALS AND METHODS

Study population and study design

An *In-vivo* parallel study was conducted among 90 adult subjects age between 18 to 25-years. The participants were selected randomly from the Bachelor of Business Management (BBM) and Master of Business Administration (MBA) colleges in Davanagere city, Karnataka State, India. Ethical approval was taken from the institution. Written informed consent was taken from study participants.

Inclusion criteria

- Male and female subjects aged 18 to 25-years.
- The number of teeth present ≥ 20 .
- Subjects who were non-smokers.

Exclusion criteria

- Subjects with systemic illness or condition.
- Subjects who received antibiotics, steroids, or antifungal medication 3 months before study enrolment.
- Subjects with acute or chronic periodontitis.



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- Subjects with a history of allergy to mouthwashes under study.
- Subjects without written informed consent.
- Subjects with fixed or removable orthodontic appliances or removable prosthesis.
- Subjects with a history of recent extraction.
- Subjects on anticoagulant medications.

Preparation of garlic extract and tea tree oil mouthwashes

Fresh garlic was obtained from the local market. The garlic cloves were peeled, and 50 grams of cleaned fresh garlic bulbs were chopped and homogenized with 100 ml sterile distilled water. After 24 hours, the mixture was filtered through a muslin cloth and then re-filtered by passing through Whatman's filter paper No. 1. The filtrate was concentrated by complete evaporation of the solvent on a hot water bath to yield the pure extract. This extract was considered as the 100% concentration of the extract. The tea tree oil (100%) was obtained from the Department of Pharmaceutics, Bapuji College of Pharmacy, Davanagere, India. An in-vitro study was conducted to determine the Minimum Inhibitory Concentration (MIC) for garlic extract and tea tree oil. MIC was determined by the serial tube dilution test.[14,15] The garlic extract showed a MIC of 2.5% and tea tree oil 0.2%. Hence these concentrations were used for the preparation of the respective test mouthwashes. The mouthwashes were prepared in sterile distilled water with sorbitol and peppermint oil as sweetener and flavouring agents, respectively.

A pilot study was carried out among five subjects to determine the sample size and acceptability of 2.5% garlic extract and 0.2% tea tree oil mouthwashes. Based on pilot study result (mean the difference among test and controls-4.7, α error 5%, power of the study 80%), a sample of 20 was calculated, which was rounded to 30 in each group keeping in mind the possible attrition of subjects in follow-up visits. The study was conducted for a period of five weeks. The order of intervention is as follows:

The first week

Baseline, resting whole saliva samples were collected in the morning on the third and sixth day from the subjects directly in graduated sterilized polypropylene vials. The saliva samples were subjected to microbial analysis for the quantification of *Candida albicans*.

The second week

All subjects were submitted to one-minute mouthwash using a control solution (sterile distilled water) and sodium fluoride dentifrice, carried out after the last tooth brushing of the day. Resting whole saliva samples were collected in the morning of the third and sixth days and were subjected to microbial analysis.

The third week

Subjects were randomly allocated by lottery method into 3 study groups (Group A, B, and C) with 30 subjects in each group. The three study groups were:

Group A: Garlic extract mouthwash (2.5%)

Group B: Tea tree oil mouthwash (0.2%)

Group C: Chlorhexidine mouthwash (0.12%, Facemed Pharmaceuticals Private Limited, Delhi, India).

All the participants received brief instructions for the procedure they had to perform, i.e., oral rinsing, in addition to their routine tooth brushing. Subjects were provided with measuring cups of 10 ml and were instructed to use 10 ml of mouthwash for one minute carried out after the last tooth brushing of the day for seven days. Each subject was provided with a sodium fluoride dentifrice (Close up®, Hindustan Unilever Ltd). All the subjects were instructed to follow their routine oral hygiene practices and the assigned regimen and maintain a chart on daily product use. During their visit, compliance with their study regimen was assessed. During the study period, the use of oral



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hygiene tools other than the attributed was strictly prohibited. Resting whole saliva samples were collected in the morning of the third and sixth days and subjected for microbial analysis (mouthwash groups mean).

Fourth and fifth week

The treatment was discontinued. Resting whole saliva samples were collected once a week for microbial analysis (4th and 5th week mean counts) to observe the re-growth or antimicrobial residual effects upon *Candida albicans*.

Collection of saliva

On the day of saliva collection, participants were instructed to refrain from oral hygiene practice and breakfast until the collection of samples. To control the circadian variations, samples were collected between 7:00 am – 8:00 am. The subjects were instructed to let saliva collect on the floor of the mouth without swallowing it for at least 1 min, and then to expectorate into the graduated sterile vial. This procedure was continued for a period of 5 minutes. The vials with the saliva samples were carried in a vaccine carrier with a freezing mixture to the laboratory, where samples' analysis was done on the same day.

Microbial analysis

The saliva sample was homogenized manually by stirring using a stirrer. A 100 µl of saliva was diluted with 1 ml of sterile peptone water to obtain a 1:10 dilution of saliva. 100 µl of the diluted saliva was further added to 1 ml. of sterile peptone water to obtain a dilution of 1:100. This procedure was repeated to obtain a dilution of 1:1000. This dilution of saliva was used for microbial analysis. *Candida albicans* was cultured on Sabouraud's Dextrose agar. Using an inoculation loop (2mm inner diameter) five µl of the 1:1000 dilution sample was streaked on Sabouraud's Dextrose agar under strict aseptic conditions. The agar plates were incubated for 48 hours at 37°C, aerobically in the incubator. After 48 hours of incubation, *Candida albicans* appeared as white or cream, smooth and glistening colonies. Colonies so identified based on their morphology were counted using an electronic colony counter.

Blinding

The containers with different mouthwashes were coded as I, II, and III. The participants, the person who collected the saliva sample, and the person who did the microbial and statistical analysis were blinded regarding the material used.

Statistical analysis

Data collected by experiments were computerized and analyzed using the Statistical Package for Social Sciences (SPSS) version 17.0. One way Analysis of Variance (ANOVA) and repeated measure ANOVA was used for multiple group comparisons followed by Tukey Post Hoc for group-wise comparison. For all tests, a p-value of < 0.05 was considered statistically significant.

RESULTS AND DISCUSSION

Table 1 compares *Candida albicans* counts in saliva amongst the three mouthwash groups at different time intervals. At baseline and on the 6th day, no statistically significant difference was observed for *Candida albicans* counts between the three mouthwash groups ($p = 0.067$ for baseline and $p = 0.647$ for the 6th day). On the 12th day, 18th day, and 24th day, a statistically significant difference ($p < 0.001$) was observed between the three mouthwash groups. The least CFU count was observed in the TTO group, followed by the CHX group on the 12th, 18th, and 24th day.

Table 2 shows the mean colony counts of *Candida albicans* in saliva at different time intervals following the different mouthwashes. There was a statistically significant difference between the mean counts of *Candida albicans* at different time intervals for all three groups ($p < 0.001$). The mean colony counts of *Candida albicans* in all the three groups at



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baseline showed significantly higher counts followed by that in the 24th day, 18th day, and 12th day respectively when compared at different intervals. The present in-vivo study was conducted to evaluate the effect of mouthwashes containing garlic extract (GE) and tea tree oil (TTO) on *Candida albicans*. The therapeutic agents were delivered in mouthwash preparation because of the effective delivery of therapeutics, focusing on the penetration of ingredients between the teeth [16-18].

Candidal infections occur in a variety of instances from childhood throughout adult life. From causative agents for dental caries to an opportunistic infection during the immune compromised condition, candida infection has also been associated with many systemic conditions, including diabetes mellitus, malignancies, HIV infection, drug-induced infections, etc [19-21]. Allopathic medications are effective in the treatment of oral fungal infections including candidiasis. However, long-term use of antifungal drugs has proven toxic effects, with the development of resistance to these medications [5,22]. In the present study, Chlorhexidine was used as a positive control to compare other products' efficacy since it is believed that chlorhexidine is a gold standard. However, the incidence of side effects such as undesirable tooth discoloration, unpleasant taste, dryness, and burning sensation in the mouth discourage patients from using this mouthwash. An *In-vitro* study was done before the in-vivo study to assess mouth rinses' antifungal activity and determine the MIC. In agreement with previous in-vitro studies,[23-26] present results showed antifungal activity of GE and TTO against *Candida albicans* on Sabouraud's Dextrose agar with MIC of 2.5% and 0.2%, respectively.

The present in-vivo study result showed the effectiveness of TTO mouthwash against candida species. The observed antifungal effectiveness is significantly greater than that of 0.12% CHX mouthwash. However, the garlic extract mouthwash demonstrated antifungal effectiveness significantly lower than CHX. The CFU count analysis till the 24th day showed a probable carryover effect in all three groups over a period of 2 weeks after discontinuing the mouthwashes. Comparison of present in-vivo results with previous studies was limited due to the scarce availability of in-vivo studies regarding the effect of garlic and tea tree oil mouthwashes against *Candida albicans*. A previous study by Thomas et al. showed significant antifungal effectiveness of Garlic and lime mouthwash against *Candida albicans* [27]. Antifungal effect of fresh garlic extract may be attributed to its allicin content, an oxygenated sulphur compound, which inhibits the thiol enzyme. Maghu et al. demonstrated the efficacy of tea tree oil rinse in oral fungal infection.[28]Antimicrobial activity of TTO is attributed to its hydrocarbon structure and attendant lipophilicity, which increases the permeability of *Candida albicans* [29]. High antifungal effectiveness of TTO is also attributed to its less miscibility in saliva. Therefore, it will remain at the affected site for a longer time, thereby producing a better pharmacological effect [30]. Hence, mouthwashes are a preferred route of medication delivery topically for effective management of oral fungal infections.

The present study's findings suggest that herbal mouthwashes may be an alternative to conventional mouth rinses in the management of candidal infections. This study illustrates the need for modern medicine and science to turn its attention to the plant world once again to find a new medicine that might cure various diseases and conditions in a safe way.

CONCLUSIONS

All of the three types of mouthwashes namely, garlic extract (2.5%), tea tree oil (0.2%), and chlorhexidine (0.12%) mouthwash, when used in undiluted form for one minute at a volume of 10 ml, once daily after the last tooth brushing of the day for one week, demonstrated significant antifungal activity against salivary *Candida albicans* which was evident by the reduction in the number of the respective microorganisms after the intervention when compared with the baseline counts. After the intervention, comparing the three mouthwash groups demonstrated that the highest reduction *Candida albicans* counts was exhibited by tea tree oil mouthwash followed by chlorhexidine mouthwash and garlic extract mouthwash. All the three types of mouthwashes also showed significantly reduced



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levels of *Candida albicans* in saliva in the two follow up intervals (18th day and 24th day) with the least number of colony counts in the 18th day, which represents that the three types of mouthwashes demonstrated residual effects after the mouthwash was discontinued.

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Table 1: *Candida albicans* counts in saliva amongst the three mouthwash groups at different time intervals (expressed as 10³ CFU/ml).

	Garlic extract mouthwash (A)	Tea tree oil mouthwash (B)	Chlorhexidine Mouthwash (C)	ANOVA	Tukey post Hoc
Baseline	23.83± 1.40	24.20 ± 1.26	23.90 ± 1.31	F = 5.4 p = 0.06	A = B (p = 0.322) B = C (p = 0.918) A = C (p = 0.215)
6 th day	23.78 ± 1.01	24.02 ± 0.84	23.97 ± 1.06	F = 7.5 p = 0.06	A = B (p = 0.483) B = C (p = 0.828) A = C (p = 0.056)
12 th day	21.17 ± 0.86	5.33 ± 0.86	18.68 ± 0.80	F = 28.2 p = 0.0001	A > B (p<0.001)* B < C (p<0.001)* A > C (p<0.001)*
18 th day	22.60 ± 0.85	18.77 ± 1.69	21.37 ± 1.10	F = 18.3 p = 0.001	A > B (p<0.001)* B < C (p<0.001)* A > C (p<0.001)*
24 th day	23.73 ± 0.94	20.30 ± 1.26	22.70 ± 1.02	F = 19.1 p = 0.001	A > B (p<0.001)* B < C (p<0.001)* A > C (p<0.001)*

(P value < 0.05 –Significant)





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Table 2: Mean colony counts of *Candida albicans* in saliva at different time intervals following the use of the different mouthwashes. (expressed as 10³ CFU/ml of saliva)

		Garlic extract mouthwash	Tea tree oil mouthwash	Chlorhexidine mouthwash
Mean Baseline (1)		23.83 ± 1.40	24.20 ± 1.26	23.90 ± 1.31
Mean 6 th day sample (2)		23.78 ± 1.01	24.02 ± 0.84	23.97 ± 1.06
Mean 12 th day sample (3)		21.17 ± 0.86	5.33 ± 0.86	18.68 ± 0.80
Mean 18 th day sample (4)		22.60 ± 0.85	18.77 ± 1.69	21.37 ± 1.10
Mean 24 th day sample (5)		23.73 ± 0.94	20.30 ± 1.26	22.70 ± 1.02
Repeated measure ANOVA	F value	27.9	37.6	22.5
	p value	0.0001	0.0001	0.0001
Tukey post Hoc		1 > 5 > 4 > 3 1>2, p =0.786 1>5, p <0.001 5>4, p <0.001 4>3, p <0.001	1 > 5 > 4 > 3 1>2, p =0.173 1>5, p <0.008 5>4, p <0.001 4>3, p <0.001	1 > 5 > 4 > 3 1>2, p = 0.372 1>5, p <0.001 5>4, p <0.001 4>3, p <0.001

(1 = Mean Baseline; 2 = Mean 6th day sample; 3 = Mean 12th day sample; 4 = Mean 18th day sample; 5 = Mean 24th day sample)





Financial Literacy: The Requisite for a Developing Society

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ABSTRACT

Financial literacy is an important phenomenon as the above stated situation can solve safely, promptly and with a great assurance if one is aware of these financial tools. Thus, we can say financial literacy is about empowering and enlightening individuals about the financial concepts, tools, techniques, products and services available in the market. It's about provisioning knowledge about finance so that they can use the same in evaluating the financial opportunities, choose the best one and thus can take well informed financial decisions.

Keywords: Education Science Services, Financial literacy, online education, products mobile banking

INTRODUCTION

The revolutionary changes in the financial market has made it mandatory for the consumers to be more informed, knowledgeable and efficient in managing their finance. With this background the understanding of financial concepts, products, services and the relationship among various financial principles is necessary in order to have financial security and stability. The world as on today is open with various options of investments, as the financial market provides ample of investment opportunities, the access to financial services has been increased through technology, easy payment options through the use of credit cards, debit cards, net banking, mobile banking as well as now a day mobile wallet makes it easier to pay and to receive money as and when needed. Today, the financial market offers various options for saving as well as investments. Also, there are numerous tools like debit cards, credit cards, online transaction facilities, online trading of securities which require awareness of how these tools work. The personal involvement of women in the financial market has increased. The world at large has realised the fact that it is important for women to be financially literate so as to take well informed financial decisions resulting in favourable financial outcomes. Financial literacy is the ability to understand, access, and utilize information regarding monetary concepts and institutions so that it contributes to money management. There is an increased responsibility on the individuals to take their financial decisions wisely because of the availability of variety of financial products and services. It is imperative that individuals should develop sound understanding of the world

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of finance, to be more knowledgeable and competent in managing the finance and for that it is necessary to choose such products and services that are most appropriate to their financial goals and needs. Individuals who are not literate about the financial concepts usually saves less, only few of them plans with regard to their retirement needs and thus, majority get engaged in the high cost mortgages.

Literature Review

Hogarth, (2002) defined financial literacy as the ways how people manage their money in terms of insuring, investing, saving and budgeting. It is about the capability to understand the basic financial concepts, and the ability to use them to plan and manage their financial decisions. The evidence collected revealed that an individual who have better understanding of the financial market and highly educated as well can manage efficiently their money in terms of insuring, investing, saving and budgeting, take effective financial decisions and can make their future as financially stable and secure.

Marcolin and Abraham, (2006) argues that Financial literacy is the ability of managing money effectively and efficiently on financial decision making process.

OECD and INFE, (2011) the OECD definition of financial literacy is that it as "A combination of awareness, knowledge, skill, attitude and behaviour necessary to make sound financial decisions and ultimately achieve individual financial wellbeing."

Beck, T., Demirguc-Kunt, A., & Peria, M.P.M, (2008) states Financial literacy is a set of knowledge and skills necessary for people to financially secure themselves and to behave actively in the market of financial products and services. It is one of the parts of economic literacy. The numerical literacy being the use of mathematical skills to solve numerical problems), information literacy being the ability to search, evaluate and use the relevant information and legal literacy are being associated with financial literacy. If a citizen is financially literate, he is capable enough to understand concepts related to finance, how the market mechanism works to determine the prices, how bank performs the various financial functions and can manage their personal budget effectively.

Michael, (2009) states that the ability to make well informed decisions of an individual can't be there if there is no financial literacy. So, in order to solve any concern related to financial decision making, if one is not financially literate. For people who exhibit problems with financial decision making, financial advice can be a better substitute for the financial capabilities required.

Dvorakova, (2009) The definition of the financial literacy follows financial literacy is a set of knowledge, skills and attitudes of citizens necessary to financially secure themselves and their family in contemporary society. Financially literate citizens are well versed in issues of money and prices, are actively performing in the market of financial products and services and are able to responsibly manage their personal or family budget, including the management of financial assets and financial liabilities with regard to changing life situations.

Remund, (2010) argues that financial literacy is a measure of the degree to which one understands key financial concepts and possesses the ability and confidence to manage personal finances through appropriate short-term decision-making and sound, long-range financial planning, while mindful of life events and changing economic conditions.

Adams and Rau, (2011) concludes that financial literacy is an important concept whose awareness helps an individual to make proper financial plans for his retirement. His studies demonstrated that having a clear understanding of the basic concepts and principles of saving and investments has a direct effect on financial preparation.

Jason West, (2012) However identified that it is not necessary that individuals who are able enough to use and manage money properly, that is, are financially literate will reveal good financial behaviour. Financial literacy programs can increase the level of financial knowledge but in no case can improve the financial behaviour of consumers. To improve financial behaviour of the consumer which is an important dimension identified of financial literacy in an individual. He should be educated on the psychological biases, limitations observed in research so as to overcome the same.



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Nayak, (2012) To have a secure, safe and financially settled life is very essential for every individual's life. The expenses now a day of every individual has been increased by leaps and bounds, there is thus a substantial increase in their consumption related expenditure. Lack of financial literacy may cause long term serious problems. The result of all these is observed in a drop in the saving rates of an individual.

Agarwalla, (2013) states those now days the educational level is comparatively higher. However, this high education level does not result into rise in the level of financial literacy. The study finds that the general education process is not so effective as far as financial literacy is concerned because there is absence of necessary material in the education system.

Mahdzan, N.S., Tabiani, S., (2013) states how financial literacy is positively associated with individual saving behaviour. The research work examines the various factors which determine the financial literacy level like the ability of risk taking, saving behaviour, socio demographic characteristics. The frequency to save in a systematic and regular manner is influenced to a greater extent by education level, gender and income pattern of an individual. Studies insisted that the saving pattern among the household can be influenced positively if financial education is imparted by arranging regular financial education programs.

Bhushan & Medury, (2013) identifies that the level of financial literacy in India, being low, in comparison to other countries. The financial literacy is largely affected by gender, age, education, nature of employment but is not affected by age and geographic location of an individual.

Sane, (2014) When the level of financial literacy is low because of very restricted access to the financial education it does not allow an individual to properly perform his wealth planning resulting in serious consequences like social and economic ones.

Ciemleja, et al. (2014) has done the practical evaluation of financial literacy and suggests that it is necessary to measure the level of financial literacy among the individuals so as to know how efficient is the education system, to identify the gaps in the level of financial knowledge and for all of such concerns it is important to have a reliable instrument to measure the same. In order to measure the financial literacy level, the understanding of various related concepts and components, factors affecting the financial literacy and the evaluation instrument needed for the same should be clear. The researchers also suggested that the measuring the level of financial literacy is necessary for intra country as well as inter countries comparison of the literacy levels.

Financial literacy

Financial literacy not only aims at making an individual equipped with financial decision making capabilities but also to raise the level of awareness about financial risks, products and services, rights and responsibilities, market at a large. There is a systematic lack of personal finance education in our education system resulting serious financial illiteracy, costly consequences and thus affecting personal productivity in work place. There is tremendous development in the financial market various policy makers as well as the decision makers identify the need of increasing the financial literacy level among the public. Today, making the individuals financially literate is one of the areas of concern, one of the national strategies to boost the economic growth in the country. In order to improve the financial well-being of citizen's government of many nations accepted financial literacy as one of the national strategies and for the same many financial education programs are organised at a large scale world-wide.

Today, the financial market is highly vulnerable. A lot of complexities are being identified in various avenues like derivative trading, credit schemes, loan options, saving and investment scheme, insurance – banking facilities, timely payment of installments etc. The issue of financial literacy is being identified as of great concern internationally because of increasing magnification of international transactions, mobility of men and machines due to liberalized economies worldwide. Because of low level of financial literacy people cannot take sound financial decisions. Majority of time they are in financial stress and thus, anxiety prevails in their life affecting financial security and stability. Knowledge and enlightenment of financial concepts, principles can help to effectively control the emotions that affect the rubber cultivators' financial decision making and make them more confident on financial management capabilities.



**Santhosh****CONCLUSION**

An individual can plan a lot with regard to the available credit options, insurance coverage, transparent financial services. Thus, the consumer if is financially literate can create pressure on the government and financial institutions to work in the right direction with regard to the market standards. Thus, financially literate consumer reinforces healthy pressure on market players for fair prices and negotiation, transparency in prices and services. Financial literacy is being identified as a mechanism which goes beyond the provisioning of financial information and advice, provides an understanding of various products belonging to financial market, the related risk and return attached so as to make proper decisions and to save an individual from potential market abuses. Financial literacy being defined as the basic of financial knowledge, essential skills for all round development of society. It is one of the essential commodities for the mankind for survival and development.

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Budgeting and Budgetary Control Practices - A Study With Reference To Visakhapatnam Steel Plant

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ABSTRACT

A financial plan is a foreordained assertion of the executives strategy during a given period, which gave a norm to examination with the outcomes really accomplished. Budgetary control is an arrangement of controlling the expenses incorporates the spending readiness, interdepartmental coordination and their responsibilities, comparison of Budget prepared and the amount spent to achieve maximum profitability. Visakhapatnam steel plant is preparing the budgets with most care effectively. Still it should focus at preparing actual figures of budgeted expenditure to achieve maximum profitability.

Keywords: Budget, Budgetary Control, Total Expenditure, Actual Cost, Net Profit, Cash Profit, Gross Margin, Gross Sales, Net Sales, Total income, Net Income.

INTRODUCTION

In any country, economy relies upon the solid base of the iron and steel industry. It is an adaptable material with numerous valuable properties, making and accomplishing ceaseless development of the economy as development, fabricating foundation or consumables. For the development of any association arranging is vital. Plans are outlined to accomplish better outcomes. Control is the way toward checking if the plans are being clung to. Revenue driven arranging and control, Budgets are the main apparatus.

Need for the Study

There is a special role of every industry barring up on the need essentiality where everything need to be done in accordance with standards that are regulated by the government. To get this, applied thought isn't just adequate yet in addition it needs a wide information and comprehension of the variables that are influencing them.



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Presently, the investigation includes breaking down every one of the boundaries which will show the spending negative at the beginning of preparation the monetary year to End up with high emphatically toward the finish of the monetary year. The investigation of planning in RINL, Visakhapatnam assists with getting viable information on scholastic learning.

Objectives of the study

1. To contemplate the authoritative profile of the RINL, Visakhapatnam.
2. To study the theoretical concept of budgeting and its significance.
3. To study the process of preparing budgets in RINL, Visakhapatnam.

Limitations of the study

1. The time of study that is two months was sufficiently not to do concentrate exhaustively.
2. The examination is restricted to 6 years information from 2011 to 2017.
3. The investigation is done with communication of the workers in the monetary office and they gave the data and records gave by the association the consents from the Concerned Superior power.

INDUSTRY**Introduction**

India's Steel Industry is over extremely old. Creation of Steel in India included simply by the Tata Steel, was refereed to as the lone significant private area organization. After that Sail and Tata Steel have generally been the significant steel makers of India. The advancement of the India economy prompts the kickoff of different ventures remembering the steel business for the year 1992. This lead to the expansion in the quantity of makers, expanded interests in the steel business and expanded creation limit. India in 2015, remains in the tenth Place in the creation of Steel addressed TATA steel Company and Now its position raised to eighth biggest maker of steel on the planet with a creation limit of 35million tones. The Consumables, Construction bars, Mild steel bars, all assortments of steel is created in India. Contingent upon the utilization of steel in the homegrown market, development of the steel business in India will change in an enormous way either emphatically or adversely.

Size of the India's Steel Industry

The size of India's steel industry has expanded impressively lately. The steel business in India has capital ventures of more than Rs 100,000 crores. The size of the any Industry depends on the space and apparatus as well as on the work strength and it has crossed 2,000,000 roughly both immediate and circuitous business.

Global Demand for Steel and Indian Steel Industry

The worldwide interest for steel is at a record-breaking high these days. A significant part of the huge interest for steel all throughout the planet might be credited to the various development projects that are going on around the world. Since India has a great deal of iron metals, we can create adequate measure of steel and the specialists are additionally gone to the assessment that the development of steel industry in India would proceed in the coming years. Dislike significant economies like China and the United States of America, the way that India is certainly not a ravenous purchaser of steel implies that would have the option to utilize the excess steel it produces for trading to different nations so their requests are met.

PROFILE OF VISAKHAPATNAM STEEL PLANT

"One of the significant steel makers in India is Visakhapatnam Steel Plant, prevalently known as vizag Steel" First coast based steel plant of India is Visakhapatnam steel plant. VSP has an introduced limit of fluid steel of 7.3 million tones for each annum and saleable steel of 6.773 million tones. VSP items fulfill demanding global quality guidelines, for example, JIS, DINAND BIS, and BS and so on.





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VSP has become the principal incorporated steel plant in the nation to be guaranteed for climate the board (ISO-14001), for Occupational Health and Safety (OHSAS-18001).

Introduction

The material that involves the first spot among the materials being used today and overruns varying backgrounds is Steel. The versatility of steel with assortment of valuable properties making it feasible for persistent efficient development. By knowing the significance of steel, the accompanying incorporated steel plants with unfamiliar cooperation were set up in the public area in the post autonomy period:

Sl. No	Steel plant	Collaborated by
1	Durgapur steel plant	Britain
2	Bhilai steel plant	Erstwhile USSR
3	Bokaro steel Plant	Erstwhile USSR
4	Rourkela steel plant	Germany

VSP Technology: State-of-the-Art

1. 7 meter tall coke broiler batteries with coke dry extinguishing.
2. Greatest Blast Furnaces in the country
3. Ringer less top charging framework in impact Furnace.
4. 100% slag granulation at the BF cast house.
5. Stifled burning - LD gas recuperation framework.
6. 100% constant projecting of fluid steel.
7. "Tempore" and "Stelmor" cooling measure in LMMM and WRM.
8. Broad waste warmth recuperation frameworks.
9. Thorough contamination control measures.

Major Sources of Raw Materials

Raw Material	Source
Iron Ore Lumps & Fines	Bailadilla, MP
BF Lime Stone	Jaggayyapeta, AP
SMS Lime Stone	UAE
BF Dolomite	Madharam, AP
SMS Dolomite	Madharam, AP
Manganese Ore	Chipurupalli, AP
Boiler Coal	Talcher, Orissa
Coking Coal	Australia
Medium Coking Coal (MCC)	Gidi/Swang/Rajarappa/Kargali

VISION, MISSION AND OBJECTIVES

VISION

To be a constantly developing a-list organization we will:

1. Harness our development potential and support beneficial development
2. Deliver top caliber and cost cutthroat items and be the best option of clients
3. Create a moving workplace to release the innovative energy of individuals
4. Achieve greatness in big business the executives.
5. Be a regarded corporate resident, guarantee spotless and green climate and foster energetic networks around us.





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MISSION

Through innovative up-degree, operational effectiveness and extension fulfillment of 16 million ton fluid steel limit; To deliver steel at worldwide guidelines of cost and quality; and to meet the goals of the partner there ought to be a guaranteed supply of crude materials.

Goals

1. As per the corporate arrangement by 2011-12, expansion of Plant ability to 6.3 Mt. with the mission to extend further in resulting stages.
2. To make existing impact heaters energy proficient to contemporary levels and to expand their ability by 1.0 Mt, in this manner making absolute hot metal ability to 7.5 Mt.
3. To be one of the best five most minimal expense steel makers on the planet.
4. Achieve consumer loyalty to the pinnacle levels.
5. Vibrant work culture in the association.
6. Be proactive in rationing climate, keeping up undeniable degrees of security and tending to social concerns.

Theoretical Frame work of Budget

Introduction:

The fundamental administrative capacity is arranging and furthermore helps in deciding the strategy to be followed for accomplishing hierarchical objectives. It is a choice ahead of time, what to do, how to do and who will do a specific undertaking? Plans are outlined to accomplish better outcomes. Control is the way toward checking if the plans are being clung to. The main apparatus of benefit arranging and control and go about as an instrument of co-appointment are financial plans..

Definition

Spending plan is characterized as a sort of future bookkeeping in which issues of future are met on the paper before exchanges really happen. As per CIMA, Official Terminology, "A Budget is a monetary and additionally quantitative assertion arranged preceding a characterized timeframe, of the approach to be pressed together during that period to achieve a give objective".

Need of the spending plan

1. To figure and to get ready for the future to stay away from misfortunes and boost benefits for example to help in arranging.
2. To achieve coordination's between various capacity of a venture i.e., to help in co-appointment.
3. To control genuine activities by guaranteeing that real are on top of target i.e., to help in controlling.

Essentials of the financial plan

1. Budget is set up ahead of time for future activity.
2. Budget depends on accomplishments to be finished during an unmistakable future period.
3. Budget is an instrument for fostering the co-activity, co-appointment and control among workers.

Advantages of the spending plan

1. It figures essential strategies important to accomplish authoritative destinations.
2. It powers all degrees of the board to take part during the time spent setting and Fulfillment of targets.
3. It makes the sensation of co-activity and comprehension between various Departments of the business
4. It guarantees ideal use of assets so as to boost returns.
5. It features upon the in effectiveness in the business and in this way helps the
6. Management to make healing moves.





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Budget, Budgeting and Budgetary Control

The blue print of an arrangement communicated in quantitative terms is Budget. The method utilized for planning spending plans is Budgeting. On the other hand, the thing that alludes to the standards and strategies of accomplishing given destinations through financial plans is called Budgetary control.

Destinations of Budgetary Control

For strategy arranging and control budgetary control is fundamental and furthermore it goes about as an instrument of co-appointment. The principle targets of budgetary control are as per the following:

1. By setting up different financial plans, to guarantee making arrangements for future.
2. The exercises done by various offices are to be facilitated.
3. Efficiently and monetarily working different offices and cost focuses.
4. Elimination of wastage of materials and expansion in the benefit of the organization.

Qualities of Good Budgeting

1. Including of people at various levels while setting up the financial plans tends to great planning framework.
2. Authority's appropriate obligation and obsession ought to be there and there ought to be a legitimate method of assignment of power.
3. The focuses of the spending plan ought not be too high that they can't be accomplished.
4. A great arrangement of bookkeeping is additionally crucial for make the planning fruitful.

Advantages of Good Budgeting

The budgetary control framework deals with choosing the objectives and endeavors are made appropriately till accomplishing its objectives. Benefits of budgetary control are:

1. Maximization of benefit: The fundamental point of budgetary control is to accomplish greatest benefits. There ought to be an ideal arranging and co-appointment of various capacities to accomplish this objective .
2. Co-appointment: There ought to be a legitimate co-appointment between the working of various areas and offices. For accomplishing planned focuses on, the coordination of different chiefs and subordinates is essential.
3. Tools: Various divisions are given focuses by Budgetary control which thus gives a device to estimating administrative execution. For deciding the deviations, Actual outcomes are contrasted with planned targets.
4. Economy: There will be orderly arranging of consumption and there will spend of economy. The advantages inferred for the worry will at last reach out to industry and afterward to public economy.
5. Determining shortcoming: The deviations in planned and real execution will empower the assurance of frail games. Endeavors are focused on those viewpoints where execution is not exactly the specified.
6. Corrective activity: The management, at any time, should be prepared to take remedial measures at whatever point there is inconsistency in execution.

Limits of Budgetary Control

Limits of budgetary control are:

1. Questionable future
2. Budgetary modifications required
3. Debilitate effective people
4. Issue of co-appointment
5. Struggle among various offices
6. Relies on help of top administration





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Key components

The factor that restricts the complete movement is known as key factor which impact spending plans. It is additionally called chief spending factor. Coming up next are instances of key factor:

1.	MATERIALS	i) ii)	Availability of supply Restriction imposed by licenses, quotas etc.,
2.	LABOUR	i) ii)	General storage Less number of skilled labor
3.	SALES	i) ii) iii)	Consumer demand Inadequate advertising and warehousing facilities Dearth of experience or successful salesman;
4.	PLANT	i) ii) iii)	Limited capacity due to lack of capital Limited capacity due to lack of space In sufficient capacity due to shortage of supply; Bottleneck incretion key processes;
5.	MANAGEMENT	i)	Insufficient capital

Spending Committee

Spending advisory group generally manages spending arrangements, which incorporates the accompanying leaders:

1. Chief leader
2. Production administrator
3. Sales administrator
4. Materials administrator
5. Standards and quality control administrator
6. Finance administrator
7. Other departmental heads.

Budgetary Process in Visakhapatnam Steel Plant

Each association gets ready financial plans with the goal that it can get ready for its future and meet any unexpected possibilities and Visakhapatnam. Steel plant is no special case for this standard. In numerous associations, the budgetary interaction is taken up by any senior chief of account office. Since VSP is an enormous association it has a different spending segment in the account office, which deals with the budgetary cycle.

Destinations of Preparing Budget in Visakhapatnam Steel Plant. The destinations at planning Budget in Visakhapatnam Steel Plant

1. To produce benefits and define the arrangements to accomplish the objective.
2. To perform coordination and co-appointment among the different divisions like development office, works office, crude material taking care of office, money office, and so on
3. To inspire the firmly related offices and the people for accomplishing the ideal objective.
4. To go about as a manual for the board choice so the executives can realize how effectively the targets being accomplished.

Building up spending Centers

A spending place is characterized by the budgetary control as the association of any private or public endeavor. Visakhapatnam Steel Plant has various well is on the premise at assortment of firmly related works into one spending community.

a) Corporate arranging Department: This office is going by the General Manger (Corporate Planning) and crafted by strategy to be drawn up by this association is to be taken consideration by this office.





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- b) Medical Department: Headed by the central clinical official, this office deals with keeping up the wellbeing of the representatives of the organization and their area of expertise
- c) Marketing Department: Headed by General Manager (Marketing) this division deals with obtaining orders for the organization and selling the merchandise delivered by Visakhapatnam Steel Plant
- d) Works Department: Headed by Director (Operation), this is the life and surge of the organization as this office deals with assembling the different things.
- e) G.M. (Upkeep) Department: Heads by General Manager, this office is endowed with the obligation of keeping up the different machines and downplaying the separate level.
- f) Information Technology Department: This division deals with keeping up the different PC offices in the organization and improving the effectiveness of creation.
- g) Ancillary Development Department: Headed by General Manager (Ancillary Development) this office deals with over seeing the improvement at subordinate businesses in and around the plant.
- h) Town and Administration Department: Headed by the Chief Town Administrator, this office deals with keeping up the Steel Plant municipality and meeting its prerequisites.
- i) Personnel Department: Headed by Director (Personnel), this office deals with keeping up worker records.
- j) Commercial Department: Headed by Director (Commercial), this office deals with material administration in the organization.
- k) Project Division: Headed by Director (Operation) this division deals with the development action in the plant.
- l) Human Resource Development: This division deals with fostering the abilities of the workers by leading different character improvement programs.
- m) Training Department: This division deals with giving hands on preparing and off the work preparing for new enlists
- n) Finance Department: Headed by Director (Finance) this division deals with playing out the different monetary exercises at the organization. It additionally readies the compensation rolls.

Spending Manual

A spending manual is characterized as a record that contains the subtleties identifying with planning association and method which empowers each representative of the association to think about their spending plan. Visakhapatnam Steel Plant additionally has an all around spread out spending manual which enrolls the obligations of various chiefs and Headed of Department of different spending places.

Spending Committee

A spending board is a gathering of chiefs at different significant capacities eg. Overseeing chief, Works Manager, Production Manager, Sales Manager, Accountant and so on, in Visakhapatnam Steel Plant, the spending council comprises of the Board at Directors, Chairman-cum-Managing Director of Visakhapatnam Steel Plant.

Spending Period

It alludes to the period for which the financial plan is arranged and utilized. There is no fixed time for spending period. The length of the period relies upon.

1. The nature of the creation.
2. The local of the interest and supply of the item
3. Extent of control.

Key Factor

The factor, which restricts the absolute action, is known as the critical factor because of troublesome and the significant expenses engaged with the acquisition of crude materials and furthermore because of less interest for the item.





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Computation of Items in MWR (Monthly Working Result)

1. Gross Sales: Data took care of from month to month NSR report given by the Branch deals A/cs is sufficient to figure the gross deals.
2. Net Sales: Data took care of from Monthly NSR report given by the branch Sales A/cs is additionally enough to ascertain the net deals.
3. Export Benefits: This thing is inferred dependent on the Export benefits per ton and Export Quantities given by Export Sales Section. (Fare Benefit = Export advantage per ton X Qty Exported)
4. Interest on Term Deposit: Interest can be straightforwardly from information given by the money Section.
5. Interest Others: This thing is assessed dependent on before year information, However consolidation of administrations to be done to current year information.
6. Miscellaneous Income: This thing is assessed dependent on earlier year. Anyway consolidation of administrations to be done to current year information.
7. Raw Material Consumption: Consumption amounts of different Raw material are esteemed at weighted normal costs of similar utilization amounts incorporates Handling misfortune, Transit misfortunes, Moisture misfortune and so on
8. Stores and Consumables: This thing can be gotten dependent on stores JV subtleties acquired from stores accounts. And furthermore from General records voucher subtleties.
9. Employees Remuneration & Benefits: This thing can be gotten dependent on Salary JV produced by pay area and a few things under this gathering depend on gauges dependent on before year's information.
10. Power, Fuel & Water: This thing can be gotten dependent on utilization amounts given by DNW and PPM and evaluating data given by MM Department.
11. Repairs and Maintenance: This thing depends on voucher information got from General Accounts, Operation Bills, Works charges, Stores Accounts and so forth Some are assessed at earlier year level.
12. Other Expenses: This thing depends on assessed authoritative rates for scrap handling amounts and some are based on assessments at earlier year genuine level.
13. Adjustments: All the above things are emotional to modification or changes dependent on real factors and likely arrangement that may emerge.

Gross Sales

Interpretation: From the table 1 it is observed that gross sales revealed adverse conditions in all the years. It recorded gross sales for actual less than the budgeted due to more economic pressure.

Net Sales

Interpretation: From the table 2, it is observed that net sales revealed adverse conditions in all the years.

Total Income

Interpretation: From the table 3, it is observed that the total income revealed adverse conditions in all the years.

Total Expenditure

Interpretation: From the table 4, it is observed that expenditure was favourable in five years. But remaining one year expenditures are adverse. There existed a big gap between budgeted and actual expenditure of the organization. Actual expenditure is less than budgeted; it shows the good efficiency of the organization in estimating the expenses.

Gross Margin

Interpretation: From the table 5, it is observed that the gross margin is adverse to the organization in all the years except for the year 2011 – 12.





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Cash Profit

Interpretation: From the table 6, it is observed that the cash profit is not at all favourable to the organization from 2012-13, 2014-17.

Net Profit

Interpretation: From the table 7, it is observed that the net profit is more amount is in adverse conditions in last three years. The company highest net loss in 2015.

FINDINGS

1. The actual total expenditure is less than the budgeted figures. It reflects very good and efficiently work done in estimating by the organization.
2. During all the years, all actual incomes are less than the budgeted figures. On other hand, actual figures of expenditure are also less than the budgeted.
3. The firm failed to forecast the actual raw material cost. The original cost of raw material is more than budgeted.
4. The firm properly forecasted the incomes but failed to forecast expenditure.

SUGGESTIONS

- 1.The company should take proper steps to reduce the expenses to enjoy maximum gains.
- 2.It is advised to forecast improve the forecasting ability of expenditure to avoid financial difficulties.
- 3.The firm should properly forecast the inventory required to the organisation. If not there might be a chance of interruption of production due to no availability of raw materials.

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Table 1: Gross Sales For the Period Of 2011-12 To 2016-17

YEARS	BUDGET	ACTUALS	VARIANCE	FAVOURABLE	ADVERSE
2011-2012	16159.84	14462.00	1697.84	0	1697.84
2012-2013	16533.58	13552.93	2980.65	0	2980.65
2013-2014	16417.46	13364.17	3053.29	0	3053.29
2014-2015	19790.60	11674.66	8115.94	0	8115.94
2015-2016	18755.08	10059.34	8695.74	0	8695.74
2016-2017	15171.93	12317.32	2854.61	0	2854.61

Table 2. Net Sales For Period Of 2011-12 To 2016-17

YEARS	BUDGET	ACTUALS	VARIANCE	FAVOURABLE	ADVERSE
2011-2012	14388.06	12685.02	1703.04	0	1703.04
2012-2013	14384.80	11588.59	2796.21	0	2796.21
2013-2014	14293.23	11371.48	2921.75	0	2921.75
2014-2015	16951.35	9913.89	7037.46	0	7037.46
2015-2016	15843.12	8321.09	7522.03	0	7522.03
2016-2017	12689.66	10447.73	2241.93	0	2241.93

Table 3. Total Income For The Period Of 2011-12 To 2016-17

YEARS	BUDGET	ACTUALS	VARIANCE	FAVOURABLE	ADVERSE
2011-2012	14671.88	13159.08	1512.8	0	1512.8
2012-2013	14504.47	12372.33	2132.14	0	2132.14
2013-2014	14516.95	11528.46	2988.49	0	2988.49
2014-2015	17148.76	8747.17	8401.59	0	8401.59
2015-2016	15977.13	9886.19	6090.94	0	6090.94
2016-2017	13020.61	11141.34	1879.27	0	1879.27

Table 4. Total Expenditure For The Period Of 2011-12 To 2016-17

YEARS	BUDGET	ACTUALS	VARIANCE	FAVOURABLE	ADVERSE
2011-2012	13403.71	11430.89	1972.82	1972.82	
2012-2013	13370.88	11250.69	2120.19	2120.19	
2013-2014	13227.3	10560.93	2666.37	2666.37	
2014-2015	14894.5	10797.28	4097.22	4097.22	
2015-2016	13243.92	8279.51	4964.41	4964.41	
2016-2017	11248.51	11444.17	195.66		195.66





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Table 5. Gross Margin For The Period Of 2011-12 To 2016-17

YEARS	BUDGET	ACTUALS	VARIANCE	FAVOURABLE	ADVERSE
2011-2012	1000.02	1645.47	645.45	645.45	0
2012-2013	1307.39	1072.60	234.79	0	234.79
2013-2014	1194.27	1158.75	35.52	0	35.52
2014-2015	2181.67	808.71	1372.96	0	1372.96
2015-2016	2661.81	-790.49	3452.3	0	3452.3
2016-2017	1374.90	-263.89	1638.79	0	1638.79

Table 6. Cash Profit For The Period Of 2011-12 To 2016-17

YEARS	BUDGET	ACTUALS	VARIANCE	FAVOURABLE	ADVERSE
2011-2012	812.18	1454.87	642.69	642.69	
2012-2013	1014.13	713.35	300.78	0	300.78
2013-2014	768.41	820.63	52.22	52.22	
2014-2015	1686.66	373.98	1312.68	0	1312.68
2015-2016	2226.81	-1441.19	3668	0	3668
2016-2017	608.90	-1031.63	1640.53	0	1640.53

Table 7. Net Profit For The Period Of 2011-12 To 2016-2017

YEARS	BUDGET	ACTUALS	VARIANCE	FAVOURABLE	ADVERSE
2011-2012	1061.91	2923.43	1861.52	1861.52	
2012-2013	754.34	1066.18	311.84	311.84	
2013-2014	978.50	1187.08	208.58	208.58	
2014-2015	2436.97	436.36	2000.61		2000.61
2015-2016	3233.72	-2861.83	6095.55		6095.55
2016-2017	619.32	-2294.78	2914.1		2914.1

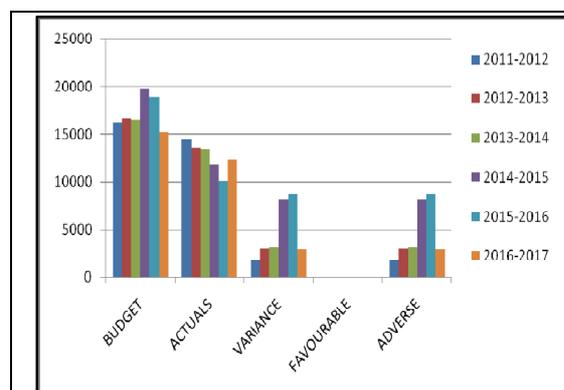


Fig.1. Gross Sales

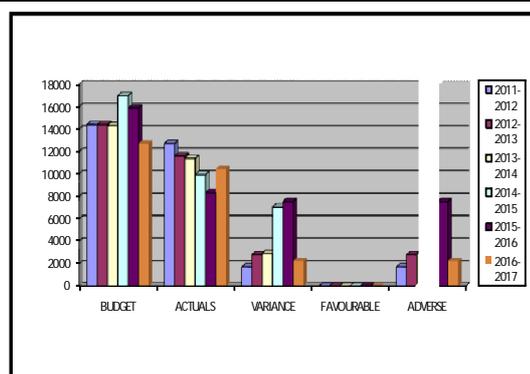


Fig.2. Net Sales





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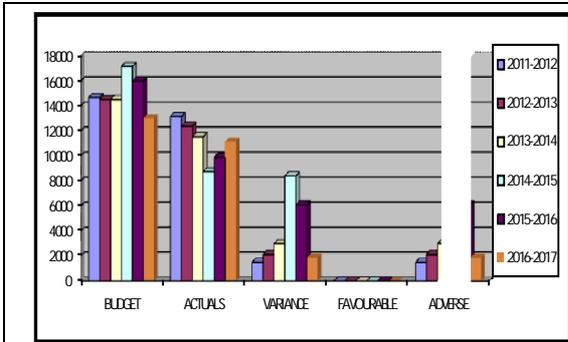


Fig.3. Total Income

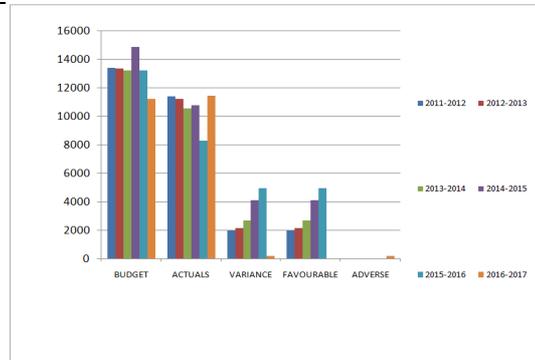


Fig.4. Total Expenditure

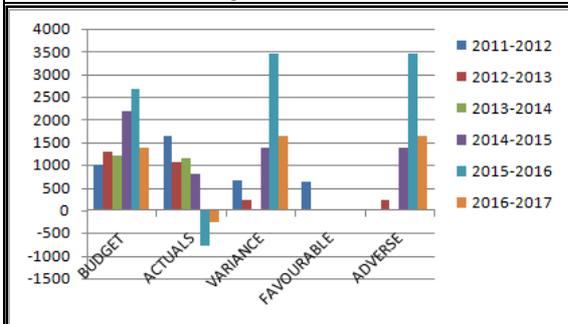


Fig.5. Gross Margin

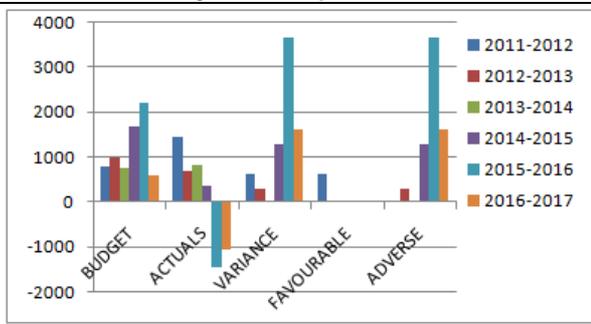


Fig.6. Cash Profit

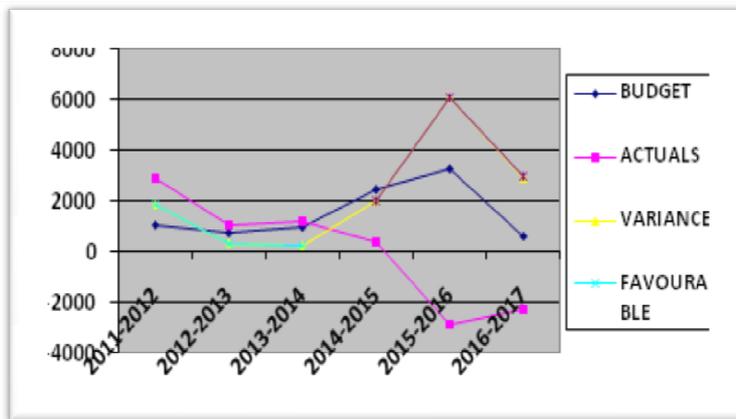


Fig.7. Net Profit





Investigation of Dielectric and Relaxor Behaviour of Bismuth Doped Barium Titanate Ceramic

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ABSTRACT

The preparation of Bi doped compositions $Ba_{1-x}Bi_{2x/3}TiO_3$ ($x=0.1$) was done by conventional solid state method. The property related to structure and phase of the composition was studied by X-Ray Diffraction technique. The XRD data demonstrates tetragonal structure having single phase and a space group $P4mm$ which is quite in agreement with standard JCPDS no. 05-0262. Scanning Electron Microscope is used to study the surface morphology of the pellets which shows well defined grains and distinct grain boundary. The temperature variant dielectric constant at diverse frequencies of the ceramic composition was studied and a diffuse dielectric behaviour was observed. The diffusivity of the doped material was calculated by modified Curie-Weiss law. A relaxor behaviour was observed in the composition and the Vogel-Fulcher fitting of the composition was carried out to obtain the parameters.

Keywords: XRD, Dielectric Study, Phase Transition, Relaxor Ferroelectric

INTRODUCTION

Relaxor ferroelectrics has drawn interest in research in recent years due to manufacture of multilayer ceramic capacitors, actuators, transducers etc. Extensive study has been done since many years in order to investigate the ferroelectric-relaxor behavior with diffuse phase transition [1]. In order to explain the properties of relaxor behaviour, different physical models have been proposed like microscopic composition fluctuation, order-disorder transition, switching of micro and macro domain, dipolar-glass model and slaked random field [2-6]. In recent years, although investigations has undergone to understand and outline the amazing properties of relaxor ferroelectrics,



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not much success has been achieved so far and hence a subject of intensive research. The relaxor nature of the material is an outcome of substitution mechanism resulting the micropolar regions and the relaxor effect is substantially influenced by the atomic radii and different chemical valence of ions.

Most of the ferroelectrics executing relaxor behavior like PLZT, PNN–PZT, PMN–PT etc. are often considered as a model system belonging to the family of oxides of Pb-based materials [7,8]. However due to toxicity of lead and its volatility nature, effort has been made to investigate environment-friendly 'lead-free' relaxors. The investigation has been made on account of electrical properties, dielectric relaxation and phase transition of the ferroelectrics for Pb-free materials like BaTiO₃, KNbO₃, (Bi_{1/2}K_{1/2})TiO₃ and (Bi_{1/2}Na_{1/2})TiO₃ [9,10]. Out of many of those, investigations have undergone on the BaTiO₃-based ceramics extensively due to two reasons: (i) firstly, commercially availability of wide range of applications of BaTiO₃-based materials and (ii) secondly, can be perceived as a lead free 'model' which is ABO₃ type ferroelectric perovskite exhibiting several phase transitions and can be used to relate the properties like dielectric or ferroelectric such as deviations in transition temperatures, permittivity and loss tangent with doping of chemicals and microstructure of the ceramics.

The investigation of electrical properties of BaTiO₃ is very important in research because of its importance from technical point of view and the rise of difficulty of through explanation of the behaviour. An effective control over the electrical resistance and curie temperature of the ferroelectric can be done by incorporating with donor impurity either at Barium or Titanium site [11-14]. The practical applications of Barium titanate and its allied compounds are found in the production of PTC resistors and multilayer ceramic capacitors. Due to the possession of high dielectric constant, BaTiO₃ has been used as a capacitor material with high permittivity. [15]. A drastic change in physical properties can be achieved by the variation in thermal treatment or chemical composition while substantial retention of piezoelectric properties [16]. So another degree of freedom is added in order to prompt the co-occurrence between ferroelectric and relaxor on the introduction of a disorder on the Ba-site in BaTiO₃. This can be done by substituting aliovalent Bi³⁺ ion into Ba²⁺ cation. This kind of selection of Bi³⁺ ion is made due to the existence of its 6s² lone pair electrons as that of Pb²⁺ and that kind of environment is suitable for the relaxor effect as compared to the disadvantage of pollution caused due to utilization of lead [17]. Certain quantity of Bismuth doping has a remarkable effect on decreasing the sintering temperature which is a characteristic for many BaTiO₃-based multilayer capacitors available commercially. For BaTiO₃-based PTC thermistors incorporation of Bismuth acts as a donor dopant [18] and has the ability to enrich the extent of positive coefficients of resistance [19].

MATERIALS AND METHODS

High purity chemicals of BaCO₃, TiO₂ and Bi₂O₃ purchased from E. Merck India Ltd. and calculated stoichiometrically were weighed for the sample Ba_{1-x}Bi_{2x/3}TiO₃ (x=0.1). The powders were ball milled in a ball milling machine for 8 hours in acetone media with the use of small zirconia balls. After drying, the powders had undergone a process of calcination at 1200° C for 4 hours in a conventional programmable furnace. The calcined powders were grinded with the help of an agate mortar and 5 wt% PVA solution is mixed that acts as binder. Then the powders were pressed into discs in a hydraulic press at a pressure 5tons. Sintering of the discs have been carried out at 1300°C for 4 hours by heating the pellets at a rate of 5°C min⁻¹. The XRD data confirms the phase purity of the calcined powders. XRD analysis of the samples has been done by using a Philips diffractometer (model PW-1830) with Cu-K_α (λ=1.5418 Å) radiation in a range of 2θ (20° < 2θ < 70°) at a scanning rate of 2° min⁻¹. The density of the pellets were determined by Archimedes principle and the information about microstructure was obtained by Scanning Electron Microscope with model No. JEOL T-330. For better electrical measurements, silver pastes were applied on the two sides of the disk faces followed by heating at 300°C for 5 minutes. The dielectric measurements with respect to temperature were carried out at different frequencies by using Hioki LCR meter connected to a computer.



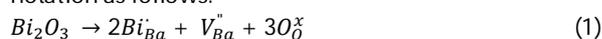


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RESULTS AND DISCUSSIONS

X-Ray Diffraction and Microstructure

The development of a single-phase structure of the powders was studied by XRD. Fig. 1 shows the room temperature XRD data of Bismuth doped BaTiO₃ with a varied 2θ ranging from 20°-70° at the scanning rate of 2°/min. All the peaks that have been obtained in the patterns are quite matching well with JCPDS card 05-0626 [20] and displaying a purely tetragonal single phase crystal structure with space group of *P4mm*. The existence of the precursor phase of BaCO₃, TiO₂ or Bi₂O₃ by XRD has been ruled out and the matched *hkl* values are indexed in Fig.1. Fig.2 shows the SEM image of as-prepared sample sintered at 1300°C for 4 hrs. The microstructure shows well defined grains with inhomogeneous microstructure. In an ideal cubic perovskite ABO₃, the A-sites having coordination 12. The substitution of Bi³⁺ for Ba²⁺ is due to comparable values of ionic radii being 0.145 nm for Bi³⁺[21] to that of 0.16 nm for Ba²⁺. Consequently, the substitution mechanism of Bi³⁺ for Ba²⁺ ion will take place according to the Kroger-Vink notation as follows:



where Bi_{Ba}^+ denotes a Bismuth atom on Barium site carrying unit positive charge, $V_{Ba}^{''}$ is doubly negatively charged barium vacancy and O_O^x is an oxygen atom that is neutral and present on oxygen site. Hence, a charge compensation mechanism takes place due to the incorporation of Bi₂O₃ in the BaTiO₃ ceramics that results the formation of barium vacancy and effects the microstructure.

Dielectric study

The variation of dielectric constant (ϵ') with respect to temperature for Ba_{1-x}Bi_{2x/3}TiO₃ ($x=0.1$) measured at various frequencies of 1 kHz, 10 kHz, 100 kHz and 1 MHz is shown in Fig. 3. A gradual increment of the dielectric permittivity is observed with temperature till the transition temperature T_m and there by decreases. The measured dielectric permittivity with temperature at different frequencies displays the frequency dispersion about the dielectric peak that depicts relaxor behaviour of the material. This specifies the sensitivity of the dielectric loss towards a small distortion or otherwise the entrance of polar micro-regions in the samples [22,23].

The phase transition diffusivity as proposed by Curie–Weiss law has been modified by Uchino and Nomura [24] given by:

$$\frac{1}{\epsilon} - \frac{1}{\epsilon_m} = \frac{(T - T_m)^\gamma}{C_1} \quad (at T > T_m) \quad (2)$$

where γ and C_1 are the constants that has been modified, with $1 < \gamma < 2$. The nature of the phase transition is determined by the value of γ . The limiting values of γ are, $\gamma = 1$ and $\gamma = 2$. The value of γ being 1 for normal ferroelectrics and 2 for an ideal relaxor type ferroelectrics [25-27]. Hence, the relaxor type behaviour of a material has been characterized by the value of γ . Fig. 3 depicts a plot between $\ln(1/\epsilon - 1/\epsilon_m)$ versus $\ln(T - T_m)$ for the sample. By, the exponent, determining the degree of diffuseness of the phase transition γ has been obtained from the slope of $\ln(1/\epsilon - 1/\epsilon_m)$ vs $\ln(T - T_m)$ plot by linear fitting with equation 2 and is shown in insert of Fig. 3. The calculated diffuseness of the phase transition by modified Curie-Weiss law is well agreed with normalized dielectric constant spectrum.

In compounds of perovskite, the appearance of relaxor type behaviour occurs when a minimum of two cations occupy the same crystallographic site i.e. either at A-site or at B-site. The vacancy is generated in our sample due to the occupation of Bi³⁺ atom at A-site which has a higher valence than that of A-site atom (Ba²⁺). In the ceramic, the disorder has been generated due to higher valence producing the dielectric constant that varies with temperature and frequency. The accountability of the dielectric relaxation nature in relaxor materials can be done by the use of Vogel–Fulcher (VF) relationship [28]. The resulted dielectric relaxation is due to reversals of polarization that has been activated thermally in between two comparable variants. Basing on this, the relation between polarization flipping frequency ν_0 and the activation energy E_a (the gap between two similar polarization states) is given as follows:





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$$v = v_0 \exp \left[\frac{-E_a}{k_B(T_m - T_f)} \right] \quad (3)$$

where v_0 is the dipole reorientation attempt frequency, E_a is the activation energy, k_B is Boltzmann's constant and T_f is the static freezing temperature. Fig. 4 shows the temperature dependent relaxation frequency, a plot between T_m versus $\ln f$ which is the best fit to that of experimental data. The observed relaxor behaviour in the ceramic may be due to many reasons like microscopic composition fluctuation, the merging of micropolar regions into macropolar regions or a coupling of order parameter and local disorder mode through the local strain. The foremost reason behind the relaxor behaviour of the material is due to the random distribution of electrical strain field in a mixed oxide system as reported by Vugmeister and Glinchuk [29]. Due to non-existence of macroscopic phase separation in the ceramic, the chemical heterogeneity cannot be excluded in nanoscale. The existence of random field may be a result of the distortion occurred in the oxygen octahedra, charge redistribution and local formation of charge center. This type of random field is considerably weaker than that restricting from the substitution of heterovalent cation that exists in relaxors of conventional type. Hence at high temperature, the resulted polar nano regions may be due to the changing dipole moments of the individual unit cell. Here the polar correlations are lessened strongly and the nucleation of polar domains are less likely. The reduction in the grain size is not only due to the substitution of Bismuth, but also due to the size and distribution of the polar-regions which ultimately results the broadening of relaxation time and noteworthy improvement of the relaxor properties of Bi-doped BaTiO₃ ceramics.

CONCLUSIONS

The present composition was fabricated by using the conventional solid-state route. The XRD study of the composition shows a single perovskite structure. The microstructure shows inhomogeneous grain with distinct grain boundary. The temperature and frequency dependent dielectric study shows a diffuse behaviour in the system. The diffuseness of the phase transition was analyzed using modified Curie-Weiss law. A frequency variant transition temperature was obtained which provides the signature of relaxor behaviour and Vogel-Fulcher fitting was carried out. The dielectric relaxations matches quite well with the Vogel-Fulcher relationship confirming a relaxor mechanism.

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Table-1: Cell parameters and volume of Ba_{1-x}Bi_{2x/3}TiO₃ (x=0.0, 0.1)

Sample (x mol%)	a (Å)	b(Å)	c(Å)	Volume of unit cell(Å ³)
X=0.0	4.0061	4.0061	4.2879	68.816
X=0.1	3.9924	3.9924	4.0233	64.129





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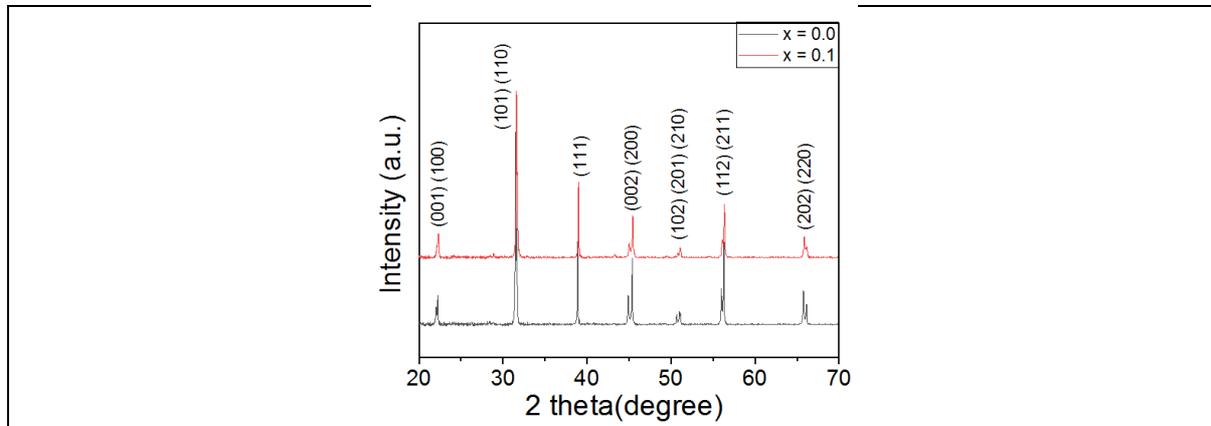


Fig 1: XRD plots of $Ba_{1-x}Bi_{2x/3}TiO_3$ ($x=0.00, 0.1$) sintered at $1300^\circ C$ for 4 hours

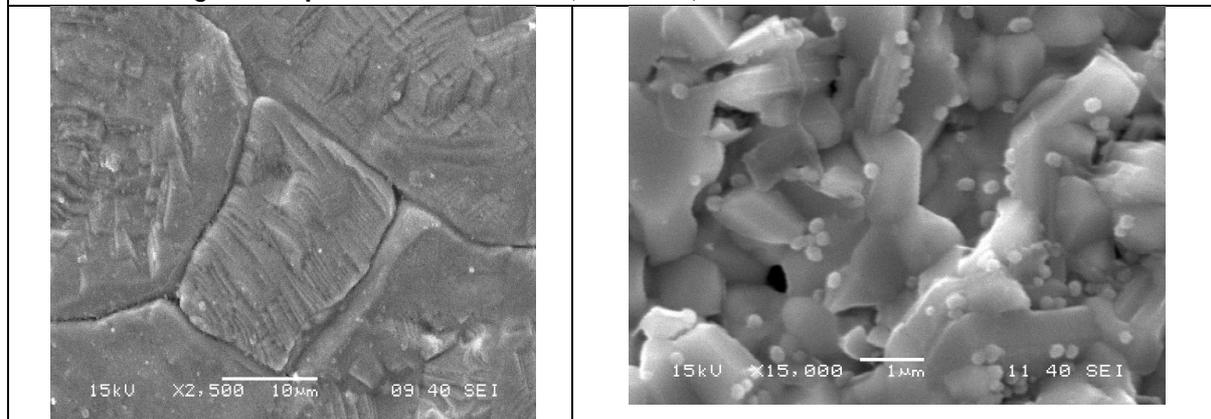


Fig 2: SEM micrographs of $Ba_{1-x}Bi_{2x/3}TiO_3$ ($x=0.00, 0.1$) sintered at $1300^\circ C$ for 4 hours

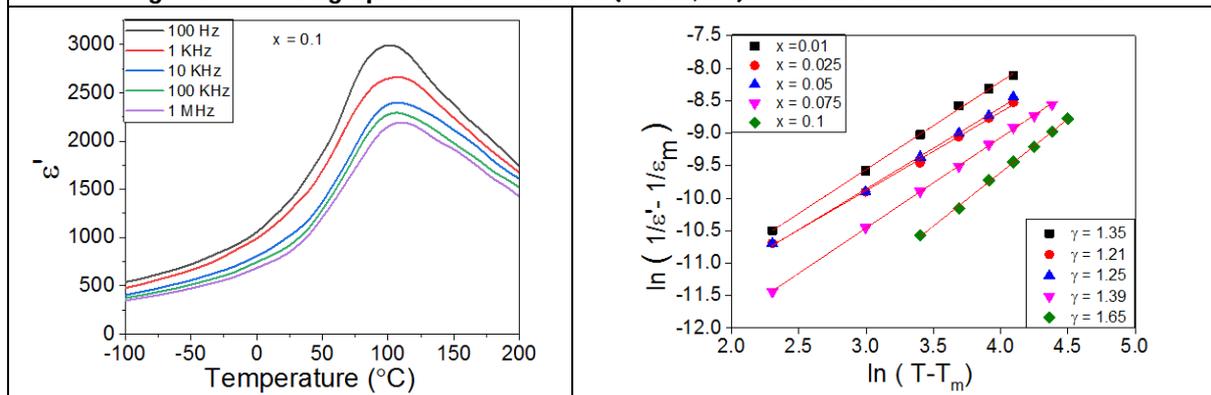


Fig 3: Variation of dielectric constant (ϵ') with temperature for the $Ba_{1-x}Bi_{2x/3}TiO_3$ ($x=0.1$)





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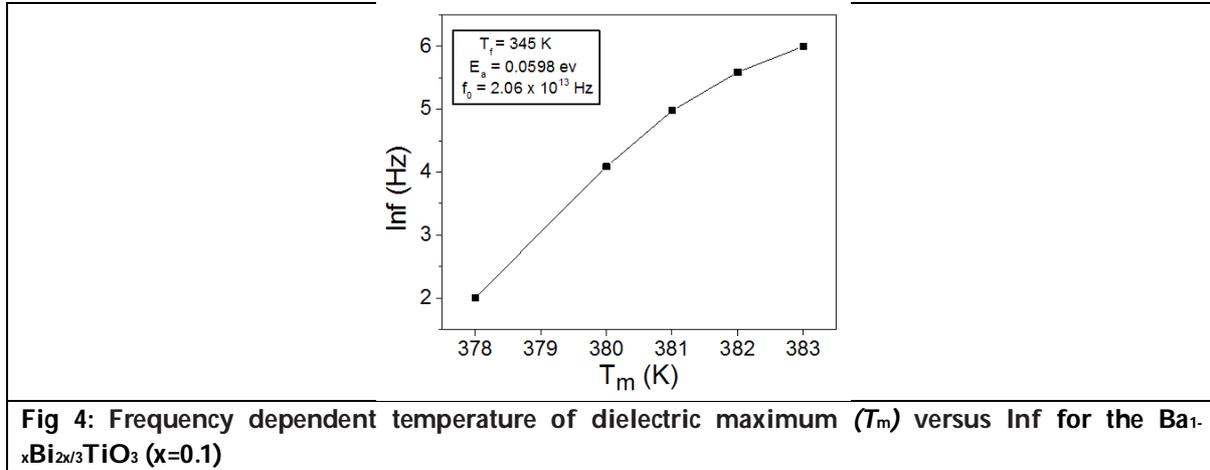


Fig 4: Frequency dependent temperature of dielectric maximum (T_m) versus Inf for the $\text{Ba}_{1-x}\text{Bi}_{2x/3}\text{TiO}_3$ ($x=0.1$)





Epidemiology of Snake Bite in and Around Chikmagalur District

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ABSTRACT

Snakebite is a significant health hazard that leads to high mortality rate especially in India. ~15,000 people reportedly die due to snakebites in India. Despite its importance, there have been fewer proper clinical studies of snake-bite than of almost any other tropical disease. All age groups were just about equally involved. Females are affected more often than males; male to female ratio being 1 : 0.90 of the cases occurred during the months of April to June coinciding with end of summer and start of rainy season. Maximum snakebites occurred in outdoor settings to farming related occupations inferring this to be an occupational hazard. Maximum cobra bite cases recorded day time during outdoor activities.

Keywords: Snake bite, envenomation fangs, Antivenom, Chikmagalur.

INTRODUCTION

Snakebite envenoming is a greatly underreported neglected tropical disease (NTD) responsible for up to 138,000 deaths and 400,000 permanently disabled victims worldwide every year [Gutiérrez, 2017]. Seasonal snake bites in south Asia linked to rainy season. Similarly, flooding due to hurricanes and cyclones has been connected to an increased incidence of snakebite in the United States [Wozniak 2006], the Gulf of Yucatan in Mexico [Yañez-Arenas, 2006], and Odisha in India [Patra 2013, Shubhankar and Ramkumar, 2010]. South Asia is the most affected Region due to snakebite envenomation (Chippaux 1998, Kasturiratne et al 2008), and India contributes to 50 per cent of the estimated deaths due to venomous snakebites globally (Gutiérrez et al., 2017). In India, highest number of deaths due to snakebites have been reported in Uttar Pradesh, Andhra Pradesh, Bihar, Tamil Nadu, West Bengal and Maharashtra (Mahaptra et al 2011). Anti-snake venom (ASV) is the only effective specific treatment of snakebite envenoming (WHO 2018).



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The annual incidence of snakebite was 36 per 100,000 populations which was comparable to Vidarbha region, Maharashtra (Asawale 2018) lower than Sri Lanka (Ediriweera et al 2016) Bangladesh (Rahman et al 2010), Myanmar (Mahmood et al 2018) and Chitwan and Nawalparasi districts in Nepal (Pandey 2006) Seventy six per cent snakebite cases (n=110) were due to venomous and 24 per cent (n=35) were due to non-venomous snakebites. Five of the 110 venomous snakebites had fatal outcome resulting in 4.5 per cent CFR with an annual incidence of one snakebite death per 100,000 populations. (Asawale et al 2018, Kirte et al 2006, Inamdar et al 2010). The present study was taken up to know the incidence of snake bite poisoning in urban and rural areas of Chikmagalur region. To survey the severity of incidents of snake bite in Chikmagalur. An attempt is also being made to suggest measures to prevent deaths from snake bite poisoning

CASE STUDY

The prospective research was conducted in the District hospital Araluguppe Mallegowda Government Hospital Chikmagalur during July to October 2012. It is situated roughly in the south-western part of Karnataka state. A large area of this district is 'malnad', i.e., a largely forested hilly region of heavy rainfall. All the patients admitted to Araluguppe Mallegowda Hospital with history of snakebite were followed up from the time of admission throughout their stay in hospital. Snakes were identified based on the description given by the patients/ relatives/ bystanders and by correlating the clinical manifestations. All the cases of snake bite (n=61) were included in the study. Case details of snake bite were obtained from patients, relatives and hospitals records depicting age, sex, time of bite clinical manifestations and outcome.

RESULTS

The age and sex incidence of snakebite victims throw light on the vulnerable section of the population. While snake bite is observed in all age groups, the large majority (90%) are males aged between 11-50 years, because of outdoor activity men are at more risk. The highest rates are in during the study period 61 cases of confirmed snake bite were admitted to Araluguppe Mallegowda District Hospital Chikmagalur (AMDH). Maximum number of victims were males (n=32: 52.45%) & females about (n=29: 47.54%) as given in Table 1, while the lowest rates in children (n=1) indicated. The maximum number of cases (n= 61) is the age group of 11 -55 years, while only 36.06% were above the age of 60 years. The high incidence in the age group of 11 – 40 years is again because of occupational exposure, this being the productive age group (Table 1: Fig a) Males have higher fatality rates than females. The high incidence of snake bites in males is probably due to their lifestyles and occupational exposures as farmers or herdsmen, while most females are usually housewives, thus less exposed to snake bites. Among the host factors, people involved in occupations and / or lifestyles requiring movement (Table2).

During the study period 20 cases of confirmed cobra snake-bite were admitted most of the victims in our study were bitten during the day time (n=38, 62.29%), in outdoor sittings (n=40, 65.57%) and indoor (n=21, 34.04%) respectively (Table 3 : Fig 2a & Table 4 : Fig 2b). The high incidence of snake bite cases compared to upper limbs (n= 17, 27.86%) followed by lower limbs (n=32,52.45%) and trunk (n=12, 19.67%) (Table 5: Fig 2c) 77.04% received first aid measures prior to hospitalization local pain and swelling, vomiting, confusion, and difficulty in breathing were the presenting complaints at the time of admission (Table 7: Fig e). Monthly distribution of snake bite shown in (Table 10 & 11: Fig h&i). The incidence of snake bite shows a distinct seasonal pattern closely related to rain fall and temperature which compels the reptiles to come out of their shelter. Lack of knowledge and ignorance or poor light, during night patients fail to identify. A large number of bites occur in fields where most individuals are unable to spot the snake due to tall grass and crops.

A case where fang marks could not be appreciated showed signs of envenomation while one case with scratches did not show any signs of envenomation. Local pain and swelling, vomiting, confusion, and difficulty in breathing were the presenting complaints at the time of admission. Systemic manifestations observed in cases of cobra bite included



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blurring of vision, ptosis, ophthalmoplegia, dysarthria, muscular weakness and respiratory embarrassment. Ptosis was the chief neurotoxic feature followed by dysarthria. Cellulitis as a complication was observed in 61 cases. Anti Snake Venom (ASV) vials were used during treatment and number ASV vials administered to each patient of cobra bite ranged from 0 to 26 vials, at an average of 12.4 ASV vials per patient. Three (3) fatalities were reported from cobra bites during the study period. Forty eight (48) victims completely recovered in the hospital while other Ten (10) left the hospital against medical advice (Table 8 & Fig f). However, in 2017, the WHO included snakebite envenoming in the priority list of neglected tropical diseases (World Health Organization (WHO), 2019b) and launched in 2019 a strategy for prevention and control of snakebite, aiming to halve the numbers of deaths and cases of serious disability by 2030 as compared to 2015 baseline (World Health Organization (WHO), 2019c).

DISCUSSION

The more ambulant population involved in farming is at increased risk of snakebite. Age group of thirty to fifty years with a peak incidence of the victims in their third decade has been observed in the earlier studies in India. Comparatively mean age of patients was higher. A male preponderance among snake bite victims with a male to female ratio 1:0.90 is frequently observed. In our study snakebite victims were predominantly males. In India, female preponderance in Himachal Pradesh and Maharashtra and a male preponderance in Davangere, Jammu and Haryana are reported.

Most of the victims were involved in farming related activities. Farming community is increasingly prone for accidental contact with the snakes while working in the fields. These snake densities are sometimes very high, particularly in grain agriculture which attracts the largest rodent and amphibian populations that are eaten by snakes (Whitaker and Captain, 2004; Mise et al., 2016). The maximum victims of snakebite in our study are reported during daytime corresponding to the period of their outdoor activities. A study conducted at Davangere and Maharashtra also reported high incidence during daytime. Upper limbs were involved in maximum number of cases. Bites on the lower limbs occur usually due to the accidental stamping of a snake while working, while bites on the upper limbs occur because of accidental contact with snakes while trying to hold the grass during harvesting (Monteiro et al 2010). Victims bitten on the trunk was sleeping at the time of the incident. Fangs of cobra are fixed and immobile. Apart from routine punctures (fang marks) only scratch and with unappreciable fang marks also showed envenomation sign. This suggests the importance of keeping the patient under observation in all the alleged cases of snakebite irrespective of the presence or absence of fang marks.

Second quarter of the year (April to June) witnessed half of the snake bite cases. This time of the year corresponds to the summer and pre-monsoon months in the region. During the summer months, snakes usually come out of their burrows due to the heat in search of cooler places, thereby increasing the risk of accidental contact with humans (Monteiro et al 2010). During the harvesting season, abundant vegetation attracts the rodents to the fields and the snakes come out of their burrows in search of their prey. Thus harvesting season with busy agricultural activity creates an ideal atmosphere for snakebites. Most of the patients were brought to the hospital within the first twelve hours of cobra bite and more than half of the victims had received first aid measures prior to hospitalization. Most of the victims showed local and/ or systemic signs of envenomation. Polyvalent Anti Snake Venom (ASV) vials were used during specific treatment of cobra bites. Only Three (3) fatalities were reported from cobra bites during the study period that may be attributed to the delayed arrival in the tertiary care center and fail to initiation of specific therapy. Many of the features of snakebites and deaths were known or suspected, but few were quantified reliably (Mohapatra et al., 2011).



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SUMMARY

It is clear that in this region, snake-bites an important medical emergency and cause of hospital admission. True scale of death and snake bite is not uncertain due to lack of reporting in every part of the study area. To remedy this deficiency, it is strongly recommended that snake-bite should be made a specific modifiable disease. Snake-bite is an occupational disease of farmers, plantation workers, and, fishermen, and other food producers. It is recommended that snake-bite should be formally recognized as an important occupational disease in India. Despite its importance, there have been fewer proper clinical studies of snake-bite than of almost any other tropical disease. It is recommended that governments, academic institutions, pharmaceutical, agricultural and other industries and other funding bodies, should actively encourage and sponsor properly designed clinical studies of all aspects of snake-bite. Some ministries of health in the region have begun to organise training of doctors and other medical workers in the clinical management of snake-bite patients.

CONCLUSIONS

Snakebite is a significant health hazard that leads to high mortality rate especially in India. This anti snake venom is usually derived from horse sera. In severe envenomation, large amounts of antivenin must be injected and adverse reaction risks are increased. The cost of antivenin limits the supply where such a therapy is strongly useful. One solution could be to improve antivenin manufacturing to better concentrate the specific antibody activity and remove any unsuitable proteins. All age groups were just about equally involved. Females are affected more often than males; male to female ratio being 1 : 0.90 of the cases occurred during the months of April to June coinciding with end of summer and start of rainy season. Maximum snakebites occurred in outdoor settings to farming related occupations inferring this to be an occupational hazard. Maximum incidence of cobra bites during the daytime corresponds to the period of outdoor activities and the fact that cobra being active diurnally. Envenomation was observed even when fang marks were unappreciable, suggesting the importance of keeping the victim under observation in all the alleged snakebite cases even in the absence of fang marks. Ptosis was observed as the major neurotoxin feature in envenomed victims. Cellulitis was observed as a common complication of bite due to cobra. Prompt hospitalization and specific treatment and prior first aid measures may be responsible for preventing systemic envenomation and reducing the mortality Snake bite is a neglected disease that afflicts the most impoverished inhabitants of rural areas in tropical developing countries. It is an unusually challenging medical problem that deserves further investigation after the prolonged neglect by medical science. Female illiteracy in rural areas and increased temperature below 20°C were associated with higher risks of snakebite mortality, and vice versa for urban status and increased altitude at altitude level above 400 m. For time trend, snakebite mortality risks showed a decreasing trend over time (Wilson et al 2020).

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Table 1 Age wise grouping of snake bites

Age	Total	Percentage (%)	Male	Percentage (%)	Female	Percentage (%)
Below 18	14	22.79	05	35.71	09	64.28
19 – 35	25	40.98	15	60.00	10	40.00
36 - 55	22	36.06	12	54.54	10	45.45
Total	61		32	54.45	29	47.54





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Table 2: Percentage of snake bite based on Occupation wise grouping

	Total	Percentage (%)	Male	Percentage (%)	Female	Percentage (%)
Agriculture	29	47.54	14	48.27	15	51.72
Labours	29	47.54	16	55.17	13	44.82
Others	03	4.91	02	66.33	01	33.33
Total	61		32	52.45	29	47.54

Table 3: Percentage of snake bite based on diurnal variation

	Numbers	Percentage (%)
Day	38	62.29
Night	23	37.70
Total	61	100

Table 4: Percentage of Incidence of place of snakebite

Incidence place of snake bite	Numbers	Percentage (%)
Indoor	40	65.57
Outdoor	21	34.42
Total	61	100

Table 5: Percentage of Site of biting on body

	Numbers	Percentage (%)
Upper limb	17	27.86
Lower limb	32	52.45
Trunk	12	19.67
Total	61	100

Table 6: Victim Details of Hospitalization in Snake bite case

	Total	Percentage (%)	Male	Percentage (%)	Female	Percentage (%)
Within one hour	19	31.14	10	52.65	09	47.36
1 – 6 hour	29	47.54	16	55.17	13	44.82
7 -12 hour	13	21.31	06	46.15	07	53.84
Total	61		32	52.45	29	47.54

Table 7: Percentage of First Aid case prior to Hospitalization

	Total	Percentage (%)	Male	Percentage(%)	Female	Percentage(%)
First aid	47	77.04	26	55.31	21	44.68
No first aid	14	22.95	06	42.85	08	57.14
Total	61		32	52.45	29	47.54

Table 8: Final out come

	Total	Percentage(%)	Male	Percentage(%)	Female	Percentage (%)
Recovered	48	78.68	28	58.33	20	41.66
DAMA*	10	16.93	03	30.00	07	70.00
Death	03	04.91	01	33.33	02	66.33
Total	61		32	52.45	29	47.54

*(DAMA- Discharge Against Medical Advice)





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Table 9: Percentage of snake bite cases according to Area wise

Area	Total	Percentage(%)	Male	Percentage(%)	Female	Percentage(%)
Chikmagalur	37	60.65	21	56.75	16	43.24
Mudigere	10	16.39	04	40.00	06	60.00
Belur	08	13.21	05	62.25	03	37.50
Kadur	05	08.19	02	40.00	03	60.00
Arasikere	01	01.63	00	0.00	01	100
Total	61		32	52.45	29	47.54

Table 10: Month wise table representing number of snake bites in Chikmagalur district of the year 2011 - 2012

Month	Total	Percentage (%)	Male	Percentage (%)	Female	Percentage (%)	Death
January	28	06.04	20	71.42	08	28.57	00
February	15	03.23	10	66.66	05	33.33	00
March	24	05.18	16	66.66	08	33.33	00
April	20	04.31	12	60.00	08	40.00	00
May	40	08.63	23	57.50	17	42.50	01
June	50	10.79	24	48.00	26	52.00	01
July	70	15.11	42	60.00	28	40.00	03
August	55	11.87	39	70.00	16	29.09	01
September	46	09.93	30	65.21	16	34.78	01
October	49	10.58	28	57.14	21	42.85	00
November	39	08.42	25	64.10	14	35.89	00
December	27	05.83	14	51.85	13	48.14	02
Total	463		283	61.12	180	38.87	09

Table 11: Month wise table representing number of snake bites in Chikmagalur district of the year 2012 - 2013

Month	Total	Percentage (%)	Male	Percentage (%)	Female	Percentage (%)	Death
January	19	06.98	16	84.21	03	15.78	00
February	28	10.29	14	50.00	14	50.00	00
March	26	09.55	16	61.53	10	38.46	00
April	40	14.70	24	60.00	16	40.00	00
May	57	20.95	33	57.89	24	42.10	00
June	49	18.01	25	51.02	24	48.97	00
July	53	19.48	34	64.15	19	35.84	00
Total	272		162	59.55	110	40.44	00

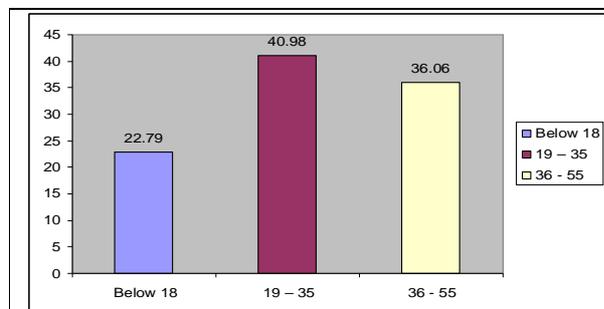


Fig. 1. percentage of age wise grouping of snake bites

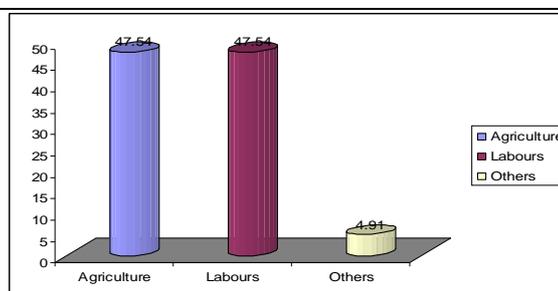


Fig. 2. Percentage of snake bite based on Occupation wise grouping





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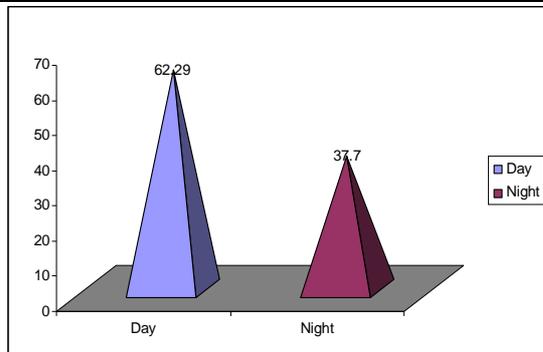


Fig.3. Percentage of snake bite based on diurnal variation

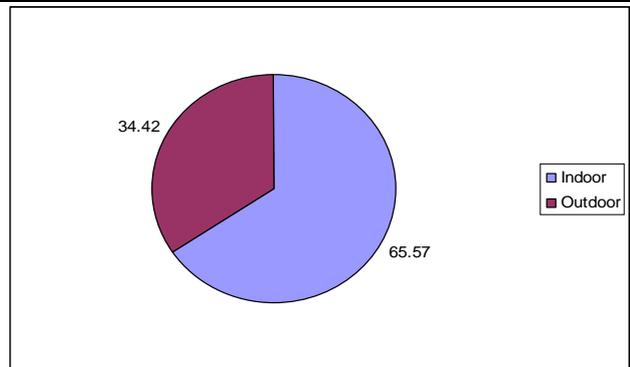


Fig.4. Percentage of Incidence place of snake bite

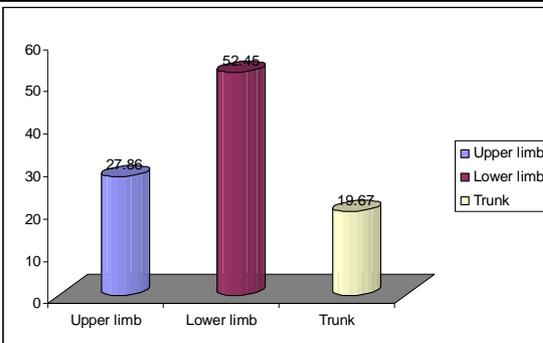


Fig. 5. Percentage of Site of biting on body

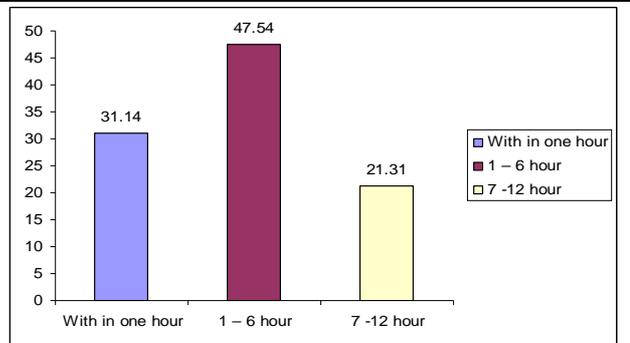


Fig. 6. Victim Details of Hospitalization in Snake bite case

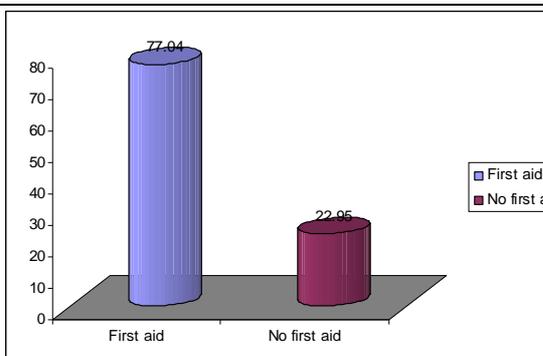


Fig.7. Percentage of First Aid case prior to Hospitalization

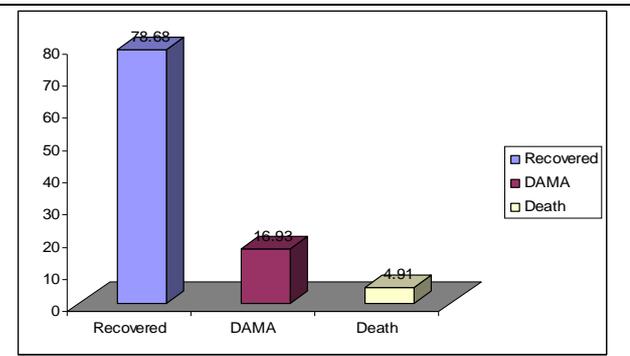


Fig.8. Final out come





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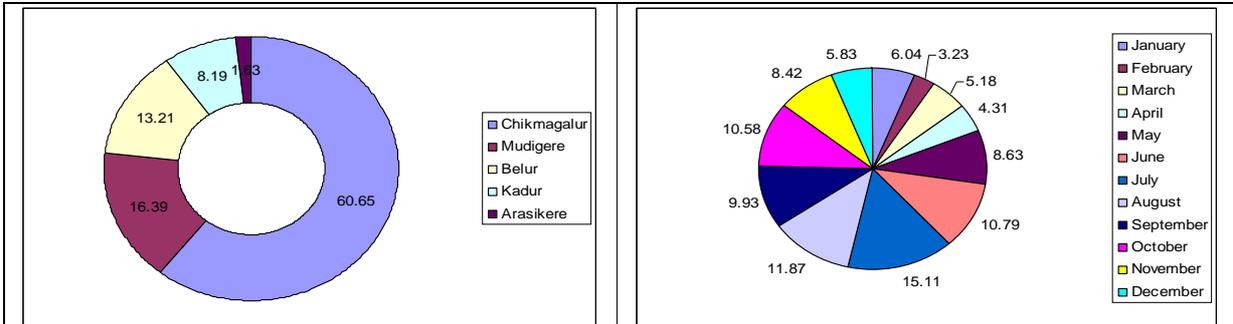


Fig.9. Percentage of snake bite cases according to Area wise

Fig.10. Month wise representing number of snake bites in Chikmagalur district of the year 2011 - 2012

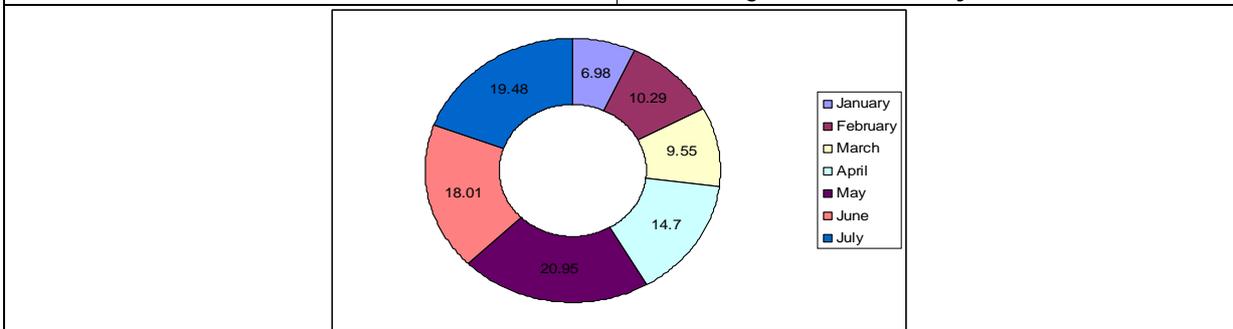


Fig. 11. Month wise table representing number of snake bites in Chikmagalur district of the year 2011 - 2012





A Study to Analyze the Role of Physical Therapy to Improve Balance, Proprioception and Kinesthesia in Patients with Knee Osteoarthritis : A Systemic Review

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ABSTRACT

Osteoarthritis is a major cause of musculoskeletal disability worldwide. Knee Osteoarthritis patients have proprioception deficits, alter balance and postural control due to that risk of falls is increase and affect the quality of life. A study to analyze the role of physical therapy to improve Balance, Proprioception and Kinesthesia in patients with Knee Osteoarthritis Authors searched Pubmed, the Online Library, the Archives, Google Scholar, MEDLINE, the Cochrane Library from 1999 to 2021. Total of 3264 participants were included in the 15 RCT studies. The result of the study showed that an improvement in proprioception, balance, and kinesthesia had a significant role in increased quality of life due to the decreased risk of fall in osteoarthritis knee patients. So, physical therapy treatment helps to improve the efficacy of Balance, Proprioception and Kinesthesia in knee Osteoarthritis patients.

Keywords: Knee Osteoarthritis, Balance, Proprioception, Kinesthesia, Physical Therapy.

INTRODUCTION

Osteoarthritis (OA) is one of the most prevalent forms of arthritis in contemporary. Knee osteoarthritis a chronic degenerative disease of an inflammatory nature which affect the entire synovial joint and exhibit multiple phenotypes [1]. OA can be characterized by two main features, The first features of OA are progressive damage of articular cartilage, bone remodeling and new bone formation, while the second features are when synovial inflammation, fibrosis of ligaments, tendons, menisci and capsules occur in the body, the presence of fibrillation areas, and cracking and thickening of the subchondral bone [2,3].



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Primary osteoarthritis is mostly related to aging [4,5]. Secondary osteoarthritis is caused by another disease or condition [6]. According to World Health Organization (WHO) 9.6% of men and 18.0% of women age over 60 years have symptomatic osteoarthritis worldwide. 80% of those with osteoarthritis have limitations in movement, and 25% cannot perform their major daily activities of life. In globally suffer from osteoarthritis, 100 million people reported worldwide in cause of disability. Osteoarthritis is the second most common rheumatologic problem and it is the most frequent joint disease with a prevalence of 22% to 39% in India [1]. Women are more affected by OA knee than men [7]. OA is strongly associated with aging and Asian countries are aging rapidly. Asian elderly aged ≥ 65 years old had increased from 7% in 2008 and is predicted to achieve 16% in 2040 [8]. Knee osteoarthritis is prevalent musculoskeletal condition affecting the people causing pain, functional disability and deterioration in the quality of life [9,10]. People with knee OA experience loss of proprioception, which may affect postural stability and risk of fall. osteoarthritis include joint pain particularly after prolonged activity and weight bearing, loss of motion, joint stiffness that is experienced after inactivity, decreased muscle strength, proprioceptive deficits, reduced balance, occasional swelling and crepitus [11,12,13].

Subjects with knee osteoarthritis have quadriceps muscle weakness as well as proprioceptive deficits, which can alter balance and postural control. Such deficits cause a change in dynamic stability provided by muscles around the joint, generating a functional instability that limits the individual's ability to perform ADL's [14,15]. The advantages of weight bearing exercises, strength training, gait training is becoming more accepted and used in clinical practice and are found to improve balance [16,17]. People with osteoarthritis knee sometimes report episodes of knee instability that may result in fall or limit their activities of daily living [18]. Imbalance in the center of gravity of the body could reduce stability and increases the risk of falls [19], which would result in bone fractures or fatal injuries for older adults. Meanwhile, proprioception could influence the ability of limb coordination, which played a great role in postural control [20]. Therefore, proprioception impairment was harmful to the balance of skeletal muscles around the knee joint and increased the risk of falling [21].

Kinesthesia, balance and agility is a form of proprioceptive training that has been gaining interest among researchers in the management of knee OA and knee-related injuries. The exercise is typically designed to improve dynamic joint stability and neuromuscular control using a series of physical activities that challenge the individual's neuromuscular system to maintain balance and coordination [22]. Knee osteoarthritis is a common degenerative disease, with its prevalence increasing with age and multifactorial aetiology. It is a common cause of disability worldwide. Many studies have demonstrated that impaired proprioception, balance, kinaesthesia may cause degenerative joint disease. Therefore, improvement in proprioception, balance, kinaesthesia have a significant role in increased quality of life due to the decreased risk of fall in osteoarthritis knee patients. So, need arise to find out the efficacy of Balance, Proprioception and Kinesthesia in Osteoarthritis of Knee Joint.

MATERIALS AND METHODS

The study based on the PICOS (participants, interventions, comparisons, outcomes and study design) format. We included randomised controlled trials (RCTs) and published in the English language. All studies involving individuals with knee Osteoarthritis. We were interested in the effects of physical therapy and efficacy of Balance, Proprioception and Kinesthesia in Osteoarthritis of Knee Joint. We selected the studies that investigated or compared the physical therapy interventions. Studies that evaluated other forms of therapy without exercise or other physical interventions were excluded. We also excluded studies of surgical or pharmacologic treatments for knee Osteoarthritis. The authors considered all interventions that involved an element of physical training such as balance training, proprioceptive training, kinaesthetic training, strength training, endurance training and physiotherapy interventions such as physical therapy.



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We searched Pubmed, the Online Library, the Archives, Google Scholar, MEDLINE, the Cochrane Library by using the following keywords: (knee osteoarthritis), (falls or falls risk), (balance), (proprioception), (kinesthesia) and (physical therapy) from 1999 to 2021. We searched ClinicalTrials.gov for completed trials related to the key questions. We did not contact primary investigators, but we did request additional information from sponsors of on-going trials.

RESULTS AND DISCUSSION

15 RCTs were selected for this systematic review, with the main characteristics summarised in Supplementary data, Appendix Table-1. Total of 3264 participants were included in the 15 RCT studies. The duration of intervention and follow-up ranged between 1 week to 30 months. The studies employed a large variety of physical therapy interventions. Balance and kinesthesia training, proprioceptive training, strengthening training mainly used in our selected studies. Common assessment tools (TUG, BBS, Step Test, 6MWT and WOMAC) were employed in 12 out of 15 studies. Three studies used TUG test, two studies used BBS, two studies used Step Test, one study used 6MWT and nine studies used WOMAC. Two studies used KOOS, two studies used physical function score. Osteoarthritis causes deficits in gait and balance which increases the risk of falls. Postural instability in individuals with OA may result from quadriceps muscle weakness, pain or altered neuromuscular control. Strengthening exercise can improve muscle strength and proprioception which may reduce the progression of OA. Thus, in order to improve balance and reduce falls risk in individuals with knee OA, any RCTs should include interventions that can improve muscle strength, reduce pain and improve neuromuscular control.

Proprioception is the awareness of joint position, whereas kinesthesia is the cognizance of joint movement. Mechanoreceptors (pacinian corpuscles, Ruffini endings, muscle spindle, and Golgi tendon organs located in muscles, capsules and ligaments provide sensory input into the central nervous system. These mechanoreceptors act together to give sensory awareness of joint position, movement via afferent pathways to the central nervous system. The central nervous system provides an efferent response to the surrounding joint musculature to elicit the desired response. Several authors have demonstrated a decline in joint position sense in subjects with osteoarthritic knees. A functional change with OA is reported to be alteration in gait patterns. It has been suggested that this altered gait may represent an effort to maximize proprioceptive input. Additionally, proprioception has been shown to decline with age. It has been suggested that reduced proprioception in the elderly and in patients with OA of the knee may be responsible for initiation and advancement of degeneration. It is also believed that impaired proprioception may be an important pathologic factor in determining the severity of OA. Some research suggests an increased likelihood of developing OA in the contralateral knee in subjects with unilateral disease. A decrease in proprioceptive sense may have a role in the pathogenesis of this OA.

Balance is generally defined as the ability to maintain the center of mass over the base of support. Balance can be disrupted when the mechanoreceptors found in the ankle, hip and knee do not properly detect or correct motion to preserve the center of gravity over the base of support. Multiple studies shown that knee osteoarthritis patients may suffer from impaired proprioceptive accuracy (for both position and motion sense). A few studies, however, did not find an impairment in knee osteoarthritis patients, possibly due to lack of power or an absence of patients with severe knee osteoarthritis. Unilateral knee osteoarthritis patients may have lack of proprioception in both knees. In our included studies Uzunkulaogla et al. concluded that "Both single- and dual-task trainings are effective in improving balance performance under single- and dual-task conditions in elderly patients with knee OA. Dual-task training is not superior to single-task training for balance improvement in elderly osteoarthritic patients." Braghin R.M.B. et al. concluded that "The practice of physical exercises is important for symptomatic individuals, in the self-perception of improvement in function and reduction of pain; for asymptomatic individuals, in transposition of step; and for both in decreases in the number of falls." J.E. Bullock-Saxton et al. concluded that "the knee JPS does not deteriorate with age in the FWB condition. It is proposed that this finding reflects the effect of maximised afferent inputs from all



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proprioceptors around the knee and associated joints. When the contribution for muscular activity was reduced, as in PWB, knee joint-position sensitivity was found to decrease as age increased." Walter H. Ettinger et al. concluded that "Older disabled persons with osteoarthritis of the knee had modest improvements in measures of disability, physical performance, and pain from participating in either an aerobic or a resistance exercise program. These data suggest that exercise should be prescribed as part of the treatment for knee osteoarthritis." David T. Felson et al. concluded that "Proprioceptive acuity as assessed by the accuracy of reproduction of the angle of knee flexion had modest effects on the trajectory of pain and physical functional limitation in knee OA." L R Garsden et al. concluded that "Subjects with unilateral OA of the knee demonstrated poorer performance on both legs in a partial weight-bearing reposition test than did control subjects." Pazit Levinger et al. concluded that "Balance exercises are key exercises recommended for fall prevention, carefully designing and evaluating an exercise intervention to address knee pain is crucial in order to develop safe, acceptable and effective fall-prevention interventions in this high-risk group." Judit Takacs et al. concluded that "A ten week dynamic balance training program for people with knee OA 25 significantly improved self-reported knee pain, physical function, and fear of movement, 26 though there was no change in dynamic balance as quantified by the Community Balance and Mobility Scale."

Demirhan Dıracoglu et al. concluded that "Additive positive effects of kinesthesia and balance exercises in knee OA have been demonstrated. Used in clinical applications, they should be able to increase the functional capacities of patients." Aysha I. Adhama et al. concluded that "the effectiveness of KBA exercise program and the ideal number of sessions needed to achieve the highest effectiveness, which may guide clinical practice and minimize waste of time and effort." PeixinShen et al. concluded that "a 6-week PNF intervention positively affects KOA treatment by relieving pain, recovering proprioception, and improving joint force distribution in the elderly with KOA. The overall climbing stair function level was enhanced." Omer Gezginaslan et al. concluded that "balanced strengthening of knee flexors and extensors in patients with knee OA may result in improvements with respect to pain, stiffness, ROM, balance, proprioception and functionality, and in a decrease in the risk of fall. Balanced strengthening of knee flexors and extensors exercises can be eligible therapeutic options for knee OA patients." K. Kotteeswaran et al. concluded that "weight bearing exercises on wobble board might be a better therapeutic intervention as compared to weight bearing exercises on stable platform for treating subjects with OA knee." Srinivas Mondam et al. concluded that "proprioceptive exercises could be a better choice of adjacent from physiotherapy point of view in the management of osteoarthritis of knee with conventional treatment." Zehua Chen et al. concluded that "for KOA patients, 4-week BW combined with conventional therapy presented no significantly greater improvement in proprioception than conventional therapy used alone."

In conclusion, our study analysis suggested that knee Osteoarthritis patients have impaired proprioception, balance and kinaesthesia. Therefore, improvement in proprioception, balance, and kinaesthesia have a significant role in increased quality of life due to the decreased risk of fall in osteoarthritis knee patients. So, physical therapy treatment helps to improve the efficacy of Balance, Proprioception and Kinesthesia in Osteoarthritis of Knee Joint.

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Table 1 : Overview of the characteristics of the included studies.

Author, Year (Reference)	Study Size	Outcomes Assessment Tools	Time Interval	Protocol
Uzunkulaogla et al., 2019 [23]	50	BBS, kinesthetic ability trainer static and dynamic scores, TUG test and walking speed activities-specific balance confidence scale	4 weeks	Single-task balance training (group 1) and dual-task balance training (group 2).
Braghin R.M.B. et al., 2017 [24]	42	WOMAC, Step Up/Over test	8 weeks	Warm-up; strengthening exercises – SLR with hip flexion, abduction and extension; knee flexion in a standing position; isometry of the quadriceps; aerobic exercise on a stationary bicycle; balance training
J.E. Bullock-Saxton et al.; 2000 [25]	60	Three common tests - stamp out an imaginary fire, step up onto a block and kick a ball towards a target	5 trials	Full weight-bearing protocol and Partial weight-bearing protocol
Walter H. Ettinger et al., 2013 [26]	439	self-reported disability score ,knee pain score, performance measures of physical function, x-ray score, aerobic capacity, and knee muscle strength.	78 weeks	Eerobic exercise program, a resistance exercise program, and a health education program.
David T. Felson et al., 2009 [27]	2243	WOMAC, physical function score	130 weeks	proprioceptive acuity
L R Garsden et al., 1999 [28]	40	partial weight-bearing test	6 trials	Experimental set-up simulating single-leg stance in weight-bearing under low load
PazitLevinger et al., 2017 [29]	-	Feasibility and safety outcomes, Cognitive tests, WOMAC,	8 weeks	High-speed resistance training, High-speed





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		AQoL, IPEQ, Short FES-I, SAPS		resistance and balance training
JuditTakacs et al., 2017 [30]	36	Community Balance and Mobility Scale, WOMAC	10 weeks	Targeted dynamic balance training
DemirhanDiracoglu et al., 2005 [31]	66	WOMAC, SF-36 Form	8 weeks	kinesthesia and balance exercises, strengthening exercises
Aysha I. Adhama et al., 2017 [32]	84	Ibadan Knee and Hip Osteoarthritis Outcome Measure, VAS, KOOS, Osteoarthritis Knee and Hip Quality of Life Questionnaire	8 weeks	Ultrasound therapy, stretching and strengthening exercises
PeixinShen et al., 2020 [33]	27	WOMAC, knee joint proprioception test, ascent stair gait test	6 weeks	PNF stretching
Omer Gezginaslan et al., 2019 [34]	39	VAS, WOMAC-P, WOMAC-PF, TUG, Five Times Sit to Stand Test, 6MWT WOMAC-S, BBS	6 weeks	Isokinetic muscle strengthening exercises
K. Kotteeswaran et al., 2020 [7]	40	KOOS outcome and TUG test	4 weeks	Weight bearing exercises on wobble board along with interferential therapy, weight bearing exercises on stable platform along with interferential therapy
SrinivasMondam et al., 2012 [9]	50	WOMAC, VAS	2 weeks	Isometric quadriceps exercises, proprioceptive exercise, ultrasound therapy
Zehua Chen et al., 2021 [35]	48	Static stability, proprioception, NRS, WOMAC	4 weeks	Conventional treatment comprising acupotomy, medications, and routine exercise





A Study on Dominating Sets of Interval Graphs and Circular – ARC Graph

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ABSTRACT

In this work, dominating sets of interval graphs and circular are graph deals finding a minimum dominating set is complete for subclasses of planer graph. The minimum weight dominating sets and independent dominating sets in strongly chordal graphs. The domatic number of a graph is the maximum number of a graph is the maximum number of dominating sets which partition the nodes. Also finding a minimum dominating set in a circular are graph, the domatic number problem is investigated. The exact value of complementary tree domination number and minimal complementary tree domination sets of some particular classes of interval graphs are obtained.

Keywords: Anti-Median, dominating sets, Interval Graphs.

INTRODUCTION

operators on Median and Anti-Median Graphs

The median of a graph is one of the centrality concepts, together with the notions such as centre and centroid, is defined using distance, which is one of the widely used concepts in graph theory. In network theory these concepts are known as 'facility locations'. The problems of finding facility location naturally arise in situations like placing post offices, warehouse or emergency services such as hospitals or fire stations. For instance, the median of a graph is a node in a graph or network which minimizes the sum of the distance to other nodes in that graph. In network theory, the problem of finding the median is significant as it is related to the optimization problems involving the placement of network servers, the core of the entire networks, especially in very large interconnection networks.

The studies on the structure of facility locations started with, where it is shown that the centre and the centroid of a tree consists of one vertex or two adjacent vertices. The number of vertices used for such a construction was

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shown to be $\leq 2|V(G)|$, and it was improved to $2|V(G)| - \delta(G) + 1$ in [21]. Median location is shown to be the optimum location for minimizing the transportation costs to a facility and center to be the optimum location for an emergency response facility, studies and surveys on locations in graphs are presented.

When the graph operators under consideration maps a graph into its subgraphs, the problem of finding a common root graph is also referred to as a simultaneous embedding problem. For instance, in [21] it is shown that given two graphs G_1 and G_2 , there exists a graph H with G_1 as the median and G_2 as the center and still be disjoint. In another words, there is a common root graph H such that $M(H) \cong G_1$ and $C(H) \cong G_2$. Later, $d_H(G_1, G_2)$ can be any integer n in such a construction. The problems offending common roots for different operators such as center, periphery, median, anti-median, centroid, etc.,

However, the median constructions for general graphs cannot be directly applied to many networks as their underlying graph belong to different classes of graphs. Hence, the study of the median operator for different classes of graphs is also significant. We note that the underlying graphs of many networks are bipartite. For example, most of the analysis in network communities are done using preference networks and they are modeled using bipartite graphs. We present a study on the root graphs of k -partite graphs and some related sub-classes under median and anti-median operators. We also provide some general solutions using the techniques developed.

Median and Anti-Median Problems on Bipartite graph

This chapter deals with the median problem on k -partite graphs and some of its sub classes. We prove the existence of k -partite graphs as the root graphs of k -partite graphs, for some k , under the median and anti-median operators. Similar results for some subclasses of k -partite graphs are also presented in this chapter. The commutative properties of the median and anti-median operators with two graph operators, the bipartite graph of a graph and the square of a graph, are also discussed. When presenting the results for k -partite graphs, we use different methods for the cases when $k=2$ and $k \geq 3$.

Bipartite Graphs with Prescribed Median and Anti-Median.

Theorem 1

Given a bipartite graph G of n vertices, there exists a connected bipartite graph H such that G is an induced subgraph of H and all the vertices of G in H have equal status in H .

Proof:

Let X, Y be a bipartition of $V(G)$ and X', Y' be the copy of X, Y such that v' denote the copy of vertex $v \in V(G)$. Consider two new vertices v_x and v_y . Make v_y adjacent to all vertices of $X \cup X'$ and v_x adjacent to all vertices $Y \cup Y'$. Also for each $v \in X(Y)$ makes v' adjacent to $Y \setminus N(v) (X \setminus N(v))$. Now, when $v \in X$, $S_{H'}(v) = 1. |N(v) \cup Y \setminus N(v) \cup \{v_y\}| + 2. |X \setminus \{v\} \cup X' \cup \{v_x\}| + 3. |N(v) \cup Y \setminus N(v)| = 4n + 1$. A similar calculation when $v \in Y$ gives $S_{H'}(v) = 4n + 1$, for all $v \in V(G)$. Also, it follows from the construction that H' is bipartite.

Remark:

The graph H' is called the bipartite gadget graph of G . Let $|x| = n_1$ and $|y| = n_2$. Then we have, in H' , $S(v_x) = 4n + 1 - (2n_1 - 2)$, $S(v_y) = 4n + 1 - (2n_2 - 2)$ and $4n + 1 \leq s(v) \leq 4n + 1 + 2\Delta(G) + 2 + \max(n_1, n_2)$, for each $v \in V(G)$.

Theorem 2

Given a bipartite graph G there exists a bipartite graph H such that $M(H) \cong G$.

Proof:

The proof is by construction. Let H' be the bipartite gadget graph G . Choose a positive integer $s > \max(n_1, n_2) - 1$. Introduce s copies of K_2 and make one end of each K_2 adjacent to all the vertices of X and the other end to all





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the vertices of Y . Denote this graph by H . Then for each vertex $v \in V(G), S_H(v) = S_{H'}(v) + s + 2s = 4n + 1 + 3s$. Also, for each $v \in V(H \setminus G)$ the status is increased by $5s$. Let x be an arbitrary vertex from the newly added s copies of K_2 . It easy to verify that $S_H(x) \geq 4n + 1 + 5s$. Hence $S_H(v) < S_H(u)$, for all $v \in V(G)$, for all $u \in V(H \setminus G)$, hence $M(H) \cong G$.

**Median And Anti-Median Based Onbipartitegraphs And Connected Graphs
Median and Anti-Median Problems on Symmetric Bipartite Graphs**

Theorem 3

Given a symmetric bipartite graph G , there exists a connected symmetric bipartite graph G' such that G is an induced subgraph of G' and all the vertices of G in G' have equal status in G' .

Proof

Let $(X, Y)_f$ be a symmetric bi-partition of G . Let X', Y' be the copy of X, Y such that v' denote the copy of a vertex $v \in V(G)$. Consider two new vertices v_x and v_y . Let $A = X \cup X' \cup \{v_x\}$ and $B = Y \cup Y' \cup \{v_y\}$. Define a map g from A to B such that $g(v) = f(v), g(v'), \forall v \in X$ and $g(v_x) = v_y$.

Then, makes v_y adjacent to all the vertices in A and v_x adjacent to all vertices of B . Also, for each $v \in X(Y)$ make v' adjacent to $Y \setminus N(v) \cup \{g(v)\} (X \setminus N(v) \cup \{g^{-1}(v)\})$. Call this graph of G' and $S_{G'}(v) = 4n + 1$, for all $v \in V(G)$.

The graph G' is called the symmetric bipartite gadget graph of G .

Theorem 4.

Given two symmetric bipartite graphs G and J there exists a symmetric bipartite graph H with $M(H) \cong G$ and $C(H) \cong J$.

Proof

The proof is by construction. Let G' be the symmetric bipartite gadget graph of G with symmetric bi-partition $(A, B)_f$ and $(R, S)_g$ be a symmetric bi-partition of J . For $k \geq 3$, introduce two ladder graphs $\{X_i, Y_i\}_{i=1}^{k-1}$ and $\{u_i, v_i\}_{i=1}^{k+1}$ with symmetric bi-partitions $(X_1, Y_1)_{f_1}$ and $(X_2, Y_2)_{f_2}$ respectively.

Make x_i adjacent to $X \cup \{v_x\}, y_1$ to $Y \cup \{v_y\}, x_{k-1}$ to R, y_{k-1} to S, u_1 to R and v_1 to S . Denote this graph by H_0 . Introduce s copies of K_2 and $a_i b_i, i = 1, \dots, s$ be the edges in sK_2 . Make $\{a_i\}_{i=1}^s$ adjacent to all the vertices in X and $\{b_i\}_i^s$ adjacent to all the vertices in Y . Denote this new graph by H . Clearly $C(H) \cong J$ with $e(v) = k + 2$, for all $v \in V(J)$ and $S(x) = S(y) = 4n + 1 + (2k + 1)(2k + 2 + |R|) + 3s$, for all $x \in X, y \in Y$.

For a vertex $u \in V(H)$, let $S^*(u) = d(u, a_m) + d(u, b_m)$, where $a_m b_m$ be an edge in the s copies of K_2 in H . Then, $S^*(u) = 3, u \in V(G)$ and $S^*(u) \geq 5, u \in V(H \setminus G \setminus \{a_m, b_m\})$. Hence $M(H) = G$, when $s > SD(H_0)/2$.

When k is even, let $A' = A \cup X_1 \cup X_2 \cup R \cup \{b_i\}$ and $B' = H \setminus A'$. Let h be the function defined on A' by $h(x) = f_i(x)$, when $x \in A, h(x) = g(x)$, when $x \in R, h(x) = f_i(x)$, when $x \in X_i, i = 1, 2$, and $h(b_i) = a_i, 1 \leq i \leq s$. It is clear that (A', B') . Redefining $h(x) = g^{-1}(x)$, for the vertices $x \in S. (A', B')_h$ becomes a symmetric bi-partition of H .

Convex Representation For Median And Anti-Median Graphs

Convex Median and Anti- Median

An optimal solution to the problem of simultaneous embedding of two graphs as the median and anti-median subgraphs of a graph is also given.

An upper bound to maximum status difference in a graph

For any vertex v in a graph G on n vertices, $n - 1 \leq S_u(v) \leq \frac{n(n-1)}{2}$. Hence, an obvious upper bound for $SD(G)$ is $\frac{n(n-1)(n-2)}{2}$. However, this upper bound is sharp only when the graph is $P_n, n \leq 3$, where p_n is the path on n vertices.

We obtain a sharp upper bound $SD(G)$ through the following results.





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Root Graphs

Adjacency Properties of Edges of $L(G)$

The hanging graph $H = (V, E)$, with $|V| = n$ and $|E| = m$, by a vertex z is the function h_z that assign to each vertex x of H the value $d(z, x)$. The i^{th} level of H in a hanging h_z is defined as $L_i = \{x \in H: h_z(x) = i\}$. A hanging can be obtained using a breath first search(BFS), which has a time complexity of $O(m + n)$.

For a vertex v in L_i , a supporter of v is a vertex in L_{i-1} , which is adjacent to v . A vertex in L_i is an ending vertex if it has no neighbors in L_{i+1} . An arbitrary supporter of v is denoted by $S(v)$. It is clear that any vertex v in the level L_i for $i \geq 1$ has atleast one supporter.

We use the following, well known, forbidden subgraph characterization of a line graph.

Theorem 5.

A graph H is a line graph if and only if the nine graphs in fig 6.1 are forbidden subgraphs for H .

Theorem 6.

Consider a hanging of a line graph H by an arbitrary vertex in H and let uv denote the edge joining u and v in the same level L_i . Then, the following statements hold

1. All common neighbors of uv in L_{i-1} are adjacent to each other.
2. All common neighbors of uv in L_{i+1} are adjacent to each other.
3. If uv has no common neighbors in L_{i-1} , then all the common neighbors of uv in L_i which are adjacent to all other neighbors of uv are adjacent to each other.
4. There is at most one common neighbor of uv in L_i , which is adjacent to all the neighbors of uv but not adjacent to the common neighbors of uv in L_{i-1} and L_i .

Proof

1. Let x and x' be two (distinct) common neighbors of an edge uv in L_{i-1} , then $i \geq 2$. Assume that x and x' are not adjacent. Now, if x and x' have a common neighbors in L_{i-2} , then $\langle w, x, x', u, v \rangle \cong F_2$ in fig 6.1 which contradicts the fact that H is a line graph. So, let w and w' be any two vertices in L_{i-2} adjacent to x and x' respectively. Then $\langle w, w', x, x', u, v \rangle \cong F_7$ or F_4 according as, w and w' are adjacent or not.
2. Let w and x be two common neighbors of an edge uv in L_{i-1} . Assume that x and w are not adjacent. Now, if z is a supporter of u in L_{i-1} , then $\langle z, u, w, x \rangle \cong K_{1,3}$, which is a contradiction.
3. Let uv has no common neighbors in the level L_{i-1} and hence $i \geq 2$. Let x and w be two common neighbours of uv in L_i which are adjacent to all neighbors of uv . Assume that x and w are not adjacent. Now u and v cannot have a common supporter. So let z and z_2 be two supporters of u and v respectively. Since z_1 and z_2 are neighbors of uv , both x and w are adjacent to them. Now, the vertices z_1, x, w and $S(z_1)$ induce a $K_{1,3}$ which is a contradiction.
4. Assume that x and w are two nonadjacent common neighbors of uv in L_i which are not adjacent to the common neighbors of uv but adjacent to all the other neighbors of uv in L_{i-1} and L_i . So, it is clear that $i \geq 2$. Let z be a common neighbors of uv in L_{i-1} other than the common neighbors of uv in L_{i-1} , for otherwise, the vertices u, x, w and z induce a $K_{1,3}$ which is a contradiction. Similar is the case for the vertex v . So let z_1 and z_2 be two neighbors (but not common neighbors) of u and v in L_{i-1} respectively. But, we have $\langle S(z_1), z_1, x, w \rangle \cong K_{1,3}$, which is also a contradiction.

CONCLUSION

In this result the root graphs of some graph operators are studied. We have shown the existence of root graphs of different graph classes and provided solutions to some of the existing problems in graph theory. The solutions





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to the problems of finding common root graphs of median, anti-median, center operators are also given. An algorithm to find the root line graph based on a partition on the edge set of a line graph is provided.

We list below some problems which we found are interesting, but could not be attempted for various reasons.

1. Given three k -partite graphs G_1, G_2 and G_3 , find a k -partite graph H such that $M(H) \cong G_1, AM(H) \cong G_2$ and $C(H) \cong G_3$.
2. Check the existence of the graph of the form (G_1, G_2, r) with a prescribed center, for $r \geq 1$.
3. Find the relation between $M(G^k)$ and $M(G)^k$. Similarly for AM operator.
4. Find upper bounds of $SD(G)$ in different graph classes.
5. Find root line graphs of some more graph classes.

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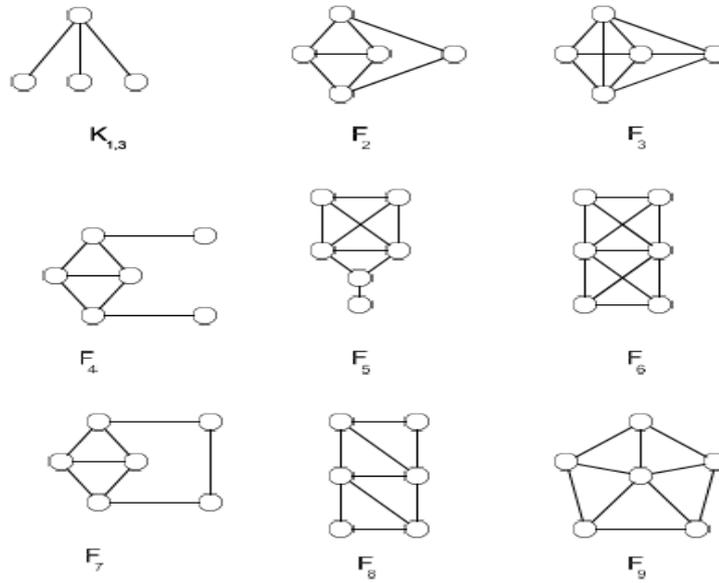


Figure 1. Forbidden Subgraph of line graph.





Influence of Vertical Magnetic Field and Nonuniform Temperature Gradients on Double Component Marangoni Convection in a Two-Layer System in the Presence of Variable Heat Source/Sink

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ABSTRACT

The problem of non-Darcian-Bénard double component Marangoni convection is investigated in an infinite two layer system consisting of an electrically conducting fluid layer at the top of a porous layer sparsely saturated with the same fluid, with constant heat sources/sink in both the layers in the presence of vertical magnetic field. The problem is solved for the Eigen value, the thermal Marangoni number in closed form obtained for three different temperature profiles. Also, corresponding three thermal Marangoni numbers are obtained and the influence of the different parameters on non-Darcian-Bénard double component Marangoni convection in the presence of vertical magnetic field are investigated in detail.

Keywords: Double component, magnetic field, heat source, thermal ratio, Marangoni number.

INTRODUCTION

In standard Bénard problem, density difference was the only diffusing component due to which the system was unstable. This instability is due to the difference in temperature between the two surface boundaries of the fluid. This situation where the temperature is the only diffusing component is referred to as single component diffusion. If the fluid has an additional salt (solute) dissolved in it then there are two destabilizing sources for the density difference that is temperature and salt, which is known as double diffusion. The applications of these type of instabilities are in solidification of molten alloys, geothermally heated lakes, oceanography, high quality crystal



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production, oceanography, production of pure medication, underground water flow and many more. The presence of external forces like magnetic field which happens to be stabilizing in the case of single component instability, can be destabilizing in the case of double diffusive instabilities. There are some papers available on double diffusive convection problems in single fluid /porous in the presence/absence of magnetic field and are, numerical study of double-diffusive natural convective heat and mass transfer in an inclined rectangular cavity filled with a porous medium by Khaled. Al-Farhany and Turan (2012). Sumithra (2014) studied the double-diffusive magneto Marangoni convection in a composite layer by using regular perturbation techniques. The critical thermal Rayleigh number, which is the criterion for the stability of the system is obtained. Marangoni convection in a horizontal layer with a uniform internal heat source and the vertical magnetic field is analyzed by Gangadharaiah (2017).

Ananda and Gangadharaiah (2018) examined the Influence of vertical magnetic field on the onset of Rayleigh-Bénard-Marangoni convection in superposed fluid and porous layers with the deformable free surface. Khaled Al-Farhany and Turan (2019) experimentally investigated the mixed convection in a square enclosure partitioned in two layers. The results showed that the effect of cylinder rotation was around cylinder only. Komala and Sumithra (2019) studied the effects of non-uniform salinity gradients on the onset of double-diffusive magneto-Marangoni convection in a composite layer. Ali Ahmadpour *et al.* (2019) studied the laminar natural convection of a non-Newtonian ferrofluid inside an elliptical porous cavity that was numerically simulated in the presence of a non-uniform external magnetic field. They show that by applying the magnetic field by a wire, the overall heat transfer rate increased significantly.

Recently, Talha Anwar *et al.* (2020) studied the molecule's unsteady radiative natural convective MHD nanofluid flow past a porous moving vertical plate with heat source/sink. They found that increasing values of heat sink parameter and Prandtl number drop the thermal profile. The effect of the magnetic field on the onset of double-diffusive convection in a porous medium coupled with cross-diffusion in a micropolar fluid studied by Annicy *et al.* (2020). Ali J. Chamkha *et al.* (2020) introduces a numerical analysis to investigate the importance of hybrid nanofluid in the free convection inside a partially heated square cavity, and subjected to the inclined magnetic field with heat generation/absorption. Jha and Samaila (2020) examine the relevance of heat source/sink on magnetohydrodynamics free convection flow in a vertical channel with an induced magnetic field. Results reveal that the Brownian motion parameter and Buoyancy ratio augment enhances the shear stress, whereas the contrast is observed with Hartman number and thermophoretic parameter. Mahanthesh *et al.* (2020) investigated the impact of internal heat generation/absorption on Rayleigh-Benard convection in a non-Newtonian dielectric fluid with Maxwell-Cattaneo heat flux. Kanchana *et al.* (2020) studied the effect of boundary conditions on the onset of chaos in Rayleigh-Benard convection using energy-conserving Lorenz models. A numerical solution of double-diffusive convective flow past a chemical reactive vertically inclined infinite plate with heat source/sink studied by Kannan and Pullepu (2020). Sumithra *et al.* (2020a, 2020b), Manjunatha and Sumithra (2020c, 2020d) and Manjunatha *et al.* (2021a, 2021b) studied the effect of constant heat source / sink and temperature gradients on composite layer with and without magnetic field. They obtained the closed form of solution to thermal Marangoni number for three different temperature profiles. In this paper, the problem is solved for the Eigen value, the thermal Marangoni number (tMn) in closed form obtained for three different temperature profiles also, corresponding three tMn's are obtained and the influence of the different parameters on non-Darcian-Bénard double component Marangoni convection in the presence of vertical magnetic field are investigated in detail.

MATERIALS AND METHODS

Consider a horizontal double component, electrically conducting fluid saturated isotropic, incompressible sparsely packed porous layer of thickness d_m underlying a two component fluid layer of thickness d with an imposed magnetic field intensity H_0 in the vertical z-direction and with heat sources Φ_m and Φ respectively. The lower





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surface of the porous layer rigid and the upper surface of the fluid layer is free with surface tension effects depending on temperature and concentration. A Cartesian coordinate system is chosen with the origin at the interface between porous and fluid layers and the z-axis, vertically upwards. The basic equations for fluid and porous layer respectively governing such a system are,

$$\nabla \cdot \vec{V} = 0 \tag{1}$$

$$\nabla \cdot \vec{H} = 0 \tag{2}$$

$$\rho_0 \left[\frac{\partial \vec{V}}{\partial t} + (\vec{V} \cdot \nabla) \vec{V} \right] = -\nabla P + \mu \nabla^2 \vec{V} + \mu_p (\vec{H} \cdot \nabla) \vec{H} \tag{3}$$

$$\frac{\partial T}{\partial t} + (\vec{V} \cdot \nabla) T = \kappa \nabla^2 T + \Phi \tag{4}$$

$$\frac{\partial C}{\partial t} + (\vec{V} \cdot \nabla) C = \kappa_c \nabla^2 C \tag{5}$$

$$\frac{\partial \vec{H}}{\partial t} = \nabla \times \vec{V} \times \vec{H} + \nu \nabla^2 \vec{H} \tag{6}$$

$$\nabla_m \cdot \vec{V}_m = 0 \tag{7}$$

$$\nabla_m \cdot \vec{H} = 0 \tag{8}$$

$$\rho_0 \left[\frac{1}{\varepsilon} \frac{\partial \vec{V}_m}{\partial t} + \frac{1}{\varepsilon^2} (\vec{V}_m \cdot \nabla_m) \vec{V}_m \right] = -\nabla_m P_m - \frac{\mu}{K} \vec{V}_m + \mu_m \nabla_m^2 \vec{V}_m + \mu_p (\vec{H} \cdot \nabla_m) \vec{H} \tag{9}$$

$$A \frac{\partial T_m}{\partial t} + (\vec{V}_m \cdot \nabla_m) T_m = \kappa_m \nabla_m^2 T_m + \Phi_m \tag{10}$$

$$\varepsilon \frac{\partial C_m}{\partial t} + (\vec{V}_m \cdot \nabla_m) C_m = \kappa_{cm} \nabla_m^2 C_m \tag{11}$$

$$\varepsilon \frac{\partial \vec{H}}{\partial t} = \nabla_m \times \vec{V}_m \times \vec{H} + \nu_{em} \nabla_m^2 \vec{H} \tag{12}$$

where for fluid layer, \vec{V} is the velocity vector, ρ_0 is the fluid density, t is time, μ is fluid viscosity, P is the total pressure, \vec{H} is the magnetic field, T is temperature, κ is the thermal diffusivity of the fluid, ν is the magnetic viscosity and μ_p is the magnetic permeability. For porous layer, ε is the porosity, μ_m is the effective viscosity of the fluid in the porous layer, K is the permeability of the porous medium, A is the ratio of heat capacities, κ_m is the thermal diffusivity, ν_{em} is the effective magnetic viscosity and the subscript 'm' denotes the quantities in porous layer.

The aim of this paper is to investigate the stability of a quiescent state to infinitesimal perturbations superposed on the basic state.

The basic state is quiescent, have the following solutions





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Fluid layer

$$\vec{V} = 0, P = P_b(z), T = T_b(z), C = C_b(z), \vec{H} = H_0(z) \tag{13}$$

Porous layer:

$$\vec{V}_m = 0, P_m = P_{mb}(z_m), T_m = T_{mb}(z_m), C_m = C_{mb}(z_m), \vec{H} = H_0(z_m) \tag{14}$$

The temperature distribution in the basic state are obtained by

$$T_b(z) = \frac{-\Phi z(z-d)}{2\kappa} + \frac{(T_u - T_0)f(z)}{d} + T_0 \quad 0 \leq z \leq d \tag{15}$$

$$T_{mb}(z_m) = \frac{-\Phi_m z_m(z_m + d_m)}{2\kappa_m} + \frac{(T_0 - T_l)f_m(z_m)}{d_m} + T_0 \quad -d_m \leq z_m \leq 0 \tag{16}$$

The concentration distributions in the basic state are obtained by

$$C_b(z) = C_0 - \frac{(C_0 - C_u)z}{d} \quad 0 \leq z \leq d \tag{17}$$

$$C_{mb}(z_m) = C_0 - \frac{(C_l - C_0)z_m}{d_m} \quad -d_m \leq z_m \leq 0 \tag{18}$$

where $T_0 = \frac{\kappa d_m T_u + \kappa_m d T_l}{\kappa d_m + \kappa_m d} + \frac{d d_m (\Phi_m d_m + \Phi d)}{2(\kappa d_m + \kappa_m d)}$, $C_0 = \frac{\kappa_c d_m C_u + \kappa_{cm} d C_l}{\kappa_c d_m + \kappa_{cm} d}$ are the interface temperature and concentration, $f(z)$ & $f_m(z_m)$ are the temperature gradients in fluid & porous layer respectively.

To investigate the stability of the basic state, infinitesimal disturbances are superimposed on fluid and porous layer respectively

$$\vec{V} = \vec{V}', P = P_b + P', T = T_b(z) + \theta, C = C_b(z) + S, \vec{H} = H_0(z) + \vec{H}' \tag{19}$$

$$\vec{V}_m = \vec{V}_m', P_m = P_{mb} + P_m', T_m = T_{mb}(z_m) + \theta_m, C_m = C_{mb}(z_m) + S_m, \vec{H} = H_0(z_m) + \vec{H}' \tag{20}$$

Following the standard linear stability analysis procedure and assuming that the principle of exchange of stability holds [15-20], we arrive at the following stability equations:

in $0 \leq z \leq 1$

$$(D^2 - a^2)^2 W(z) = Q D^2 W(z) \tag{21}$$

$$(D^2 - a^2)\theta(z) + [f(z) + R_l^*(2z - 1)]W(z) = 0 \tag{22}$$

$$\tau(D^2 - a^2)S(z) + W(z) = 0 \tag{23}$$

in $-1 \leq z_m \leq 0$

$$[(D_m^2 - a_m^2)\hat{\mu}\beta^2 - 1](D_m^2 - a_m^2)W_m(z_m) = Q_m \beta^2 D_m^2 W_m(z_m) \tag{24}$$

$$(D_m^2 - a_m^2)\theta_m(z_m) + [f_m(z_m) + R_{lm}^*(2z_m + 1)]W_m(z_m) = 0 \tag{25}$$

$$\tau_m(D_m^2 - a_m^2)S_m(z_m) + W_m(z_m) = 0 \tag{26}$$

In the above equations Q , $R_l^* = \frac{R_l}{2(T_0 - T_u)}$, $R_l = \frac{\Phi d^2}{\kappa}$, $\tau = \frac{\kappa_c}{\kappa}$ are namely, the Chandrasekhar number, the modified internal Rayleigh number, the internal Rayleigh number, the diffusivity ratios respectively for fluid layer





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and $\hat{\mu} = \frac{\mu_m}{\mu}$, $\beta = \sqrt{\frac{K}{d_m^2}}$, Q_m , $R_{im}^* = \frac{R_{im}}{2(T_l - T_0)}$, $R_{im} = \frac{\Phi_m d_m^2}{\kappa_m}$, $\tau_m = \frac{\kappa_{cm}}{\kappa_m}$ are namely, the viscosity ratio, the porous parameter, the Chandrasekhar number, the modified internal Rayleigh number, the internal Rayleigh number and the diffusivity ratio respectively for porous layer. $W(z)$ & $W_m(z_m)$ are the vertical velocities, $\theta(z)$ & $\theta_m(z_m)$ are the temperature distributions and $S(z)$ & $S_m(z_m)$ are the concentration distributions in fluid and porous layers respectively and a, a_m are the horizontal wave numbers. Since the horizontal wave numbers must be the same for the composite layers, so that we have $\frac{a}{d} = \frac{a_m}{d_m}$ and hence $a_m = \hat{d}a$, here $\hat{d} = \frac{d_m}{d}$ is the depth ratio.

The following boundary conditions are used to solve the equations (21) to (26) and they are

$$D^2W(1) + M_t a^2 \theta(1) + M_s a^2 S(1) = 0 \tag{27}$$

The velocity boundary conditions are

$$\begin{aligned} W(1) = 0, W_m(-1) = 0, D_m W_m(-1) = 0, \hat{T}W(0) = W_m(0), \\ \hat{T}\hat{d}^2(D^2 + a^2)W(0) = \hat{\mu}(D_m^2 + a_m^2)W_m(0), \hat{T}\hat{d}DW(0) = D_m W_m(0) \\ \hat{T}\hat{d}^3\beta^2[(D^3 - 3a^2D)]W(0) = [-D_m + \hat{\mu}\beta^2(D_m^3 - 3a_m^2D_m)]W_m(0) \end{aligned} \tag{28}$$

The temperature distribution boundary conditions are

$$D\theta(1) = 0, \theta(0) = \hat{T}\theta_m(0), D\theta(0) = D_m\theta_m(0), D_m\theta_m(-1) = 0 \tag{29}$$

The salinity distribution boundary conditions are

$$DS(1) = 0, S(0) = \hat{S}S_m(0), DS(0) = D_m S_m(0), D_m S_m(-1) = 0 \tag{30}$$

In the above equations, $\hat{S} = \frac{C_l - C_0}{C_0 - C_u}$ is the solute diffusivity ratio, $\hat{T} = \frac{T_l - T_0}{T_0 - T_u}$ is the thermal ratio,

$M_t = -\frac{\partial\sigma_t}{\partial T} \frac{(T_0 - T_u)d}{\mu\kappa}$ is the thermal Marangoni number, $M_s = -\frac{\partial\sigma_t}{\partial C} \frac{(C_0 - C_u)d}{\mu\kappa}$ is the solute

Marangoni number and σ_t is the surface tension.

METHOD OF SOLUTION

The solutions of $W(z)$ and $W_m(z_m)$ are obtained by solving (21) and (24) using the velocity boundary conditions (28), as follows

$$W(z) = A_1[\cosh \delta z + a_1 \sinh \delta z + a_2 \cosh \zeta z + a_3 \sinh \zeta z] \tag{31}$$

$$W_m(z_m) = A_1[a_4 \cosh \eta_m z_m + a_5 \sinh \eta_m z_m + a_6 \cosh \psi_m z_m + a_7 \sinh \psi_m z_m] \tag{32}$$

Where

$$\begin{aligned} \delta = \frac{\sqrt{Q} + \sqrt{Q + 4a^2}}{2}, \zeta = \frac{\sqrt{Q} - \sqrt{Q + 4a^2}}{2}, \eta_m = \sqrt{\frac{E + \sqrt{E^2 - 4F}}{2}}, \psi_m = \sqrt{\frac{E - \sqrt{E^2 - 4F}}{2}}, \\ E = \frac{(2\hat{\mu}\beta^2 a_m^2 + 1 + Q_m\beta^2)}{\hat{\mu}\beta^2}, F = \frac{(a_m^2 + a_m^4 \hat{\mu}\beta^2)}{\hat{\mu}\beta^2}, \end{aligned}$$





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$$a_1 = \frac{1}{\delta_{14}}(a_6\delta_{15} + a_7\delta_{16} + \delta_{17}), a_2 = a_6\delta_5 + \delta_6, a_3 = \frac{1}{\delta_9}(a_1\delta_{10} + a_7\delta_{11}),$$

$$a_4 = \delta_7 + a_6\delta_8, a_5 = a_1\delta_{12} + a_7\delta_{13}, a_6 = \frac{\delta_{23}\delta_{25} - \delta_{26}\delta_{22}}{\delta_{25}\delta_{21} - \delta_{24}\delta_{22}},$$

$$a_7 = \frac{\delta_{23}\delta_{24} - \delta_{26}\delta_{21}}{\delta_{24}\delta_{22} - \delta_{25}\delta_{21}}, \delta_1 = \hat{T}\beta^2\hat{d}^3(\delta^3 - 3a^2\delta), \delta_2 = \hat{T}\beta^2\hat{d}^3(\zeta^3 - 3a^2\zeta),$$

$$\delta_3 = \hat{\mu}\beta^2(\eta_m^3 - 3a_m^2\eta_m) - \eta_m, \delta_4 = \hat{\mu}\beta^2(\psi_m^3 - 3a_m^2\psi_m) - \psi_m,$$

$$\delta_5 = \frac{\hat{\mu}[(\psi_m^2 + a_m^2) - \hat{T}(\eta_m^2 + a_m^2)]}{[\hat{T}\hat{d}^2(\zeta^2 + a^2) - \hat{\mu}\hat{T}(\eta_m^2 + a_m^2)]}, \delta_6 = \frac{[\hat{\mu}(\eta_m^2 + a_m^2) - \hat{d}^2(\delta^2 + a^2)]}{[\hat{d}^2(\zeta^2 + a^2) - \hat{\mu}(\eta_m^2 + a_m^2)]},$$

$$\delta_7 = \hat{T}(1 + \delta_6), \delta_8 = \hat{T}\delta_5 - 1, \delta_9 = \delta_2 - \frac{\hat{T}\hat{d}\zeta\delta_3}{\eta_m}, \delta_{10} = -\delta_1 + \frac{\hat{T}\hat{d}\delta\delta_3}{\eta_m},$$

$$\delta_{11} = \delta_4 - \frac{\psi\delta_3}{\eta_m}, \delta_{12} = \frac{1}{\eta_m}(\hat{T}\hat{d}\delta + \frac{\zeta\delta_{10}}{\delta_9}), \delta_{13} = \frac{1}{\eta_m}[(\frac{\hat{T}\hat{d}\zeta\delta_{11}}{\delta_9} - \psi_m)],$$

$$\delta_{14} = \sinh \delta + \frac{\delta_{10} \sinh \zeta}{\delta_9}, \delta_{15} = \delta_5 \cosh \zeta, \delta_{16} = \frac{\delta_{11} \sinh \zeta}{\delta_9},$$

$$\delta_{17} = \delta_6 \cosh \zeta + \cosh \delta, \delta_{18} = \frac{\delta_{12}\delta_{15}}{\delta_{14}}, \delta_{19} = \frac{\delta_{12}\delta_{16}}{\delta_{14}} + \delta_{13}, \delta_{20} = \frac{\delta_{12}\delta_{17}}{\delta_{14}},$$

$$\delta_{21} = \delta_8 \cosh \eta_m - \delta_{18} \sinh \eta_m + \cosh \psi_m,$$

$$\delta_{22} = -\delta_{19} \sinh \eta_m - \sinh \psi_m, \delta_{23} = \delta_{20} \sinh \eta_m - \delta_7 \cosh \eta_m,$$

$$\delta_{24} = -\eta_m \delta_8 \sinh \eta_m - \delta_{18} \eta_m \cosh \eta_m - \psi_m \sinh \psi_m, \delta_{25} = -\eta_m \delta_{19} \cosh \eta_m + \psi_m \cosh \psi_m,$$

$$\delta_{26} = \delta_{20} \eta_m \cosh \eta_m + \delta_7 \eta_m \sinh \eta_m.$$

Solving equations (23) and (26) for the salinity distributions $S(z)$ and $S_m(z_m)$ using the following salinity/concentration boundary conditions (30), as follows

$$S(z) = A_1[c_{13} \cosh az + c_{14} \sinh az + f_1(z)] \tag{33}$$

$$S_m(z_m) = A_1[c_{15} \cosh a_m z_m + c_{16} \sinh a_m z_m + f_{m1}(z_m)] \tag{34}$$

where $f_1(z) = \frac{-1}{\tau} \left[\frac{\cosh \delta z + a_1 \sinh \delta z}{\delta^2 - a^2} + \frac{a_2 \cosh \zeta z + a_3 \sinh \zeta z}{\zeta^2 - a^2} \right]$

$$f_{m1}(z_m) = \frac{-1}{\tau_{pm}} \left[\frac{a_4 \cosh \eta_m z_m + a_5 \sinh \eta_m z_m}{\eta_m^2 - a_m^2} + \frac{a_6 \cosh \psi_m z_m + a_7 \sinh \psi_m z_m}{\psi_m^2 - a_m^2} \right]$$

$$c_{13} = \hat{S}c_{15} + \Delta_{100} + \Delta_{101}, c_{14} = \frac{1}{a}(c_{16}a_m + \Delta_{102} + \Delta_{103}), c_{15} = \frac{\Delta_{108}a_m \cosh a_m - \Delta_{107}\Delta_{105}}{a_m \sinh a_m \Delta_{107} + \Delta_{106}a_m \cosh a_m},$$

$$c_{16} = \frac{\Delta_{105}\Delta_{106} + a_m \sinh a_m \Delta_{108}}{a_m \sinh a_m \Delta_{107} + \Delta_{106}a_m \cosh a_m}$$





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$$\Delta_{100} = \frac{-\hat{S}}{\tau_{pm}} \left[\frac{a_4}{\eta_m^2 - a_m^2} + \frac{a_6}{\psi_m^2 - a_m^2} \right], \Delta_{101} = \frac{1}{\tau} \left[\frac{1}{\delta^2 - a^2} + \frac{a_2}{\zeta^2 - a^2} \right]$$

$$\Delta_{102} = \frac{-1}{\tau_{pm}} \left[\frac{\eta_m a_5}{\eta_m^2 - a_m^2} + \frac{\psi_m a_7}{\psi_m^2 - a_m^2} \right], \Delta_{103} = \frac{1}{\tau} \left[\frac{a_1 \delta}{\delta^2 - a^2} + \frac{a_3 \zeta}{\zeta^2 - a^2} \right],$$

$$\Delta_{104} = \frac{1}{\tau} \left[\frac{(\sinh \delta + a_1 \cosh \delta) \delta}{\delta^2 - a^2} + \frac{(a_2 \sinh \zeta + a_3 \cosh \zeta) \zeta}{\zeta^2 - a^2} \right],$$

$$\Delta_{105} = \frac{1}{\tau_{pm}} \left[\frac{\eta_m (-a_4 \sinh \eta_m + a_5 \cosh \eta_m)}{\eta_m^2 - a_m^2} + \frac{\psi_m (-a_6 \sinh \psi_m + a_7 \cosh \psi_m)}{\psi_m^2 - a_m^2} \right],$$

$$\Delta_{106} = \hat{S} a \sinh a, \Delta_{107} = a_m \cosh a, \Delta_{108} = \Delta_{104} - (\Delta_{100} + \Delta_{101}) a \sinh a - (\Delta_{102} + \Delta_{103}) \cosh a$$

Linear profile

Consider the linear profile,

$$f(z) = 1 \text{ and } f_m(z_m) = 1 \tag{35}$$

substituting equation (35) into (22) and (25), the temperature distributions $\theta(z)$ and $\theta_m(z_m)$ are obtained using the temperature boundary conditions (29), as follows

$$\theta(z) = A_1 [c_1 \cosh az + c_2 \sinh az + g_1(z)] \tag{36}$$

$$\theta_m(z_m) = A_1 [c_3 \cosh a_m z_m + c_4 \sinh a_m z_m + g_{m1}(z_m)] \tag{37}$$

Where $g_1(z) = A_1 [\delta_{27} - \delta_{28} + \delta_{29} - \delta_{30}]$, $g_{m1}(z_m) = A_1 [\delta_{31} - \delta_{32} + \delta_{33} - \delta_{34}]$

$$g_1(z) = A_1 [\delta_{27} - \delta_{28} + \delta_{29} - \delta_{30}], g_{m1}(z_m) = A_1 [\delta_{31} - \delta_{32} + \delta_{33} - \delta_{34}]$$

$$\delta_{27} = \frac{(E_2 z + E_1)}{(\delta^2 - a^2)} (\cosh \delta z + a_1 \sinh \delta z) \delta_{28} = \frac{2\delta E_2}{(\delta^2 - a^2)^2} (a_1 \cosh \delta z + \sinh \delta z)$$

$$\delta_{29} = \frac{(E_2 z + E_1)}{(\zeta^2 - a^2)} (a_2 \cosh \zeta z + a_3 \sinh \zeta z) \delta_{30} = \frac{2\zeta E_2}{(\zeta^2 - a^2)^2} (a_3 \cosh \zeta z + a_2 \sinh \zeta z)$$

$$\delta_{31} = \frac{(E_{2m} z_m + E_{1m})}{(\eta_m^2 - a_m^2)} (a_4 \cosh \eta_m z_m + a_5 \sinh \eta_m z_m) \delta_{32} = \frac{2\eta_m E_{2m}}{(\eta_m^2 - a_m^2)^2} (a_5 \cosh \eta_m z_m + a_4 \sinh \eta_m z_m)$$

$$\delta_{33} = \frac{(E_{2m} z_m + E_{1m})}{(\psi_m^2 - a_m^2)} (a_6 \cosh \psi_m z_m + a_7 \sinh \psi_m z_m) \delta_{34} = \frac{2\psi_m E_{2m}}{(\psi_m^2 - a_m^2)^2} (a_7 \cosh \psi_m z_m + a_6 \sinh \psi_m z_m)$$

$$E_1 = R_I^* - 1, E_2 = -2R_I^*, E_{1m} = -(R_{Im}^* + 1), E_{2m} = -2R_{Im}^*$$

$$c_3 = \frac{\Delta_8 \Delta_{10} - \Delta_{11} \Delta_6}{-\Delta_7 \Delta_{10} - \Delta_9 \Delta_6}, c_4 = \frac{\Delta_8 \Delta_9 + \Delta_{11} \Delta_7}{\Delta_6 \Delta_9 + \Delta_{10} \Delta_7},$$

$$c_1 = c_3 \hat{T} + \Delta_2 - \Delta_3, c_2 = \frac{1}{a} (c_4 a_m + \Delta_4 - \Delta_5),$$

$$\Delta_1 = -[\delta_{35} + \delta_{36} + \delta_{37} + \delta_{38}], \delta_{35} = \frac{\delta(E_2 + E_1)}{(\delta^2 - a^2)} (a_1 \cosh \delta + \sinh \delta),$$





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$$\delta_{36} = \left[\frac{E_2}{(\delta^2 - a^2)} - \frac{2\delta^2 E_2}{(\delta^2 - a^2)^2} \right] (\cosh \delta + a_1 \sinh \delta), \delta_{37} = \frac{\zeta (E_2 + E_1)}{(\zeta^2 - a^2)} (a_3 \cosh \zeta + a_2 \sinh \zeta),$$

$$\delta_{38} = \left[\frac{E_2}{(\zeta^2 - a^2)} - \frac{2\zeta^2 E_2}{(\zeta^2 - a^2)^2} \right] (a_2 \cosh \zeta + a_3 \sinh \zeta),$$

$$\Delta_2 = \hat{T} \left[\frac{E_{1m} a_4}{(\eta_m^2 - a_m^2)} - \frac{2E_{2m} \eta_m a_5}{(\eta_m^2 - a_m^2)^2} + \frac{E_{1m} a_6}{(\psi_m^2 - a_m^2)} - \frac{2E_{2m} \psi_m a_7}{(\psi_m^2 - a_m^2)^2} \right],$$

$$\Delta_3 = \frac{E_1}{(\delta^2 - a^2)} - \frac{2\delta a_1 E_2}{(\delta^2 - a^2)^2} + \frac{a_2 E_1}{(\zeta^2 - a^2)} - \frac{2\zeta a_3 E_2}{(\zeta^2 - a^2)^2},$$

$$\Delta_4 = \left[\frac{E_{2m}}{(\eta_m^2 - a_m^2)} - \frac{2\eta_m^2 E_{2m}}{(\eta_m^2 - a_m^2)^2} \right] a_4 + \frac{\eta_m a_5 E_{1m}}{(\eta_m^2 - a_m^2)} + \Delta_{400}$$

$$\Delta_{400} = \left[\frac{E_{2m}}{(\psi_m^2 - a_m^2)} - \frac{2\psi_m^2 E_{2m}}{(\psi_m^2 - a_m^2)^2} \right] a_6 + \frac{\psi_m a_7 E_{1m}}{(\psi_m^2 - a_m^2)}$$

$$\Delta_5 = \frac{E_1 \delta a_1 + E_2}{(\delta^2 - a^2)} - \frac{2E_2 \delta^2}{(\delta^2 - a^2)^2} + \frac{E_1 \zeta a_3 + E_2 a_2}{(\zeta^2 - a^2)} - \frac{2a_2 E_2 \zeta^2}{(\zeta^2 - a^2)^2},$$

$$\Delta_6 = a_m \cosh a_m, \Delta_7 = a_m \sinh a_m, \Delta_8 = -[\delta_{39} + \delta_{40} + \delta_{41} + \delta_{42}],$$

$$\delta_{39} = \left[\frac{E_{2m}}{(\eta_m^2 - a_m^2)} - \frac{2\eta_m^2 E_{2m}}{(\eta_m^2 - a_m^2)^2} \right] (a_4 \cosh \eta_m - a_5 \sinh \eta_m),$$

$$\delta_{40} = \eta_m \frac{(E_{1m} - E_{2m})}{(\eta_m^2 - a_m^2)} (a_5 \cosh \eta_m - a_4 \sinh \eta_m),$$

$$\delta_{40} = \left[\frac{E_{2m}}{(\psi_m^2 - a_m^2)} - \frac{2\psi_m^2 E_{2m}}{(\psi_m^2 - a_m^2)^2} \right] (a_6 \cosh \psi_m - a_7 \sinh \psi_m),$$

$$\delta_{41} = \psi_m \frac{(E_{1m} - E_{2m})}{(\psi_m^2 - a_m^2)} (a_7 \cosh \psi_m - a_6 \sinh \psi_m) \Delta_9 = \hat{T} a \sinh a, \Delta_{10} = a_m \cosh a,$$

$$\Delta_{11} = \Delta_1 - a(\Delta_2 - \Delta_3) \sinh a - (\Delta_4 - \Delta_5) \cosh a.$$

From the boundary condition (27), we have

$$M_t = - \frac{D^2 W(1) + M_s a^2 S(1)}{a^2 \theta(1)}$$

The tMn for the linear temperature profile is as follows

$$M_{t1} = - \frac{[\delta^2 (\cosh \delta + a_1 \sinh \delta) + \zeta^2 (a_2 \cosh \zeta + a_3 \sinh \zeta)]}{a^2 (c_1 \cosh a + c_2 \sinh a + \Lambda_1 + \Lambda_2)} \tag{38}$$

where $\Lambda_1 = \frac{(E_2 + E_1)}{(\delta^2 - a^2)} (\cosh \delta + a_1 \sinh \delta) - \frac{2\delta E_2}{(\delta^2 - a^2)^2} (a_1 \cosh \delta + \sinh \delta)$





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Parabolic profile

For the parabolic temperature profile,

$$f(z) = 2z \text{ and } f_m(z_m) = 2z_m \tag{39}$$

Substituting (39) into (22) and (25), the temperature distributions $\theta(z)$ and $\theta_m(z_m)$ are obtained using the temperature boundary conditions (29), as follows

$$\theta(z) = A_1[c_5 \cosh az + c_6 \sinh az + g_2(z)] \tag{40}$$

$$\theta_m(z_m) = A_1[c_7 \cosh a_m z_m + c_8 \sinh a_m z_m + g_{m2}(z_m)] \tag{41}$$

Where $g_2(z) = A_1[\delta_{43} - \delta_{44} + \delta_{45} - \delta_{46}]$, $g_{m2}(z_m) = A_1[\delta_{47} - \delta_{48} + \delta_{49} - \delta_{50}]$

$$\delta_{43} = \frac{(E_4 z + E_3)}{(\delta^2 - a^2)} (\cosh \delta z + a_1 \sinh \delta z) \quad \delta_{44} = \frac{2\delta E_4}{(\delta^2 - a^2)^2} (a_1 \cosh \delta z + \sinh \delta z)$$

$$\delta_{45} = \frac{(E_4 z + E_3)}{(\zeta^2 - a^2)} (a_2 \cosh \zeta z + a_3 \sinh \zeta z), \quad \delta_{46} = \frac{2\zeta E_4}{(\zeta^2 - a^2)^2} (a_3 \cosh \zeta z + a_2 \sinh \zeta z)$$

$$\delta_{47} = \frac{(E_{4m} z_m + E_{3m})}{(\eta_m^2 - a_m^2)} (a_4 \cosh \eta_m z_m + a_5 \sinh \eta_m z_m)$$

$$\delta_{48} = \frac{2\eta_m E_{4m}}{(\eta_m^2 - a_m^2)^2} (a_5 \cosh \eta_m z_m + a_4 \sinh \eta_m z_m)$$

$$\delta_{49} = \frac{(E_{4m} z_m + E_{3m})}{(\psi_m^2 - a_m^2)} (a_6 \cosh \psi_m z_m + a_7 \sinh \psi_m z_m)$$

$$\delta_{50} = \frac{2\psi_m E_{4m}}{(\psi_m^2 - a_m^2)^2} (a_7 \cosh \psi_m z_m + a_6 \sinh \psi_m z_m)$$

$$E_3 = R_I^*, E_4 = -2(R_I^* + 1), E_{3m} = -R_{Im}^*, E_{4m} = -2(R_{Im}^* + 1)$$

$$c_5 = c_7 \hat{T} + \Delta_{13} - \Delta_{14}, c_6 = \frac{1}{a} (c_8 a_m + \Delta_{15} - \Delta_{16}), c_7 = \frac{\Delta_{19} \Delta_{20} - \Delta_{22} \Delta_{17}}{-\Delta_{18} \Delta_{20} - \Delta_{21} \Delta_{17}}, c_8 = \frac{\Delta_{19} \Delta_{21} + \Delta_{22} \Delta_{18}}{\Delta_{17} \Delta_{21} + \Delta_{20} \Delta_{18}}$$

$$\Delta_{12} = -[\delta_{51} + \delta_{52} + \delta_{53} + \delta_{54}], \quad \delta_{51} = \frac{\delta(E_4 + E_3)}{(\delta^2 - a^2)} (a_1 \cosh \delta + \sinh \delta),$$

$$\delta_{52} = \left[\frac{E_4}{(\delta^2 - a^2)} - \frac{2\delta^2 E_4}{(\delta^2 - a^2)^2} \right] (\cosh \delta + a_1 \sinh \delta), \quad \delta_{53} = \frac{\zeta(E_4 + E_3)}{(\zeta^2 - a^2)} (a_3 \cosh \zeta + a_2 \sinh \zeta),$$

$$\delta_{54} = \left[\frac{E_4}{(\zeta^2 - a^2)} - \frac{2\zeta^2 E_4}{(\zeta^2 - a^2)^2} \right] (a_2 \cosh \zeta + a_3 \sinh \zeta),$$

$$\Delta_{13} = \hat{T} \left[\frac{E_{3m} a_4}{(\eta_m^2 - a_m^2)} - \frac{2E_{4m} \eta_m a_5}{(\eta_m^2 - a_m^2)^2} + \frac{E_{3m} a_6}{(\psi_m^2 - a_m^2)} - \frac{2E_{4m} \psi_m a_7}{(\psi_m^2 - a_m^2)^2} \right],$$

$$\Delta_{14} = \frac{E_3}{(\delta^2 - a^2)} - \frac{2\delta a_1 E_4}{(\delta^2 - a^2)^2} + \frac{a_2 E_3}{(\zeta^2 - a^2)} - \frac{2\zeta a_3 E_4}{(\zeta^2 - a^2)^2},$$

$$\Delta_{15} = \left[\frac{E_{4m}}{(\eta_m^2 - a_m^2)} - \frac{2\eta_m^2 E_{4m}}{(\eta_m^2 - a_m^2)^2} \right] a_4 + \frac{\eta_m a_5 E_{3m}}{(\eta_m^2 - a_m^2)} + \Delta_{150}$$





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$$\Delta_{150} = \left[\frac{E_{4m}}{(\psi_m^2 - a_m^2)} - \frac{2\psi_m^2 E_{4m}}{(\psi_m^2 - a_m^2)^2} \right] a_6 + \frac{\psi_m a_7 E_{3m}}{(\psi_m^2 - a_m^2)}$$

$$\Delta_{16} = \frac{E_3 \delta a_1 + E_4}{(\delta^2 - a^2)} - \frac{2E_4 \delta^2}{(\delta^2 - a^2)^2} + \frac{E_3 \zeta a_3 + E_4 a_2}{(\zeta^2 - a^2)} - \frac{2a_2 E_4 \zeta^2}{(\zeta^2 - a^2)^2},$$

$$\Delta_{17} = a_m \cosh a_m, \Delta_{18} = a_m \sinh a_m, \Delta_{19} = -[\delta_{55} + \delta_{56} + \delta_{57} + \delta_{58}]$$

$$\delta_{55} = \left[\frac{E_{4m}}{(\eta_m^2 - a_m^2)} - \frac{2\eta_m^2 E_{4m}}{(\eta_m^2 - a_m^2)^2} \right] (a_4 \cosh \eta_m - a_5 \sinh \eta_m)$$

$$\delta_{56} = \eta_m \frac{(E_{3m} - E_{4m})}{(\eta_m^2 - a_m^2)} (a_5 \cosh \eta_m - a_4 \sinh \eta_m)$$

$$\delta_{57} = \left[\frac{E_{4m}}{(\psi_m^2 - a_m^2)} - \frac{2\psi_m^2 E_{4m}}{(\psi_m^2 - a_m^2)^2} \right] (a_6 \cosh \psi_m - a_7 \sinh \psi_m)$$

$$\delta_{58} = \psi_m \frac{(E_{3m} - E_{4m})}{(\psi_m^2 - a_m^2)} (a_7 \cosh \psi_m - a_6 \sinh \psi_m) \quad \Delta_{20} = \hat{T} a \sinh a, \Delta_{21} = a_m \cosh a,$$

$$\Delta_{22} = \Delta_{12} - a(\Delta_{13} - \Delta_{14}) \sinh a - (\Delta_{15} - \Delta_{16}) \cosh a$$

From the boundary condition (27), the tMn for parabolic temperature profile is as follows

$$M_{i2} = - \frac{[\delta^2 (\cosh \delta + a_1 \sinh \delta) + \zeta^2 (a_2 \cosh \zeta + a_3 \sinh \zeta)]}{a^2 (c_5 \cosh a + c_6 \sinh a + \Lambda_3 + \Lambda_4)} \tag{42}$$

where $\Lambda_3 = \frac{(E_4 + E_3)}{(\delta^2 - a^2)} (\cosh \delta + a_1 \sinh \delta) - \frac{2\delta E_4}{(\delta^2 - a^2)^2} (a_1 \cosh \delta + \sinh \delta)$

$$\Lambda_4 = \frac{(E_4 + E_3)}{(\zeta^2 - a^2)} (a_2 \cosh \zeta + a_3 \sinh \zeta) - \frac{2\zeta E_4}{(\zeta^2 - a^2)^2} (a_3 \cosh \zeta + a_2 \sinh \zeta)$$

Inverted parabolic profile

Consider inverted parabolic profile as

$$f(z) = 2(1 - z) \text{ and } f_m(z_m) = 2(1 - z_m) \tag{43}$$

Substituting (43) into (22) and (25), the temperature distributions $\theta(z)$ and $\theta_m(z_m)$ are obtained using the temperature boundary conditions, as follows

$$\theta(z) = A_1 [c_9 \cosh az + c_{10} \sinh az + g_3(z)] \tag{44}$$

$$\theta_m(z_m) = A_1 [c_{11} \cosh a_m z_m + c_{12} \sinh a_m z_m + g_{m3}(z_m)] \tag{45}$$

Where $g_3(z) = A_1 [\delta_{59} - \delta_{60} + \delta_{61} - \delta_{62}]$, $g_{m3}(z_m) = A_1 [\delta_{63} - \delta_{64} + \delta_{65} - \delta_{66}]$

$$\delta_{59} = \frac{(E_6 z + E_5)}{(\delta^2 - a^2)} (\cosh \delta z + a_1 \sinh \delta z) \quad \delta_{60} = \frac{2\delta E_6}{(\delta^2 - a^2)^2} (a_1 \cosh \delta z + \sinh \delta z)$$

$$\delta_{61} = \frac{(E_6 z + E_5)}{(\zeta^2 - a^2)} (a_2 \cosh \zeta z + a_3 \sinh \zeta z) \quad \delta_{62} = \frac{2\zeta E_6}{(\zeta^2 - a^2)^2} (a_3 \cosh \zeta z + a_2 \sinh \zeta z)$$





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$$\delta_{63} = \frac{(E_{6m}z_m + E_{5m})}{(\eta_m^2 - a_m^2)} (a_4 \cosh \eta_m z_m + a_5 \sinh \eta_m z_m)$$

$$\delta_{64} = \frac{2\eta_m E_{6m}}{(\eta_m^2 - a_m^2)^2} (a_5 \cosh \eta_m z_m + a_4 \sinh \eta_m z_m)$$

$$\delta_{65} = \frac{(E_{6m}z_m + E_{5m})}{(\psi_m^2 - a_m^2)} (a_6 \cosh \psi_m z_m + a_7 \sinh \psi_m z_m)$$

$$\delta_{66} = \frac{2\psi_m E_{6m}}{(\psi_m^2 - a_m^2)^2} (a_7 \cosh \psi_m z_m + a_6 \sinh \psi_m z_m)$$

$$E_5 = R_l^* - 2, E_6 = 2(1 - R_l^*), E_{5m} = -2 - R_{lm}^*, E_{6m} = 2(1 - R_{lm}^*)$$

$$c_9 = c_{11} \hat{T} + \Delta_{24} - \Delta_{25}, c_{10} = \frac{1}{a} (c_{12} a_m + \Delta_{26} - \Delta_{27}),$$

$$c_{11} = \frac{\Delta_{30} \Delta_{31} - \Delta_{33} \Delta_{28}}{-\Delta_{29} \Delta_{31} - \Delta_{32} \Delta_{28}}, c_{12} = \frac{\Delta_{30} \Delta_{32} + \Delta_{33} \Delta_{29}}{\Delta_{28} \Delta_{32} + \Delta_{31} \Delta_{29}}, \Delta_{23} = -[\delta_{67} + \delta_{68} + \delta_{69} + \delta_{70}],$$

$$\delta_{67} = \frac{\delta(E_6 + E_5)}{(\delta^2 - a^2)} (a_1 \cosh \delta + \sinh \delta), \delta_{68} = \left[\frac{E_6}{(\delta^2 - a^2)} - \frac{2\delta^2 E_6}{(\delta^2 - a^2)^2} \right] (\cosh \delta + a_1 \sinh \delta),$$

$$\delta_{69} = \frac{\zeta(E_6 + E_5)}{(\zeta^2 - a^2)} (a_3 \cosh \zeta + a_2 \sinh \zeta),$$

$$\delta_{70} = \left[\frac{E_6}{(\zeta^2 - a^2)} - \frac{2\zeta^2 E_6}{(\zeta^2 - a^2)^2} \right] (a_2 \cosh \zeta + a_3 \sinh \zeta),$$

$$\Delta_{24} = \hat{T} \left[\frac{E_{5m} a_4}{(\eta_m^2 - a_m^2)} - \frac{2E_{6m} \eta_m a_5}{(\eta_m^2 - a_m^2)^2} + \frac{E_{5m} a_6}{(\psi_m^2 - a_m^2)} - \frac{2E_{6m} \psi_m a_7}{(\psi_m^2 - a_m^2)^2} \right],$$

$$\Delta_{25} = \frac{E_5}{(\delta^2 - a^2)} - \frac{2\delta a_1 E_6}{(\delta^2 - a^2)^2} + \frac{a_2 E_5}{(\zeta^2 - a^2)} - \frac{2\zeta a_3 E_6}{(\zeta^2 - a^2)^2},$$

$$\Delta_{26} = \left[\frac{E_{6m}}{(\eta_m^2 - a_m^2)} - \frac{2\eta_m^2 E_{6m}}{(\eta_m^2 - a_m^2)^2} \right] a_4 + \frac{\eta_m a_5 E_{5m}}{(\eta_m^2 - a_m^2)} + \Delta_{260}$$

$$\Delta_{260} = \left[\frac{E_{6m}}{(\psi_m^2 - a_m^2)} - \frac{2\psi_m^2 E_{6m}}{(\psi_m^2 - a_m^2)^2} \right] a_6 + \frac{\psi_m a_7 E_{5m}}{(\psi_m^2 - a_m^2)}$$

$$\Delta_{27} = \frac{E_5 \delta a_1 + E_6}{(\delta^2 - a^2)} - \frac{2E_6 \delta^2}{(\delta^2 - a^2)^2} + \frac{E_5 \zeta a_3 + E_6 a_2}{(\zeta^2 - a^2)} - \frac{2a_2 E_6 \zeta^2}{(\zeta^2 - a^2)^2},$$

$$\Delta_{28} = a_m \cosh a_m, \Delta_{29} = a_m \sinh a_m, \Delta_{30} = -[\delta_{71} + \delta_{72} + \delta_{73} + \delta_{74}]$$

$$\delta_{71} = \left[\frac{E_{6m}}{(\eta_m^2 - a_m^2)} - \frac{2\eta_m^2 E_{6m}}{(\eta_m^2 - a_m^2)^2} \right] (a_4 \cosh \eta_m - a_5 \sinh \eta_m)$$

$$\delta_{72} = \eta_m \frac{(E_{5m} - E_{6m})}{(\eta_m^2 - a_m^2)} (a_5 \cosh \eta_m - a_4 \sinh \eta_m)$$





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$$\delta_{73} = \left[\frac{E_{6m}}{(\psi_m^2 - a_m^2)} - \frac{2\psi_m^2 E_{6m}}{(\psi_m^2 - a_m^2)^2} \right] (a_6 \cosh \psi_m - a_7 \sinh \psi_m)$$

$$\delta_{74} = \psi_m \frac{(E_{5m} - E_{6m})}{(\psi_m^2 - a_m^2)} (a_7 \cosh \psi_m - a_6 \sinh \psi_m) \quad \Delta_{31} = \hat{T}a \sinh a, \Delta_{32} = a_m \cosh a,$$

$$\Delta_{33} = \Delta_{23} - a(\Delta_{24} - \Delta_{25}) \sinh a - (\Delta_{26} - \Delta_{27}) \cosh a$$

From the boundary condition (27), the tMn for inverted parabolic temperature profile is as follows

$$M_{t3} = - \frac{[\delta^2 (\cosh \delta + a_1 \sinh \delta) + \zeta^2 (a_2 \cosh \zeta + a_3 \sinh \zeta)]}{a^2 (c_9 \cosh a + c_{10} \sinh a + \Lambda_5 + \Lambda_6)} \tag{46}$$

where $\Lambda_5 = \frac{(E_6 + E_5)}{(\delta^2 - a^2)} (\cosh \delta + a_1 \sinh \delta) - \frac{2\delta E_6}{(\delta^2 - a^2)^2} (a_1 \cosh \delta + \sinh \delta)$

$\Lambda_6 = \frac{(E_6 + E_5)}{(\zeta^2 - a^2)} (a_2 \cosh \zeta + a_3 \sinh \zeta) - \frac{2\zeta E_6}{(\zeta^2 - a^2)^2} (a_3 \cosh \zeta + a_2 \sinh \zeta)$

RESULTS AND DISCUSSION

Non-Darcian-Bénard double diffusive magneto-Marangoni convection, produced by unstable density distribution along with the surface tension effects depending on both temperature and concentration, in a two layer system is investigated in the presence of heat sources in both the layers. The effect of thermal Marangoni number (tMn) versus the thermal ratio \hat{T} for diverse parameters are drawn. The three different temperature profiles considered are linear, parabolic and inverted parabolic profiles with the corresponding tMns are M_{t1}, M_{t2} and M_{t3} . Basically for all the temperature profiles, the tMns increase as the value of thermal ratio increases. The effects of porous parameter, the Chandrasekhar number, viscosity ratio, modified internal Rayleigh numbers in the fluid and the porous layers and the solute Marangoni number on Non-Darcian-Bénard double diffusive magneto-Marangoni convection are explained in the Figures 1 to 7 for the parameters $a = 2.5, \hat{d} = 0.2, \beta = 1.0, \hat{\mu} = 2, \hat{S} = 1, \tau = \tau_{pm} = 0.25, Q = 10, M_s = 10, R_l^* = 1, R_{lm}^* = 1$ and when one parameter is varied, the supplementary parameters are fixed. One of the observation from the graphs of Figures 1 to 7 is that, for any set of parameters, the tMn for linear temperature profile is the lowest and the same for inverted parabolic temperature profile is largest.

The graphs of M_{t1}, M_{t2} and M_{t3} versus the thermal ratio \hat{T} for different values of the porous parameter β are portrayed in Figures 1(a,b,c) respectively for linear, parabolic and inverted parabolic temperature profiles and values taken for $\beta = 0.1, 1, 10, 50, 100$. One can observe that the effect of porous parameter is to delay non-Darcian-Bénard double diffusive magneto-Marangoni convection and hence stabilize the two layer system as the increase in β is increasing the tMns for all the three temperature profiles. That is the more freedom for the fluid to move in the porous layer delays non-Darcian-Bénard double diffusive magneto-Marangoni convection increasing the porous parameter actually means increasing permeability of the porous region. Also the tMns increase more rapidly for linear, rapidly for parabolic and less rapidly for inverted parabolic temperature profiles. The diverging curves indicate that the effect of β is prominent for larger values of \hat{T} .





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The Chandrasekhar number are exhibited in Figures 2(a,b,c) respectively for linear, parabolic and inverted parabolic temperature profiles and values taken for Q are 1, 5, 10, 50 and 100. The significance of magnetic field is depicted by the Chandrasekhar number Q and the diverging curves say that the Q is important or vital only for larger values of thermal ratio \hat{T} that is when $T_l - T_0 \gg T_0 - T_u$. Also the effect of Q is to decrease tMns for all the three temperature profiles. Hence effect of magnetic field here is to prepone non-Darcian-Bénard double diffusive magneto-Marangoni convection and hence destabilize the two layer system.

Figures 3 (a,b,c) represent the influence of viscosity ratio $\hat{\mu}$ on non-Darcian-Bénard double diffusive magneto-Marangoni convection respectively for linear, parabolic and inverted temperature profiles and the values of $\hat{\mu}$ are 0.1, 0.5, 1.0, 1.5 and 2. From these figures it can be noted that, as the effective viscosity of the fluid in the porous region dominates the viscosity of the fluid in the fluid region, there is an increase in the value of tMns for all the three profiles. However, the extent of variation is larger for linear and parabolic temperature profiles than that of inverted parabolic profile. Hence this domination of effective viscosity can help in controlling non-Darcian-Bénard double diffusive magneto-Marangoni convection which is very much necessary in situations like crystal growth.

The effect of heat source/sink in the fluid region is given by the modified internal Rayleigh number R_l^* is demonstrated in Figures 4(a,b,c) for linear, parabolic and inverted temperature profiles respectively for $R_l^* = -2, -1, 0, 1, 2$. As the value of R_l^* increases (from sink to source), the tMns increase for all the three temperature profiles, that is the presence of heat source in the fluid region is actually delaying non-Darcian-Bénard double diffusive magneto-Marangoni convection which is not expected and this may be due to the presence of second diffusing component and magnetic field. Also the effect of this heat source is drastic for larger values of thermal ratio. The extent of variation with respect to R_l^* is same as the extent of divergence is same for all the three profiles.

The impact of heat source in the porous region is indicated by the modified internal Rayleigh number R_{lm}^* which is shown in Figures 5(a,b,c) for linear, parabolic and inverted temperature profiles respectively for $R_{lm}^* = -2, -1, 0, 1, 2$. As the value of R_{lm}^* is raised (from sink to source), the tMns decreases for all the three temperature profiles, for larger values of thermal ratio, hence non-Darcian-Bénard double diffusive magneto-Marangoni convection is preponed, so the system gets destabilized earlier. This may be happening due to the presence of second diffusing component and magnetic field in the system. Also the diverging curves for all the three profiles indicate that the effect of this heat source is vital for larger values of thermal ratio. However the extent of divergence is lesser for parabolic temperature profile.

The effects of solute Marangoni number on non-Darcian-Bénard double diffusive magneto-Marangoni convection in a two layer system are displayed in Figures 6 (a,b,c) respectively for linear, parabolic and inverted parabolic temperature profiles and the values of M_s are 1, 5, 10, 50 and 100. From the figures it is evident that the presence of solute concentration is to delay the non-Darcian-Bénard double diffusive magneto-Marangoni convection for all the three profiles except for some values of thermal ratio, which is for parabolic temperature profile.

The graphs of M_{i1}, M_{i2} and M_{i3} versus the thermal ratio \hat{T} for different values of diffusivity ratio are exhibited in Figures 7(a,b,c) respectively for linear, parabolic and inverted parabolic temperature profiles and values taken for τ are 0.1, 0.25, 0.50, 0.75 and 1.0. The diverging curves say that the τ is important or vital only for larger values of thermal ratio \hat{T} that is when $T_l - T_0 \gg T_0 - T_u$. Also the effect of τ is to decrease tMns for all the three



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temperature profiles. Hence effect of diffusivity ratio here is to postpone non-Darcian-Bénard double diffusive magneto-Marangoni convection and hence destabilize the two layer system.

CONCLUSION

From this case study the following conclusions can be drawn:

- (i) Inverted Parabolic temperature profile can be utilized in the situations where non-Darcian-Bénard double diffusive magneto-Marangoni convection needs to be controlled and linear temperature profile for the situations where this convection is to be augmented.
- (ii) Higher values of porous parameter, solute Marangoni number, Viscosity ratio and the fluid modified internal Rayleigh number will postpone non-Darcian-Bénard double diffusive magneto-Marangoni convection in a two layer system irrespective of the profile chosen.
- (iii) Higher values of Chandrasekhar number, porous modified internal Rayleigh number and diffusivity ratio augment non-Darcian-Bénard double diffusive magneto-Marangoni convection in a two layer system irrespective the temperature profile.
- (iv) By choosing appropriate strength of heat source/sink, onset of non-Darcian-Bénard double diffusive magneto-Marangoni convection can be controlled.

CONFLICTS OF INTEREST

The authors declare that no competing interests exist.

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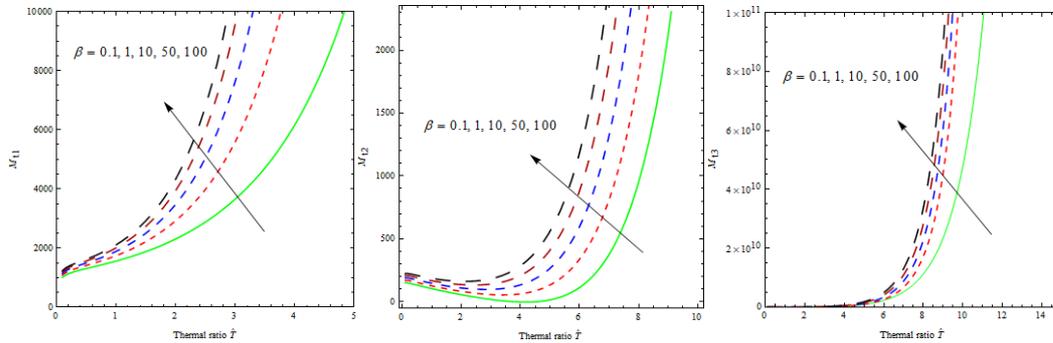


Figure 1. Effects of porous parameter β

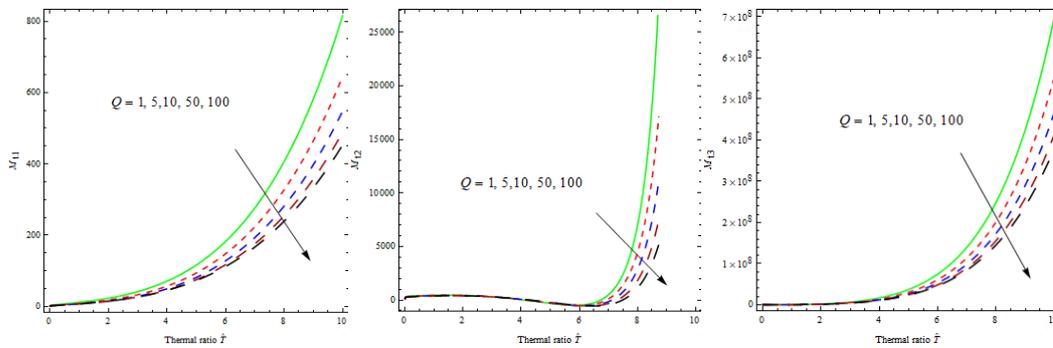


Figure 2. Effects of Chandrasekhar number Q

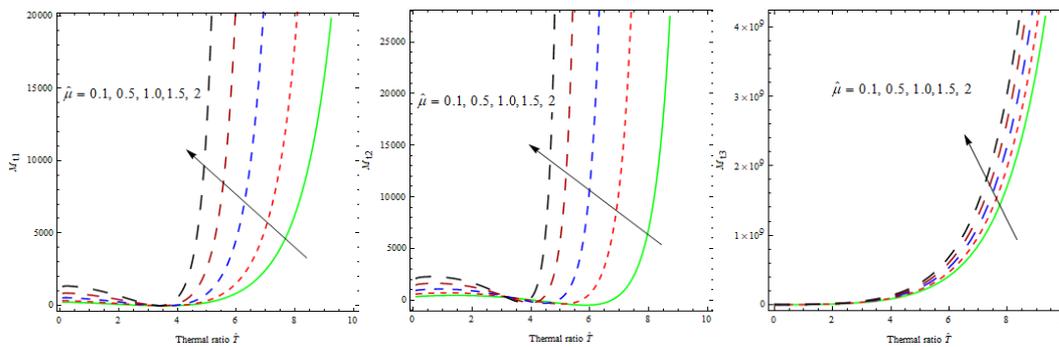


Figure 3. Effects of viscosity ratio $\hat{\mu}$





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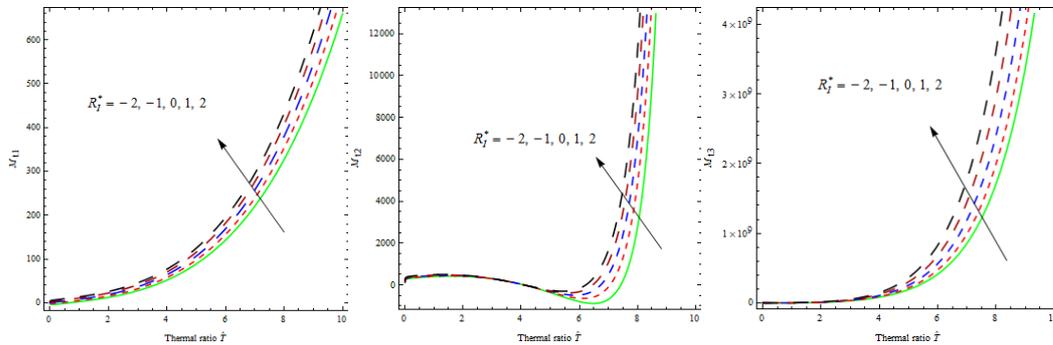


Figure 4. Effects of modified internal Rayleigh number for fluid region R_1^*

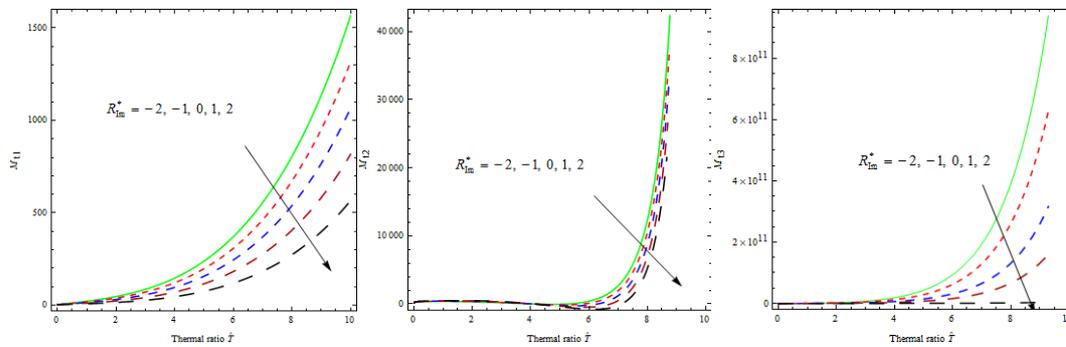


Figure 5. Effects of modified internal Rayleigh number for porous region R_{1m}^*

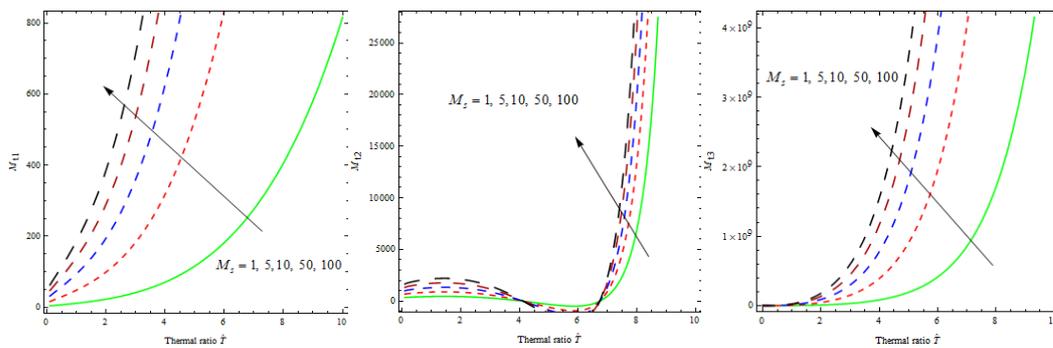


Figure 6. Effects of solute Marangoni number M_s





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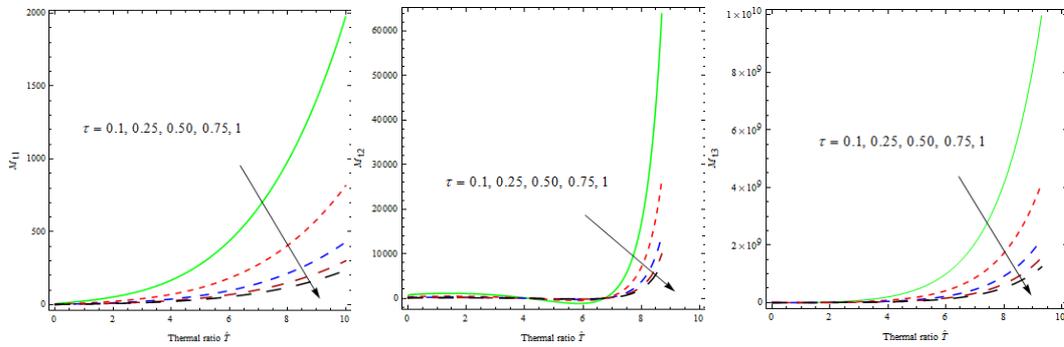


Figure 7. Effects of diffusivity ratio τ





Comprehensive Study on Prime Combination Labeling of Graphs

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ABSTRACT

A graph labeling is an assignment of real values to the vertices or edges, or both, subject to certain conditions. Labeled graphs are becoming an increasingly useful family of mathematical models for a broad range of applications. The concept of labeling is spread into several types such as prime labeling and combination labeling. In this paper we study prime labeling and combination labeling of graphs. We investigate some classes of graphs which admit prime combination labeling. Finally we discuss some of the related properties in detail.

Keywords: Prime labeling, combination labeling, prime combination labeling, path, cycle, star, Olive tree.

INTRODUCTION

The field of Graph Theory plays an important role in various areas of pure and applied sciences. Graph labeling of a graph G is an assignment of real numbers either to the vertices or edges or both subject to certain conditions. Graph labeling is a very powerful tool that eventually makes things in different fields very easy to be handled in mathematical way. Nowadays graph labeling has much attention from different brilliant researches in Graph Theory which has rigorous applications in many disciplines such as communication networks, coding theory, optimal circuits layouts, astronomy, radar and graph decomposition problems. Graph labelings were first introduced in the mid sixties. A labeling or valuation or numbering of a graph is an assignment of real values or subsets of a set to the vertices (a vertex labeling), or an assignment of the labels to the edges (an edge labeling), or an assignment of the labels to the combined set of vertices and edges of the graph (a total labeling). Graph labelings were first introduced Rosa [1] in 1967 and he called a function f a β -valuation of a graph G with q edges if f is an injection from the

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vertices of G to the set $\{0,1,\dots,q\}$ such that, when each edge xy is assigned the label $|f(x) - f(y)|$, the resulting edge labels are distinct. His discovery of β -valuation translated the problem into the language of graph labelings and Golomb's [2] introduction of the name "graceful" gave it its catchy name in 1972. Harmonious graphs naturally arose in the study by Graham and Sloane [3] of modular versions of additive bases problems stemming from error – correcting codes. They defined a graph G with q edges to be harmonious if there is an injection f from the vertices of G to the group of integers modulo q such that when each edge xy is assigned the label $f(x) + f(y) \pmod{q}$, the resulting edge labels are distinct. Most graph labeling methods trace their origin to one introduced by Rosa [1] or one given by Graham and Sloane [3]. Bloom and Hsu [4] and Bloom and Hsu [5] extended graceful labelings to directed graphs by defining a graceful labeling on a directed graph $D(V, E)$ as a one-to-one map θ from V to $\{0,1,2,\dots,|E|\}$ such that $\theta(y) - \theta(x) \pmod{(|E|+1)}$ is distinct for every edge xy in E . We refer the interested reader to an exhaustive survey of graph labelings due to Gallian [6]. Vast amount of literature is available on different types of graph labeling. Here we consider the finite, simple and undirected graphs. We adopt the notations and terminology which are almost similar to those used in Bondy and Murthy [7].

Prime Labeling of Graphs

The notion of a prime labeling originated with Roger Entringer [8] and was introduced in a paper by Tout et al. [9]. A graph with vertex set V is said to have a prime labeling if its vertices are labeled with distinct integers $1, 2, \dots, |V|$ such that for each edge xy , the labels assigned to x and y are relatively prime. Around 1980, Entringer [8] conjectured that all trees have a prime labeling. So far, there has been little progress towards proving this conjecture. According to Deretsky et al. [10] all cycles are prime labeling. The complete graph K_n does not have a prime labeling for $n \geq 4$ and W_n is prime if and only if n is even (See Lee et al. [11]).

Definition 1. Let $G = (V(G), E(G))$ be a graph with p vertices. A bijection $f : V(G) \rightarrow \{1, 2, \dots, p\}$ is called a prime labeling if for each edge $e = uv$, $\gcd(f(u), f(v)) = 1$. A graph which admits prime labeling is called a prime graph. Seoud et al. [12] provided necessary and sufficient conditions for a graph to be prime. They also gave a procedure to determine whether or not a graph is prime. Sundaram et al. [13] investigated the prime labeling behaviour of all graphs of order at most 6 and established that only one graph of order 4, one graph of order 5, and 42 graphs of order 6 are not prime. Klee et al. [14] extended the notion of prime labeling to the Gaussian integers. A dual of prime labelings has been introduced by Deretsky et al. [10]. According to their study, a graph with edge set E has a vertex prime labeling if its edges can be labeled with distinct integers $1, 2, \dots, |E|$, such that for each vertex of degree at least 2, the greatest common divisor of the labels on its incident edges is 1. Vaidya and Prajapati [15] introduced the concept of k -prime labeling. A injection $f : V(G) \rightarrow \{k, k+1, k+2, \dots, k+p-1\}$ is called a k -prime labeling if for each edge $e = uv$, $\gcd(f(u), f(v)) = 1$. A graph which admits k -prime labeling is called a k -prime graph. Patel and Shrimali [16] discussed a bijective function f from $V(G)$ to $\{1, 2, \dots, n\}$ which is a neighborhood-prime labeling of G , if for every vertex $v \in V$ with $\deg(v) > 1$, $\gcd\{f(u) : u \in N(v)\} = 1$ where $N(v)$ is the open neighborhood of v . A graph that admits a neighborhood-prime labeling is called a neighborhood-prime graph.





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Sundaram et al. [17] introduced a labeling of G called prime cordial labeling which is a map f from the set of vertices $V(G)$ to the set $\{1, 2, \dots, p\}$ such that when each edge $e = uv$ is assigned the label 1 if $\gcd(f(u), f(v)) = 1$ and 0 if $\gcd(f(u), f(v)) > 1$, and satisfies the condition the number of edges labeled 0 and the number of edges labeled 1 differ at most by 1. A graph which admits a prime cordial labeling is called a prime cordial graph. Ponraj et al. [18] introduced a labeling of (p, q) -graph G called k -prime cordial labeling which is a map f from the set of vertices $V(G)$ to the set $\{1, 2, \dots, k\}$ where $2 \leq p \leq k$ such that when each edge $e = uv$ is assigned the label $\gcd(f(u), f(v))$ and satisfies the inequalities $|v_f(i) - v_f(j)| \leq 1$ for $i, j \in \{1, 2, \dots, k\}$ and $|e_f(0) - e_f(1)| \leq 1$, where $v_f(x)$ denote the number of vertices labeled with x and $e_f(0)$ and $e_f(1)$ respectively denote the number of edges labelled with 0 and number of edges labelled with 1. A graph which admits a k -prime cordial labeling is called a k -prime cordial graph.

Combination Labeling of Graphs

Hedge and Shetty [19] defined a graph G with p vertices to be a permutation graph if there exists a injection f from the vertices of G to $\{1, 2, \dots, p\}$ such that the induced edge function g_f defined by

$$g_f(uv) = \frac{f(u)!}{|f(u) - f(v)|!}$$

which is injective and nonnegative integer. They also defined a graph G with p

vertices is a combination graph if there exists a injection f from the vertices of G to $\{1, 2, \dots, p\}$ such that the

induced edge function g_f defined by $g_f(uv) = \binom{f(u)}{f(v)}$ which is injective and non-negative integer. Again in

their work, they also proved that K_n is a permutation graph if and only if $n \leq 5$; K_n is a combination graph if and only if $n \leq 5$; C_n is a combination graph for $n > 3$. They derived a necessary condition for a (p, q) -graph to be a combination graph which states that $4q \leq p^2$ if p is even and $4q \leq p^2 - 1$ if p is odd. Moreover, they strongly believed that W_n is a combination graph for $n \geq 7$ and all trees are combination graphs.

Definition 2. A (p, q) graph $G = (V, E)$ is said to be combination graph if there exists a bijection $f : V(G) \rightarrow \{1, 2, \dots, p\}$ such that the induced edge function $g_f : E(G) \rightarrow \mathbb{N}$ defined as

$$g_f(uv) = \begin{cases} \binom{f(u)}{f(v)} & \text{if } f(u) > f(v) \\ \binom{f(v)}{f(u)} & \text{if } f(v) > f(u) \end{cases}$$

is injective, where $\binom{f(u)}{f(v)}$ is the number of combinations of $f(u)$

things taken $f(v)$ at a time. Such a labeling f is called combination labeling of G .





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Hegde and Shetty [19] also defined a (p, q) -graph $G = (V, E)$ to be a strong k -combination graph if there exists an injection f from $V(G)$ to $\{1, 2, \dots, p\}$ such that the induced edge function g_f from $E(G)$ to $\{k, k+1, k+2, \dots, k+q-1\}$ defined by $g_f(uv) = \binom{f(u)}{f(v)}$ is bijective and non-negative integer for some positive integer k . They proved that paths and stars are strong k -combination graphs. Moreover, they defined a (p, q) -graph $G = (V, E)$ to be a strong k -permutation graph if there exists an injection f from $V(G)$ to $\{1, 2, \dots, p\}$ such that the induced edge function g_f from $E(G)$ to $\{k, k+1, k+2, \dots, k+q-1\}$ defined by $g_f(uv) = \frac{f(u)!}{|f(u) - f(v)|!}$ is bijective and non-negative integer for some positive integer k .

Seoud and Anwar [20] provided necessary conditions for combination graphs, permutation graphs, strong k -combination graphs, and strong k -permutation graphs. Ghodasara and Patel [21] discussed some new combination graphs. Tharmaraj and Sarasija [22] defined a graph $G = (V, E)$ with p vertices to be a beta combination graph if there exist a bijection f from $V(G)$ to $\{1, 2, \dots, p\}$ such that the induced function B_f from $E(G)$ to the natural numbers given by $B_f(uv) = \frac{(f(u) + f(v))!}{f(u)!f(v)!}$ for every edge uv of G is injective. Such a function is called a beta combination labeling.

Ponraj et al. [23] introduced a labeling of G called parity combination cordial labeling which is an injective map f from the set of vertices $V(G)$ to the set $\{1, 2, \dots, p\}$ such that when each edge $e = uv$ is assigned the label $\binom{u}{v}$ or $\binom{v}{u}$ according as $u > v$ or $v > u$ and satisfies the condition the number of edges labeled with even integers and the number of edges labeled with odd integers differ at most by 1. A graph which admits a parity combination cordial labeling is called a parity combination cordial graph.

Murali et al. [24] introduced a labeling of G called combination cordial labeling which is a map f from the set of vertices $V(G)$ to the set $\left\{ \binom{n}{i} ; 0 \leq i \leq n \right\}$ such that when each edge $e = uv$ is assigned the label 1 if $f(u) = f(v)$ and 0 if $f(u) \neq f(v)$. And this satisfies the condition that the number of edges labeled 0 and the number of edges labeled 1 differ at most by 1. A graph which admits a combination cordial labeling is called a combination cordial graph.

In this paper, we study two different types of graph labelings such as prime labeling and combination labeling. Also, we introduce the concept of prime combination labeling and we investigate several families of graphs such as path, cycle, star, Olive tree, $S_{m,n}$, $C_n \oplus P_m$ and $C_n \oplus K_{1,m}$ which admit such a labeling.





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PRIME COMBINATION LABELING OF GRAPHS

In this paper we assume that all graphs are finite, simple, undirected and connected. We combin these two labelings such as prime labeling and combination labeling which is a new labeling introduced in this paper called prime combination labeling. A vertex labeling of a graph is an assignment of prime labels and an edge labeling of a graph is an assignment of combination labels. A graph $G = (V, E)$ with p vertices is said to be a prime combination graph if there exists a bijective vertex labeling function f from $V(G)$ to $\{1, 2, \dots, p\}$ such that for each pair of adjacent vertices u and v , $\gcd(f(u), f(v)) = 1$ and a edge labeling function P_f from $E(G)$ to \mathbb{N} defined by

$$P_f(uv) = \begin{pmatrix} f(u) \\ f(v) \end{pmatrix} \text{ is injective and positive integer.}$$

If a graph G is not prime labeling or not combination labeling or not both, then G is not a prime combination graph. The cycle C_4 is prime graph (See Deretsky et al. [10]) and combination graph (See Hegde and Shetty [19]). But this is not a prime combination labeling. So, if G admits a prime labeling and combination labeling, then G need not admit a prime combination labeling.

Definition 3. Let $G = (V, E)$ be a graph with p vertices and q edges. Let $f: V(G) \rightarrow \{1, 2, \dots, p\}$ be an injective map such that for each pair of adjacent vertices u and v , $\gcd(f(u), f(v)) = 1$. Then f is called a prime combination labeling of G if the induced edge labeling $P_f(uv)$ equals $\begin{pmatrix} f(u) \\ f(v) \end{pmatrix}$ or $\begin{pmatrix} f(v) \\ f(u) \end{pmatrix}$ according as $f(u) > f(v)$ or $f(v) > f(u)$ is injective onto the set of natural numbers. A graph with a prime combination labeling is called a prime combination graph (See Fig. 1).

Prime Combination Labeling of Simple Graphs

In this section, we discuss the prime combination labeling of some simple graphs. First we investigate the prime combination labeling behavior of path.

Theorem 1. The path P_n admits a prime combination labeling.

Proof. Let P_n be the path $v_1 v_2 \dots v_n$. Then assign $1, 2, \dots, n$ to the consecutive vertices until we get $n - 1$ edges with labels $\begin{pmatrix} i+1 \\ i \end{pmatrix}$ for $1 \leq i \leq n - 1$. But according to Burton [25], it is known that two consecutive integers are relatively prime. Therefore, the adjacent vertex labelings are relatively prime and the edges $v_i v_{i+1}$ for $1 \leq i \leq n - 1$ have distinct labels $2, 3, \dots, n$. So the path P_n admits a prime combination labeling.

Theorem 2. The cycle C_n admits a prime combination labeling for $n > 4$ and n is odd.

Proof. Denote the vertices of C_n consecutively as v_1, v_2, \dots, v_n such that v_1 is adjacent to v_n and v_i is adjacent to v_{i+1} for $1 \leq i \leq n - 1$. Define a labeling f from vertex set of C_n to the set $\{1, 2, \dots, n\}$ by $f(v_1) = 2$,





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$f(v_2) = 1$ and $f(v_i) = i$ for $3 \leq i \leq n$. But due to Burton [25], it is known that two consecutive integers are relatively prime, and for n is any integer, $\gcd(n, 2) = \begin{cases} 1 & \text{if } n \text{ is odd} \\ 2 & \text{if } n \text{ is even} \end{cases}$. Therefore it is clear that every two adjacent vertex labelings are relatively prime.

Also we get an edge labels are $\binom{2}{1}, \binom{3}{1}, \binom{i+1}{i}$ for $3 \leq i \leq n-1$ and $\binom{n}{2}$. That is, $2, 3, \dots, n$ and $\frac{n(n-1)}{2}$ are edge labels of C_n . Again due to Hedge and Shetty [19], if $n > 3$, then $\binom{n}{2} > n$. Therefore it is noted that these edge values are distinct. Hence C_n admits a prime combination labeling for $n > 4$ and n is odd.

Corollary 1. The cycle C_6 does not admit prime combination labeling.

The next theorem shows that the star is a prime combination graph.

Theorem 3. The star $K_{1,n}$ admits a prime combination labeling.

Proof. Let v_0 be a center vertex and v_1, v_2, \dots, v_n be the other vertices of $K_{1,n}$. Assign the label 1 to the central vertex v_0 and then assign the labels $2, 3, \dots, n+1$ to the pendent vertices v_i for any $i, 1 \leq i \leq n$. Clearly all adjacent vertex labels are relatively prime and we get n edges with distinct edge labels $2, 3, \dots, n+1$. Hence $K_{1,n}$ admits a prime combination labeling.

Prime Combination Labeling of Classes of Trees

In this section we use the concept of prime combination labeling to discuss some classes of trees.

Definition 4. In a rooted tree, vertex v_i is said to be at level l_i if v_i is at a distance l_i from the root and the root is at level 0. An Olive tree is a rooted tree consisting of k branches, where the i -th branch is a path of length i (See Suresh Singh [26]).

Theorem 4. Olive tree admits a prime combination labeling.

Proof. Let v_{00} be the root of the given Olive tree G . Let $v_{11}, v_{12}, \dots, v_{1n}$ be the vertices in the first level such that there are n edges. Let $v_{22}, v_{23}, \dots, v_{2n}$ be the vertices in the second level such that there are $n-1$ edges. Let $v_{33}, v_{34}, \dots, v_{3n}$ be the vertices in the third level such that there are $n-2$ edges.

Proceeding like this, Let v_{mn} be the unique vertex in the n^{th} level and the corresponding lonely edges be $v_{(n-1)n}v_{mn}$.

Then the total number of vertices and edges in G are $\frac{n(n+1)}{2} + 1$ and $\frac{n(n+1)}{2}$ respectively. Define f from

vertex set of G to the set $\left\{1, 2, \dots, \frac{n(n+1)}{2} + 1\right\}$ by $f(v_{00}) = 1$; and $f(v_{ij}) = f(v_{(j-1)(j-1)}) + i, 1 \leq j \leq n, 1 \leq i \leq j$.





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Then we can easily verify that $\gcd(f(v_{00}), f(v_{1j})) = 1, 1 \leq j \leq n$; and $\gcd(f(v_{ij}), f(v_{(i+1)j})) = 1, 2 \leq j \leq n, 1 \leq i \leq j - 1$. Therefore, every two adjacent vertex labels are relatively prime. Next we get a distinct edge labels which can be listed as $2, 3, \dots, \frac{n(n+1)}{2} + 1$. So the induced function P_f from the edge set of G to the

set $\left\{ 2, 3, \dots, \frac{n(n+1)}{2} + 1 \right\}$ defined as $P_f(v_{00}v_{1j}) = f(v_{(j-1)(j-1)}) + 1, 1 \leq j \leq n$; and

$P_f(v_{ij}v_{(i+1)j}) = f(v_{(j-1)(j-1)}) + i + 1, 2 \leq j \leq n, 1 \leq i \leq j - 1$ is injective. Hence Olive tree admits a prime combination labeling.

Using Theorem 4, a prime combination labeling of Olive tree with $n = 5$ is displayed in Fig. 2.

Definition 5. Let $S_{m,n}$ stand for a star with n spokes in which each spoke is a path of length m (See Sridevi et al. [27]).

Theorem 5. The graph $S_{m,n}$ admits a prime combination labeling.

Proof. Let v_0 be the center vertex of star and v_j^i be the vertices of path of length m where $1 \leq i \leq n$ and $1 \leq j \leq m$. Then the total number of vertices and edges in G are $mn + 1$ and mn respectively. Define f from the vertex set of $S_{m,n}$ to the set $\{1, 2, \dots, mn + 1\}$ by $f(v_0) = 1$; and for $1 \leq i \leq n, f(v_j^i) = (i - 1)m + j + 1, 1 \leq j \leq m$. Note that all the vertex labelings are distinct and we can easily verify that $\gcd(f(v_0), f(v_1^i)) = 1, 1 \leq i \leq n$ and $\gcd(f(v_j^i), f(v_{j+1}^i)) = 1, 1 \leq i \leq n, 1 \leq j \leq m - 1$. Therefore, all the adjacent vertex labeling are relatively prime.

Next we can find the edge labels which are $2, 3, \dots, mn, mn + 1$. So the induced function P_f from the edge set of $S_{m,n}$ to the set $\{2, 3, \dots, mn, mn + 1\}$ defined as $P_f(v_0v_1^i) = (i - 1)m + 2, 1 \leq i \leq n$ and $P_f(v_j^i v_{j+1}^i) = (i - 1)m + j + 2, 1 \leq i \leq n, 1 \leq j \leq m - 1$ is injective. Hence $S_{m,n}$ admits a prime combination labeling.

Prime Combination Labeling of Join of Two Graphs

In this section we use the concept of prime combination labeling to discuss some classes of graphs which are prime combination.

Definition 6. An (n, m) – kite consists of a cycle of length n with m – edge path attached to one vertex and it is denoted by $C_n \oplus P_m$ (See Sridevi et al. [28]).

Theorem 6. The graph $C_n \oplus P_m$ admits a prime combination labeling when $m + n$ is odd.

Proof. Let $G = C_n \oplus P_m$ be a graph with $m + n$ vertices and $m + n$ edges. Denote the vertices of C_n by u_1, u_2, \dots, u_n where u_1 is adjacent to u_n and u_i is adjacent to u_{i+1} for $1 \leq i \leq n - 1$. Let $v_1 v_2 \dots v_m$ be the path P_m joined with the vertex u_n of C_n .





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Define a vertex labeling function f from vertex set of G to the set $\{1, 2, \dots, m + n\}$ by $f(u_n) = 2, f(u_1) = 1, f(v_i) = i + 2$ for $1 \leq i \leq m$ and $f(u_j) = m + j + 1$ for $2 \leq j \leq n - 1$. Then we can verify that every pair of adjacent vertices are relatively prime.

We claim that this is a valid prime combination labeling of G . The edge $u_n u_1$ have label 2. The edge $u_n v_1$ have label 3. The edges $v_i v_{i+1}, 1 \leq i \leq m - 1$ have labels $4, 5, \dots, m + 2$. The edges $u_j u_{j+1}, 1 \leq j \leq n - 2$ have labels $m + 3, m + 4, \dots, m + n$. The edge $u_{n-1} u_n$ have label $\binom{m+n}{2}$. Therefore, the edge labels $2, 3, \dots, m + n, \binom{m+n}{2}$ are all distinct and are listed in increasing order. Hence the graph $C_n \oplus P_m$ admits a prime combination labeling when $m + n$ is odd.

Using Theorem 6, a prime combination labeling of $C_5 \oplus P_4$ is displayed in Fig. 3.

Definition 7. The graph $G = C_n \oplus K_{1,m}$ consists of a cycle C_n of length n and a star $K_{1,m}$ is attached with the vertex u_n of C_n (See Sridevi et al. [28]).

Theorem 7. The graph $C_n \oplus K_{1,m}$ admits a prime combination labeling when $m + n \geq 5$.

Proof. Let $G = C_n \oplus K_{1,m}$ be a graph with $m + n$ vertices and $m + n$ edges. Denote the vertices of C_n by u_1, u_2, \dots, u_n where u_1 is adjacent to u_n and u_i is adjacent to u_{i+1} for $1 \leq i \leq n - 1$. Let v_1, v_2, \dots, v_m be the pendent vertices of $K_{1,m}$ attached with the vertex u_n of C_n . Let us define a vertex labeling for the following two cases.

Case 1. $m + n$ is odd.

Assign the label 1 to u_n and assign the label 2 to u_{n-1} . Then assign the labels $3, 4, \dots, m + 2$ to the vertices v_i for any $i, 1 \leq i \leq m$. Next assign the labels $m + 3, m + 4, \dots, m + n$ to the vertices u_1, u_2, \dots, u_{n-2} respectively.

Case 2. $m + n$ is even.

Assign the label 1 to u_n and assign the label 2 to u_{n-1} . Then assign the labels $3, 4, \dots, m + 1, m + n$ to the vertices v_i for any $i, 1 \leq i \leq m$. Next assign the labels $m + 2, m + 3, \dots, m + n - 1$ to the vertices u_1, u_2, \dots, u_{n-2} respectively.

Now, we know that two consecutive integers are relatively prime and if $n > 3$, then $\binom{n}{2} > n$. Also, if $n \geq 5$, then

$\binom{n-1}{2} > n$. Hence, we get both the cases every two adjacent vertex labelings are relatively prime and the induced

function P_f from the edge set of G to the set of natural numbers defined by $P_f(uv) = \binom{f(u)}{f(v)}, f(u) > f(v)$





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for every uv belongs to the edge set of G is injective. Hence the graph $C_n \oplus K_{1,m}$ admits a prime combination labeling when $m + n \geq 5$.

Using Theorem 7, a prime combination labeling of $C_5 \oplus K_{1,3}$ is displayed in Fig. 4.

CONCLUSION

Nowadays graph labeling has much attention from different brilliant researches in graph theory which has rigorous applications in many disciplines such as communication networks, coding theory, optimal circuits layouts, astronomy, radar and graph decomposition problems. In this paper specially, we studied the two types of labeling namely, prime labeling and combination labeling and their properties. We introduced the new concept of prime combination labeling and several families of graphs such as path, cycle and tree related graphs which admit such a labeling were presented. Also we proved that if G admits a prime and combination labeling, then G need not admit a prime combination labeling. Moreover, we discussed that a graph C_n is a prime graph for $n \geq 3$ and a combination graph for $n \geq 4$. Finally it is shown that C_4 and C_6 do not admit prime combination labeling. In our future work we plan to extend this idea to some more graph operations.

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<p>Fig. 1. A prime combination graph</p>	<p>Fig. 2. A prime combination graph of Olive tree with $n = 5$</p>
<p>Fig. 3. A prime combination graph of $C_5 \oplus P_4$</p>	<p>Fig. 4. A prime combination graph of $C_5 \oplus K_{1,3}$</p>





RP-HPLC Method Development and Validation for Estimation of Lidocaine 4% Transdermal Patch

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ABSTRACT

An easy, specific, accurate, and precise, reverse phase high-performance liquid chromatography method was developed for the estimation of Lidocaine 4% patch. Chromatographic procedures were developed using Chromatopak, Peerless C18 column (Column dimensions: 300 mm x 3.9 mm, 4 μ m), column temperature ambient and rate of flow 1 ml/minutes. The mobile phase was sodium acetate buffer: Acetonitrile in ratio 70:30 (pH adjusts to with 1N sodium hydroxide) with detection wavelength at 254 nm. Temperature was maintained at 30°C. The Retention time of lidocaine 4% is 4.045 \pm 0.02 min. Linearity of lidocaine was found in concentration range of 320.1 - 960.3 μ g/ml with $r^2=0.999$. Limit of Detection and Limit of Quantification were found to be 3.1- 9.5 μ g/ml. %RSD values for intraday and interday precision were also found to be >2%. Accuracy studies were also in range between 95%-105%. The method proved to be robust when chromatographic parameters like P^H, mobile phase ratio, flow rate, wavelength were altered. The proposed RP-HPLC method can be useful in the quality control analysis of lidocaine 4% transdermal patch .

Keywords: Lidocaine, Transdermal Patch, RP-HPLC.

INTRODUCTION

A transdermal patch could even be a medicated adhesive patch set on the outside of the skin to convey a chose portion of drug into lower layers of the skin and consequently the circulatory system. The advantages of transdermal medication conveyance frameworks (TDDS) incorporate keeping away from gastro-intestinal medication retention challenges, filling in for oral organization of prescription, keeping away from first-pass impact, staying away from the bothers of parenteral treatment and giving ability to end drug impact quickly. (Naik et. al., 2000). Lidocaine [also

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named as 2-(diethylamino)- N-(2,6-dimethylphenyl) acetamide] is once in a while utilized as a neighborhood sedative and antiarrhythmic. (Gandhi *et. al.*, 2020) It's a White translucent strong structure. Sub-atomic equation ($C_{14}H_{22}N_2O$) and relative sub-atomic mass is $234.343 \text{ g}\cdot\text{mol}^{-1}$ (Kumar *et.al.*, 2012). Its sedative specialist material with solid and effective. It's a high penetrability of the tissue and is appropriate for outer utilized for skin treatment to alleviate tingling, consuming, and torment from skin aggravations. (Salman *et. al.*, 2017). Lidocaine has a place with the group of opiate medicates and will be utilized as a sedative by the dependability of the anxious film which delivers a way agony and eliminate it stifled gave by the most elevated of the nerve signals inside the skin. It are regularly acclimated mitigate the inconvenience coming about because of the infection Herpes which influences the skin likewise on the grounds that the disease inside the varying sorts of activity and dental treatment, labor and epidural sedation upon entering the world and recognizable proof of conjunctivitis and is used especially for the treatment of cardiovascular arrhythmias in the wake of suffering a heart attack. (Gandhi *et. al.*, 2020).

Different logical strategies are accessible for assessment of Lidocaine in natural and drug tests which joins GC (Edhorn *et.al.*, 1971), Capillary electrophoresis (Li *et.al.*, 2006), HPLC (Nebaihi *et.al.*, 2017) Spectrophotometric assurance of Lidocaine in drugs (Karthikkumar *et.al.*, 2012), HPLC-UV technique for Simultaneous Determination of Lidocaine and Prilocaine in Topical Formulation (Narendra *et. al.*, 2017), TLC for the Determination of Hydrocortisone Acetate and Lidocaine during a Pharmaceutical Preparation (Dołowy *et. al.*, 2014), RP-HPLC technique advancement and approval isn't accounted for in writing for assessment of Lidocaine 4% skin fix. This current Research work is to create straightforward, exact, precise RP-HPLC technique for assessment of lidocaine 4% skin patch.

MATERIALS AND METHODS

Reagents and chemicals

Standard medication and lidocaine 4% Patch was blessing from INTERMED Porur, Chennai, HPLC grade Acetonitrile were from Merck, HPLC grade Methanol were from J.T.Baker, HPLC grade Glacial acidic corrosive and insightful evaluation Sodium hydroxide pellets were from Fisher Scientific, Water utilized all through the examination was Purified HPLC grade water.

Apparatus and Software

Chromatography was performed on Shimadzu LC-2030 (Shimadzu Corporation, Kyoto, Japan) chromatographic framework furnished with siphon and Shimadzu waters 2695/2489 PDA indicator. Tests were infused through a Rheodyne 7725 injector valve with fixed circle at $15 \mu\text{l}$. Information procurement and incorporation was performed utilizing lab arrangement programming. The chromatographic elution of analyte was acquired by utilizing CHROMATOPAK, Peerless C18 section (Column measurements: $330 \text{ mm} \times 3.9 \text{ mm}$, $4 \mu\text{m}$). Scientific Balance, pH meter from Mettler, UK and Micropipette from Fischer, Germany was utilized.

Method development

Preparation of 1N sodium hydroxide

Accurately weigh and transfer $4.0 \text{g} \pm 0.4 \text{g}$ of sodium hydroxide pellets into a 100 mL volumetric flask. Add about 40 ml of water and sonicate to dissolve. Cool to room temperature and make up to the volume with water and mix well.

Preparation of mobile phase

Preparation of Mobile phase "A"

Measure and transfer about 930ml water and 50 ml glacial acetic acid in a suitable container. Mix well. Adjust the pH of the resultant solution to $\text{pH } 3.40 \pm 0.05$ using 1N sodium hydroxide. Filter the solution through $0.45 \mu\text{m}$ membrane filter.



**Aswin and Kottai Muthu****Preparation of Mobile phase "B"**

Use 100% acetonitrile. Sonicate to degas.

Diluent Preparation

Use 100% methanol as diluent. Sonicate to degas

Preparation of Standard solution of lidocaine

Accurately weigh and transfer about 32 mg \pm 3.2 mg of Lidocaine into a 50 mL volumetric flask. Make up to the volume with methanol. Mix well. (concentration of lidocaine is about 640 ppm).

Preparation of Sample solution of lidocaine 4% transdermal patch

Precisely gauge and move around 1000 mg \pm 150 mg of Lidocaine fix without liner. Spot the fix into a 100 ml volumetric carafe. Pipette out 50.0 ml of methanol and sonicate at 60°C for 15 minutes. Shake the volumetric cup by hand energetically for around 5 minutes. Cool to room temperature. Channel the arrangement through 0.45 μ m polytetrafluoroethylene needle channel by disposing of around barely any ml of the filtrate. Gather the filtrate into a HPLC vial. (convergence of lidocaine test is around 640 ppm).

Chromatographic conditions

Chromatographic partition was done Peerless section Basic C18, 300mm x 3.9mm x 4 μ . with The portable stage utilized for isocratic elution was set up by utilizing a sythesis of 930 ml of water with 50 ml of chilly acidic Adjust the pH of the resultant answer for pH 3.40 \pm 0.05 utilizing 1N sodium hydroxide and blend in with Acetonitrile. The Ratio is (70:30) .Before use, the portable stage was channel through 0.45 μ m layer channel and degassed by ultrasonication. The stream rate was 1mL/minutes, section temperature 30°C, the infusion volume was 15 μ L, and location was performed at 254 nm utilizing a PDA identifier. The Data were coordinated utilizing LAB arrangement programming.

RESULT AND DISCUSSION**Optimization of Chromatographic Conditions**

To upgrade the chromatographic conditions, the impact of chromatographic factors like creation of versatile stage, proportion of portable stage and stream were contemplated. Chromatographic investigation was performed on a Shimadzu model LC-2030. The subsequent chromatograms were recorded utilizing PDA-finder and furthermore the chromatographic boundaries like uneven factor, and hypothetical plates were determined. At long last, a simple and modest technique was created by utilizing a portable stage sythesis of 930 ml of water with 50 ml of icy acidic Adjust the pH of the resultant answer for pH 3.40 \pm 0.05 utilizing 1N hydrated oxide and mix with Acetonitrile. The Ratio is (70:30) .Optimized chromatographic conditions are recorded in Table.1

Method Validation**System suitability**

System suitability results were presented in table 2 and 3. System suitability test indicate the reliability and therefore the performance of analytical system on every day, The tests are supported the concept that the equipment, electronics, analytical operations and samples to be analyzed constitute an integral system which was evaluated as a full (Sharma *et. al.*, 2021)

Specificity

Specificity results was presented in table 3 and Fig.2. Specificity is that the power to assess accurately the analyte within the presence of components which might be expected to be present within the sample matrix. Typically these might include impurities, degradants, matrix, etc (Pasbola *et. al.*, 2017).



**Aswin and Kottai Muthu****By retention time**

Analyze tile blank (diluent) placebo preparation, standard preparation and sample preparations and spiked placebo preparation as per analytical method

Accuracy

Accuracy of the strategy was examined utilizing standard expansion technique at three distinct levels (50, 100, and 150%) by recuperation tests. (Salas et.al., 2008) Known measures of ordinary arrangements containing LID (319, 639,959ug/ml) were added to 1 of the promoted plan of fixation 639ug/ml to achieve half, 100% and 150% levels. Rate Recovery was the mean of three judgments at every standard expansion level. Exactness is estimated on the grounds that the portion of the analyte recuperated by test. Three fixations half, 100%, 150%, were infused during a three-fold way and sum Recovered and rate Recovery were shown in Table 5.

Precision

Precision is a measure of the reproducibility of the whole analytical method (including sampling, sample preparation and analysis) under normal operating circumstances. (Klein et.al., 1994)

System precision

System precision results were presented in table 6. System precision is calculated from the information obtained on repeatedly analyzing the only standard solution and calculating the relative variance of the responses. (Salman et. al., 2017). System Precision was administered by performing six replicate injections at 100% of the test concentration and calculating the %RSD of the measured area.

Intermediate precision

Intermediate precision expresses within-laboratories variations: different days, different analysts, different equipment, etc. (Salman et. al., 2017) intermediate Precision was meted out by performing six replicate injections at 100% Concentration of sample solution were analyzed in brief interval times in an exceedingly same day. From the result mean, variance and %RSD was calculated. The appropriate limit of result was shown in Table 7.

Reproducibility or Ruggedness

Reproducibility expresses the precision between laboratories (collaborative studies, usually applied to standardization of methodology).(Gandhi et. al., 2020)Different instrument, analyst, laboratory and day, reproducibility was disbursed by performing six sample preparation injections at 100% Concentration of sample solution were analyzed 3 times for the three consecutive days and also the result mean, variance and %RSD was calculated. The suitable limit results were shown in Table 8.

Linearity and Range

Prepare the blank (diluent) and standard preparation as per analytical method. The linearity is to be determined by injecting the solutions containing analyte standard starting from 50%, 80%, 100%, 120% and 150% of assay concentration. The calibration curve was constructed by plotting concentrations of LID versus peak areas, and also the regression equations were calculated. (Salman et. al., 2017) The linearity of the strategy was investigated by using concentrations within the range 320.1 µg /mL to 960.3 µg/ml .Retention time for LID was found to be 4.045 min respectively. The regression toward the mean equation is $Y = 1.587.1772x - 5976.3041$ ($r^2 = 0.999$). The plot obtained from simple regression is given in fig: 3, table 9.

Limit of detection

The boundary LOD dictated by investigation of test with known convergence of analyte and by setting up the base level at which the analyte might be dependably detected. The cutoff of discovery (LOD) determined upheld the quality deviation of the reaction and thusly the slant of the adjustment bend. As far as possible is additionally



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communicated as $LOD = 3.3 (SD/S)$, separately, where SD is that the fluctuation of the stature territory and S is that the slant of the relating alignment bend. (Shrivastava et. al., 2011) LOD discovered to be $3.1\mu\text{g/ml}$.

Limit of quantification

The boundary LOQ controlled by investigation of test with known grouping of analyte and by setting up the base level at which the analyte will be evaluated with satisfactory exactness and accuracy. Cutoff of measurement (LOQ) determined upheld the quality deviation of the reaction and accordingly the incline of the alignment bend. As far as possible is likewise communicated as $LOQ = 10(SD/S)$, separately, where SD is that the fluctuation of the stature territory and S is that the slant of the relating alignment bend. (Shrivastava et. al., 2011) The LOQ discovered to be $9.5\mu\text{g/ml}$.

Robustness

The robustness results were introduced in table 10. The robustness of a scientific methodology might be a proportion of its ability to remain unaffected by little, yet intentional varieties in strategy boundaries and gives an indication of its unwavering quality during typical utilization. Little conscious changes in technique like stream, versatile stage proportion, pH and section temperature are made however there have been no perceived change inside the outcome and are inside range. (Gandhi et. al., 2020).

Stability of solution

Prepared blank, standard preparation and test preparation as per method of study, stored the quality preparation and sample preparation at temperature up to 24 hours. Analyzed the quality and sample preparation at pre-determined time intervals (0, 12 & 24 hours) (Narendra et. al.,2017). Prepared standard preparation freshly every time of study and calculated the % recovery of ordinary preparation and % assay of sample preparation.(Zivanovicet.al., 1996). The solution stability of standard preparation were presented in Table 11 and 12.

Assay

Standard preparations are made up of the API and Sample Preparations are from Formulation. Both sample and standards are injected six homogeneous samples. Drug within the formulation was estimated by taking the quality because the reference When the LID marketed formulation was analyzed by these proposed HPLC method, sharp peaks was obtained at t_R 4.045 minutes, when scanned at 254 nm. The number of the label claim measured patch the bounds are (95%-105%) are shown in Table 13.

CONCLUSION

The proposed RP-HPLC method has been developed for the estimation of Lidocaine 4% transdermal patch. This developed method is straightforward, precise, linear, accurate, rugged and robust enough, inexpensive and desires only a awfully small volume of the sample. The sample solution was found to be stable up to 48 hours at ambient condition. The proposed RP-HPLC method has validated. Percentage Assay values of transdermal patch where found to be within the prescribed range. Hence RP- HPLC method is also used for routine control analysis of Lidocaine from its various Pharmaceutical dosage forms.

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Conflicts of Interest

The authors declare no conflict of interest.



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Authors contribution statement

Aswin carried out the experiment work under the guidance of Dr.A.Kottai Muthu. Both the authors are prepared this manuscript.

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Table 1. optimization of the chromatographic condition

METHOD PARAMETER	OPTIMIZED VALUE
COLUMN	CHROMATOPAK, Peerless C18 column (Column dimensions: 300 mm x 3.9mm, 4 μm).
MOBILE PHASE	Mobile phase A : B 70: 30
FLOW RATE	1 ml/min
RUN TIME	20 min
PDA-DETECTION WAVELENGTH(nm)	254
COLUMN TEMPERATURE	30°C
INJECTION VOLUME	15μL
RETENTION TIME	4.045 ± 0.02 min
TAILING FACTOR	1.3 ± 0.01
THEORITICAL PLATE	4182 ± 14.5

Table 2: system suitability

S. No.	Lidocaine 4 % Patch		
	Retention time (min)	Peak area	USP plate count
1	4.057	950444.060	4177
2	4.049	949679.580	4197
3	4.043	952756.409	4183
4	4.046	950202.828	4165
5	4.040	949101.023	4159
Mean		950436.780	4182
Relative standard deviation (%)		0.15	NA
Limit		NMT 2.0	NLT 1500

Table 3: system suitability result

Property	Lidocaine
Retention time	4.045 ±0.02 min
Theoretical plates	4177±88.33
Tailing factor	1.3±0.019

Table 4: specificity Results

Sample Name	Average retention time (min)	Mean peak area of Lidocaine	% Assay
Placebo	9.395	NA	NA
Sample preparation	4.036	910205.420	100.31
Spiked sample preparation	4.031	923536.390	97.332
Spiked placebo preparation	9.392	NA	NA

The % assay difference of sample preparation and spiked sample preparations 3.0 (Limit: NMT10.0)





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Table 5: Accuracy

Sample Name	Peak area	Amount added (ppm)	Amount found (ppm)	%Recovery	Average % Recovery	%RSD
Accuracy-50% P1	490901.452	319.80	319.67	99.959	99.99	0.1
Accuracy-50% P2	490970.552	319.80	319.71	99.971		
Accuracy-50% P3	491408.981	319.80	320.00	100.06		
Accuracy-100% P1	976740.072	639.61	639.04	99.441	99.57	0.1
Accuracy-100% P2	978964.664	639.61	637.49	99.668		
Accuracy-100% P3	978560.839	639.61	637.22	99.626		
Accuracy-150% P1	1473290.406	959.42	959.39	99.996	100.1	0.2
Accuracy-150% P2	1476148.712	959.42	961.25	100.19		
Accuracy-150% P3	1477933.915	959.42	962.41	100.31		
Limit				NLT 90.0% & NMT 115.0%		NMT 2.0

Table 6: System precision

Lidocaine		
Injection	Retention time (min)	Peak area
1	4.159	992332.277
2	4.195	992181.257
3	4.195	994595.168
4	4.199	992850.061
5	4.199	992850.061
6	4.195	996417.654
Mean	4.198	992395.221
Mean	993675.283	
Relative standard deviation (%)		0.15
Limit		NMT2.0

Table 7: Intermediate precision

Sample preparation	Mean peak area n =3
1	954428.050
2	965794.086
3	983152.504
4	910851.768
5	950459.946
6	898375.968
Mean	920459.502
Relative standard deviation (%)	0.16
Limit	NMT 1





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Table 8: Reproducibility or Ruggedness

Sample preparation	Mean peak area
1	1001064.055
2	997203.446
3	1002214.906
4	1003652.742
5	1007221.918
6	1002271.414
Mean	1001064.055
Relative standard deviation (%)	0.37
Limit	NMT 2.0

Table 9: linearity

Linearity Level	Standard Concentration in %	Concentration of Lidocaine in ppm	Mean peak area n=2	Correlation coefficient (r2)
Level — 1	50	320.114	503292.248	0.9998 1.00
Level — 2	80	512.183	810313.680	
Level — 3	100	640.229	1003252.629	
Level — 4	120	768.274	1213135.913	
Level — 5	150	960.343	1520904.940	
Limit				NLT 0.99

Table 10: Robustness

Parameters	Retention Time	Mean Peak area(n=6)	% RSD	USP Plate count	Correlation Coefficient	Mean assay	%RSD Assay
Organic composition							
(20: 80)	4.126	1000503.771	0.1	4175	1.00	4.0	3.7
(23:77)	4.905	1008015.393	0.1	3267	1.00	4.1	3.4
(17: 83)	3.765	956530.459	0.2	2602	1.00	4.2	3.6
pH Variation							
pH3.4	4.126	1000503.771	0.1	4175	1.00	4.0	3.7
pH 3.3	3.995	983236.383	0.2	3507	0.99	3.9	3.3
pH3.5	4.118	993775.211	0.1	4599	0.99	3.8	3.5
Column temperature							
30.00C	4.126	1000503.771	0.1	4175	1.00	4.0	3.7
28.0 C	4.113	995767.083	0.1	4387	1.00	4.0	3.5
32.00C	4.098	996619.31	0.1	4450	1.00	4.1	3.4
Flow Rate							
1.5 mL/min	4.126	1000503.771	0.1	4175	1.00	4.0	3.7
1.4 mL/min	4.549	1110807.215	0.8	4379	1.00	4.0	3.6
1.6 mL/min	3.743	909504.153	0.1	4268	1.00	4.0	3.5

Table 11: Solution stability- Standard preparation

Sample Name	Mean peak area	% Recovery
Standard preparation - Initial	993675.283	NA
Standard preparation - 12h	995064.433	100.13-100.1
Standard preparation - 24	1008174.660	101.45-101.5





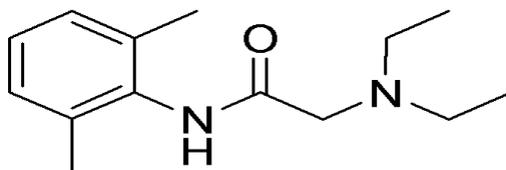
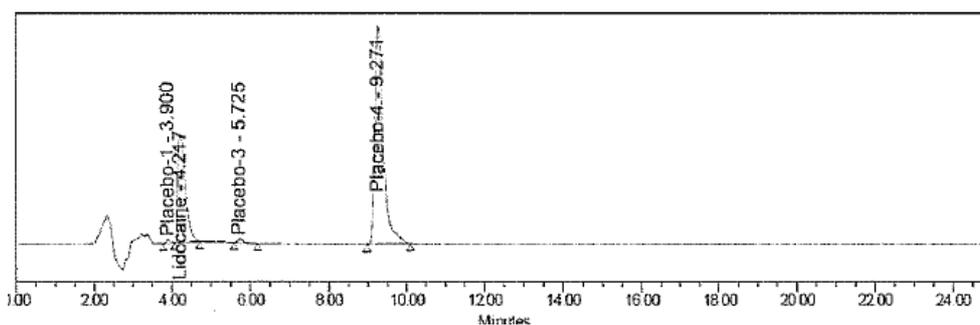
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Table 12: Solution stability- Sample preparation

Sample Name	Mean peak area N=2	% Assay
Sample preparation - initial	953692.915	4.0212
Sample preparation - 12h	959572.444	4.0460
Sample preparation - 24h	944537.683	3.9826
Cumulative Mean		4.0166
Cumulative % RSD		0.79543
Limit:		NTM 2.0

Table 13: Assay

S.NO	LIDOCAINE 4 % PATCH
1	99.51
2	100.54
3	99.00
4	101.01
5	99.16
6	101.14
Mean	100.08
STD	96.00
% RSD	0.95


Fig. 1. Chemical Structure of lidocaine

Fig. 2. Chromatogram of specificity

No interfering peak should be observed at the retention time of Lidocaine from blank and placebo.





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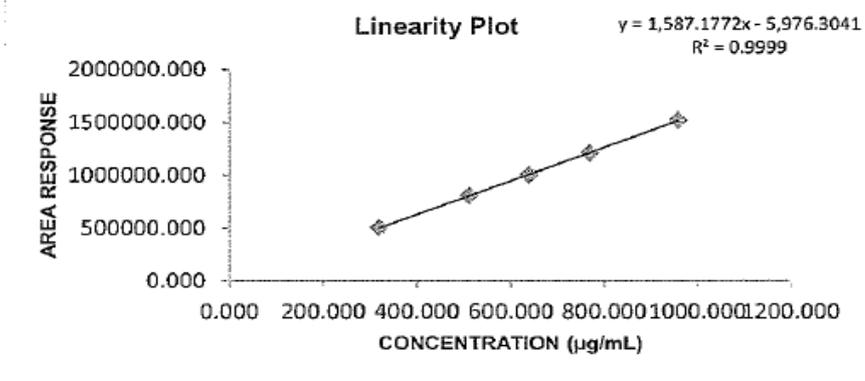


Fig 3: linearity plot





Mathematical Modeling of Estimating Viral Infection Parameters

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ABSTRACT

In this paper, I had devised a simple model for determining number of infected population and number of virions by considering the production rate of virions and mortality rate of cells. Though simple, this model provides vital information about how to tackle with viral affected people in immunology discipline. After describing the calculations of the model, I had provided two illustrations to actually compute the number of infected population and number of virions.

Keywords: Virions, Production Rate, Cell Mortality Rate, Maximization, Burst Size

INTRODUCTION

We know that the immune system and the pathogen will be in an evolutionary battle that is closely matched. In this paper, I consider ideas pertaining to the HIV virus, initiator of so much immunological research. I confine my discussion to two topics that are of course not restricted to HIV. HIV is very much on the attack against the crucial CD4⁺ T-cells of the mammalian immune system. When it infects a cell, the host obligingly produces hundreds to thousands of new virions before it succumbs to membrane depletion, viral protein buildup, and the like. It is certainly in the short-term interest of the virus to adjust its replication rate to maximize the burst size—the total virions produced—before the cell dies, and in particular it had better not kill the cell too fast (at longer time, it will be the number of virions produced per unit time in the host population that matters). In this paper, I will present a model concerning with mortality rate of a cell . . .

Describing the Model

To see the nature of the optimum replication schedule that would come about during viral evolution, we have to model the mortality rate of a cell. Suppose $I(t)$ represent size of infected population at time t (after infection); $N(t)$ be





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the number of virions produced until t ; P be the production rate of virions per cell per unit time; μ represent the cell mortality rate per unit time.

A particularly simple model can be presented by imagining that N itself is a good measure of physiological time, since it both measures accumulated damage and the increasing virally induced protein complement of the cell, which could well serve as a quantitative signal. In this case, we would have a given $\mu(N, P)$ and would seek the viral strategy $P(N)$. Our system is then simply (normalized to one initial cell) given by the following system of

$$\dot{N} = PI, \dot{I} = -\mu I, I(0) = 1 \quad (2.1)$$

From (2.1), we have $\frac{dI}{dN} = \frac{\dot{I}}{\dot{N}} = -\frac{\mu(N, P(N))}{P(N)}$ (2.2)

Now integrating (2.2) with respect to N , in the interval $[0, N]$ using Fundamental Theorem of Calculus, we get

$$I(N) - I(0) = -\int_0^N \frac{\mu(N, P(N'))}{P(N')} dN'. \text{ Since } I(0) = 1 \text{ we have}$$

$$I(N) = 1 - \int_0^N \frac{\mu(N, P(N'))}{P(N')} dN' \quad (2.3)$$

The burst size \bar{N} is defined as value of N for which $I(N) = 0$. Hence from (2.3) we obtain

$$\int_0^{\bar{N}} \frac{\mu(N, P(N'))}{P(N')} dN' = 1 \quad (2.4)$$

Now our objective is to maximize the burst size \bar{N} . For this, we need to select $P(N)$ to minimize the integrand of (2.4) for each value of N . such that

$$\frac{\partial}{\partial P(N)} \left\{ \frac{\mu(N, P(N))}{P(N)} \right\} = 0 \quad (2.5) \text{ and } \frac{\partial^2}{\partial P(N)^2} \left\{ \frac{\mu(N, P(N))}{P(N)} \right\} \geq 0 \quad (2.6)$$

Knowing $\mu(N, P)$, we can maximize the burst size \bar{N} satisfying (2.5) and (2.6).

Illustrations

3.1 If we consider $\mu(N, P) = \mu(N) + \gamma^2 P^2$ which represent sum of intrinsic and induced mortality rates such that $\mu(N, P) = 2\mu(N)$ we then have $P(N) = \frac{\sqrt{\mu(N)}}{\gamma}$. Substituting this in (2.4), we get

$$\int_0^{\bar{N}} \frac{2\mu(N)}{\left(\frac{\sqrt{\mu(N)}}{\gamma}\right)} dN = 1 \cdot \text{That is, } \int_0^{\bar{N}} \sqrt{\mu(N)} dN = \frac{1}{2\gamma} \quad (3.1)$$

Now in particular, if $\mu(N)$ happens to be a constant say $\mu(N) = \mu$ then from (3.1) we see that the burst size is given by $\bar{N} = \frac{1}{2\gamma\sqrt{\mu}}$ (3.2). In this case, from (2.3), we get

$$I(N) = 1 - \int_0^N \frac{2\mu}{\left(\frac{\sqrt{\mu}}{\gamma}\right)} dN = 1 - 2\gamma\sqrt{\mu}N \quad (3.3) \cdot \text{But from (2.1), we know that } \dot{I} = -\mu I, I(0) = 1 \cdot$$





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From this, we get $\frac{dI}{dt} = -2\mu I \Rightarrow \frac{dI}{I} = -2\mu dt \Rightarrow I = ce^{-2\mu t}$ (3.4). Since $I(0) = 1$ we get $c = 1$.

Hence $I = 2e^{-\mu t}$ (3.5). Substituting this in (3.3), we get $N = \frac{1 - 2e^{-\mu t}}{2\gamma\sqrt{\mu}}$ (3.6)

Though the model provides all values quite easily it is far from practical purposes.

3.2 The way to improve the proposed model is to imagine that μ in fact depends upon physical time as $\mu(t, P)$ and seek to maximize $P(t)$. Here the probability of a cell surviving until time t is then given by

$I(t) = e^{-\int_0^t \mu(\tau, P(\tau)) d\tau}$ (3.7). In this case, the burst size \bar{N} through $\dot{N} = PI$ is given by

$$N(P) = \int_0^{\infty} P(t) e^{-\int_0^t \mu(\tau, P(\tau)) d\tau} dt \quad (3.8)$$

The function $N(P)$ in (3.8) is to be maximized for the choice of $\{P(t)\}$ subject to the biological restriction $P(t) \leq P_M$. In particular, if we know μ in terms of P then using (3.8) we can compute $N(P)$ and easily find the burst size \bar{N} from that. This way we can greatly improve the ideas presented in the model.

CONCLUSION

The main aim of this paper is to determine the number of infected people and number of virions through a simple model. In describing the model in section 2, I had arrived at the equations (2.3), (2.5) and (2.6). Through these equations we can compute the required values. Two illustrations were provided in section 3 to illustrate the computations made in the model. In the first illustration of section 3.1, if we consider that the mortality rate per unit time is constant and does not depend on time or number of virions then the number of infected people and number of virions are given by (3.5) and (3.6) respectively. In (3.5) we notice as time is very large then the number of infected population will decrease where as in (3.6) we see that in very large time, the number of virions attains the burst size value given in (3.2). But these calculations are not applicable especially in the case of pandemic like HIV or COVID – 19. To get rid of this difficulty the second illustration is provided which is practically applicable even in pandemic situations. Once if we know the production rate of virions and cell mortality rate, then we can compute the number of infected population and number of virions through equations (3.7) and (3.8) respectively. These values also help us to determine the burst size value \bar{N} . Thus using simple model I had demonstrated ways of determining the vital information in situations like handling HIV virus as well as for other viral infections.

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Computers and IoT Security Systems with Biometrics

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ABSTRACT

To use DSP techniques, identify the finger print pattern and provide authentication. This project can be used in a variety of settings, including computers and security systems, research centres, and industries. This project will primarily consist of two steps: enrolment and authentication. Enrollment is the process of identifying an individual within a group of people. It often scans a database for a person's identity using the person's fingerprint as an index. The database size can vary from a few people (for personal use) to hundreds of people (for commercial use). A digital image of a finger print is saved in a database. During authentication, the print of the user's finger is detected and stored in the database. The stored data was then compared to the new data, and matching algorithms were used to recognise the user. Finally, the user information was displayed. For security reasons, biometric authentication is a critical method for identifying and verifying individuals. There are many biometric systems in use today, as well as those being researched. Tongue print authentication is a modern biometric authentication technique that is one-of-a-kind and difficult to forge since no two tongue prints are alike. The aim of this research is to look at the different morphological features of the tongue and how they differ between males and females. The effectiveness of using an alginate impression and a dental cast to produce a lingual impression was also assessed.

Keywords: Authentication, fingerprint, Security systems.



**Sathees babu et al.****Authentication by Fingerprint**

Fingerprints are detected using a sensor, then converted to frequency domain and stored in a database. The stored data is then compared to new data, and matching algorithms are used to recognise the user. Finally, the user's information is displayed.

Installation

The finger print sensor is connected to the DSP board, and the image is collected using the DSP and stored in the DSP. The image is then converted to frequency components using 2D FFT, and the features of the finger print are extracted and stored in a database. The Enrollment protocol is followed in the Authentication section, and the features are compared to the database.

History of Fingerprints and Their Spread

Fingerprint systems can be classified into two categories based on the intent of application: identification and authentication applications. The term "identification application" refers to the process of identifying a person within a group of people. It often scans a database for a person's identity using the person's fingerprint as an index. The database size can vary from a few people (for personal use) to hundreds of people (for commercial use). The output of such a system is determined by the size of the database. A common example of identification is access control. Enrollment occurs when a consumer registers a fingerprint in the system for the first time. The authentication unit is the heart of the system.

As the Internet has grown in popularity, it has become important to verify people's identities online. The password is the most basic type of individual authentication, but it does not provide high standards of protection. Statistics show that the average person in the United States of America, where the Internet is most created, has eleven passwords. Easy-to-remember passwords, on the other hand, can put personal information at risk, and net crime is on the rise. Security experts have developed biometrics as a result of their understanding of this security flaw. Authentication in biometrics is achieved by using a physical characteristic of the person. Voice, iris, hand, ears, and veins can all be used in addition to fingerprints, but fingerprints are preferred for their cost-effectiveness and authentication accuracy. Solid-state sensors based on capacitive technology achieve reliable operation, low power consumption, and physical compactness, outperforming more traditional optical sensors in the fingerprint sensor sector.

Principle of Fingerprint Detection

The capacitive-based solid-state sensors have a hard protective layer covering an array of capacitor electrodes (e.g. 76,000 electrodes on the MBF200). Depending on the distance between the finger's surface and each electrode, different charges accumulate around the collection. The sensor reads each capacitor value and converts it to an image of the fingerprint using an 8-bit AD conversion. Since the condensers have a pitch of 50 m, the sensor can detect ridges in the fingerprint that are larger than 200 m with high accuracy (500 dpi).

Fingerprint Detection Principle

The capacitor charges (C1, C2, C3) that correspond to the fingerprint's ridges and troughs are calculated. On the MBF200, 76,800 pixels of fingerprint data are translated to 8-bit scale data.

Properties of solid-state capacitive fingerprint sensors

A silicon semiconductor system that functions reliably without the use of optical mechanisms. The use of standard silicon semiconductor technology allows for the easy integration of different types of control circuits, memory, interfaces, and other components. Reduced power consumption is also achieved by proven technologies. Sensors come in a variety of sizes to fit your needs. Durable, ultra-hard protective coating.



**Sathees babu et al.**

CONCLUSION

Fingerprint enrollment and finger print authentication are the two key stages in the finger print authentication scheme. During finger print registration. The picture of a finger is captured using a sensor and a DSP processor. After that, the spatial domain data is converted to frequency domain data, and the characteristics of a specific finger are stored in a database. Normally, the stored data is used for authentication, and the fingerprint is detected using a sensor. After that, the spatial domain data will be converted to frequency domain and stored in a database, after which the stored data will be compared to the new data and matching algorithms will be applied for identification, and finally, the user information will be displayed. This project can be used in a variety of settings, including computers and security systems, research centres, and industries. When high protection is needed, this project will be more beneficial.

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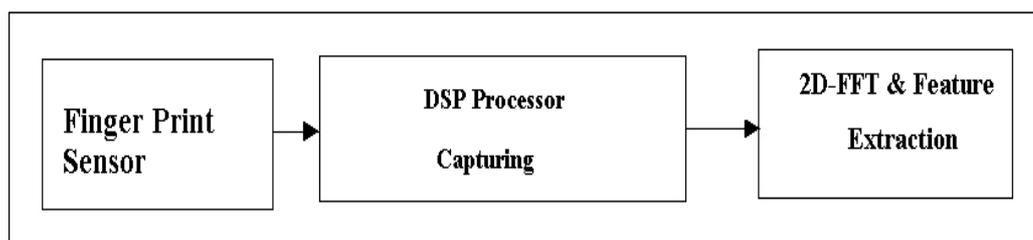


Fig. 1. Fingerprint Enrollment Block Diagram





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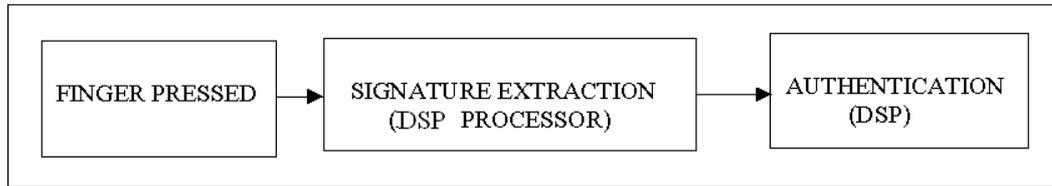


Fig. 2. Authentication Block Diagram

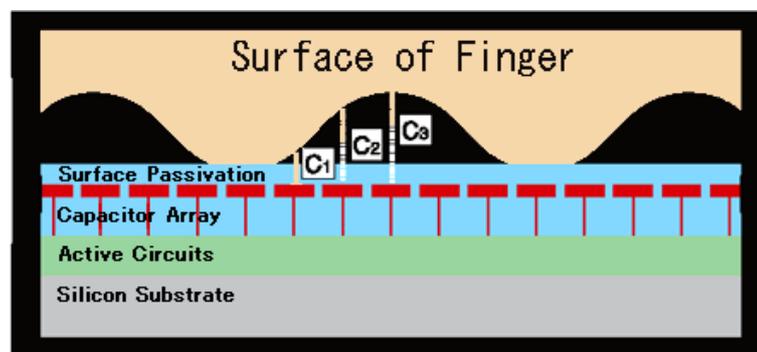


Fig. 3. Finger Surface





An Enhanced Optimized Probability Distribution Approach for Transportation Problem using Artificial Neural Network

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ABSTRACT

This paper represents a number of essential real time issues faced at loading and unloading service centers within organization. It provides finest probability distribution for the solving of difficult transportation problem with the help of appropriate statistical software. For solving most common problems related to transportation, Queuing theory plays a most significant role. In this manuscript, an attempt has made for make understand the process to getting finest and cost effective probability distribution of service providers.

Keywords: Problems related to Transportation, Artificial Neural Network and Statistical Tool.

INTRODUCTION

In present situation, nearly everyone organization are facing the problem of over load on its loading and unloading services providers or centers. So waiting time of the vehicles is increase at loading and unloading services centers. Organizations must have to solve such problem and it want to get the finest number of loading and unloading service centers within the system. Mostly organizations like toy industry, Plastic goods industry, Rice industry, electronics goods industry, wheat industry and etc. are want the effective solution of such problems. We make attempt to solve such type of problem for organizations. A lot of vehicles are arriving into the organization per day and each vehicle desire the service of the loading or unloading service centers according to need. But actually, it is not achievable because the number of loading or unloading services centers is very restricted. Due to this condition, the waiting time of the vehicles is enhanced. According to various researches, the usual waiting time of the vehicles is approximate 20 hours within an organization. A number of conditions work on the vehicles as like not

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fixed arrival time of vehicles, number of queue, a lot of vehicles arrive on organization at same time, minimum output, bulk arrives of the vehicles and several other problems within the organization [1-4]. The actual circumstances of the organization are very difficult to solve such problem due to no appropriate model presented. At this time, particular model is necessary for find out the finest number of loading and unloading service centers within the organization. In particular model, Arrival time of each vehicle is very significant because the inter arrival time of vehicles and service time of the vehicles are two most important aspects to design and develop it. For finding the most efficient and appropriate model, we apply queuing theory. Queuing theory provides a number of substitute mathematical models for explaining and solving common waiting line problems. It provides the statistical details of the queue according to the behavior. Such problem is concerning with waiting lines, evaluation of the existing system of organization and the most common issue related to waiting line problems. It decided that the finest level of service centers within the organization should provide too much service than involve unnecessary cost [5-10].

This research paper contains some following sections

In section-II: describe the methodology, In section-III: explain how to find out the finest probability distribution, In section-IV: discuss about the finding, section-V has the main conclusion, In the last section-VI, we explain about future research work.

METHODOLOGY

The research methodology is very difficult assignment to design. Most important steps of the research methodology are collection of data after that analysis that data. Raw data are collected from the organization. The collected data may be in random form like in hours form or minutes form after that find out the inter-arrival time of vehicles. Then collected data upload in to the statistical software like Number analytics tool, Matlab tool, *Minitab* tool [5] and etc. to find out the appropriate and finest probability distribution.

PROBABILITY DISTRIBUTION

We find out the inter arrival time of vehicles in to the system by using data gathering process of the organization. After getting data, it uploads in to the Minitab software for find out the finest probability distribution for the inter arrival time of the vehicles within the organization. We use the superlative software for find out the probability distribution of the inter arrival time between the vehicles. In current era, various software present in the market. These software's provide the cost efficient and proper probability distribution for inter arrival time between the vehicles within the organization.

The frequency table 1 is given below:

Average inter arrival time = 24.9 Minutes

By load the data into the Minitab for inter arrival time, the parameter and Anderson-Darling value (A-D value) for the different possible distribution is given below (fig.1-5).

Here, the logistic distribution gives the minimum of A-D value which is equal to the 2.111. So the logistic distribution has been accepted for inter arrival time distribution.

Again we find out the data as service time of vehicles in to the system using data collection process. Data provided by the organization. After receiving data, it loads in to the Minitab for finding the suitable probability distribution for the service time of the vehicles in to the organization.

The frequency table 2 is given below.

Average service time = 62.5 minutes

By load the data into the Minitab for service time, the parameter and Anderson-Darling value (A-D value) for the different possible distribution is given below (fig.6-10).





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Here, the logistic distribution gives the minimum of A-D value which is equal to the 0.748. So the logistic distribution has been accepted for service time distribution.

FINDING

We find the average inter arrival time and service time, and suitable probability distribution for inter arrival time and service time, we have to find out the optimum number of unloading service centers for organization. We use queuing theory for solving such type of problem. We use multi-server queuing model which is (M/M/C) : (FCFS/N). Firstly, we observed the existing system of organization. We found the two unloading service centers in organization and maximum vehicles waiting time is 44 hours. The normal queue length is 50 vehicles and the normal waiting time of most common vehicle is 25.53 hours into the system. Now we estimate standard waiting line length and standard waiting time of the most common vehicles in organization with various number of unloading service providers using Multi-Servers Queuing Model:

CONCLUSION

According to probability distribution graphs, we use logistic distribution for the inter arrival time and unloading service time both and also calculate the average queue length and average waiting time of the vehicles with different number of unloading service centers in the organization for unloading vehicles. But when organization increase the unloading service centers then the total cost of the product will also increase.

PROPOSED FUTURE WORK

In proposed future work, we will calculate the total unloading cost with the different number of unloading service centers with many other conditions. On the basis of minimum total cost, we will decide the optimum number of unloading service centers in organization. After that we will find the optimum number of loading service centers with in the organization based on the previously find out optimized unloading service centers. Organization produce large amount of product. So the fast delivery of the product will be effected due to unsuitable number of loading service centers and also try to reduce the delivery time of the product from organization to destination by selecting best way to deliver the product using Artificial Neural Network [2].

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Table 01: Time interval for inter-arrival time distribution

Time interval (minutes)	Mid Points	Frequency	Cumulative Frequency
0 – 25	12.5	400	400
25 – 50	37.5	50	450
50 – 75	62.5	30	480
75 – 100	87.5	04	484
100 – 125	112.5	04	488
125 – 150	137.5	03	491
150 – 175	162.5	00	491
175 – 200	187.5	03	494
200 – 225	212.5	00	494
225 – 250	237.5	00	494
250 – 275	262.5	02	496
275 – 300	287.5	02	498
300 – 325	312.5	00	498
325 – 350	337.5	00	498
350 – 375	362.5	01	499
375 – 400	387.5	00	499
400 – 425	412.5	00	499
425 – 450	437.5	00	499
450 – 475	462.5	01	500

Table 02: Time interval for service time distribution

Time interval (minutes)	Mid Points	Frequency	Cumulative Frequency
0 – 15	7.5	01	01
15 – 30	22.5	00	01
30 – 45	37.5	00	01
45 – 60	52.5	30	31
60 – 75	67.5	20	51
75 – 90	82.5	05	56
90 – 105	97.5	03	59
105 – 120	112.5	01	60

Table 03: Queue length and waiting time for unloading service providers

S.No.	Number of Unloading Service Providers	Queue Length (approx.)	Waiting Time (Approx. in hours)
1.	03	44	22.5
2.	04	17	8.5
3.	05	08	04
4.	06	04	02
5.	07	02	1.12
6.	08	01	0.64





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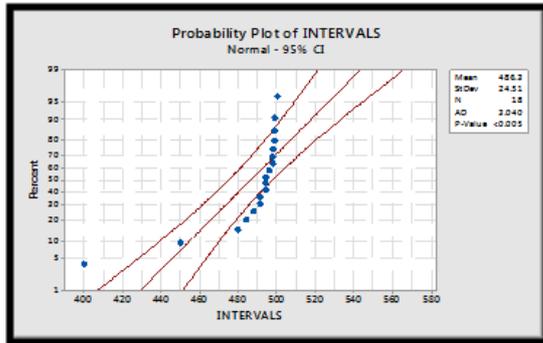


Fig 1: Normal Probability Graph

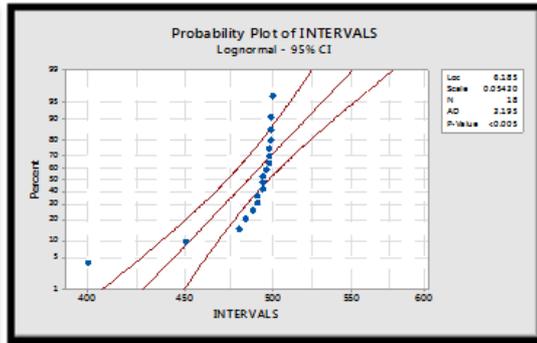


Fig 2: Lognormal Probability Graph

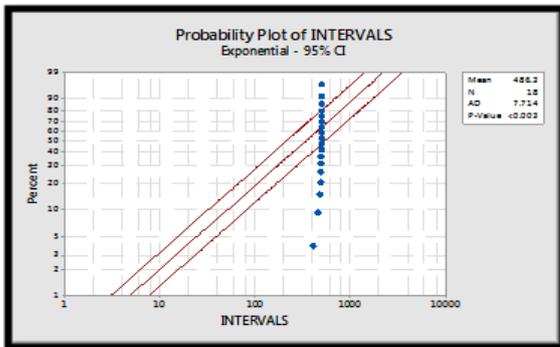


Fig 3: Exponential Probability Graph

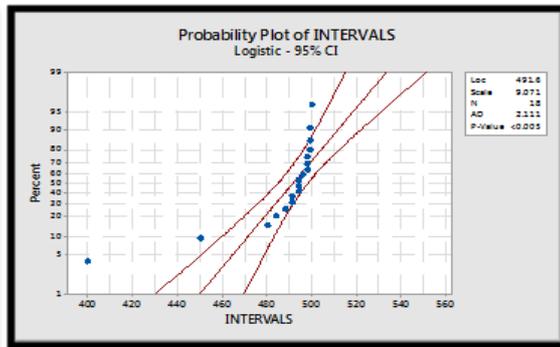


Fig 4: Logistic Probability Graph

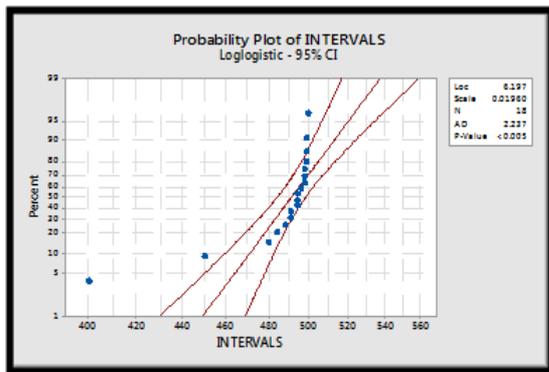


Fig 5: Loglogistic Probability Graph

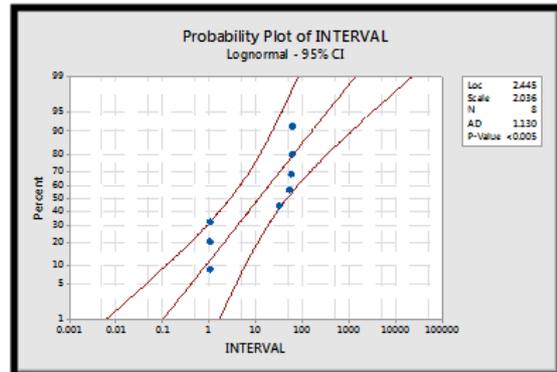


Fig 6: Lognormal Distribution Graph





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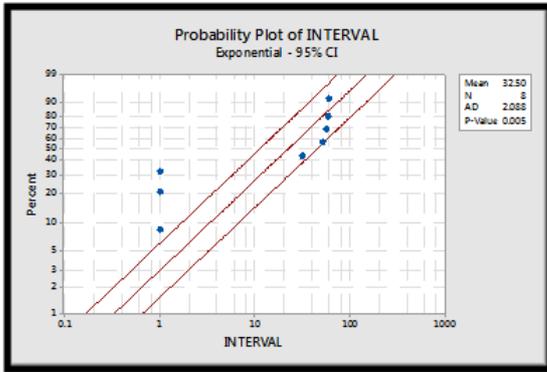


Fig. 7: Exponential Distribution Graph

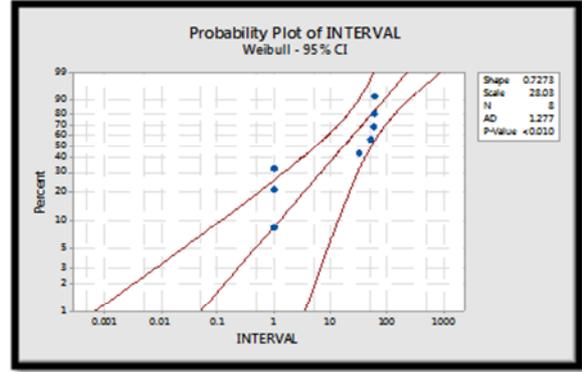


Fig. 8: Weibull Distribution Graph

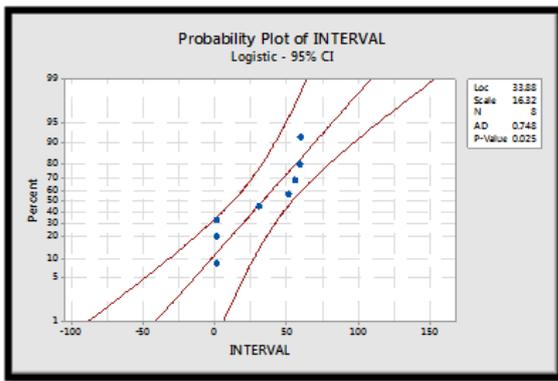


Fig. 9: Logistic Distribution Graph

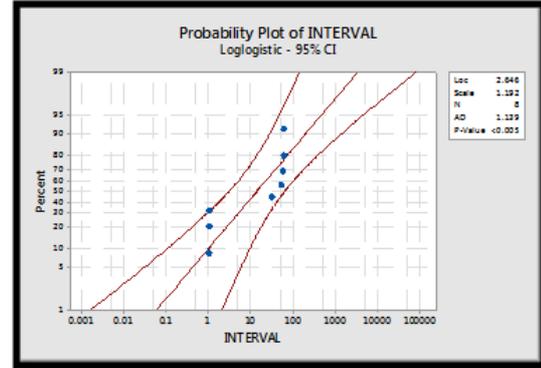


Fig. 10: Log logistic Distribution Graph





Method Development and Validation of Vortioxetine Hydrobromide in Tablet Dosage Form by UPLC

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ABSTRACT

The Superior UPLC method was established over the HPLC method and validated for the estimation of vortioxetine hydrobromide in tablet dosage form. Enhanced Aquity UPLC HSS system from waters, Aquity UPLC BEH C8 column (100mm x 2.1mm, 1.7 μ) Buffer: Acetonitrile :Methanol: (55 : 35 :10 v/v) with a flow rate of 0.4 ml/min and UV detection at 274 nm. Recovery was perceived 99.45 % to 99.97 %.Accuracy of the method was observed to be within the limits of 98% to 102% by mean of 3 determinations. Precision of drugs was found to be less than 2.%RSD 2.0 from the mean of six preparations. Linearity was observed in the concentration range50 – 300 μ g/mL. LOD and LOQ were found to be 2.357 μ g/mL and 7.141 μ g/mL respectively. The method was validated as per ICH guidelines.

Keywords: Vortioxetine hydrobromide, UPLC, Method Validation, Tablet dosage form, Method development.



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INTRODUCTION

Vortioxetine HBR is chemically 1-{2-[2,4-dimethylphenyl] sulphonyl} phenyl} piperazine monohydrobromide (**Figure.1**). Vortioxetine HBR is used for the treatment of major depressive disorder. Vortioxetine HBR combines with serotonin transporter and its antidepressant action is due to enhancing serotonin level in central nervous system by reduction in reuptake of serotonin. Vortioxetine HBR is a serotonin modulator and simulator. It is partial agonist of 5-HT_{1B} receptor and agonist of 5-HT_{1A} and antagonist of 5-HT₃ receptor [1]

Literature survey shows that the analytical methods are available in UV, HPLC, LC-MS. IR and NMR [2-4]. Some of other methods were reported in Bio analytical studies by Using HPLC-MS, UPLC-MS/MS [5-6] and Pre column derivitization methods with HPLC-MS [7]. Genotoxicity studies performed by using HILIC-MS [8]. According to literature survey, there was no method reported in UPLC for the estimation of Vortioxetine HBR in formulated dosage form. Hence the UPLC method was developed and validated as per ICH guidelines [9].

MATERIALS AND METHODS

Standards and chemicals

The standard drug Vortioxetine HBR was obtained as a gift sample from SR chemicals, Mumbai. HPLC grade milliQ water was procured from Rankem chemicals, Chromatography grade acetonitrile and methanol purchased from, Merck Ltd., Potassium dihydrogen phosphate was procured from Fisher scientific, Mumbai, India.

Chromatographic conditions

Ultra performance liquid chromatography was performed on Waters Acquity UPLC system with 2996 PDA Detector and Acquity UPLC BEH C8 column (100mm x 2.1mm, 1.7 μ) column with a Injection volume 2 μ L injected by Auto sampler, Selected wavelength 274 nm for analysis. System was equipped with Empower-3 software for data acquisition. The mobile phase components are Buffer (6.8 g of potassium dihydrogen phosphate in 1000 ml of water): Acetonitrile: Methanol (55: 35:10 v/v) at a flow rate of 0.4 mL/min in isocratic mode. The mobile phase was filtered through a 0.22 μ m. The retention time of Vortioxetine HBR was 2.1 min and the total run time 7 min.

Preparation of Working Standard Solution

Accurately weighed and transferred 64.0 mg of Vortioxetine HBR into a 50mL volumetric flasks, added 35 ml of acetonitrile. Sonicated to dissolve, diluted up to mark with water. Further diluted 10 ml to 50ml volumetric flask made up to the volume with water. To obtain the final concentration of 200- μ g/mL of Vortioxetine.

Method Validation

Method Development and Optimization of Chromatographic Conditions. The mobile phase components are Buffer: Acetonitrile: Methanol (55: 35:10 v/v) was found to be satisfactory and given symmetric and well-resolved peak for Vortioxetine HBR (Figure 2). The retention time for Vortioxetine HBR was 2.15 min. The asymmetric factor was 1.02 for Vortioxetine HBR Standard peak. The mobile phase flow rate was maintained at 0.4 mL/min. Based on literature review 274nm was selected as a detection wavelength.

Precision

Precision of the method was estimated by performing repeatability and inter day study. In repeatability study, six individual preparations of sample analysed. Inter day precision, six individual preparations analysed on different day from repeatability study.



**Ravisankar et al.****Accuracy**

Accuracy studies were performed by standard addition method. Known amount of the standard solution spiking into the sample solution. The standard solution at the level of 50%, 100%, and 150% spiked into the sample. In this method the known concentration standard drug was added to the assay sample. Triplicate samples prepared and injected at each level.

Linearity

Linearity of the method was established by injecting the standard solution in different level from 25% to 150%.

Specificity

The Chromatograms of standard, sample and diluent of were compared.

LOD and LOQ

Ability of the method to detect lowest concentration of the drug and lowest level of the quantification. Limit of detection and Limit of the Quantification determined from linearity curve. Calculated through non-instrumental method

The LOD calculated from $LOD = 3.3 \times N/S$

The LOQ calculated from $LOQ = 10 \times N/S$

Where, N is the standard deviation of the peak area and S is the slope of the Calibration curve obtained from linearity.

Robustness

Analysed by changing the mobile phase flow rate ($\pm 10\%$) and wave length (± 3 nm) of the method. Measured the corresponding responses from three individual preparations.

Assay of formulation

Five numbers of tablets were transferred into 100 mL volumetric flask. Added 70 ml of Acetonitrile. Sonicated for 20 minutes with intermittent shaking. Introduced in mechanical shaking for 20 minutes at 200 RPM. Diluted up to the volume with water and mixed well. Further centrifuged at 5000 RPM for ten minutes. Filtered the supernatant liquid by using 0.22 μ PDVF filter. Further diluted 10mL to 25 mL with water to produce of 200 μ g/mL of Vortioxetine HBR.(Figure.2 –Figure.4)

RESULTS**Precision**

Assay % RSD for six individual preparations was found to be 0.29 for Vortioxetine HBR.. For Inter day precision, Assay % RSD was found to be 0.40 for Vortioxetine HBR. Therefore it indicates better precise and rugged condition of the developed method.(Table.1)

Accuracy/Recovery

Recovery study results for Vortioxetine HBR within the range of 99.45 – 99.97.The % RSD lies below 2.0 %.(Table.2)

Linearity

The linearity curve for Vortioxetine HBR was found to be linear in the concentration range of 50–300 μ g/mL. Correlation co-efficient 0.999 shows the linear of the developed method.(Table.3)

Specificity

Specificity study shows the absence of any other peaks and no interference at the retention time of Vortioxetine HBR. The purity angle was found lesser than the purity threshold shows the specificity of the method.(Table.4)



**Ravisankar et al.****Robustness**

In Robustness study, Variation in the flow rate and wavelength has been changed to the analytical method to assess the ability of the method to remain unaffected by such variations The average assay was found with in the acceptance criteria.(Table.5 and Table.6).

Limit of detection and Limit of quantification

LOD & LOQ values were found 2.357µg/mL and 7.141 µg/mL respectively.

CONCLUSION

The projected UPLC chromatographic method was found to be Precise, Accurate, Linear Specific, Robust and Rugged for determination of Vortioxetine HBR in tablet dosage form. The proposed method is innovative and less in time consumption, Injection volume and mobile phase quantity compare than previously reported chromatographic method. This method having ability to full fill the regulatory requirements as per ICH guidelines. Hence this method can feasible for routine analysis of Vortioxetine HBR.

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Table.1: Method Precision and Intermediate Precision Results

Name	% Assay Results (Intraday)	% Assay Results (Interday)
Preparation-01	99.87	99.61
Preparation-02	99.73	100.12
Preparation-03	99.45	100.21
Preparation-04	99.11	100.13
Preparation-05	99.22	99.23
Preparation-06	99.42	99.54
Average	99.47	99.81
% RSD	0.29	0.40

Table.2: Accuracy Results

Name	% Recovery	% Average	%RSD
Accuracy-50%-01	99.78	99.63	0.17
Accuracy-50%-02	99.45		
Accuracy-50%-03	99.65		
Accuracy-100%-01	99.82	99.88	0.08
Accuracy-100%-01	99.97		
Accuracy-100%-01	99.84		
Accuracy-150%-01	99.63	99.81	0.16
Accuracy-150%-02	99.93		
Accuracy-150%-03	99.86		

Table.3: Linearity Results

Name	Concentration (µg/ml)	Peak area
Linearity-25%	50	899708
Linearity-50%	100	1799416
Linearity-100%	200	3598833
Linearity-125%	250	5488909
Linearity-150%	300	7318545
Slope	36747.5112	
Intercept	-37406.25711	
Steyx	26241.97203	
Correlation-Co efficient	0.9999	

Table.4: Specificity Results

Name	Results
Vortioxetine HBR	3.2 Minutes (Retention time)
Blank	Absence in the RT of Vortioxetine HBR
Purity threshold (Vortioxetine HBR)	2.978
Purity Angle (Vortioxetine HBR)	1.256





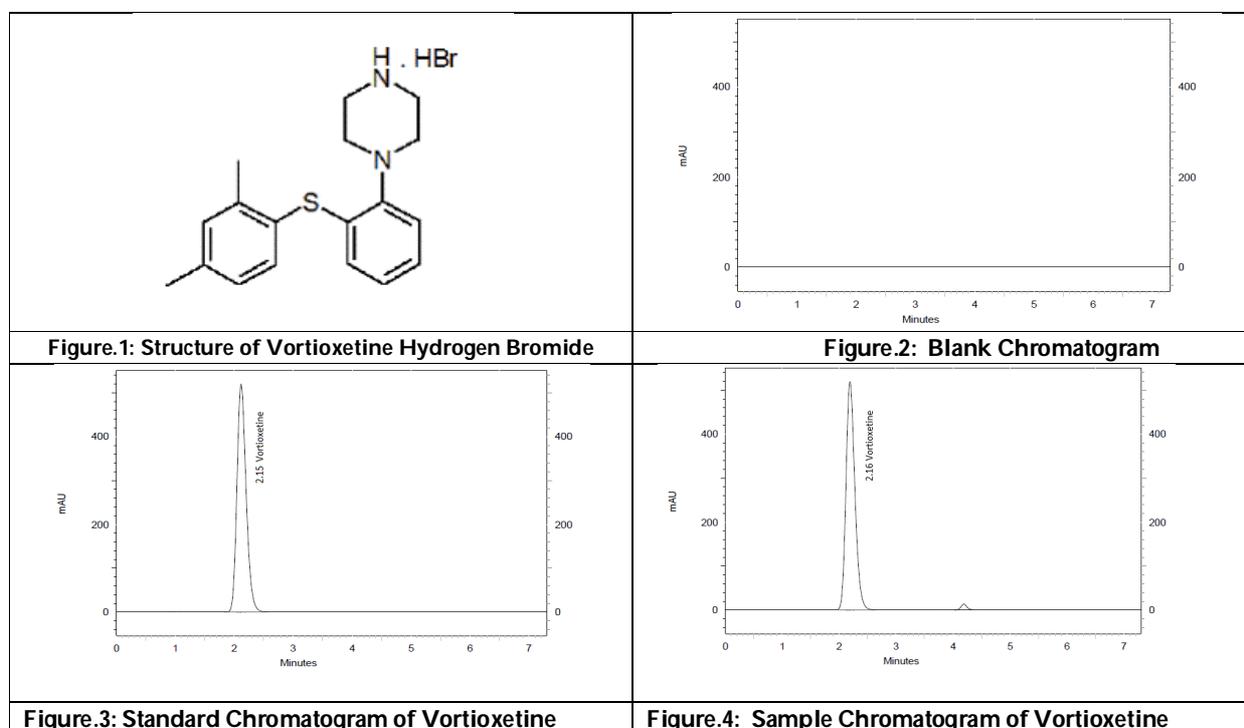
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Table.5: Robustness Study (Flow rate variation) Results

Parameter	Name	% Assay
Flow Rate Minus 0.36 ml/min	Preparation – 01	100.43
	Preparation – 02	99.62
	Preparation – 03	100.32
	Average	100.12
Flow Rate Minus 0.44 ml/min	Preparation – 01	100.34
	Preparation – 02	99.89
	Preparation – 03	99.34
	Average	99.86

Table.6: Robustness Study (Wavelength variation) Results

Parameter	Name	% Assay
Wavelength 271 nm	Preparation – 01	100.32
	Preparation – 02	99.64
	Preparation – 03	99.98
	Average	99.98
Wavelength 277 nm	Preparation – 01	99.17
	Preparation – 02	99.30
	Preparation – 03	99.37
	Average	99.28





A Study on Common Challenges of Work from Home (WFH) During the Corona Virus Pandemic 2020

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ABSTRACT

The difficulties of telecommuting during the Covid pandemic and how bosses can deal with assistance representatives feel less pushed and be more beneficial. Numerous businesses are pushing back courses of events for representatives to get back to the working environment as the quantity of new instances of COVID-19 floods in the U.S. Telecommuting is the most ideal approach to keep workers who have the ability to do so protected. In any case, it doesn't come without its difficulties. Representatives working distantly during the Covid pandemic wrestle with interruptions, the obscured line between work and home and they additionally experience difficulty keeping a daily practice. Businesses can restrict every one of these channels on profitability and occupation fulfillment to bring down the danger of burnout and keep the group associated while representatives keep on telecommuting.

Keywords: Challenges, WFH, COVID 19, Work – life Balance, Flexibility.

INTRODUCTION

Home stirring opens up another scope of opportunities for the manner in which organizations can work and construction themselves. With the flare-up of the (COVID-19) pandemic, home working has given a few bosses the

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adaptability they need to proceed with their business activities while focusing on staff and client wellbeing and prosperity as a feature of their general wellbeing obligation. Preceding the Covid pandemic, telecommuting was on the increment as numerous businesses recognized the advantages that it can bring to their business and the improved harmony between serious and fun activities for their representatives. Regardless of whether you don't figure telecommuting would be valuable for your business, representatives with 26 weeks administration have a legal option to demand adaptable working courses of action like home working and you, as a business, need to genuinely think about such demands.

Interruptions

1. 56 percent of workers have more interruptions at home
2. 42 percent of representatives think that it's difficult to zero in on work at home
3. 16 percent of representatives think that it's difficult to zero in on work with everything going on the planet

Bosses can help representatives limit interruptions while telecommuting by being forthright about them. Examine how normal interruptions like pets, youngsters and innovation can pull from their concentration and what can be done. Each representative arrangement with shifting interruptions yet provoking them to distinguish what pulls from their concentration and assisting them with discovering approaches to work around or work with it can have a major effect.

Without a Routine and Work-Life Balance

1. 67 percent of representatives are bound to fill in for late shifts and ends of the week when telecommuting
2. 48 percent of representatives thought that it was difficult to keep limits among work and home life
3. 26 percent of representatives are beginning and completing work later when telecommuting

Building up a solid daily schedule and defining solid limits between work life and home life is basic to effectively telecommuting. It's significant for representatives to have a set timetable when telecommuting but at the same time it's confounded on the grounds that one of the significant advantages of distant work is having some adaptability over how and when they complete their work. Representatives should plan to chip away at those very days for a similar measure of time every week except stay adaptable and speak with managers if that timetable should be changed marginally for things like childcare, clinical arrangements or different obligations.

BENEFITS OF REPRESENTATIVES TELECOMMUTING

With expanding quantities of representatives working at home - or utilizing home as a turning out base for at any rate part of the week - it's unmistakable there are various advantages for business.

Flexibility and Dexterity

Home working empowers greater spryness and adaptability in working game plans. With representatives not, at this point attached to an office, they might be better positioned and more willing to work adaptable hours like prior or later in the day or even at ends of the week. This may help you meet certain business needs e.g., on the off chance that you are exchanging with clients living in an alternate time region.

Improved Worker Maintenance

Home working can help hold representatives as the adaptability of home working can help them address childcare issues, decrease their drive and empower them to accommodate their work around their own life. Being permitted to telecommute, staff will likewise feel expanded degrees of trust from their boss, which can contribute incredibly to staff faithfulness.





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Attract New Ability

Home working can be offered as a motivation to come and work for you assisting you with drawing in new ability to your business. Indeed, even contribution the choice to telecommute will give you a benefit in the work market over contenders that don't offer home filling in as a choice to their staff.

Increased Profitability

Because of less interferences, which would regularly happen in an office climate. Paradoxically, telecommuting takes into consideration a calmer climate that can work with more engaged work. You may likewise find that representatives will work longer hours as they can likewise utilize their time saved from driving to begin work prior, later or both.

Increased Staff Inspiration

By telecommuting staff will feel more trusted by their boss as the functioning relationship isn't as firmly checked and representatives are permitted a level of independence to continue ahead with their work. Staff will likewise be more joyful building up a home working schedule that suits them better and this can contribute towards them feeling more spurred to put forth a valiant effort.

Improved Staff Wellbeing and Prosperity

Telecommuting dispenses with the requirement for a drive to work that can be unpleasant to your representatives. Time reserve funds, for example, this likewise empowers staff to get additional medical advantages like extra rest, investing more energy with family, practicing or planning better suppers.

Financial Advantages

Reserve funds on office space, office supplies, service bills and different offices. Staff may likewise have the option to exploit the assessment alleviation accessible from HM Revenue and Customs (HMRC) for telecommuting - see guarantee charge help for your work costs - telecommuting.

Convenience

You may have staff that do a ton of visits to client areas and are consequently not routinely in the workplace. Permitting them to base themselves from home might be more advantageous and prompts further time and costs reserve funds.

Better Work / Life Balance

Telecommuting can assist representatives with improving their balance of fun and serious activities e.g., staff that would have needed to drive can now utilize that time for themselves giving the reason for a superior harmony between serious and fun activities. Staff are additionally ready to fit in family errands around their functioning day giving them all the more extra energy in the nights e.g., stacking or emptying the dishwasher or planning supper on their lunch break.

Technology Makes It Simpler

The web has made it workable for staff to be constantly associated with the workplace. Apparatuses, for example, Skype have made correspondence among partners and groups a lot simpler and now and again can prompt more proficient and viable gatherings.

Less Disorder Unlucky Deficiencies

Staff are bound to feel more joyful and more empowered telecommuting and subsequently less possibility of their invulnerable framework being adversely affected by burnout. Additionally, the way that representatives are working in disengagement there is less possibility of contaminations spreading as would be the situation inside an office climate.





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Less Requirement for Standard Occasions

Telecommuting can feel like a break from the workplace despite the fact that staff are as yet working. Telecommuting staff can feel more invigorated and will invest more energy with their family and hence won't want to take as much leave. Anyway, it is your obligation as a business to guarantee staff take their days off - see realize how much occasion to give your staff.

BURDENS OF REPRESENTATIVES TELECOMMUTING

In spite of the fact that there are a few weaknesses to representatives working at home, a large portion of these identify with those telecommuting for all, instead of part, of their functioning week.

Working from Home Sometimes Falls Short for Everybody

Telecommuting probably won't be fit to everybody's character or capacity. A few representatives may lean toward the everyday practice and design that working in an office climate gives them. Some staff may lean toward individual association with partners and furthermore discover vis-à-vis direction with their chief very advantageous in assisting them with finishing errands and accomplish their objectives. You additionally should be aware of workers with an incapacity. Telecommuting may contrarily affect the help they need to manage their work. Telecommuting may likewise not fit in with everybody's home-life e.g., a few groups may have little youngsters that might be unconscious of limits and cause interferences during the functioning day. Others might not have the actual space needed to make an appropriate committed working region.

Staff Inclination Detached

People telecommuting may feel a distinction from their associates and association all in all that an office climate normally permits. To address this issue managers could guarantee that correspondence is more normal. So, by booking speedy catch-ups by telephone or normal group gatherings through different advancements like Skype, staff are given greater freedom to feel included and part of the group. More casual and social catch-ups would likewise help neutralize any sensations of confinement.

Difficulty Checking Execution

There could be trouble overseeing home specialists and observing their presentation. Various characters may likewise react to observing with fluctuating levels of inspiration. You could take a gander at defining objectives and focuses with laborers that are effortlessly estimated so that if their objectives aren't being met you can recognize and cure any exhibition issues at a beginning phase. See overseeing staff execution and viably oversee representatives who telecommute.

Home Interruptions

Albeit home working eliminates the interruptions that may happen in the workplace if a laborer doesn't have an appropriately peaceful devoted working space at home, they may get quickly drawn offtrack by family clamors or different individuals from their family.

Potential Burnout

Where an office gives an unmistakable actual qualification among work and home life, working at home can prompt staff neglecting to separate between work-life and home-life. This may prompt representatives thinking that it's hard to tell when to turn off from work prompting longer hours, expanded pressure and inescapable burnout. Businesses ought to urge their staff to take customary breaks and help them to remember the significance to withdraw.

Cost of Telecommuting

Starting expenses of preparing and giving reasonable gear like workstations, cell phones and other IT hardware. You will likewise need to think about transformations to satisfy wellbeing and security guidelines.





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Problems with Staff Improvement

You may track down that not having staff in close actual vicinity prompts trouble in keeping up staff advancement and redesigning abilities. In any case, you could urge staff to accept the open door to master new abilities through online occasions and courses. To begin look for occasions on our Events Finder.

Information Security Hazard

Data security issues could be bound to happen when staff are telecommuting. There is increment hazard with PCs being brought home and the requirement for staff to get to workers distantly. Managers ought to guarantee they set up measures to ensure organization information by introducing encryption programming and far off wipe applications if cell phones given by you disappear. Virtual private organizations additionally encode your information and give secure admittance to a far-off PC over the web. These aides keep your records and information secure yet availability to your staff. See IT security and dangers.

Negative Effect on Psychological Wellness

The change to telecommuting may adversely affect your laborer's emotional well-being on the off chance that they can't track down a standard that works for them, are battling to isolate work and home life or are feeling secluded. To assist you with canning your representatives to build up a functioning daily schedule, set up a committed work space and set limits for other family individuals. Set out more open doors for staff to remain associated by conveying through customary talks and group get ups. Eating soundly and taking standard exercise can likewise help improve emotional wellness particularly when woven into a customary daily schedule.

Decreased Staff Confidence

It tends to be more earnestly to keep up camaraderie when representatives are working at home all alone.

Not All Positions Suit Home Working

Telecommuting suits a few positions better compared to other people. Similarly, telecommuting suits some character types yet not others. A few groups may incline toward associate contact by up close and personal correspondence.

Poor Broadband Rates

You ought to be careful that relying upon where your staff reside, they might be not having the option to get to broadband rates that empower them to tackle their work adequately e.g., provincial broadband is frequently extremely lethargic. The Covid pandemic has given a few managers, that might not have in any case thought about telecommuting a possibility for staff, a viable knowledge into what it means for their business and representatives. It has empowered businesses to have direct insight of the benefits and disservices of home working. This experience can be exceptionally advantageous in taking care of into the future heading of representatives' functioning works on pushing ahead.

FUNDAMENTAL TIPS FOR WORKING FROM HOME DURING THE CORONAVIRUS PANDEMIC

Amidst the new Covid pandemic, numerous organizations are carrying out intentional or compulsory work-from-home approaches. That implies heaps of us are managing an uncommon test: telecommuting interestingly, all day. Regardless of whether you've done it previously, telecommuting due to Covid may feel like an entirely different world: It's presumably unexpected. It very well may be for an all-inclusive timeframe as opposed to a day to a great extent (and you're not under any condition sure how long it'll last). Your entire organization is included. Furthermore, you can't really associate face to face outside of work. These tips will help you ensure that you're effective, both at completing your work and at keeping up your psychological prosperity.



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It may appear to be a basic hint, yet it's a significant one. Prior to coming to work for The Muse, I went through around eight months telecommuting when my full-time office work turned into a distant situation with minimal notice. It was enticing to remain in my nightgown throughout the day, yet any day I surrendered to enticement was much slower to begin and less profitable generally. You don't have to dress as officially as you may for work, however the straightforward demonstration of changing garments fills in as a sign that it's an ideal opportunity to awaken and complete things. Muse vocation mentor and the author of *Shatter and Shine*. "Feeling human" may appear to be something odd to need to effectively consider, however it's particularly significant during such a critical point in time, when the breakdown of your ordinary schedules may cause you to feel cut off from your "typical" life and the "genuine" world. Getting dressed additionally applies to other appearance-based undertakings: Take a shower, brush your hair, even put on cosmetics if that is the thing that you'd typically do. You don't have to go as all out as you would for the workplace on the off chance that you would prefer not to, however awakening and dealing with your appearance can go far toward assisting you with feeling like you're dealing with yourself. Furthermore, on the grounds that you're telecommuting doesn't imply that nobody from work will see you. It's 2020 and we're going to have a ton of video gatherings.

Assign A Workspace or Home Office

One of the huge difficulties with regards to working distantly is keeping your work and home lives independent. "For certain individuals it turns out to be foggy," says Muse profession mentor Lynn Berger, who represents considerable authority in assisting individuals with exploring vocation advances. On the off chance that you never completely disengage from work, your work efficiency will endure and your home life can endure a shot too. In case you're accustomed to going into an office every day, the partition among work and home is physical, and you need to attempt to reproduce that however much as could be expected with an assigned actual workspace at home. You may laugh at the possibility of a different space for a home office if, similar to me, you live in a little condo. I'm composing this in the room that is my office, kitchen, lounge, and lounge area across the board. Your workspace doesn't need to be its own room in my condo, it's a corner however it should feel as separate from the remainder of your home as could be expected. Attempt to make your workspace alright with a seat you can cover for eight hours per day and a couple of designs. Discover a region with great characteristic lighting assuming there is any chance of this happening. Regardless of whether you don't as a rule invest a great deal of energy outside, missing out on the time you spend outside during your drive can begin to burden you rapidly, and it will possibly happen quicker on the off chance that you don't have regular light coming in. Entering your workspace will help you turn "on" toward the start of the day and get down to work. On the flipside, leaving your workspace will likewise help you turn "off" toward the day's end and completely withdraw. That is the reason it's likewise significant not to spread yourself across your home while it may appear to be incredible to have the option to move from work area to sofa to bed, in the event that you let your PC creep into your personal time space, it makes it harder to keep your work separate from your home life. In case you're working at a table you need to use outside of work or a room you invest a great deal of energy in, get together your work each evening to make the finish of your day definitive.

Keep Clearly Defined Working Hours

Similarly, as you assign and separate your actual workspace, you ought to be clear about when you're working and when you're most certainly not. You'll complete your best work and be generally prepared to progress back to the workplace on the off chance that you stay with your customary hours. Besides, if your job is cooperative, being on a similar timetable as your collaborators makes everything a lot simpler. This implies considering yourself responsible, yet in addition perceiving when that's the last straw, similarly as a decent administrator may. "In the event that you feel yourself broadening your work hours since you're not doing anything in the evening, tell yourself it's an ideal opportunity to take care of work, re-energize, and start tomorrow with a new psyche. The work will be there toward the beginning of the day." In the event that you live with others, this partition is much more basic. Speak with individuals you live with to build up limits so you can eliminate interruptions during the workday and afterward



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detach and give individuals you care about your complete consideration. Making some different memories and space to work will permit you to be more present in your home life.

Incorporate Transitions into Work

Your regularly scheduled drive not just gets you to work starting with one actual area then onto the next however it likewise gives your cerebrum time to get ready for work. Since you're not voyaging doesn't mean you shouldn't cut out identical schedules to help you slip into your workday. Possibly you typically peruse or tune in to music on your drive. You can do that at home. Or then again perhaps you can invest some energy with a pet or cherished one. The difficulties of WFH are addressed in figure 1. You can even include an exercise or invest some energy on a pastime. At the opposite day's end, the evening drive does the converse. For the most part, you're not going from completing a tremendous introduction properly to making supper or tackling errands.

On the off chance that you attempt to hop straightforwardly, "your mind doesn't have the opportunity to hit the reset button, which can make you less present as you progress once again into your own life." Give yourself something that will flag the finish of work and fill in as a support. At the point when I telecommuted, I made it a propensity to take my canine for a long stroll when I was accomplished for the afternoon. It assisted me with decompressing something physical and fun, and the propensity was self-upholding since my canine would lie before the entryway when the time had come to go or would come searching for me on the off chance that I was taking excessively long.

Try Not to Get Too Sucked in By the New or Anything Else

Interruption is one of the huge difficulties confronting individuals who telecommute particularly individuals who aren't utilized to it. That implies that whatever you're generally considering returning home to after work is presently with you. It's human to get occupied. Be that as it may, you should be careful about the amount you let yourself get occupied. You most likely as of now take a couple of breaks for the duration of the day at the workplace, and that is fine to do at home, as well. Utilizing that chance to toss in a heap of clothing is OK, however do whatever it takes not to view at your new work course of action as a chance to at last clear out that wardrobe or whatever else that takes a ton of supported core interest. At the present time, perhaps the greatest interruption is the information. Furthermore, in case you're working distantly due to the new Covid, monitoring COVID-19 updates will be at the front of your psyche. It's acceptable to remain educated, obviously, but at the same time it's not difficult to scroll yourself into an on-edge mess. I recommend setting clocks for any breaks you take. You would prefer not to get excessively inundated and fail to remember that you're grinding away inside and out. In case you're somebody who's vulnerable to getting diverted each time you get a news alert, turn your warnings off during the workday, as well. The news will in any case be there after 5 PM.

Impart, Communicate

In the event that you don't generally telecommute, odds are there will be a few obstructions in the event that you need to abruptly go completely far off. The way to controlling through these knocks is correspondence particularly with your chief and direct reports. Either before you do the switch or when you know it's occurring, concoct an arrangement that spreads out assumptions for how regularly you should check in and how you'll pass on any progressions or new tasks to each other. Do likewise with anybody you normally work cooperatively with for the duration of the day. This arrangement is probably going to change as you go. Furthermore, that is OK. This is another circumstance for everybody. So, make a point to return again and change the arrangement if issues come up. You'll likewise experience extraordinary difficulties as you attempt to tackle your work distantly, which can shift enormously relying upon the sort of work you do. Try not to spare a moment to connect with similar individuals you would for the most part go to for help regardless of whether you're not in a similar structure as them. Furthermore, you don't need to stay with just content-based correspondence.



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DISCUSSION

In the wake of the COVID-19 pandemic, a greater amount of us is working distantly than at any other time. As indicated by a new Gallup overview, under 40% of laborers say that all or practically all representatives have gotten back to their working environment. Furthermore, businesses hope to have three-fold the number of telecommuters after the pandemic as they had previously. Fortunately, representatives appear to like working distantly. Nearly 59% say they might want to keep telecommuting however much as could be expected. The main benefits and detriments are addressed as in figure2. They don't need to endure long drives, far off work considers more noteworthy adaptability and numerous representatives feel more focused or innovative at home. Regardless of the advantages, distant work can be a test and exchanging rapidly to far off work during the pandemic demonstrated significantly more troublesome. About portion of new telecommuters announced innovation issues, with correspondence issues and virtual gathering disasters dragging along as the most widely recognized disappointments. Cooperation is quite possibly the most difficult parts of far-off work, yet your group can in any case be compelling while social separating. Here are five hints for working better together while separated.

Overhaul You're Undertaking the Board Programming

A clumsy undertaking the executives programming was alright when your whole group was under one rooftop. You could manage the abnormal interface, rehashed or missing errands and the manner in which it never appeared to be in a state of harmony with what you were attempting to achieve. Yet, since you're working together on projects distantly, you need a stage that better meets your requirements. Search for something that permits you to see your whole group's responsibility initially. Collaboration is one undertaking the board programming that permits you to deal with your workers' ability and activities and reshuffle errands with the drag of a mouse. It has a period following instrument, task records, in addition to charging and invoicing abilities constructed directly in so your group can flawlessly finish projects regardless of the distance away you might be.

Assist Representatives with Overseeing Interruptions

Teaming up doesn't mean you're continually cooperating. In some cases, representatives need calm opportunity to get in and stay in the zone. In an office setting, representatives can get on those unpretentious expressive gestures of "earphones in, head down," however these signs are absent in a distant workplace. This issue is exacerbated by successive virtual registration and ongoing visit instruments like Slack. On the off chance that the spring up notices weren't adequately diverting, your workers likewise need to manage yapping canines, hungry children, and felines that adoration to creep across consoles. You can't fix your representatives' home climate; however, you can help them interruption verification their workday. Take a stab at building up group "calm hours" when nobody utilizes group visit channels and urge representatives to use the "Don't Disturb" highlight. You can likewise attempt Clockwise for bunching gatherings to let loose more continuous work time.

Set Guidelines for Virtual Gatherings

No one prefers gathering seven the pre-Covid kind. In any case, being caught on a Zoom call where individuals continue talking more than each other in the midst of stirring chip packs and shouting kids is next-level damnation. A couple of basic standard procedures can go far to making virtual gatherings more gainful. Each gathering that includes at least three individuals ought to have an obviously characterized reason. Set a plan heretofore regardless of whether it's only a couple list items. You may likewise request that your colleagues quiet themselves in the event that they're not talking and to keep away from pointless crosstalk. In the event that breaks from relatives are an issue, consider moving gatherings to a period that turns out better for everybody.

Timetable Standard One-On-One Registration

At the point when most of correspondence happens through email or Slack, it's simple for battling colleagues to coast by undetected. It's a smart thought to focus on one-on-one registration among representatives and their prompt



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bosses by means of telephone or video. These talks can be a decent route for colleagues to examine difficulties they may be dealing with and address issues directly. They're likewise a decent chance to monitor representatives' emotional wellness and reinforce the brotherhood in your group.

Keep Work Individual

Telecommuting can be confining and unpleasant. Your group is presumably previously wrestling with disturbances to their family achieved by the pandemic. At the point when your tense, you're bound to think about a brief email literally or lash out at your group. It's occasionally simple to fail to remember that you're working with different people who are organically wired to mingle. Zoom cheerful hours, depictions of heavenly snacks and sharing entertaining recordings are only a couple ways groups are remaining associated. Different organizations have been crossing over the computerized partition by doing yoga together on the web or having heating meetings with their children through Zoom. The pandemic has tossed practically every work environment into disturbance. Most are urgent to get back to the same old thing, however as the infection seethes on, numerous organizations are tracking down "another typical" that incorporates some type of distant work. Regardless of whether your group intends to get back to the workplace gradually or bet everything with a far-off labor force, figuring out how to team up better from a good way will just assistance you over the long haul.

CONCLUSION

The WFH model whenever executed deliberately can bring about cost reserve funds, profitability gains, and at last a more effective labor force. It offers adaptability, better harmony between serious and fun activities and a feeling of self-governance among representatives. While the benefits are many, handling the previously mentioned difficulties ought to be a need for organizations to work with a smooth change to distant working. Booking virtual gatherings with fixed spans, preparing representatives with project the executives' devices and correspondence stages, and having a solid information security technique set up are objectives to get business achievement, particularly in such testing times. In excess of 80% of businesses intend to allow representatives to telecommute on a section or full-time premise even after the Covid pandemic and more than 40% of bosses intend to give more flex days and flex hours to improve the worker experience. The pattern towards adaptable work plans isn't easing back down. Regardless, it's acquiring velocity and bosses who consider how far off work and expanded adaptability fit into their association and how they can address the difficulties of dealing with a more intricate, mixture labor force position themselves for progress.

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Fig.1. The Difficulties of Work From Home

	<i>Advantages</i>	<i>Disadvantages</i>
<i>Employee</i>	<ul style="list-style-type: none"> - Work / Life balance - No commute - Cost savings (commute, eating out, clothing) - No dress code - Organising own workspace (light, heat, seating, desk, music) - Easy to go 'offline' when need to focus - Autonomy 	<ul style="list-style-type: none"> - Managing work / home boundaries - Too many distractions - Lower job satisfaction - Little or no space at home - Mental & physical well-being issues - Negative impact on career development - Social isolation - Perceived to be available anytime - Lost relationships: co-workers, managers - Extra expense (utilities, office equipment, wear and tear)
<i>Employer</i>	<ul style="list-style-type: none"> - Happier workers - Cost savings - Longer working hours 	<ul style="list-style-type: none"> - Lower individual & team performance - Lower productivity - Difficult to supervise - New costs

Fig. 2. The Advantages and Disadvantages of Work From Home





Effect of Temperature and Residence Time on the Char, Bed Oil Deposition in Catalytic Pyrolysis of Poly Ethylene Terephthalate Over Bentonite and HZSM-5 for Industrial Simplification

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ABSTRACT

Poly ethylene terephthalate is pyrolysed thermo-catalytically under 600°C with 5, 6, 7 and 8°C/min as heating rates with bentonite and HZSM-5 pelletized catalysts. The 5, 6 °C/min heating rates has shown a poor performance with higher char deposits and catalyst bed oil deposits. The 5°C/min batch also incurred the repolymerisation of the vapor to about 5 % of the feed. The retention temperature has been brought down to 550°C at an 8°C/min heating rate with 2.5, 5, 7.5,10 minutes as holding time periods for process simplification. The 7.5 minutes holding time period at 550°C recorded the white fibrous, glass like residue along with the char recombination. No catalyst char deposition is found except catalytic bed oil deposition at all iterations. The char percent of PET has been reduced from 18% to about 10.3% with no catalyst bed oil deposition along with a maximized gas production during 550°C and 5 minutes holding time. The plastic to bentonite ratio of 1:0.01 reported a catalyst char deposition, while when raised above 1:0.05 showed no improvement. The char is being tested for adsorption capabilities that can enhance the water treatment quality thereby protecting environment and the feasibility of being a solid fuel.

Keywords: thermo, environment, temperature, PBT, PEN, PHT





INTRODUCTION

India, a country of 1.3 billion population has been polluting its land at a rate of 60 mega tons per day. Among them 65% are PET waste, about 80% of them are recycled, but at the end of the ageing cycle, they are dumped in landfills. India contributes about 4.6% to the world's oil consumption by consuming about 4.4 mbpd. According to the PPAC, the FY2020 consumed about 194632000 metric tons of petroleum, among them 14.23% consumption was by the LPG [1]. India consumes about 386 GW of electricity every year, among them only 1.7 % are generated using gaseous thermal means [2]. Every one of these problems can be rectified using this simplified process of catalytic pyrolysis of PET.

PET is one of the most widely used and robust polymer that has a melting point of 280°C. PET is the prime polyester product while Poly Butylene Terephthalate (PBT), Poly Ethylene Naphthalate (PEN) , Poly Hexene Terephthalate (PHT) are minor and are still of growing importance. PET is the product of the condensation polymerization of terephthalic acid and ethyl glycol. Its forming and molding are easier, cheaper which makes it one of the widely used plastic around the world. Thermal decomposition of this PET produces higher concentration of acetaldehyde, alkenes, traces of methane, CO₂, CO, vinyl benzoate and dioxane with traces of benzaldehyde, toluene, and divinyl terephthalate [3]. The methane trace was due to the presence of methyl ester groups in the PET. Catalytic pyrolysis of PET plastics using HZSM-5 as the primary cracking catalyst and bentonite as the pre-cracking catalyst is discussed here.

Thermo-Catalytic pyrolysis of PET and the simplification of the process

Pyrolysis refers to the process of heating substances in an inert atmosphere which leads to the decomposition of the substance under process. On the basis of heating rate, the pyrolysis is classified as slow pyrolysis and fast pyrolysis; based on the presence of catalyst, classified as catalytic pyrolysis and thermal pyrolysis. Prediction of pyrolysis is highly complex due to the nature of the process and chemical compositions. However, many attempts were done with radioactive labelled carriers to predict the pyrolysis process. [4] has studied the polyester products pyrolysis using ¹⁸O labelled steam. [5] has observed that the pyrolysis takes place in four mechanisms namely depolymerisation, random chain scission, chain stripping and cross linking. Pyrolysis takes place in four stages

Initiation

The cracks or voids in the polymer chain are attacked and the polymer is converted into free radicals. Cyclic oligomers such as dimers, trimers and tetramers are formed during this stage due to intramolecular exchange [6].

Propagation

The free radicals obtained from the initiation stage are cracked into further smaller free radicals. In this stage, the cyclic oligomers are further decomposed.

Termination

The free radicals from the above two stages are unstable, they saturate within themselves by recombining with the co-substituents and form compounds leading to the formation of hydrocarbons termed as intermediates. The C-O bonds nearer to the C=O bonds (refer Fig 1) are likely to thermal degradation while further degradation is liable to the formation of phthalic and benzoic acids and even there is a possibility of benzene with CO₂ release.

Char is a dark solid matter deposited on the pyrolysis chamber at the end of the cycle. It consists of carbon in high concentrations, hydrogen in low concentration, and the remaining constitutes of sulphur and other constituents. Thus, it can be used instead of charcoal and it can replace the charcoal in some purpose. Due to



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the amount of carbon and ash, it is called as carbonaceous deposit or coke. Char formation in pyrolysis is unavoidable however it can be reduced to an extent. Char formation happens on both catalyst and the reactor bed. Catalyst char formation is the most horrendous one. Reactor bed char formation is a wastage of energy and feed mass. [7] Stated that the char deposition on the catalyst reduced the catalytic activity. Retention time, reaction temperature, heating rate, reaction atmosphere, and chamber type affects the process yield and char yield the most along with the catalyst selection, rate of the inert purging gas also. [8] States that char is more likely to form during a slow pyrolysis with longer retention time. PET is known for leaving 10-15% of the feed behind as char. According to [9], the char constitutes of the binder metals, binders, fillers and additives. If the plastic feed is unwashed, then the char contains the impurities [10].

PET pyrolysis is more prone to produce soft solid oligomers instead of liquid fractions while Poly Propylene pyrolysis produced a C₃ hydrocarbons concentrated oil [11]. As HZSM-5 usage enhances the gas production [12]. it is chosen, and more likely to produce C₃-C₅ range hydrocarbons. The mixing of catalyst with the plastic waste feed reduces the efficiency of the catalyst [13], so the catalyst is mounted on a glass wool bed and the pyrolysed vapor is made to pass through it. The degradation of PET begins from 300°C [6].

The PET pyrolysis with zeolite is well known to provide a gas concentrated yield from the studies of However only the calorific value of oil yield is calculated while it is not found for the gas. The oil yield calorific value of PET is found to be 28.2 MJ/kg, while the calorific value of the gas is unknown [13]. The condensate may change its proportion or composition when introduced to the room temperature after removed from the condensation chamber, so viable compounds can be lost. So this simple research is more concentrated on the gas yield and no condensation or liquefaction is done.

Process

A reduction in the retention time and catalytic char deposition is required for the process to be fast. The process and installation must be cheaper and effective in order to enable the spread of the PET pyrolysis. We are intending to provide more revenue streams through this project. We reduced the time period given for the termination stage of the pyrolysis, thereby placing the loads on the head of the catalyst. The catalytic char deposition is reduced by the introduction of two catalysts; one for the primary cracking while the other is for pre-cracking. This reduces the possibility of the catalytic char deposition.

As immediate introduction of the intermediates to HZSM-5 catalyst which is of the pore size of 5.1 x 5.3 Å [14], will enable the char to deposit, reducing the catalytic activity. Pre-cracking it with a much cheaper catalyst that has a much larger pore may ease the char formation. So bentonite is chosen as it is much cheaper. The process yield must also have the quality for a viable gaseous fuel substitute. The carbon chain must be shorter to reduce the ignition delay. There must be a unique smell for this gas for simpler and easier identification of leakage and must be toxic free [15]. States that the char is liable to form due to the repolymerisation of the free radicals from propagation stage. And also the char can form considerably if there is a very short. Retention time due to improper pyrolysis. A longer and shorter residence time are both prone to char formation if not controlled. [7] In his studies observed that if char is the need, the holding time can be below 1 minute, as a considerable portion of the plastic feed remains unpyrolysed under low holding times, low temperature and low heating rates [9].

The composition of the plastic feed influences the char formation a lot. The ash content and volatile content percentage raises the char formation possibility. So the proximate analysis of the PET is obtained [17]. In his studied has observed that the feed with high fixed carbon had moderate calorific values while those with high volatile content had high calorific values. According to [13], for a maximized gaseous yield, retention temperature of more than 500°C is preferred. An average holding time of 2 minutes at 600°C is chosen. The heating rate is varied from 5°C/min to 8°C/min. LPG heating is used for this project as it is simpler and



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cheaper. The process is conducted using an in-house designed fixed bed pyrolysis reactor. The reactor is of 200 mm diameter, 5 mm thickness, with 350 mm height. There are two chambers in the process setup. One is the process chamber in which the feeding, purging and heating takes place while the purpose of the adjacent one is to expand the cross section of the flow so as to prevent the cluster formation of the denser particles from the process chamber and introduce the flow to the catalyst bed. A reduction in the retention time and holding time will absolutely increase the particle size of the intermediates flowing from the process chamber to the catalytic chamber, reducing the flow cross section may lead to the clustering of the intermediates which also increases the possibility of the catalytic char deposition.

The intermediate vapor is made to contact with the pre-cracking catalyst bentonite, which is of the pore size of 3 – 5 nm. Then it passes through the HZSM-5 catalyst of the pore size 5.1 x 5.3 Å, where it undergoes the primary fission then it starts to saturate. HZSM-5 is chosen as the primary catalyst as it enhances the gaseous concentration of the yield to about 92%. Bentonite is chosen as it is easily available in all the forms. HZSM-5 and bentonite catalysts are used in pelletized form, so as to prevent the pressure drop in the catalyst bed. Usage of zeolite catalyst reduced the aromatic ether in the wax of the PET yield from 42% to 37.6% and reduced the aromatic content of char, thereby signifying the gas yield in the 450 – 600°C retention temperature range [18]. [19] Studied the catalytic steam PET pyrolysis over CaO, Ca(OH)₂. These catalysts increased the C7 range hydrocarbons in his yield. CaO reduced the char formation in the pet pyrolysis.

MATERIALS AND METHODS

Waste plastic PET bottles are obtained from a local plastic shredder in a shredded form. Any kind of wrappers are removed before shredding. The plastic shreds are of 2 – 3 mm size with 1 mm thickness. HZSM-5 pellets are procured from Astra Chemicals, Chennai and the pore size have been printed as 5Å. Bentonite pellets are procured from Metal Foundry, Coimbatore. The plastic shreds have been washed thoroughly with caustic free detergent and dried in sunlight for 6 hours. Then about 200g of washed plastic shreds is loaded into the process chamber. The catalyst chamber is loaded with the catalysts prior to the process. The ratio of the bentonite catalyst is calculated with respect to the waste plastic feed, while that of the HZSM-5 is calculated with the bentonite. The ratio of the plastic feed to bentonite is 1:0.05 while that of the HZSM-5 is 1:1.5, further reduction of HZSM-5 pellets ratio resulted in lower effective surface area, as there is fewer number of pellets in lesser weight fractions. The catalysts are mounted onto a 10 mm thick glass wool and loaded in to the catalytic chamber.

The chamber is sealed using a silicon rubber gasket and the purging is started. Nitrogen is used as a purging gas to get rid of the oxygen presence in the chamber. The chamber is heated with the LPG gas from room temperature to 600°C at heating rates of 5,6,7,8 °C/min. The process took the residence time to 122 minutes, 102 minutes, 88 minutes and 77 minutes respectively. After the retention and residence time, the gas is released from the process chamber through the ball valve and is passed on to the catalytic chamber where the catalytic fission happens and the gas is collected in a sampling bag and the char formation is analyzed. The retention times are shorter because a pelletized catalyst prevents pressure drops due to the usage of a powdered catalyst [20]. The retrogressive recombination of intermediates can also happen if the intermediates were not properly removed from the process chamber. So purging should be continued for some duration at the end of the process with the open ball valve.

RESULTS AND DISCUSSION

During the process, the process chamber experienced the pressure inflicted by the gas formation and is also considered as an indicator for the amount of gas generation. The pressure varied with the heating rate, retention and



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holding time. It is plotted against the heating rate in Chart 1. The heating rates are varied from 5°C/min to 8°C/min, the chamber pressure, the char percent, and the catalytic char deposition was analyzed. The gas production seemed to lessen during the 5°C/min heating rate. Due to the slower reaction speed and slower heating, the free radicals formed got saturated quickly, oil substances were found on the catalysts, and the char formation was 18% of the feed in this heating rate. The variation of char formation with the heating rate can be seen in chart 2. Increasing heating rate increased the gas generation, where the pressure reached 8 kgcm⁻². However raise of heating rate beyond 8.5 till 10 °C/min showed no more improvement in gas generation

The gas production increased and the char formation decreased with raising heating rate till 8°C/min. Further increment beyond 10°C/min, promoted the char formation and catalyst bed oil deposition. This is due to irregular thermal decomposition at a faster pace. At 5°C/min, the gasification of products were lower and about 15 ml of oil found deposited on the catalyst bed, this infers that there is a retrogressive recombination of intermediates, thus they were bigger than the bentonite pore size. The catalyst bed oil deposition is plotted with the heating rate in chart 3. At the 5 and 6°C/min heating rates, at the end of the cycles, some pale green powder like substance is found (Fig 3). This can be due to the retrogressive recombination of the intermediates. This constituted to about 5% of the feed. Char and oil deposits reduction with the raising heating rates states that the intermediates get smaller with the raising heating rates. The 8°C/min batch recorded the lowest char deposition and catalyst bed oil deposition.

The ratio of bentonite also affected the catalyst bed oil deposition of HZSM-5. The lowering of plastic to bentonite ratio below 1:0.05 increased the catalyst bed oil deposition and the catalytic char deposit is found for the first time in the whole process. The HZSM-5 pellets suffered the most char deposits at a plastic to bentonite ratio of 1:0.01. Increment of plastic to bentonite ratio than 1:0.05 was not done as it will not yield improvement [20]. Pyrolysis at 600°C with air loss requires 1.62 MJ of heat, while pyrolysing at 550°C needs only 1.5 MJ. This temperature is higher than the degradation temperature of PET, at an optimum heating rate of 8°C/min, the retention time for heating will be 69 minutes, the holding time was varied in 2.5,5,7.5,10 minutes at 550°C. The heating rate was kept constant at 8°C/min as reducing it will produce undesirable effects due to the already lowered temperature. Again the process and catalytic chambers were sterilized and catalysts are freshly loaded on a fresh glass wool of 10mm thickness with 200 grams PET plastic shreds in the process chamber. The process was repeated for 550°C, at the above heating rate with varying holding time.

The 2.5 minutes holding time showed higher char formation and lower gas production. The 7.5 minutes and 10 minutes promoted the char and oil build up and lowered gas production due to the repolymerisation of the intermediates. The 7.5 minutes and 10 minutes holding time in the 550°C regime provided some repolymerized residue along with the char. At the end of the cycle a white fibrous, glass like substance is found along with the char in the process chamber. The catalyst bed oil deposition was maximum on the 2.5 minutes and 10 minutes holding time. The 5 minutes holding time reported no oil deposition or maybe below 5 ml and a lower char percentage among all the holding periods. The table 1 shows the catalytic oil deposition, char formed for the holding time periods

CONCLUSION

The simplification of catalytic PET pyrolysis for a gas concentrated yield is possible with minimum char and catalyst bed oil deposition. With 550°C as retention temperature, and 5 minutes as holding time, the char deposited found to be 10.3% of the feed with no catalyst bed oil deposition. The process of about 77 minutes followed by 4 hours chamber cooling has been reduced to 74 minutes with 3 hours cooling without catalyst





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char deposition, the ratio of HZSM-5 can be maximized to an extent to obtain a higher valued gas yield without much concern on the catalyst char deposition and reduced catalytic activity.

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Author Contributions

A conceived the original idea. This was also discussed with other two authors for gathering data's and experiment feasibility. The proof of concept was developed by AA, however the materials used for prototype is contributed by DC and DR. All authors are equally contributed for the experimental work. DC All authors read and approved the manuscript. All Authors are also agreeing to be held accountable for the content therein

Conflicts of interest

There are no conflicts to declare

Future Work Proposed

During the R&D, some interest were created by the project to test the outputs further. So we stopped classifying the outputs as useful and useless and we began to research on the industrial benefits of them.

FTIR Analysis of the char

The FTIR analysis of the char will bring the content to the light and whether it has aromatic content or not. This will help us understand that how the reduction of retention temperature and holding time, the palletization of catalyst helped us optimize the process. This will further interest us to tailor the functional groups with pyrolysis.

Calorific value of the char and gas

Determination of the heating value of the outputs may increase the value and impact of this research. Many of the papers seem to be underestimating the PET yields potential, this step may change the verdict of the PET pyrolysis yields. As PET is abundant, its higher calorific value can be harnessed in a cheaper, abundant and efficient way.

Proximate analysis of the gas and char

The proximate analysis of the gas and char will give a perfect outlook of the emissions and elemental composition. This will help us in knowing the products and stoichiometry of the fuels. This will promote further research in the emission control, catalytic converters for this gas

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Table 1. Variation of Char and oil deposition with holding time, a constant retention temperature of 550°C

Holding time (minutes)	Char in percent of the feed	Catalyst bed oil deposition (ml)
2.5	11.2	12
5	10.3	Nil
7.5	12.57	9
10	13.83	7





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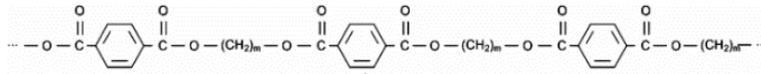


Figure 1. Structure of PET

Type of plastics	Plastics type marks	Moisture (wt%)	Fixed carbon (wt%)	Volatile (wt%)	Ash (wt%)
Polyethylene terephthalate (PET)		0.46	7.77	91.75	0.02
		0.61	13.17	86.83	0.00
High-density polyethylene		0.00	0.01	99.81	0.18
		0.00	0.03	98.57	1.40
Polyvinyl chloride (PVC)		0.80	6.30	93.70	0.00
		0.74	5.19	94.82	0.00
Low-density polyethylene		0.30	0.00	99.70	0.00
		-	-	99.60	0.40
Polypropylene		0.15	1.22	95.08	3.55
		0.18	0.16	97.85	1.99
Polystyrene		0.25	0.12	99.63	0.00
		0.30	0.20	99.50	0.00
Polyethylene (PE)		0.10	0.04	98.87	0.99
Acrylonitrile butadiene styrene (ABS)		0.00	1.12	97.88	1.01
Polyamide (PA) or Nylons		0.00	0.69	99.78	0.00
Polybutylene terephthalate (PBT)		0.16	2.88	97.12	0.00

Figure 2. Proximate analysis of plastics

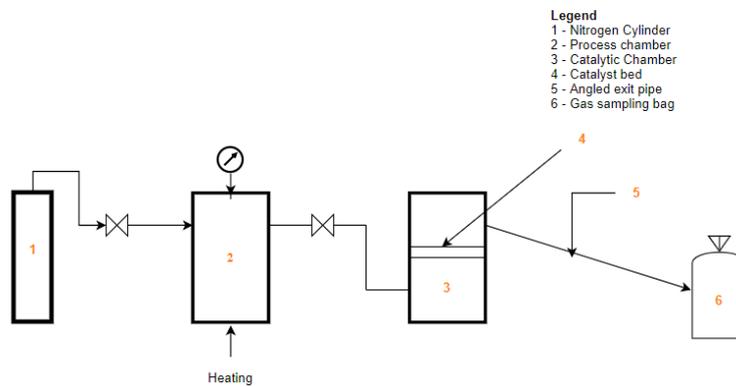


Figure 3. Reactor Diagram



Figure 4. pale green substrate, 600°C, and 50C/min

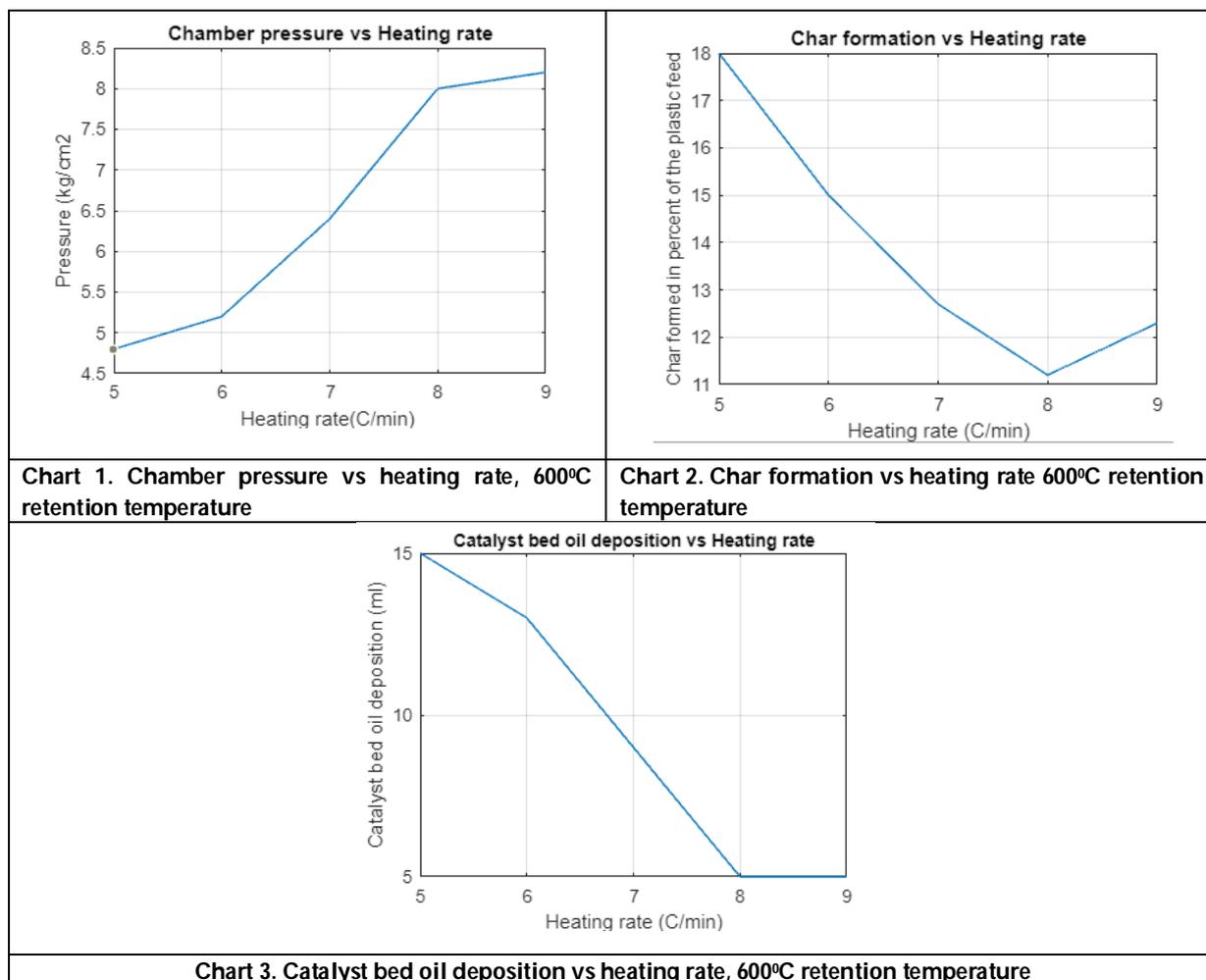




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Figure 5. Char deposited HZSM-5 Pellets, 1:0.01, plastic to bentonite ratio





Inherit – Centralized Project Collaboration, Maintenance and Contribution Tool

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ABSTRACT

Discontinuation of projects due to various reasons and a lack of public repository for idea sharing and project collaboration is the main reason for the development of this application. Project which could have been very useful for the society are discontinued due to various reasons such as lack of time and due to lack of collaborators. By maintaining a public repository for collaboration, idea sharing and project completion could greatly help the society. Our application is a code hosting and contribution platform. It lets you and others work together on projects from anywhere. It provides a perfect medium for you and the main project's maintainer to communicate and for social networking. It also lets you to find good contributors who could enhance and take your project to the next level. Thus, this project could greatly reduce project discontinuation and would promote idea sharing and open-source mindset.

Keywords: Full Stack development, MongoDB, Node JS, Platform, Project, Repository, Web development

INTRODUCTION

Ideas are very rare to get and some of them can change lives. Converting an idea into project is even more difficult. According to the university curriculum all the final year students are required to complete their final year project in their final semester. But after the completion of the course many of these projects get abandoned by the students. There could be various reason for abandoning the project like lack of time and due to lack of collaborators. Thus, many great ideas go to scrap yard. There is a need for good ideas on one end and ideas are getting abandoned on the other end. Our system aims to make these two ends meet by allowing the projects to be inherited. Our system acts as



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a bridge between wasted ideas and those that are in a desperate need of good ideas. In our application we collect the details of the projects such as the team members, documentation etc... and we display them for others to pick up. Thus, the project instead of getting discontinued will get inherited by other students. Our application is a web-based project collection and display facility with added team collaboration and recruitment options. The software is completely user friendly and available on the internet, thus the software application is easily accessible and available to any users with active internet connection and a smart computing device such as smart phone, laptop, desktop etc. The online software application runs on a web browser [1]. Web browsers such as Google Chrome, Mozilla Firefox, Microsoft Edge etc. are available across multiple smart devices with varying specifications. So, the application can run without any performance deterioration even on a low-end machine. As the web browser is available across multiple platforms this software application which runs on top of the web browser will also run across multiple platforms without any issues. Thus, this platform is platform independent.

Literature Survey

Clean architecture: a craftsman's guide to software structure and design [2] is book that explains the importance of clean architecture and its importance on maintainability of the application. The concepts of scalability, adaptability, modularity and others are also discussed deeply. It greatly influenced our decisions regarding the architecture of the application. It also encouraged us to have a clean and standard design pattern. Design and Implementation of REST API for Academic Information System [1] explains in detail about the API implementation especially REST (Representational State Transfer). We modeled our projects API request and responses as REST requests and this paper guided us throughout the development. Interactive UI Design Impacts on Human Behavior [3] explains the impact of User Interface on the behavior of the user. It deals with a psychological approach to UI design and provided us with many valuable insights that were very useful in designing the User Interface of our application. The impact of gamification in educational settings on student learning outcomes: a meta-analysis [4] explains the impact of gamification on student engagement and learning outcome. Our projects ranking system is gamified in order to improve student engagement and we owe a lot to the analysis results provided in the research paper. Performance evaluation of MySQL and MongoDB databases [12] provides a comparison between MongoDB and MySQL on various parameters related to performance. As MongoDB outperformed MySQL on the parameters that we have been looking for (based on the values provided in the paper) we chose MongoDB for our project.

Proposed System

This part of the paper describes the working of our idea in an elaborated manner. On visiting the system, the user first sees the login page. The user if they are visiting for the first time can register for the platform in the same page. The registration form asks the user some basic details such as their name, department, year and other necessary details. The registration is only allowed for valid users, valid users are the students of the institutions that are formally registered with our application. The institution that registers with us will give a list of valid students and when the student registers the students ID will be checked against the list and if it passes the validation then the user is registered if not, he is asked to contact with his institution for further details. Once the student is registered, he can login to the application by providing the user's name and the password. The passwords are transferred over secure channel and are hashed with salt before they are stored in the database. This adds a layer of security to the application that in case of a data breach the passwords cannot be manipulated. The salt makes it even more difficult for the attacker as it makes the hashes ambiguous and non-uniform. The user entered password is compared with the password hash in the database and the on successful login the user is taken to the dashboard.

The dashboard displays the various project ideas that the institution has gathered over the years. The projects are displayed on various categories such as most trending, most recent, most popular and top-rated. Also, the student can search for project based on domain, languages used. Team Name, Student Name, Supervisor Name etc. The projects are fetched from the database and the student can select the project that interests him. The dashboard also acts as the homepage from where the student can visit various other facilities such as profile, recruitment panel among others. The dashboard provides an option for uploading the project. Uploading the project is the most

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important part of the application. The student can upload his project by clicking the upload project button. Then the student is taken to a page that prompts him to enter the project details such as project title, team name, team members and their details, guide details, project description, documents and additional details if any. It is enough for one of the members of the team to upload the project. After uploading, all the students related to the project will get notified.

Once the student selects a project, he is taken to a page that is specific to the project and they can study the project in greater details from this page. Information such as the team's name, student name, project description, guide name and all other documents related to this project can be obtained from this page. Additionally, contact details of the members involved (will be useful if the students have any doubts regarding the project or if the project description is ambiguous) and an option to claim the project will also be provided. Sometimes the students may not want to completely abandon their project but may want to make it open for suggestion and collaboration (analogous to a open source project) in such a case the project will be marked as 'collaboration project' and the student selecting it cannot have the full credit of the project but instead he will work as an collaborator in that project with the original founder of the idea. This will instill an open-source mindset among the students and will make them familiar with contribution and working with a team. The student (collaborator) can give suggestion and upgrades to the project but the final verdict will always remain with the project originator. If the project originator rejects an idea, it will be rejected and if he selects the idea then he can assign it to the collaborator to implement. If the project collaborator wants to quit, he can make one of the collaborators (the most capable one) his successor. We hope that this collaboration module will save many ideas from going to waste and will encourage the teams to pursue the project goals even if the team members can collaborators change. This decouples the project from its members and ensures project continuation despite the odds.

We needed this application to be as user friendly and immersing as possible. So, for the teams to cooperate we have come up with an in-built chat module that the users can use in order to communicate with the members. This avoids the need for a third-party chat and team management application. And as the chat application is in-built it provides enormous amount of compatibility with the application ensuring better reliability and user experience. As the chat rooms are formed for each project the project related discussions can take place in a common place for all of the team members to see and to voice their opinion. Apart from the room the user can communicate with individual members if need be. We hope that this provides better intra team communication and will help the teams to discuss key ideas and arrive at a conclusion. The application takes care of the entire project lifecycle and logs key events that will be useful for the future records. The project maintenance module holds the documents can information about the project from its starting date, member's currently present and past member records among others. This will be of great use to the future collaborators that can go through the documents can the information log to find out everything they need to know about the project.

In order to be accountable for individual contributions the application also includes a contribution tracker that tracks the ideas and concept that the individual has contributed to the project. This will be displayed along with the project details as a chart with various team members (both active and passive) along with their contributions as percentage. The individual's contributions in various projects will be displayed in his profile and based upon his contributions he will be assigned a rank or title signifying his proficiency [4][5]. The rank system will encourage the student to provide more contributions and to do more projects. The rank system will also be useful for team recruitment module which we will explain later. Also, the overall project completions can be tracked provided the milestones has been set prior (projects with good requirement specifications can greatly benefit from this feature). Students in addition to selecting the project can also rate the projects. The rating will be useful for project ranking and custom project recommendation that is tailored to the user based on the project that he has rated and the rating provided for the particular project. The recommendation system uses basic algorithm that matches the likelihood of a project being selected by the particular student based upon his past behavior and the rating system can also be used for the team recruitment module by suggesting students that have similar interests [6]. Thus, we can use the project rating



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system to categorize the user as well as push the project forward by using it as a motivation point for the project team. A good project requires good team members. Bringing an idea to a project is a massive undertaking and depending upon the project size it will require various numbers of students with varying domain knowledge. Thus, more often than not teams might find themselves in a need to recruit new members (Intra College) who specializes in a particular domain. The recruitment system can be split into two sub system i.e., the recruiter subsystem and the application subsystem.

The recruiter subsystem gives the recruiter the option to advertise the teams need. The recruiter can provide various skills that he is looking for in the candidate. This will then be displayed in the recruitment tab of the application. Additionally, the team can also be recommended with suitable candidates who they can request to join the team. The recommendation system will pick the students that have interest in the specified domain (information gathered from the ranking module) and the students who have the necessary skill or rank (information gathered from the contribution management module) to recommend to the team. The team can check the profile and pick the student they seem would fit the team perfectly and send him a request. Acceptance of the request is entirely up to the student. The recruitment system is designed to recommend only active students that are pursuing their degree in the institution in order to avoid unnecessary disturbance to the passed-out students. The application system is second sub module of the recruitment system and it handles the response for the recruitment proposal. The student can see all the open recruitment needs in the recruitment section and will also be recommended personalized recommendations based on their domain expertise, rank and interest. The student can apply to the team that they desire but the acceptance of the request is entirely up to the recruiter to decide. Thus, both the modules put together will greatly help those team which are in a need for a member and those members who are in need of a team

RESULTS AND DISCUSSIONS

The user interface is built with the help of angular. Angular is a TypeScript frontend framework developed by google. Angular makes it easier to develop complex frontend web applications and they are referred to as single page application or SPA for short. The design philosophy used is material design also developed by google. Material design was picked for this project because it gives a simplistic yet professional look to the project. Having a design philosophy helps us to maintain uniformity across multiple pages in the application. The frontend communicates with the backend by API calls. The login/register page is the first page that the application renders. We have used a sliding form approach for login and register. If the user has to register for the application, they can click on the register button and it will take them to the registration form. The registration form gets the necessary details for the student to register to the application. We went with the sliding form approach to make it easier for the students to navigate to both the forms from the same page and it is also efficient when it comes to the application performance, as there is no need to go to a separate page for login and register. The sliding form helps the student to concentrate on what is on the screen and avoids unnecessary distractions.

The dashboard displays the projects that are currently present in the database. The projects are presented as maximum of twelve per page and the additional projects can be displayed by pagination. We chose pagination to improve the performance of the application as the number of projects increases it becomes incredibly difficult to fetch the entire project and display them on the page all at once. Not only does it put more stress on the server and the network it also makes the application slower (rendering all the project at once takes a lot of time) and makes for a terrible user experience on the very first page of the project. Pagination also makes it easy for the student to concentrate on few projects at a time and pick the project that they like. It is psychologically beneficial [3] too as the student is concentrating on few projects per page, he is not overwhelmed by the number of options available (google search is a good example of pagination and is also the inspiration for our design). Each project card represents a single project and it contains the title of the project and a truncated project description. In order to get a more comprehensive description the user can click on the details button. On clicking the select button the user is taken to

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the project details page. The description pop-up has the detailed description of the project and it can be used by the student to get a surface level understanding of the project. The description pop up is displayed on the same page so as to avoid unnecessary page shifts boosting the performance. The main ideology of this design is that having a huge description displayed in this pop up is generally discouraged as the student need not know the entirety of the project from this alone. The use of this description is to just provide surface level understanding, for more in depth understanding the student need to visit the project page. This choice is made to make it easier for the students to discover more projects instead of getting struck on the same project's description for long time.

The upload projects page has a basic form that the user needs to fill in order to upload his project. The form asks the necessary details such as the project title, team name, team members details, guide details, project description and other related documents. The project upload interface is designed in such a way that the user can select the information that he wants to enter now. The user can add additional details whenever they feel necessary. It is made this way because it is very difficult to have all the details and documents at the time of project uploading. If all the fields were mandated then the project can only be uploaded after the completion which is highly inefficient as the application provides various tools (recruitment, discussion rooms, contribution tracker etc.) that could be really beneficial for the student. Thus, the plan is for the students to upload their project at the earliest and make use of the tools that the application provides to get their ideas into reality.

The project details page displays the project details that the project owner has entered and made public. This page contains all the necessary details that a student needs to know in order to get into the project like title, software tools and framework used, programming languages used etc. It also contains very crucial details such as the guide details and team member's details. This page also displays the documentation of the project and very detailed description of the vision of the project which will give an in depth understanding to the reader. On future enhancements we are planning for custom pages for individual project giving the project owner full control over the design of the page (with certain restriction in order to maintain the application's design uniformity and to uphold the design philosophies used). The entire user interface was made with the user in mind thus it ensures good user experience [3]. Apart from the user, the user interface was also designed in such a way that it will boost the application's performance (indirectly enhancing user experience and satisfaction).

Backend Architecture

We have used NodeJS in the backend more specifically ExpressJS a framework based on NodeJS. We went with Express because of its performance and simplicity. ExpressJS uses a single threaded event-loop based architecture that our project can greatly benefit from. NodeJS architecture increases the server throughput thus making it the best candidate for the API based applications. ExpressJS is also a mature framework and has a good documentation and community support making our development less difficult. One of the main advantages of ExpressJS is its simplicity; we can set up a server in no time. With considering all this reasons we chose ExpressJS to be our backend framework. Our backend architecture uses clean architectural pattern with modified MVC. This architectural pattern is the most favored design pattern for API development and has almost become a standard. Our main focus when selecting a design pattern was reusability, maintainability and [2] adaptability. The design pattern must be reusable in order to avoid code duplication. As the size of a software application grows it becomes really difficult to maintain it. Thus, designing the project with maintainability in mind is very crucial and it greatly affected our decision when it comes to selecting a design pattern. We recognized that the needs of the students can change with time and that we may need to adapt our application accordingly and also there is a need to constantly update the application thus we made adaptability a main factor for selecting the design pattern. Following a design pattern standardizes the code making it easier to understand and greatly enhance team interoperability.

The API requests are given to the routers which will direct the request to the corresponding controller [1]. The controller in this case performs necessary evaluation and uses the database module to fetch the data. The database



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module is an adapter that decouples the database from the application. Connecting to the database via an adapter makes it easier to change modules related to the database. The backend also takes care of security, privacy and validation of the user details. In order to make the application penetration free and to fend off potential cyber-attacks special care is taken when designing the authentication and authorization methodology of the application [8]. Currently the application uses username and password [9] for log in with potential to upgrade to more sophisticated login methodologies such as OAuth, Open ID etc. On the authorization front currently, the application uses session-based authorization [7]. After careful consideration session-based authorization is chosen among other form of authorization such as JWT for its time-tested security capabilities. The session details are stored in the database and not on the server machine. As the database is hosted separately from server-side application (database design is discussed in the following section) it makes it easier for server-side horizontal scaling though sessions are used. Once the user authenticates him a session is generated and the session is maintained until the user logs out. If the user fails to logout, then the session expires in a week to prevent misuse of the session. The user can then be authorized based on his session cookies. Great care has been taken to ensure route protection so that no unnecessary back door exists in the application that can be exploited. Authentication takes place via comparing the hashed password with the user entered password. The password hashing and comparing module is also decoupled from the application in order to make it easier to change the hashing methodology if necessary. The password hashing method currently uses bcrypt package, a well-regarded password hashing package that provides protection against advanced cyber-attacks such as timing attacks. The package also adds salt to the password hash making it very difficult to exploit the password even after a data breach.

Database

The database that we have used in this project is MongoDB. MongoDB is a NoSQL document-based database. The reason we chose MongoDB is because it is extremely scalable and it uses NoSQL which makes it the best choice for our application. As MongoDB uses document-based NoSQL model it is extremely scalable (horizontal scaling to be more precise). As our project requires scalability, we chose MongoDB. Another main advantage of using MongoDB is that it is very efficient in processing the queries (uses minimal joins when compared with SQL) thus improving the API throughput tremendously [11][12]. The database is hosted separately from the server thus making it individually scalable and thus improves the performance. Additionally, the database is decoupled with the application meaning that in case if we want to change the database in the future, we can do so without affecting the application in the slightest. MongoDB being NoSQL is also highly adaptable to change as the schema is not predefined [10][13]. As we have stated earlier this goes in favor of the adaptability of the application and that is another reason why we went with MongoDB.

CONCLUSION

We hope that by utilizing our platform students will be able to find interesting ideas for their projects and will be able to contribute to their desired project. We believe that constant exposure to the project will create interest in students and inspire them to convert their ideas into reality. By utilizing the platform, the students will be able to get good contributors who would keep the project going even in their absence. Thus, good ideas instead of going to waste will be developed and would benefit the society greatly. This system would promote Open-source mindset which is the prominent software development methodology now a day.

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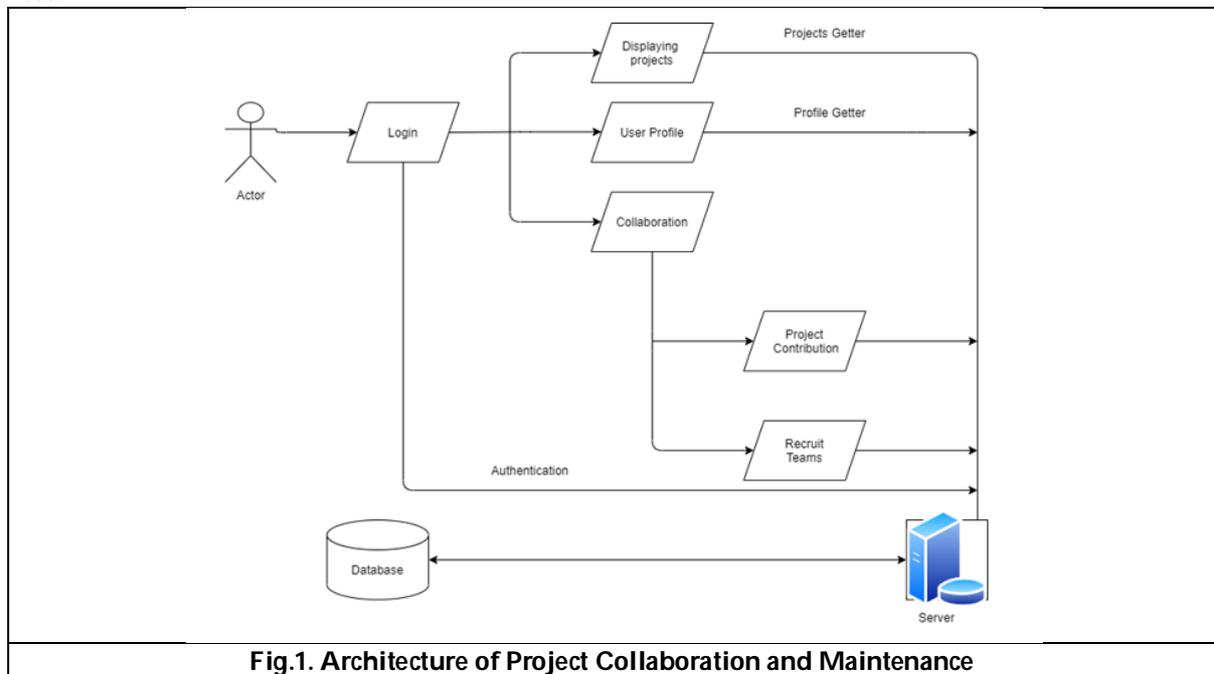


Fig.1. Architecture of Project Collaboration and Maintenance





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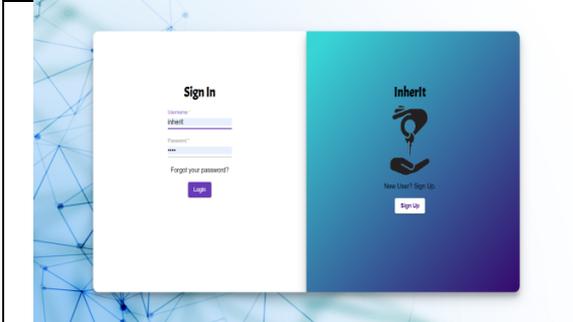


Figure.2. Login screen

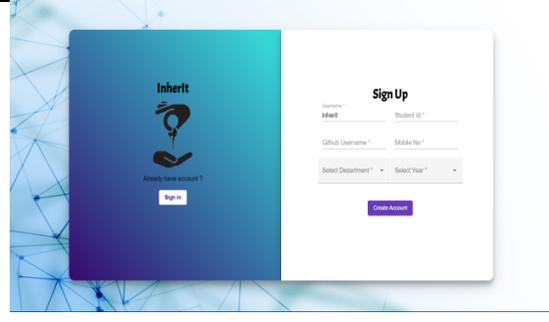


Figure.3. Registration screen

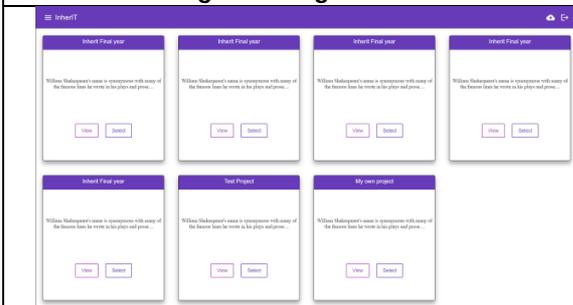


Figure.4. Application dashboard

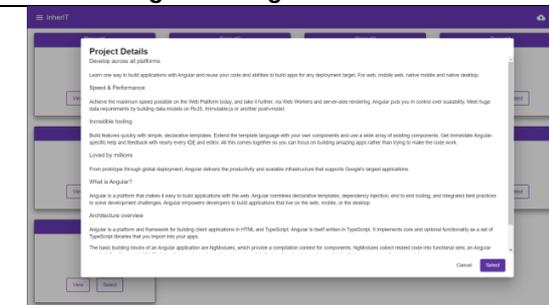


Figure.5. Description pop-up

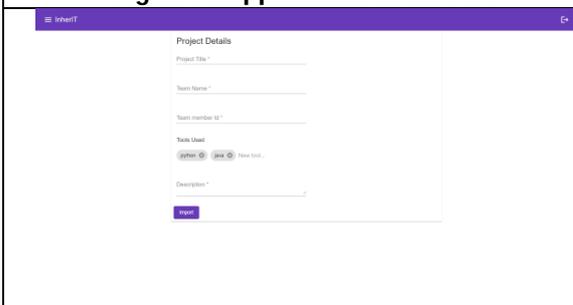


Figure.6. Project upload page



Figure.7. Project details page





Investigation of Dielectric and Optical Properties of Lead Free $\text{Bi}_{0.5}\text{Na}_{0.5}\text{TiO}_3$ (BNT) Ferroelectric Ceramic

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ABSTRACT

Bismuth sodium titanium oxide ($\text{Bi}_{0.5}\text{Na}_{0.5}\text{TiO}_3$) was prepared using conventional solid-state reaction method. Single phase formation with a rhombohedral symmetry was confirmed by the X-ray diffraction patterns at room temperature. The dielectric properties of BNT predominantly due to the interfacial effects at lower frequencies due to the presence of oxygen vacancies. This sample has a broad ferroelectric range. The temperature dependence of AC-conductivity of BNT ceramics was analyzed using Arrhenius's law. The optical properties of the materials were studied via Uv-Visible spectroscopy in the diffuse reflectance mode. The optical band gap was calculated using the Kubel-Munk equation and the optical band gap found to be 3.04 eV.

Keywords: Perovskite, Lead-free ceramics, ferroelectric relaxor, Diffuseness, Conductivity, Uv-Visible spectroscopy.

INTRODUCTION

Lead based ceramics with perovskite structure are attracting researchers for its use in high performance sensors, transducers, actuators and other applications, due to their superior piezoelectric, dielectric and electromechanical coupling co-efficient.[1] Whereas lead has major contribution in most of the cases in the composition of these devices. Lead, which is known to be very volatile, discharged to the surrounding during sintering which causes serious problems related to environment and health. Again after use of these products disposal is another cause for concern. So in industries these products are not used any more. Therefore it is necessary to produce environmental friendly





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lead-free material [2-4]. In recent years extensive research has been carried out on Bismuth containing perovskite materials as it has a similar electronic structure like Pb^{2+} ions. The 6s lone pair configuration of these ions are considered highly beneficial for greater piezoelectric response [5]. $Bi_{0.5}Na_{0.5}TiO_3$ (BNT) is considered as one of the bright candidate material among Bismuth based perovskite ceramics, because of its high Curie temperature and large polarization [6-8]. We have made an attempt to synthesize lead free perovskite based ceramic material using novel technique and to study the structural, electrical properties and optical properties of it. Further to have a better understanding about its microstructure study of its electrical properties is very essential.

EXPERIMENTAL

$Bi_{0.5}Na_{0.5}TiO_3$ ceramic was prepared by conventional solid-state reaction method using raw materials like Bi_2O_3 (99.9%), Na_2CO_3 (99%) and TiO_2 (99.9%). The weighed powders in stoichiometric ratios were ground well using ball milling in acetone medium for 12hrs. The resultant mixture was calcined at $950^\circ C$ for 3hrs. The ceramic sample was structurally characterized by X-ray diffractometer (Philips diffractometer model PW-1830) using monochromatic $CuK\alpha$ radiation. The deflection range was $20-80^\circ$ with a step size of $0.5^\circ/min$. After calcination powder was reground and mixed with 3% polyvinyl alcohol. Pellets of 10 mm diameter and 1mm thickness were prepared from these powders using hydraulic press. These pellets were sintered at $1150^\circ C$ for 3hrs and then slowly cooled to room temperature. For electrical measurements, silver paste was used on both sides of the samples as electrodes and heated at $100^\circ C$ for 10 minutes to dry the samples. Dielectric measurement of the pellets were carried out using LCR meter (N4L PSM 1731) from $25^\circ C$ to $500^\circ C$ at frequencies 50KHz, 100KHz, 500KHz and 1MHz. In order to study optical properties, UV-Visible spectroscopy of the powders were carried out by using UV-Vis Spectrometer (Shimadzu UV-Vis Spectrometer, Model: UV-1800) in diffuse reflection mode.

RESULTS AND ANALYSIS

XRD pattern of BNT powder is shown in Fig 1. The XRD analysis shows that the sample possessed a pure rhombohedral ABO_3 -type perovskite structure with R3C space group. No detectable secondary impurity phase was observed. All the diffraction peaks matches well with the JCPDS card no-98-010-653. The lattice parameters are found to be $a = 5.48 \text{ \AA}$, $b = 5.48 \text{ \AA}$, $c = 13.48 \text{ \AA}$ and the cell volume is found to be 351.79 \AA^3 .

Dielectric study

Dielectric plot (ϵ_r vs T and $\tan \delta$ vs T) of BNT ceramic at different frequencies (50 kHz, 100 kHz, 500 kHz and 1 MHz) are shown in fig.2. It has been observed from ϵ_r vs T plots that value of dielectric rises with rise in temperature and shows broad hump followed by a dielectric maxima around a particular temperature, represented as T_m , and it decreases slowly with temperature above T_m . It is further observed that dielectric constant decreases with increasing frequency from 50 kHz to 1 MHz. Below T_m another dielectric anomaly is observed at T_d , known as depolarization temperature, corresponds to the ferroelectric (FE) to antiferroelectric (AFE) phase transition and the high temperature anomaly at T_m corresponds to the anti ferroelectric to paraelectric (PE) phase transition. The dielectric constant of the former phase is smaller than the later one [9-11]. Sample shows typical character of a ferroelectric relaxor because of diffused phase transition. A modified Curie – Weiss law has been proposed to quantify the diffuseness of a phase transition at T_m [12-14],

$$(1/\epsilon_r - 1/\epsilon_{rmax}) = A(T - T_m)^\gamma \quad (1)$$

Where γ is a critical exponent which lie in the range $1 < \gamma \leq 2$. If γ is 1, it represents ideal Curie – Weiss behaviour and if its value is between 1 and 2 it indicates diffuse behaviour [15]. We had determined the value of γ from the slope of the straight line fitted to the $\log(1/\epsilon_r - 1/\epsilon_{rmax})$ vs $\log(T - T_m)$ curve measured at 500KHz as shown in Fig. 3. The value of γ is found to be 1.71, which shows that the phase transition is of diffused type and the sample has a broad ferroelectric range.





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AC conductivity analysis

Fig. 4 shows ac conductivity variation with reciprocal of temperature ($1000/T$) for BNT ceramic measured at 50KHz to 1MHz frequencies. The observed variation in ac conductivity with temperature could be divided into two regions, low temperature part and high temperature part. In the high temperature region, thermally activated oxygen vacancies function as trapping centers for the mobile charge carriers and the conductivity rises due to the hopping of the charge carriers among the available oxygen vacancies [16]. In the low temperature part ac conductivity shows strong frequency dispersion and weak temperature dependence but in the high temperature part ac conductivity shows strong temperature dependence and weak frequency dependence. In this region ac conductivity increases with an increase in frequency. At low frequency, oxygen vacancies become active. At low temperatures, the ac conductivity is seen to be almost independent of temperature but shows different values at various frequencies indicating that main contribution to the conductivity result from the presence of space charges [17]. The dielectric properties of BNT was predominantly due to the interfacial effects at lower frequencies due to the presence of oxygen vacancies. As the temperature increases, the conductivity shows an increase with all curves tending to merge at high temperatures. The activation energy (E_A) of the samples have been calculated by using Arrhenius relation [18]

$$\sigma_{ac} = \sigma_0 \exp(E_A/k_B T) \quad (2)$$

Where, σ_0 is the pre exponential factor, k_B is the Boltzmann constant and T is the absolute temperature. The activation energy (E_A) calculated from the slope of the $\ln\sigma_{ac}$ verses $1000/T$ in the low temperature region for the sample at 500KHz is 0.093eV as shown in Fig.5 .

Optical study

The optical band gap (E_g) of BNT ceramic powder was estimated by the Kubelkae – Munk modified equation

$$[F(R_\infty)h\nu]^{1/2} = C_1(h\nu - E_{gap}) \quad (3)$$

Where $F(R_\infty)$ is the Kubelkae – Munk function, $h\nu$ is the photon energy, C_1 is a proportionality constant and E_{gap} is the optical band gap . [19-23]We have determined the E_g value of BNT powder from the plot of $[F(R_\infty)h\nu]^{1/2}$ vs. $h\nu$ and it is found out to be 3.04eV. In principle, we believe that the obtained E_{gap} value for the BNT ceramic can be associated to a structural order-disorder effect into the lattice due to a symmetry break between the O-Ti-O bonds and/or distortions on the $[TiO_6]$ clusters.

CONCLUSION

The lead free Bismuth Sodium Titanate(BNT) ceramic was produced by solid state reaction method. It is found from the X-ray diffraction patterns that all samples are of perovskite phase with rhombohedral symmetry ($R3c$). The dielectric study of $(Bi_{0.5}Na_{0.5})TiO_3$ shows that sample shows the typical character of a ferroelectric relaxor because of diffused phase transition. Also, BNT shows two phase transitions Viz., ferroelectric to anti-ferroelectric and anti-ferroelectric to paraelectric, with rising temperature. The dielectric properties of BNT was predominantly due to the interfacial effects at lower frequencies due to the presence of oxygen vacancies. Conductivity obeys Arrhenius relation .The optical band was obtained from the UV-visible spectroscopy and found to be 3.04 ev. The obtained optical band gap value for the studied compound is related to a structural order–disorder defect in the lattice due to a symmetry break between the O–Ti–O bonds and/or distortions on the (TiO_6) clusters.

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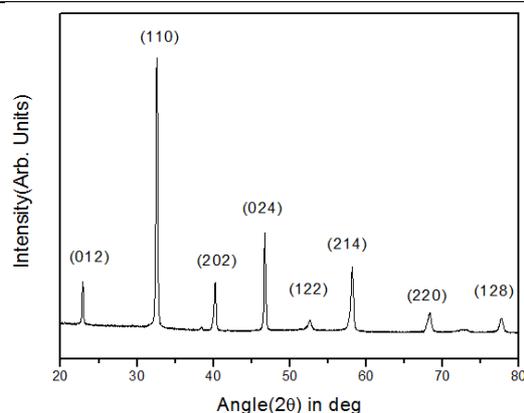
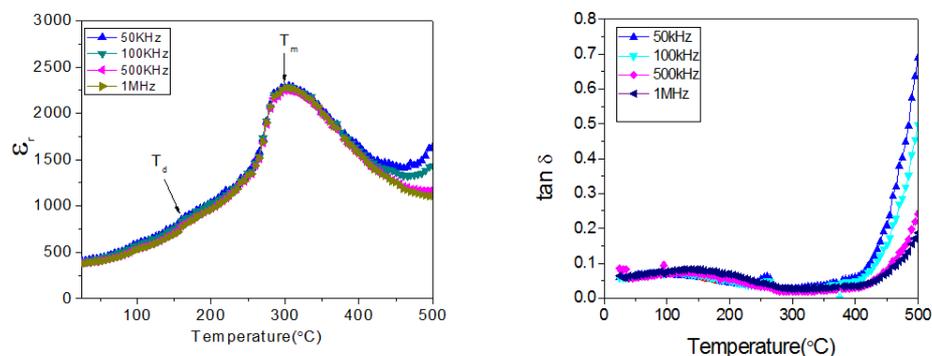


Fig 1- XRD patterns of BNT ceramic.

Fig. 2 - Temperature dependence of ϵ_r and $\tan\delta$ for BNT ceramic.



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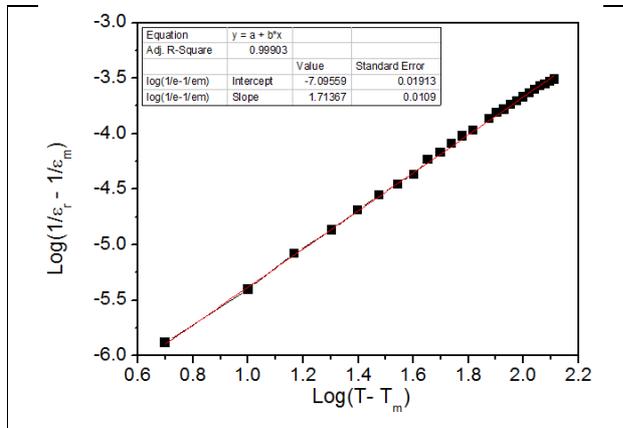


Fig.3- The Log ($\epsilon_r - \epsilon_{max}$) vs Log ($T - T_m$) of BNT at 500 kHz.

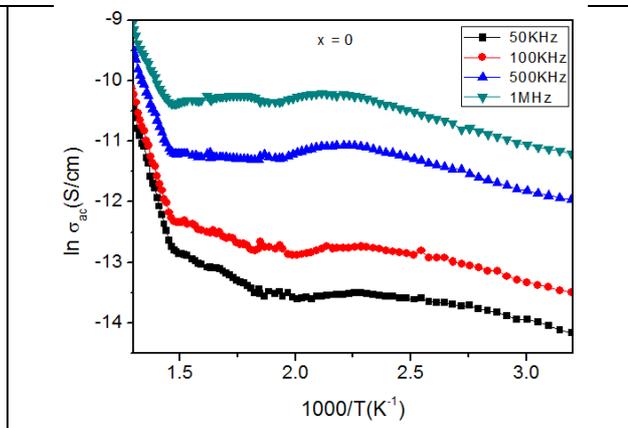


Fig.4- Conductivity plot at different frequencies for BNT ceramic

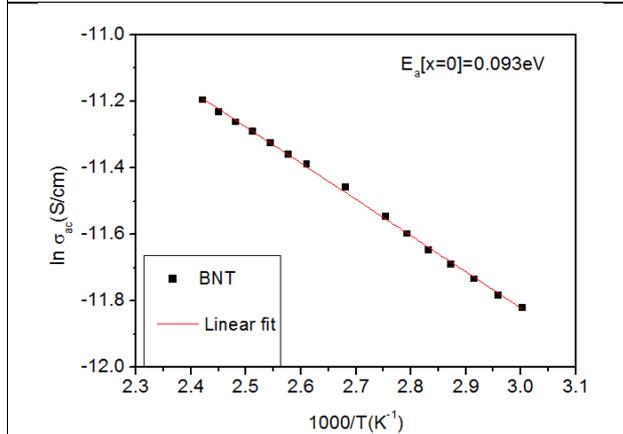


Fig. 5- Variation of $\ln \sigma_{ac}$ with $1000/T$ and fitted with Arrhenius relation

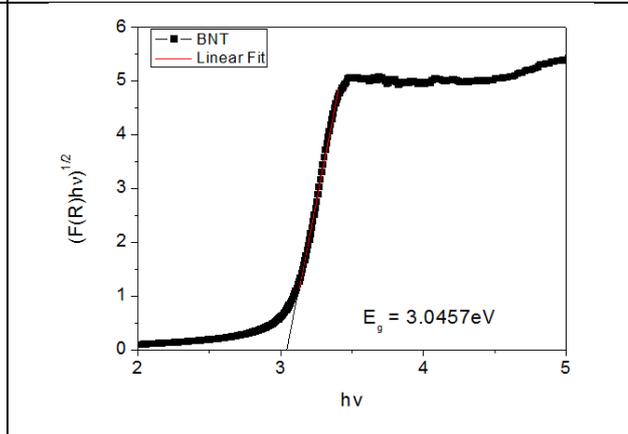


Fig.6- Kubelka-Munk plot for BNT ceramic.





Synthesis and Characterisation of Banana Fibre Reinforced Epoxy Composites from Olive Oil

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ABSTRACT

Vegetable oil is inexpensive, and readily available, can be used to develop various types of polymers. In our present study epoxidised olive oil has been synthesised from olive oil by treating acetic acid and hydrogen peroxide as oxygen donor. The epoxidation is catalysed by sulphuric acid. The epoxidation is confirmed by oxirane oxygen analysis, iodine value, fourier transform infrared spectroscopy (FT-IR), nuclear magnetic resonance (NMR) analysis. Natural fibres such as sisal coir and banana etc., are locally available and abundance in nature and have good mechanical and physical properties and can be used effectively in the fabrication of composite materials for various applications. Composites are prepared from the banana fibre with phthalic anhydride and triethylamine hardener. The tensile properties and physical properties observed are discussed in detail.

Keywords: Olive oil, Epoxidised olive oil, Composites, Banana fibre, Chemical resistance.

INTRODUCTION

The use of materials from renewable resources is of increasing importance as the world's leading industries and manufacturers seek to replace decreasing petrochemical-based feedstock with agricultural based materials [1]. Olive oil is a vegetable oil it is obtained from the fruits of the olive tree (*Olea europaea*). Olive oil mostly consist of triacylglycerols, the predominant fatty acid present in olive oil is monounsaturated oleic acid. There is also palmitic acid, linoleic acid, stearic acid, palmitoleic acid making up the remainder of olive oil TGAs. Olive oil is primarily a mixture of triacylglycerols, free fatty acids, mono and diacylglycerols and non- glyceridic constituents. Unsaturated



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polyester resin show excellent physical properties as well as good weatherability [2]. The polyester composites will display a broad range of mechanical, chemical, thermal and physical properties, depending on the composition of the unsaturated polyester [3]. The natural fibres enclose cellulose, hemicellulose, lignin, pectin, waxes and water soluble substances [4]. The compensation of natural fibres are low cost, light weight, low density, easy availability, enhanced energy recovery and biodegradability, high toughness, high specific strength, safer handling etc [5].

However, natural fibres have few disadvantages such as high moisture absorption, swelling, limited compatibility with some thermoplastic matrices, low processing temperature, low thermal stability, poor mechanical properties, high biodegradability when showing to environment and low dimensional stability [6]. Natural fibres are used in different applications such as building materials, particle boards and insulation boards. The uses of natural fibres for polymer composites are in transportation, low cost building and other construction industries [7]. The automobile industry is successfully applying composites reinforced with a variety of natural fibre to replace components such as heart panels and seat cushions made of glass mat polymer-matrix composites or polymeric foam [8]. The applications of natural fibre reinforced composites take account of automotive, aerospace, marine, sporting goods and electronic industries [9].

EXPERIMENTAL**MATERIALS**

The olive oil used in this study is obtained from local company. Hydrogen peroxide, glacial acetic acid, and sulphuric acid were obtained from Sigma-Aldrich. The banana fibre is collected locally. Phthalic anhydride and hardener triethylamine is obtained from merk.

Epoxidation of olive oil

Olive oil and acetic acid is placed in a 500ml three neck flask equipped with reflux condenser. Then a calculated amount of hydrogen peroxide is added dropwise with continuous stirring about 2 hrs. Thereafter the temperature of the reaction mixture is raised to 110°C and maintained this temperature for a period of 6hrs. (Scheme 1). Two different molar ratios of hydrogen peroxide (1:1.1 and 1:1.3). The product is cooled. The product is washed with warm water. The epoxidised olive oil (EOO) is then analysed to determine its oxirane oxygen and iodine value.

Alkali treatment of Banana fibre

The banana fibres are cleaned and dried and then kept in oven at 60°C to remove moisture. The banana fibre is soaked in 4% NaOH solution for 1 hr to remove unwanted material, washed in distilled water and dried under the sunlight for one week. Then it are weighed according to the percentage (5, 10, and 15wt.%).

Synthesis of Composites

The glass mould is coated with a silicone crease. A calculated amount of epoxidised olive oil (EOO) and phthalic anhydride and triethylamine are mixed. The mixture is heated in an water bath to 100°C for 3hrs. Different amount of treated banana fibre (5, 10, and 15wt.%) is added separately in the above mixture and stirred. The resultant mixture is poured into glass moulds. The sample is cured in an oven at 120°C for 24hrs.

CHARACTERISATION**Physico-chemical properties**

Fourier Transform Infrared (FT-IR) spectra of olive oil and epoxidised oil are carried out by KBr pellet method using Shimadzu FTIR-8400S spectrometer. ¹HNMR spectra are recorded using Bruker Avance H 500 MHz spectrometer. The solutions used are prepared in CDCl₃ using tetramethylsilane (TMS) as the internal standard. Saponification value of oil and iodine value and oxirane oxygen content of epoxidised oils are determined using standard methods.





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Moisture content test

Each specimen are weighed and then the specimens are dried in oven at temperature of 100°C until the mass became constant to successive weighing made at an interval of 2hrs.

$$\text{Moisture content} = \frac{m_o - m_f}{m_o} \times 100$$

Where, m_o and m_f are initial and final mass respectively.

Chemical resistance of composites

A chemical resistance of the composite are studied using ASTM D543.87 method. For chemical resistance test, the alkalis sodium hydroxide (10%), sodium carbonate (20%), and sodium hydroxide (10%), the acids conc. HCl (1N), H_2SO_4 (1N) and conc. HNO_3 and the solvents dimethyl acetamide, chloroform, diethyl ether, water and toluene are selected. In this test each weighed samples are dipped in a respective chemicals under study for 30 days, removed and washed with distilled water and dried by using filter paper. The percentage of weight loss is determined.

Tensile test

Tensile properties such as Tensile strength, Elongation at break and Young's Modulus are measured using ASTM D638 standard using universal testing at a crosshead speed 5mm/min. Five specimens of each sample are tested, the Young's Modulus and Tensile strength are expressed as,

$$\text{Tensile strength (MPa)} = \frac{P}{bh}$$

Where, P = Pulling force, B = Specimen width, H = Specimen thickness,

σ = Stress (N/m²), ϵ = Strain.

Soil burial degradation

Each composite are placed in a series of boxes containing moisturised soil. The composites (30 X10mm) buried the soil. After 60 days the samples are removed and washed with water and dried at room temperature, then weighed the weight loss is determined using the formula,

$$\text{Weight loss} = \frac{W_0 - W_t}{W_0} \times 100$$

Where, W_0 = Initial mass, W_t = Remaining mass at the given time t.

RESULTS AND DISCUSSION

Physico-chemical properties

The physico-chemical properties of olive oil and epoxy resins are given in Table 1.

The oxirane oxygen content and iodine value are the important properties of epoxy resins. The iodine value reveal the remaining unsaturation during epoxidation and oxirane oxygen indicates the presence of epoxy groups in the resulting products. The reduction in iodine value reveals the utilization of unsaturation during epoxidation.



**Vijithra and Sangeetha****FT-IR analysis**

The FT-IR spectrum of olive oil reveals the presence of unsaturated fatty acids. The epoxy resins showed the peak at 910 cm^{-1} indicates the formation of epoxy resins. Composites showed the irregular bands due to the presence of epoxy groups and fibres.

¹HNMR analysis

The ¹HNMR spectral analysis of epoxidised resins peak appeared at 2.909 ppm corresponds to the double bond is replaced by epoxy groups. The peaks at 3.076 ppm showed the presence of -CH- hydrogen between two epoxy groups as presented in Figure 2 – 4.

Chemical resistance of composites

The banana fibre reinforced composites seem to exhibit higher weight loss than neat epoxy sheets. The weight loss slightly increases with increasing time of exposure to the environment for all the composites. In the present study, neat epoxy sheets and its composites possess good resistance to acids alkalis and solvent medium there is no change in the physical appearance of composites.

Tensile properties

Tensile properties such as tensile strength, Young's modulus and elongation at break of epoxy composites are presented in Table 5. In the present study, the tensile properties such as tensile strength, elongation at break, and Young's modulus epoxy composites are higher due to the epoxy composites, reveals higher mechanical properties than neat sheets due to the presence of alkali treated banana fibres. As fibre content increases tensile strength and Young's modulus increases, but elongation at break decreases. Variation of tensile properties of composites by the addition of banana fibres as presented in Figure.5.

Soil burial degradation

In the present study, there is no weight loss is observed in neat epoxy sheets and 5% banana fibre reinforced composites. But small weight loss observed in 10% and 15% banana fibre reinforced composites even a period of 60 days. Hence, the composites are biodegradable

CONCLUSION

Olive oil was epoxidised by reacting hydrogen peroxide with acetic acid at the temperature range 110°C . The epoxidation was confirmed by oxirane oxygen analysis, iodine value, FT-IR and ¹HNMR studies. As the banana fibre content increases tensile properties also increases. There is no weight loss in the chemical resistance test reveals the composites resist chemical environment. The epoxy composites are biodegradable it confirmed by soil burial test.

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Table 1. Physico-chemical properties of olive oil and epoxy resins

Properties	Olive oil	EOO (1:1.1)	EOO (1:1.3)
Colour	Pale yellow	Yellow	Yellow
Saponification value	182.8	135.7	131.2
Iodine value	123.30	32.6	29.5
Oxirane oxygen	-	2.22	2.43
Specific gravity	0.922	1.13	1.16
Moisture content	0	0.1	0.12

Table 2. Stability of composites in the acidic medium

Epoxy Composites	Weight loss %		
	Conc. HNO ₃ (1N)	Conc. HCl (1N)	Conc. H ₂ SO ₄ (1N)
ES (1:1.1)	0	0	0
ES + 5% banana fibre	-0.1	-0.1	-0.1
ES + 10% banana fibre	-0.1	-0.1	-0.3
ES + 15% banana fibre	-0.1	-0.1	-0.5
ES (1:1.3)	0	0	0
ES + 5% banana fibre	-0.1	-0.1	0
ES + 10% banana fibre	-0.1	-0.1	-0.3
ES + 15% banana fibre	-0.1	-0.1	-0.5

Table 3. Stability of composites in the basic medium

Epoxy Composites	Weight loss %		
	NH ₄ OH (10%)	NaOH (10%)	Na ₂ CO ₃ (20%)
ES (1:1.1)	0	1.1	0
ES + 5% banana fibre	0	1.1	-0.1
ES + 10% banana fibre	-0.1	-0.1	-0.4
ES + 15% banana fibre	0.3	0.5	-0.5
ES (1:1.3)	0	0	0
ES + 5% banana fibre	0	-0.2	0
ES + 10% banana fibre	-0.2	-0.25	-0.3
ES + 15% banana fibre	-0.5	-0.5	-0.5





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Table 4. Stability of composites in the solvents

Epoxy Composites	Weight loss %				
	DMA	Chloroform	Toluene	Ethanol	Water
ES (1:1.1)	0	-0.3	0	0	0
ES + 5% banana fibre	0	-1.5	0.1	0	-0.1
ES + 10% banana fibre	0	-1.5	0.4	0.2	-0.4
ES + 15% banana fibre	0	-1.8	0.5	0.13	-0.5
ES (1:1.3)	0	-0.5	0	0	0
ES + 5% banana fibre	0	-2.0	0	0.11	0
ES + 10% banana fibre	0	-25	0.3	0.2	0.3
ES + 15% banana fibre	0	-3	0.5	0.22	0.5

Table 5. Tensile properties of epoxy composites

Epoxy Composites	Tensile strength (MPa)	Elongation at break (%)	Young's modulus (MPa)
ES (1:1.1)	2.2	10	15.23
ES + 5% banana fibre	3.7	13.1	25.67
ES + 10% banana fibre	6.1	14.5	43.81
ES + 15% banana fibre	10.7	16.3	73.9
ES (1:1.3)	2.5	10.35	15.27
ES + 5% banana fibre	5.3	10.9	27.45
ES + 10% banana fibre	7.8	11.5	48.21
ES + 15% banana fibre	10.9	13.5	75.24

Table 6. Soil burial degradation for epoxy composites

Epoxy Composites	Weight loss %	
	Initial	Final
ES (1:1.1)	1.61	1.61
ES + 5% banana fibre	1.64	1.64
ES + 10% banana fibre	1.73	1.70
ES + 15% banana fibre	1.82	1.76
ES (1:1.3)	1.64	1.64
ES + 5% banana fibre	1.70	1.70
ES + 10% banana fibre	1.78	1.76
ES + 15% banana fibre	1.84	1.81





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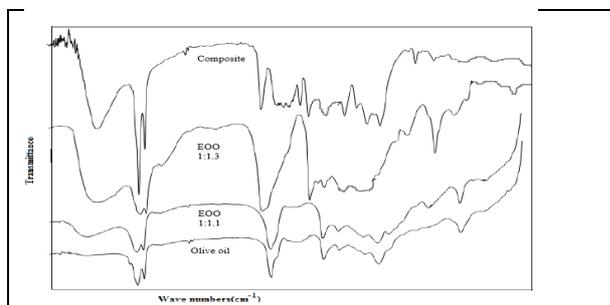


Fig. 1 FT-IR spectrum of Olive oil, Epoxy resins and composites

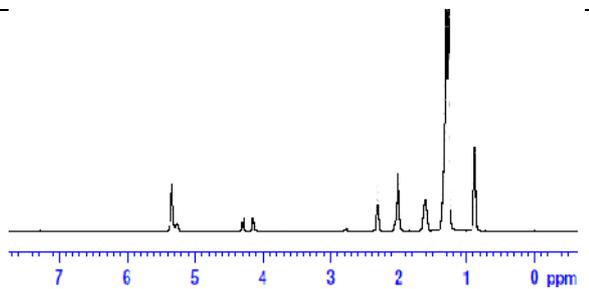


Fig. 2 ¹H NMR spectrum of Olive oil

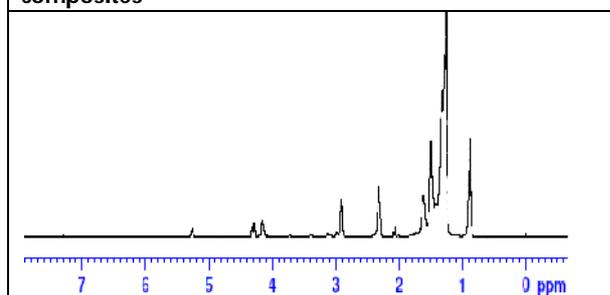


Fig. 3 ¹H NMR spectrum of EOO (1:1.1)

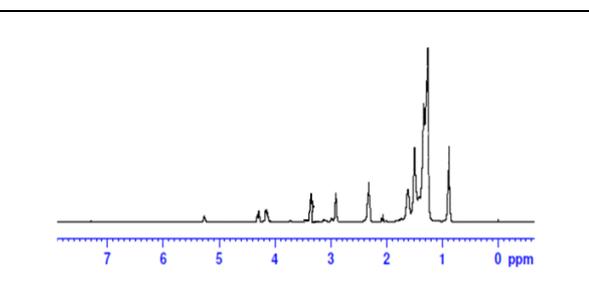


Fig. 4 ¹H NMR spectrum of EOO (1:1.3)

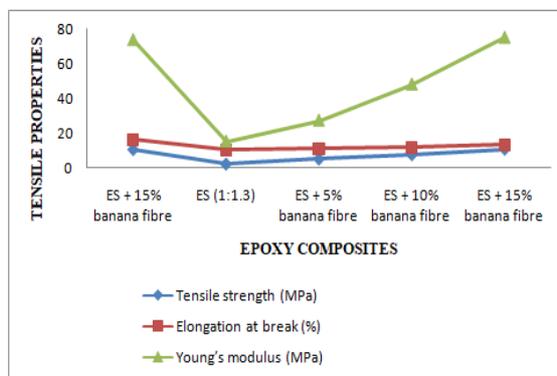
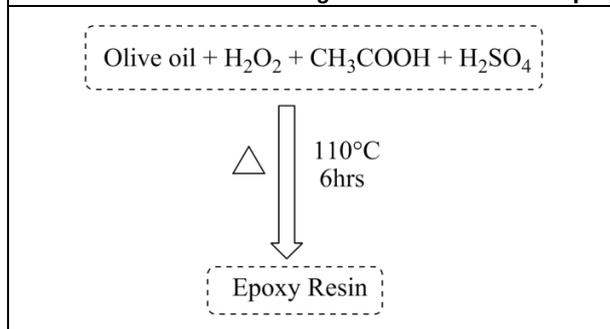
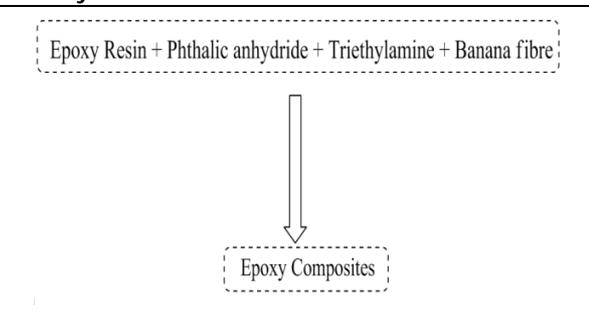


Fig. 5 Variation of tensile properties by the addition of banana fibres



Scheme 1. Formation of Epoxy Resin



Scheme 2. Formation of Epoxy Composites





Influence of Education Levels, Technical Abilities and Students' Satisfaction on dimensions of E-Learning Attitude among University Students

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ABSTRACT

To explore the university student's attitude towards e-learning on four dimensions viz., interest, usefulness, ease and confidence. In addition to that the study also analyzes the interaction effect between education levels, technical abilities and students' satisfaction on dimensions of e-learning attitude from higher education students' perspective. Researcher adopted a normative survey method and simple random technique to select 150 university students as a sample from Tezpur University. For collecting data the standardized tool "Attitude Towards e-learning Scale" developed by Dimpal Rani was used. The data were analyzed with the help of descriptive and 3-way ANOVA techniques. The results revealed university students have a moderately favourable attitude towards e-learning and its dimensions. There was no influence of education level; technical abilities; interaction between education level and technical abilities; interaction between education level and students' satisfaction; interaction between education level, technical abilities and student's satisfaction in e-learning interest, e-learning usefulness, e-learning confidence and overall attitude towards e-learning among university students. But there was a significant influence on student's satisfaction, the interaction between technical abilities and student's satisfaction in e-learning interest, e-learning usefulness, e-learning confidence, and overall attitude towards e-learning among university students. There is a rareness of research conducted to study the interaction effect between education levels, technical abilities, and student's satisfaction in e-learning and its dimensions among university students. The findings of the study can help administrators and practitioners to understand the student's perspective about e-learning and its dimensions and improve the quality of delivering online courses and learner's outcome.

Keywords: E-Learning, Interest, Confidence, Education Levels, Technical Abilities, Students' Satisfaction.



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INTRODUCTION

Education is the backbone of any country. Providing quality education and producing a confident, skilful global citizen is the source for countries' development. Such an important education system faces tremendous changes after the computer and internet explosion. This Internet communication technology helps the learners from remote places without any physical barriers to gain knowledge, communicate with others in the world, share their knowledge and experience, gather the required information, and conduct the assessment. The application of this technological advancement in education benefits both students and teachers by providing a collaborating and supportive learning environment at any time anywhere.

Among that, electronic learning is seen in different perspectives which cover a spectrum of all pedagogical approaches and technologies to meet the demand of the students as well as educators. This is an umbrella term integrating the various forms of technology in the teaching process to facilitate communication to a massive group. E-Learning is defined as "any form of information transmitted and facilitated by electronic technologies in order to support the process of learning using various technological tools. E-learning is defined as learning experiences in synchronous or asynchronous environments using different devices such as mobile phones, laptops, etc. with internet access. In this process, the learner can be anywhere to interact and learn with the teacher and other learners [1]. In the early 2000s, modern technologies and increased bandwidth boost the advancement of the new concept of E-learning. In continuation of the innovative learning environment, many educational institutions encourage the delivery of the courses through e-learning platforms. A total of 1.725 billion students globally had been affected by the closure of schools and higher education institutions in response to the COVID-19 pandemic. According to the UNESCO Monitoring Report, 192 countries have implemented nationwide closures, affecting about 99% of the world's student population [2]. Due to the situation many institutions worldwide started conducting online classes, particularly higher education institutions started to take courses using E-learning portals. Though researches conducted before this situation supported e-learning, it met the increased demands of enhanced teaching methods, made enormous advances in the quality of teaching, offers flexible opportunities for learning, and supports continuous inquiry[3].

However, E-learning allows having a customized learning experience [4], and enables the teachers to maintain the human touch by customizing their process, procedure, and materials according to the needs of their students [5]. But in most situations due to emergency shifts, the design process and different design decisions are missed out[6]. E-learning gained an important place in the education system and students, at the same time, students coming from non-technical backgrounds face difficulty with e-learning. This aligns with the findings of O'Connell report that "the students accustomed to traditional learning environments experience difficulty in absorbing learning material; also, students should be given training and awareness on how to receive the full advantage of e-learning environments"[7]. The UNESCO report provided ten recommendations for engaging in online learning. Among them are examining the readiness and choosing the most relevant tools, ensure the inclusion of the distance learning program prior to teaching psychosocial challenges should be addressed, adopt the correct approaches, applications, platforms with appropriate limits, and develop rules and monitor students' learning process [8].

At the same time, universities have the responsibility to strengthen professional competencies, enhance innovations, and produce outward-looking, competitive, independent qualified learners. As rightly pointed out by Nelasco, et.al., "it is extremely significant to layout an effective e-learning scheme for instructions education human resources, and well-trained administration staff for higher education"[9]. The important question that arises, here: are students willing to adopt learning through the e-learning platform? To find the solution to this question, the researcher will study the attitude of university students towards e-learning. India is a multifaceted country, each state and family preserves cultural and demographic values with immense care. Due to that, there are many dissimilar exists among the learners, this is an alarming situation too. Understanding the learner's demographic profile, characteristics and





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perspective is useful for practitioners to move forward and develop effective online delivery. As rightly pointed by Kar et.al., the problems of demographic dimensions are universal, but they are more implicative in the developing countries than in the advanced states[10]. Up to date research studies in E-learning focused on studying the perception towards E-learning and the impact of demographic variables such as gender, residential background, social category, age, type of institution, stream and year of study, occupation and grade points on e-learning of all the stages of education. Many researchers found students from colleges and universities having a positive attitude towards e-learning though studies also reported students negative attitudes towards online learning regardless of gender, age, academic years, education level, marital status, place of residence, internet/computer facility at home and activities, experience with the devices for e-learning. Keeping this in view, many studies were conducted to know the gender variation in e-learning. Numerous studies confirmed gender variation exists and plays a crucial effect on perceptions towards e-learning. On the other hand, several types of research were conducted to measure the influence of computer skills (experience, training, access, and frequency) on e-learning attitudes. The past studies confirmed computer skills and experience to work with specific technologies and web applications in an educational context are a significant predictor of their attitude towards online learning [11-16].

Furthermore, very few studies conducted to know the interaction effect of independent variables, system quality, and information quality. One among them conducted by Jan and Mattoo found the interactions of selected demographic variables on dimensions of attitude towards e-learning. The study revealed research scholars from the urban area and scholars from the social science field were found to have more e-learning interest than those from the rural area science field. Male research scholars from rural areas found the usefulness of e-learning more than those of female research scholars from the same area. The research scholars from social science felt considerably higher ease of e-learning than those of the art research fellow [17]. Moreover, the study revealed that the following factors can be used in modelling students' attitude to adopt e-learning are interest [18], intention toward e-learning, perceived usefulness of e-learning, and perceived ease of e-learning use [19-22], e-learning confidence[23], pressure to use e-learning and the availability of resources. Past researches attempted to identify determinants and suitable approaches to measure the success of e-learning. The studies also confirmed student satisfaction and readiness as a significant indicator that acts as a key factor and decision-directly link to students' experience to continue the service in the future or not, therefore it is important to research student's satisfaction with e-learning [19,20,24,25].

To understand the efficiency of e-learning technologies, since users are normally subjected to local norms, it should be locally measured [26]. Therefore, the study was undertaken with a major aim to examine the Tezpur University student's attitude on e-learning and its dimensions. In much of the literature, researchers explore the demographic characteristics associated/influences on e-learning adoption and very few recent researches have started concentrating on the need for isolated variables, computer self-efficacy, technical abilities, and confidence in e-learning. The review of literature enumerated exhibits only very few studies that were conducted to explore the interaction effects of variables on attitude towards dimensions of e-learning. Socioeconomic characteristics like level of education, other psychological factors, and a learner's level of technology satisfaction are not much considered in research. The literature review gives a picture that there is a rareness of research conducted to study the interaction effect between education level, technical abilities, and student's satisfaction in e-learning of university students on attitude towards e-learning dimensions. So the researcher wishes to fill this void by doing research of this nature.

RESEARCH OBJECTIVES

The current study seeks to achieve the following goals:

- To investigate the patterns of university students attitude towards overall e-learning and its dimensions.
- To study the interaction effect between education levels, technical abilities, and students' satisfaction on the interest dimension of e-learning attitude among university students.
- To study the interaction effect between education levels, technical abilities, and students' satisfaction on the usefulness dimension of e-learning attitude among university students.



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- To study the interaction effect between education levels, technical abilities, and students' satisfaction dimension of e-learning attitude among university students.
- To study the interaction effect between education levels, technical abilities, and students' satisfaction on confidence dimension of e-learning attitude among university students.
- To study the interaction effect between education levels, Technical abilities, and students satisfaction on overall e-learning attitude among university students.

RESEARCH HYPOTHESES

In line with the above objectives research hypotheses were formulated

- The university student's attitude towards overall e-learning and its dimensions is not average.
- There is no significant interaction effect between education levels, technical abilities, and students' satisfaction on the interest dimension of e-learning attitude among university students.
- There is no significant interaction effect between education levels, technical abilities, and students' satisfaction on the usefulness dimension of e-learning attitude among university students.
- There is no significant interaction effect between education levels, technical abilities, and students' satisfaction on the ease dimension of e-learning attitude among university students.
- There is no significant interaction effect between education levels, technical abilities, and students' satisfaction on the confidence dimension of e-learning attitude among university students.
- There is no significant interaction effect between education levels, technical abilities, and students' satisfaction on overall e-learning attitude among university students.

METHODOLOGY AND RESEARCH DESIGN

In this present study, the normative survey method was adopted to collect the primary data.

POPULATION AND SAMPLE OF THE STUDY

All the students enrolled at Tezpur University and pursuing courses during 2019-2020 were considered as the population of this study. Among that, a sample of 150 students' representatives of the entire existing social class in terms of gender, residence, age group, and educational level were selected using a simple random technique.

RESEARCH INSTRUMENT USED IN THE STUDY AND SCORING SCHEME

For collecting data, the standardized "Attitude towards e-learning scale" developed by Dimpal Rani was used. This questionnaire consisted of 65 statements (both positive and negative items) with four e-learning dimensions viz., interest, usefulness, ease, and confidence. Respondents were invited to complete the survey on attitude towards e-learning. Each statement was measured using a five-point Likert scale ranging 1-5 viz., strongly agree (5), agree (4), undecided (3), disagree (2), and strongly disagree (1) for positive statement and negative item vice versa. The score ranges from 65 to 325[27]. To know the respondents' background details of demographic (gender, area of residence, age, qualification levels) and skill in handling technology (own computer possession, frequency of computer and internet use per day, technologies familiarity level related to education, and satisfaction with technology use) a personal data sheet designed by the researcher was adopted.

DATA COLLECTION PROCEDURE

The present study was confined to the university students studying at the school of arts and humanities, Tezpur University and restricted to the four dimensions of e-learning. The questionnaire was distributed among 200 students and requested to provide their responses as per instruction. The researcher assured the students that the information provided by them was only used for research purposes and kept confidential. In those 170 questionnaires were received back, out of which 20 incomplete questionnaires were removed from the analysis. Thus, for further analysis 150 sample responses were retained.



**Padmavathy****STATISTICAL ANALYSIS**

The collected data were tabulated in the Ms-Excel sheet. Based on the obtained data, analysis was done using SPSS 20.0. The analysis reveals that there are two levels of education, two groups of technical abilities, and three groups in students' satisfaction. Thus, the quantitative data were analyzed using descriptive analysis to study the significant difference between means t-ratio and, in order to investigate the interaction effect between variables 2*2*3, factorial design ANOVA was used.

DATA ANALYSIS AND INTERPRETATION

The analysis of results, findings, and interpretation are presented below under the subheading. The distribution of the sample demographic characteristics, gender, residence, age, education levels, technical abilities, time dedicated to computer/ Internet learning, and student's satisfaction with e-learning are discussed. The majority of the respondents (82.7 %) were female and 17.3 % were males respondents. The distribution of the sample according to a place of residence indicates 63.3 % were from a rural background and 35.7 % were from an urban background. Taking into consideration the respondent's age group, 80.7% of respondents' age ranges above 22 – less than 25, and 19.3% were above 25 – less than 27. In the same vein, the distributions of the sample according to a place of education level indicate 59.3% were undergraduates and 40.7 % were postgraduates. Similarly considering technical abilities indicates 17.3 % were from the high technical abilities group and 82.7 % were from the average technical abilities group and considering students level of satisfaction on e-learning indicates 14.7 % were from the below-average satisfaction group; 28.7 % were from the average satisfaction group and 56.7 % were from high satisfaction group. Finally, time dedicated to the computer/Internet for learning was also considered. 35.3 % percentage of respondents spent less than 2 hours; 32.8 percentages of respondents spent more than 2 – 3 hours and 32.7% of respondents spent 4 – 5 hours for learning.

H1: The university student's attitude towards overall e-learning and its dimensions is not average.

To verify hypothesis 1, cut off point mean $\pm 1\sigma$ was established. It is classified as students having scored less than mean - 1σ as unfavourable attitude, scored between mean + 1σ and mean - 1σ was having moderately favourable attitude and scored more than mean + 1σ was having a favourable attitude towards e-learning and its dimensions. As indicated in Table 1 and Figure 1, university students more than 70% in the e-learning dimensions and more than 55% in overall e-learning attitude showed a moderately favourable attitude towards e-learning. Hence, it can be said the university student's attitude towards e-learning and its dimensions was moderate.

H2: There is no significant interaction effect between education levels, Technical abilities, and student satisfaction on the interest dimension of e-learning attitude among university students.

As apparent from Table 2, that the obtained p-value of education level ($p=0.47$); technical abilities (0.66) interaction between education level and technical abilities ($p=0.70$); interaction between education level and students satisfaction in e-learning ($p=0.44$); interaction between education level, technical abilities, and students satisfaction in e-learning ($p=0.34$) which are not significant. While student satisfaction in e-learning ($p=0.01$); interaction between technical abilities and students satisfaction in e-learning ($p=0.02$) which were significant at 0.05 level. So there was no influence of education level; technical abilities; interaction between education level and technical abilities; interaction between education level and student satisfaction; interaction between education level, technical abilities, and student's satisfaction on e-learning interest among university students. Thus, the null hypothesis that there is no significant interaction between education level, technical abilities, and student's satisfaction with e-learning, on the interest dimension of e-learning among university students was partially rejected. So it can be concluded that there was a significant influence on student's satisfaction with e-learning, the interaction between technical abilities, and student's satisfaction with e-learning in the interest dimension of e-learning attitude.

Data analysis results revealed that undergraduate and post-graduate students were found to have the same extent of attitude towards the interest dimension of e-learning. Comparing the mean score shows postgraduate students show more interest in e-learning than undergraduate students. In line with these findings, there was no significant



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difference found in the interest dimension of e-learning attitude between students having average and high technical abilities, $t(148) = 1.189$, $p = 0.237$. There was a difference in the mean score of interest dimension of e-learning attitude among average and high technical abilities groups. That is, the mean of interest dimension of the e-learning score for the average technical abilities group ($M = 44.34$, $SD = 4.84$) is higher than the high technical abilities group ($M = 43.09$, $SD = 4.87$). It may, therefore, be said those students of the average technical abilities group found e-learning more interesting than the high technical abilities group counterparts.

Further to learn which level of student satisfaction made a significant effect on the interest dimension of e-learning attitude; Tukey's HSD post hoc analysis was employed. The test results revealed the high and below-average satisfaction groups differ from the average satisfaction groups in the interest dimension of e-learning attitude. The mean plots of estimated marginal means for the interest dimension of e-learning attitude in Figure 2 also show this presence of interaction. From Figure 2, it can be seen that university students from below average and the average level of satisfaction group having high and average technical abilities responded similarly. The above result suggests that both the below average and average level of satisfaction group having high technical abilities found e-learning to be more interesting than those students having average technical abilities. On the other hand, students from the high level of satisfaction group having high technical abilities do not find e-learning to be more interesting than those students having average technical abilities. In other words, students having a high level of satisfaction with average technical abilities found e-learning to be more interesting than those of the high technical abilities group. Based on the results presented above, it can be concluded there was a significant difference between the below-average and average level of satisfaction groups having high technical abilities and high levels of satisfaction groups having average technical abilities in the e-learning interest attitude.

H3: There is no significant interaction effect between education levels, Technical abilities, and students' satisfaction on the usefulness dimension of e-learning attitude among university students.

As apparent from Table 3, that the obtained p-value of education level ($p=0.39$); technical abilities (0.94) interaction between education level and technical abilities ($p=0.22$); education level and students satisfaction in e-learning ($p=0.48$); interaction between education level, technical abilities, and students satisfaction in e-learning ($p=0.82$) which are not significant. While students satisfaction in e-learning ($p=0.02$); technical abilities and students satisfaction in e-learning ($p=0.02$) were significant at 0.05 level. So there was no influence of education level; technical abilities; interaction between education level and technical abilities; interaction between education level and students satisfaction; interaction between education level, technical abilities, and students' satisfaction on e-learning usefulness among university students. Thus, the Null hypothesis that there is no significant interaction between education level, technical abilities, and student's satisfaction with e-learning, on the usefulness dimension of e-learning among university students was partially rejected.

Data analysis results revealed that undergraduate and post-graduate students were found to have the same extent of attitude towards the useful dimension of e-learning. Comparing the mean score shows postgraduate students show more usefulness in e-learning than undergraduate students. In line with these findings, there was no significant difference in the usefulness dimension of e-learning attitude between students having average and high technical abilities, $t(148) = 1.015$, $p = 0.312$. There was a difference in the useful dimension of e-learning attitude mean score with the perceived average and high technical abilities groups. That is, the mean of the useful dimension of e-learning score for the average technical abilities group ($M = 93.46$, $SD = 8.29$) was higher than the high technical abilities group ($M = 91.46.09$, $SD = 9.30$). It may, therefore, be said that students of the average technical abilities group found e-learning to be more useful than the average technical abilities group counterparts. Further to learn which level of student's satisfaction made a significant effect on the usefulness dimension of e-learning attitude Tukey's HSD post hoc analysis was employed. The test results revealed the three levels of satisfaction groups do not have significant mean differences. Therefore, it can be revealed that all three levels of satisfaction groups have the same influence on the attitude towards the usefulness dimension of e-learning. The mean plots of estimated marginal means for the usefulness dimension of e-learning attitude in Figure 3 also show the presence of interaction.



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From Figure 3, it can be seen that university students from below the average and average level of satisfaction group having high technical abilities found e-learning to be more useful than those students having average technical abilities. Students associated with average satisfaction groups having average technical ability found e-learning more satisfactory than high technical ability groups. On the other hand, students from a high level of satisfaction group having high technical abilities do not find e-learning to be more useful than those students having average technical abilities. In other words, students from a high level of satisfaction group having average technical ability found e-learning more useful than a high technical ability group and having a high satisfaction level. In an average satisfaction group, no remarkable difference is seen in e-learning useful among average and high technical abilities groups. Based on the results presented above, it can be concluded there was a significant difference between the below-average and average level of satisfaction groups having high technical abilities and high level of satisfaction groups having average technical abilities in the e-learning useful attitude.

H4: There is no significant interaction effect between education levels, Technical abilities, students' satisfaction, and ease dimension of e-learning attitude among university students.

As apparent from Table 4, that the obtained p-value of education level ($p=0.31$); technical abilities (0.98) as students satisfaction in e-learning ($p=0.31$); interaction between education level and technical abilities ($p=0.14$); education level and students satisfaction in e-learning ($p=0.97$); technical abilities and students satisfaction in e-learning ($p=0.17$) interaction between education level, technical abilities, and students satisfaction in e-learning ($p=0.94$) which were not significant at 0.05 level. So there was no influence of education level; technical abilities; students satisfaction in e-learning; interaction between education level and technical abilities; interaction between education level and students satisfaction; interaction between education level, technical abilities and students satisfaction in e-learning; Technical abilities and Students Satisfaction on e-learning ease among university students. Thus, the null hypothesis that there is no significant interaction between education level, technical abilities, and student's satisfaction with E-learning, on the ease dimension of e-learning among university students was not rejected. It may be therefore said that the university students were found to possess the ease dimension of e-learning attitude to the same extent irrespective of education levels, technical abilities, and students' satisfaction in e-learning.

H5: There is no significant interaction effect between education levels, Technical abilities, students' satisfaction, and confidence dimension of e-learning attitude among university students.

As apparent from Table 5, that the obtained p-value of education level ($p=0.44$); technical abilities (0.25) interaction between education level and technical abilities ($p=0.25$); education level and students satisfaction in e-learning ($p=0.39$); interaction between education level, technical abilities, and students satisfaction in e-learning ($p=0.99$) which were not significant. While students satisfaction in e-learning ($p=0.02$); technical abilities and students satisfaction in e-learning ($p=0.03$) were significant at 0.05 level. So there was no influence of education level; technical abilities; interaction between education level and technical abilities; interaction between education level and student satisfaction; interaction between education level, technical abilities, and student's satisfaction on e-learning ease among university students. Thus, the null hypothesis that there is no significant interaction between education level, technical abilities, and student's satisfaction with E-learning, on the confidence dimension of e-learning among university students was partially rejected.

Data analysis results revealed that undergraduate and post-graduate students were found to have the same extent of attitude towards the confidence dimension of e-learning. Comparing the mean score shows postgraduate students show more ease in e-learning than undergraduate students. In line with these findings, there was no significant difference in the confidence dimension of e-learning attitude between students having average and high technical abilities, $t(148) = 1.507$, $p = 0.134$. There was a difference in the confidence dimension of the e-learning attitude mean score with the average and high technical abilities groups. That is, the mean confidence dimension of the e-learning score for the average technical abilities group ($M = 41.92$, $SD = 4.849$) was higher than the high technical abilities group ($M = 40.3409$, $SD = 4.85$). It may, therefore, be said those students of the average technical abilities group were found to be more confident in E-learning than average technical abilities group counterparts. Further, to learn which



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level of student satisfaction made a significant effect on the confidence dimension of e-learning attitude, Tukey's HSD post hoc analysis was employed. The test results revealed the three levels of students' satisfaction groups have significant differences. Therefore, it can be revealed all three levels of satisfaction groups have the same influence on the attitude towards the confidence dimension of e-learning. None of the three satisfaction groups was more influential than the others. The mean plots of estimated marginal means for the usefulness dimension of e-learning attitude in Figure 4 also show the presence of interaction. From Figure 4, it can be seen that university students from the below-average level of satisfaction group having average technical abilities were found to possess more confidence in e-learning than those students having high technical abilities. It can be seen that students having an average level of satisfaction slopes decline and that for the average technical abilities group. In the case of the average satisfaction group, students having average technical abilities, there is a sharp decline in the e-learning confidence. It may, therefore, be said that students associated with the average satisfaction group have higher technical abilities and possess higher confidence in e-learning than those of their counterparts. On the other hand, students from a high level of satisfaction group having high technical abilities do not find many benefits or do not gain confidence in e-learning. There was a sharp increase in the confidence in e-learning for the high satisfaction group with average technical ability. It can be said students having high satisfaction with average technical ability found more confidence than the high technical ability group and having a high satisfaction level. Based on the results presented above, it can be concluded there was a significant difference between the below average and high level of satisfaction groups having average technical abilities and the average level of satisfaction group having high technical abilities in the e-learning confidence attitude.

H6: There is no significant interaction effect between education levels, Technical abilities, student satisfaction, and overall e-learning attitude among university students

As apparent from Table 6, that the obtained p-value of education level ($p=0.47$); technical abilities (0.66) interaction between education level and technical abilities ($p=0.70$); education level and students satisfaction in e-learning ($p=0.44$); interaction between education level, technical abilities, and students satisfaction in e-learning ($p=0.34$) which were not significant. While students satisfaction in e-learning ($p=0.01$); technical abilities and students satisfaction in e-learning ($p=0.02$) were significant at 0.05 level. So there was no influence of education level; technical abilities; interaction between education level and technical abilities; interaction between education level and students satisfaction; interaction between education Level, Technical abilities, and Students Satisfaction on e-learning overall among university students. Thus, the null hypothesis that there is no significant interaction between education level, technical abilities, and student's satisfaction with E-learning, on the overall dimension of e-learning among university students was partially rejected. Data analysis revealed that undergraduate and post students were found to have the same extent of attitude towards overall e-learning. Comparing the mean score shows students having average technical abilities are better than students having high technical abilities in overall e-learning.

Data analysis results revealed that undergraduate and post-graduate students were found to have the same extent of attitude towards overall e-learning. Comparing the mean score shows postgraduate students show a higher attitude towards e-learning than undergraduate students. In line with these findings, there was no significant difference in the overall e-learning attitude between students having average and high technical abilities, $t(148) = 1.240, p = 0.217$. There was a difference in the overall e-learning attitude mean score with the average and high technical abilities groups. That is, the mean overall e-learning score for the average technical abilities group ($M = 231.46, SD = 19.30$) was higher than the high technical abilities group ($M = 236.22, SD = 19.62$). It may therefore, be said those students of the average technical abilities group were found to be more beneficial in overall E-learning than average technical abilities group counterparts. Further, to learn which level of student satisfaction made a significant effect on overall e-learning attitude, Tukey's HSD post hoc analysis was employed. The test results revealed the three levels of satisfaction groups do not have significant differences in their mean differences. Therefore, it can be revealed all three levels of satisfaction groups have the same influence on the attitude towards overall e-learning. None of the three satisfaction groups was more influential than the others. The mean plots of estimated marginal means for overall e-learning attitude in Figure 5 also show the presence of interaction.



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From Figure 5, it can be seen that university students from the below-average level of satisfaction group having high technical abilities were found to possess more attitude towards e-learning than those students having average technical abilities. In the case of the average satisfaction group, students having high technical abilities possess more attitudes towards e-learning than those students having average technical abilities. It may, therefore, be said that students associated with average technical abilities and average satisfaction group possess lower attitude in E-learning than those of high technical abilities group. On the other hand, it can be seen that students having a high level of satisfaction and average technical abilities possess a higher attitude in e-learning than in the high technical abilities group. Based on the results presented above, it can be concluded there was a significant difference between the below-average and average level of satisfaction groups having high technical abilities and high level of satisfaction groups having average technical abilities in the overall e-learning attitude.

FINDINGS OF THE STUDY

Undoubtedly, e-learning has high potential and e-learning implementation enhances the student's knowledge as well as brings an unpredictable change in the higher education sector. To tackle the Covid -19 pandemic situation influence in the education sector all over the world education institutions, particularly higher education universities suddenly started offering their courses through e- mode. The sudden shift from on-campus learning to off-campus mode raised concerns about the quality of education. On one hand, scientific innovation facilitates new learning environment; on the other hand, sudden transmission brings psychological as well as technical difficulties among the students. Therefore, to ensure the impacts on learners, successful e-learning implementation, effective use evaluation is vital.

Recent studies claimed user's satisfaction, technical abilities, and education level are the predictors for the success of e-learning. Past researches were carried out by taking one or two predictors in their study to investigate the user's acceptance, readiness, and success of e-learning. The researcher has not come across any study by taking all the predictors in single research to know the effectiveness of e-learning on the receiver. To know efficiency and user satisfaction towards e-learning among university students at Tezpur University, it has to be locally measured. In addition to that, the study also examined the interaction effect between education levels, technical abilities, and students' satisfaction on e-learning attitude among university students.

The findings revealed the majority of the university students have a moderately favourable attitude on e-learning interest, e-learning usefulness, ease of e-learning, e-learning confidence, and overall e-learning. There was no influence of education level on e-learning interest, e-learning usefulness, e-learning confidence, and overall attitude towards e-learning among university students. These findings contradict the findings that there is an influence in the educational level and satisfaction level on attitude towards e-learning [18] among university students. There was no influence of education level; technical abilities; interaction between education level and technical abilities; interaction between education level and students satisfaction; interaction between education level, technical abilities and student's satisfaction on e-learning interest, e-learning usefulness, e-learning confidence, and overall attitude towards e-learning among university students. But there is a significant influence on student's satisfaction, the interaction between technical abilities and student's satisfaction in e-learning interest, e-learning usefulness, e-learning confidence, and overall attitude towards e-learning among university students. The university students were found to possess the same extent of attitude in e-learning and its dimensions irrespective of education levels and technical abilities. Postgraduate students show a high attitude towards e-learning and its dimensions than undergraduate students. Graduates having average technical abilities group are better than high technical abilities in e-learning and its dimensions. Though the results revealed students' satisfaction groups have significant differences(except ease of e-learning), all the three-level satisfaction groups (below average, average and high) have the same level of influence on the attitude towards interest, usefulness, ease, confidence, and overall attitude towards e-learning. None of the three satisfaction groups is more influential than the others.



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Graduates having a high level of satisfaction and average technical abilities found e-learning more interesting, useful, and confident than high technical abilities group counterparts. There was a significant difference between the below-average and average level of satisfaction groups having high technical abilities and high level of satisfaction groups having average technical abilities in the e-learning interest, e-learning useful, and overall e-learning attitude. These results are in consonance with the findings of Jan and Mattoo and Suri and Sharma. On the other hand, there was a significant difference between the below average and high level of satisfaction groups having average technical abilities and the average level of satisfaction group having high technical abilities in the e-learning confidence attitude.

CONCLUSION

In today's world, the role of e-learning technologies in education is becoming more and more popular among the young generation, and the importance will continue to grow in the future. The use of technology in education tends to more student-centered learning settings in the higher education sectors. The development of e-learning cherishes the individual's life, improves user-friendliness, augments flexible communication and helps to collaborate with diversified group members in the world. It helps individuals to enhance their capacity. Though e-learning is an effective medium of imparting education to learners from a distance in a pandemic situation, its practical use in India has not gained much popularity till now. At the same time, understanding e-learning emergence in the present situation, the proper understanding of student's satisfaction and implementation in the higher education sector lead to the potential success of e-learning. The realization of the strengths and limitations from the student's perspectives will provide an efficient, applicable, and viable solution to the challenges faced by educational society. The findings of the study clearly stated students who participated in the study showed a moderately favourable attitude towards e-learning and its four dimensions. Understanding the learner's perception of the e-learning portal and the influence of variables like education levels, technical abilities, and students' satisfaction on dimensions of e-learning attitude among university students gives the policymakers, teachers, and administrators the opportunity to plan a successful e-learning portal and implement it for uplifting the skills of students.

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Table 1: Descriptive statistics of samples responses towards e-learning and its dimensions

E-learning and its dimensions	Mean	S.D	Unfavourable %	Moderately Favourable %	Highly favourable %
E- learning interest	43.3	4.9	12.7	73.3	14
E- learning usefulness	91.8	9.14	11.3	74.7	14
Ease of e- learning	51.5	7.07	8	78.7	13.3
E- learning confidence	40.6	4.86	18	70	12
Overall e- learning attitude	227.13	19.6	18.7	59.3	22





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Source of variation	Type III Sum of Squares	df	Mean Square	F	Sig.
Education Level (A)	12.31	1	12.31	0.52	0.470
Technical abilities (B)	4.51	1	4.51	0.19	0.661
Students Satisfaction with E-learning (C)	204.31	2	102.16	4.36	0.015
A * B	3.39	1	3.39	0.14	0.704
A * C	37.72	2	18.86	0.80	0.449
B * C	183.31	2	91.65	3.91	0.022
A * B * C	49.72	2	24.86	1.06	0.349
Error	3232.02	138	23.42		
Total	284955.000	150			
Corrected Total	3548.273	149			

Source of variation	Type III Sum of Squares	df	Mean Square	F	Sig.
Education Level (A)	61.649	1	61.64	0.74	0.39
Technical abilities (B)	0.447	1	0.44	0.00	0.94
Students Satisfaction with E-learning (C)	641.04	2	320.52	3.86	0.02
A * B	122.68	1	122.68	1.47	0.22
A * C	122.18	2	61.09	0.73	0.48
B * C	612.18	2	306.09	3.69	0.02
A * B * C	31.77	2	15.88	0.19	0.82
Error	11444.08	138	82.92		
Total	1276725	150			
Corrected Total	12455.39	149			

Source of variation	Type III Sum of Squares	df	Mean Square	F	Sig.
Education Level (A)	53.10	1	53.10	1.02	0.31
Technical abilities (B)	0.024	1	0.02	0.10	0.98
Students Satisfaction with E-learning (C)	120.37	2	60.18	1.16	0.31
A * B	109.23	1	109.23	2.11	0.14
A * C	2.997	2	1.49	0.02	0.97
B * C	184.082	2	92.04	1.78	0.17
A * B * C	6.344	2	3.17	0.06	0.94
Error	7122.62	138	51.61		
Total	406737	150			
Corrected Total	7456.19	149			





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Table 5: Summary of 2X2X3 Factorial Design Results – for confidence dimension of E-learning attitude

Source of variation	Type III Sum of Squares	df	Mean Square	F	Sig.
Education Level (A)	13.52	1	13.52	0.58	0.44
Technical abilities (B)	29.93	1	29.93	1.29	0.25
Students Satisfaction with E-learning (C)	174.19	2	87.09	3.75	0.02
A * B	30.68	1	30.68	1.32	0.25
A * C	43.19	2	21.59	0.93	0.39
B * C	161.38	2	80.69	3.48	0.03
A * B * C	0.47	2	0.23	0.01	0.99
Error	3197.80	138	23.17		
Total	251031	150			
Corrected Total	3533.34	149			

Table 6: Summary of 2X2X3 Factorial Design Results –Overall Attitude

Source of variation	Type III Sum of Squares	df	Mean Square	F	Sig.
Education Level (A)	555.38	1	555.38	1.471	0.22
Technical abilities (B)	63.204	1	63.204	0.167	0.68
Students Satisfaction with E-learning (C)	3653.75	2	1826.87	4.840	0.01
A * B	561.85	1	561.85	1.488	0.22
A * C	221.66	2	110.83	0.294	0.74
B * C	3304.21	2	1652.10	4.377	0.01
A * B * C	106.91	2	53.45	0.142	0.86
Error	52092.02	138	377.47		
Total	7795722	150			
Corrected Total	57289.33	149			

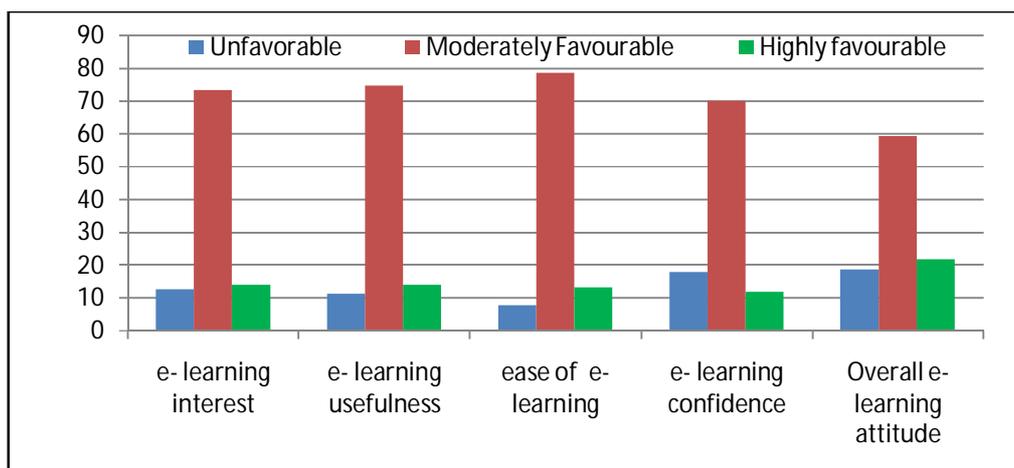


Figure 1: Bar graph showing the samples responses towards e-learning and its dimensions





Padmavathy

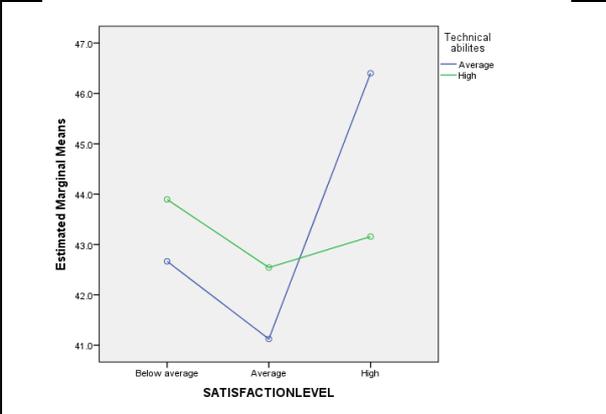


Figure 2: Means plot of estimated marginal means for interest dimension of e- learning attitude

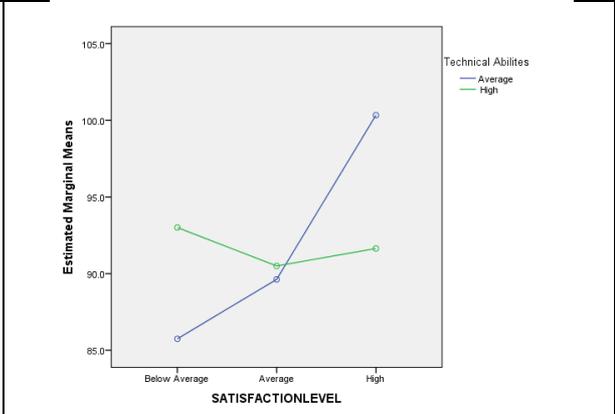


Figure 3: Means plot of estimated marginal means for usefulness dimension of e- learning attitude

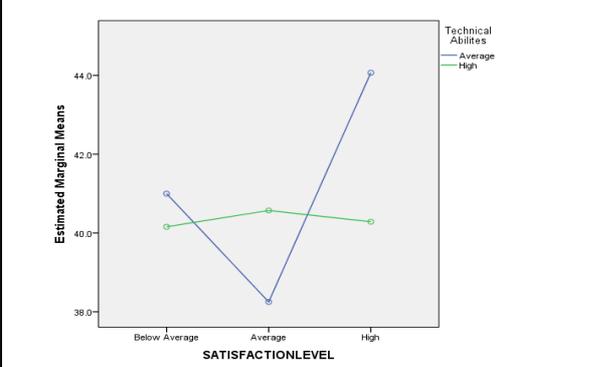


Figure 4: Means plot of estimated marginal means for confidence dimension of e- learning attitude

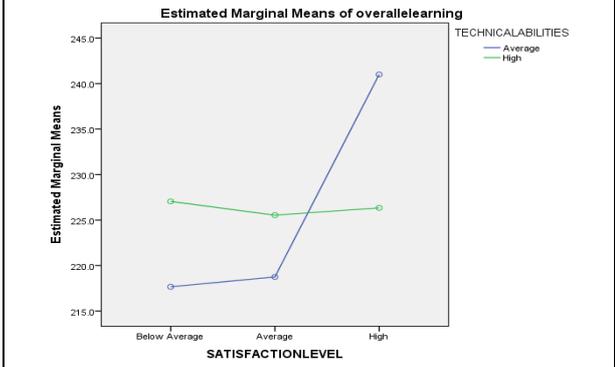


Figure 5: Means plot of estimated marginal means for overall e- learning attitude





High Dilutions of Drugs Show Distinct Variation from Each Other in their Electronic Spectra

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ABSTRACT

Drugs at high dilution (HD) produce therapeutic effect on man, animals and plants. Experimental evidence shows that free water molecules and hydrogen bond strength of OH groups constitute the physical basis of HDs which are otherwise devoid of original drug molecules. HDs are produced in aqueous EtOH by serial dilution of a substance with mechanical agitation or succussion in each step, and are called potencies. Three potencies 6 cH, 12 cH and 30 cH of two drugs *Anacardium orientale* and *Natrum muriaticum* (NaCl) and their mother tincture (MT) are used in this study. Electronic spectra of these MTs and potencies, all in 90% EtOH, were taken in the wavelength region of 190 nm – 350 nm. The objective is to find out any additional physico-chemical entities in potencies besides the aforesaid two factors. It was reported earlier that charge transfer (CT) interaction accompanies potentization of drugs. This study focused on the CT interaction. The results indicate that spectral pattern and absorbance intensities of the test samples vary from each other. Potentization involves CT interaction in consecutive potencies. Water and EtOH do not form a homogeneous mixture and have aggregates of EtOH and water molecules. CT interactions occur in these individual aggregates and are mostly inter molecular within EtOH or water. These aggregates vary from each other in the test samples. It is concluded that water and EtOH aggregates and their relative distribution constitute additional physico-chemical basis of potencies.

Keywords: High dilution, Electronic Spectra, Water, Ethanol, Charge Transfer.



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INTRODUCTION

High dilutions (HD) of a drug, used in homeopathy, are prepared by diluting the drug with aqueous ethanol 1 : 100 followed by systematic mechanical agitation or succussion through a fixed number of successive steps like 6,12,30,200,1000 etc. Depending on the number of steps used these HDs are designated as potencies such as 6cH, 12cH, 30cH etc; obviously the dilutions of the 12th potency is 10²⁴. This means 12cH and higher potencies have crossed the Avogadro number, and are expected to have no original drug molecules. According to Hahnemann (1833a; 1833b) drugs and their potencies differ from each other with respect to their therapeutic effect. The potentized drug can produce specific biological effect on man, animals and plants (Sukul and sukul, 2004; Sukul *et al.*, 2001). Since the potencies produce characteristic biological effects they must carry some distinct physicochemical entities. But standard chemical analysis shows that all potentized drugs are composed of ethanol and water. The objective of the present study is to find out difference in potencies of different drugs and the cause of variation. We have already observed differences of potencies of some drugs by their NMR and FTIR spectra, Differential Scanning Calorimetry (DSC) and Thermogravimetry (Chakraborty *et al.*,2014; Sarkar *et al.*,2016; Konar *et al.*,2016; Mondal *et al.*, 2020). The difference refers to free water molecules and hydrogen bond strength of OH group. In this study potentized drugs were analysed by their electronic spectra. Sukul (1999) reported that serial dilution and succussion involve charge transfer (CT) interaction. In this study we focused on this aspect too. CT can be intermolecular or intra-molecular. In the latter case a charge is redistributed in the excited molecule resulting in a very large excited state dipole moment (Eisenthal, 1983).

MATERIALS AND METHODS

Drugs

Drugs and their potencies tested for electronic spectra are as follows-

Anacardium orientale- θ (MT), 6cH, 12cH, 30cH

Natrum muriaticum- θ , 6cH, 12cH, 30cH

MTs and potencies of *Anacardium orientale* and *Natrum muriaticum* were prepared in our laboratory following the standard method of serial dilution and of succussion from their mother tincture. UV spectra of 5 different percentages of ethanol (90, 80, 70, 60 and 50) were taken against the background of water. Spectra of pairs of consecutive potencies like 6cH-7cH, 12cH-13cH and 30cH-31 were taken for both *Anacardium orientale* and *Natrum muriaticum*

Electronic spectra

All the potencies tested were prepared in 90% ethanol. The solvent was prepared from absolute ethanol (Merck, Germany) by adding de-ionized and distilled water (DD) to absolute EtOH in the proportion 1:9 (v/v). The solvent medium (90% EtOH) was used as a base line in all the experiments with the drug samples. Electronic Spectra were obtained in our laboratory using a UV-VIS spectrophotometer (SHIMADZU, Model-UV-VIS 1900i, Software- Lab solutions UV-VIS) at room temperature. (24 \pm 2). Spectra of all the samples were taken in the spectrum mode using the scan range 190nm-350nm, scan speed medium and data interval 0.5nm. We put the two cuvettes filled with 90% EtOH in the sample compartment to obtain the base line. After this, the sample cuvette was taken out and filled with the test sample also in 90% EtOH. The other cuvette containing only the solvent (90% EtOH) was kept there.

RESULTS

Electronic spectra of the three potencies 6cH, 12cH and 30cH and their MT are presented in figures 1-6. Fig-1 shows that the spectral pattern of the three potencies of *Natrum muriaticum* are more or less same; the spectral lines of the potencies are not parallel and show intersections. Fig-2 shows that the spectral patterns of the potencies 6cH, 12cH and 30cH of *Anacardium orientale* are different from each other and have intersections. The spectrum of 30cH shows negative absorption in the lower UV region. Fig-3 shows that the spectra of the two MTs of *Anacardium orientale* and

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Natrum muriaticum differ from each other with respect to their spectral pattern and intensity. The MTs do not intersect with each other (Fig-3). While *Anacardium orientale* θ shows very high intensity of absorption, *Natrum muriaticum* θ shows very low intensity of absorption. Fig-4 shows that the spectra of the 5percentages of EtOH run parallel with each other without any intersections. The higher is the EtOH concentration, the higher is the intensity of absorption. Fig-5a shows intersections between the spectra of *Anacardium orientale* 6cH (succussed) and 7cH (unsuccussed) at 289.21 nm and between 190 nm -200 nm. Fig-5b shows intersections between 2 spectra of *Anacardium orientale* 12cH (succussed) and 13cH (unsuccussed) at 272.38 nm and between 190 nm -200 nm. Fig-5c shows intersections between 2 spectra of *Anacardium orientale* 30cH (succussed) and 31cH (unsuccussed) at 237.93 nm, 252.2 nm, 260.91 nm and between 190 nm -200 nm. Fig-6a shows intersections between 6cH (succussed) and 7cH (unsuccussed) of *Natrum muriaticum* at 199.55 nm and lower UV region. Fig-6b shows intersections between 12cH (succussed) and 13cH (unsuccussed) of *Natrum muriaticum* at 200.55 nm and more at lower UV region. Fig-6c shows one intersection at 204.1 nm between two spectra of *Natrum muriaticum* 30cH (succussed) and 31cH (unsuccussed).

DISCUSSION

The baseline was made with 90% EtOH, and all of our drug samples were in 90% EtOH. The potencies show positive and negative absorption in the UV region. This means that the solvent (90%EtOH) in the samples contains something which has altered the absorption of incident light. Negative absorption means that the intensity of the emergent light is higher than that of the incident light. It is reported that electronic spectra of water, EtOH and chloroform show negative absorption (Ji *et al.*, 2016). According to the authors the incident light acts on the molecules of the sample which in turn produce larger energy emission. The spectral patterns of the test samples are different from each other. This indicates that the entities responsible for change in electronic transition in different potentized drugs are totally different from each other. It is evident from the results that the potentized drugs, although identical in chemical composition, have characteristic physical entities and these physical entities have arisen from the original drug molecules from which they have been prepared. The spectra of 90% ethanol and its four serial dilutions with water show gradual decrease in intensity without any intersections in the wave length region observed (Fig-4). None of the dilutions was succussed. It is noteworthy that the spectra of consecutive pairs between succussed and unsuccussed potencies show intersections at different wave lengths (Fig-5abc, 6abc). These intersections indicate charge transfer interactions (Skulski *et al.*, 1973). In our study intersections occur between succussed and unsuccussed potencies. Earlier it was observed that the charge transfer plays an important role in maintaining the specificity of homeopathic potencies (Sukul, 1999; Sukul *et al.*, 2010). In molecular complex electron of one molecule absorb a quantum of visible radiation and is excited to the vacant high energy level of the neighbouring molecule.

In electronic spectra molecules absorb or emit electromagnetic radiation due to change in their electronic arrangement vis-a-vis their electronic energy. During successive dilution the drug molecules disappear and only water molecules and ethanol molecules remain. The 90% ethanol contains three species like high graded ethanol molecules, free ethanol molecules and free water molecules (Haseba *et al.*, 1993). Both EtOH and water molecules serve as electron donor and acceptor. Homeopathic potencies 12ch onward are devoid of original drug molecules. Succussion, a systematic mechanical agitation, adds to hydrogen bond strength of OH groups primarily due to electrostatic interaction (Sarkar *et al.*, 2016; Parthasarathi *et al.*, 2006). The present experimental results show that CT interaction is a continuous process during dynamization of drug solution. The nature of the CT may vary with the type of the drugs used for preparation of potencies. Crude drugs may contain many more different atoms besides C,O,H in potencies. Structure of ethanol water solution is characterized by individual EtOH aggregates and water aggregates without a significant amount of mixed aggregates (Yoshida and Yamaguchi, 2001). In ethanol water mixture water molecules occur as hydrogen bonded clusters and strings in close packed methyl groups of EtOH with some free water molecules (Dixit *et al.*, 2002). CT may occur within the aggregates, and in that case it is mostly inter molecular of the same species. These aggregates may vary with different potentized drugs and contribute to the alteration in absorbance intensities of potencies with reference to the base line. So these aggregates are the probable physical entities in potentized drugs, and these are responsible for variation in points of intersection in the paired



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spectra. It is concluded that a potentized drug is characterized by water and EtOH aggregates in specific spatial arrangement besides hydrogen bond strength of OH group and free water molecules mentioned in the 'Introduction'. The physical entities of different potentized drugs as recorded by electronic spectra are water and EtOH aggregates in specific spatial arrangement. UV spectra of different potencies of the same drug also show variation from each other because of variation in water and EtOH aggregates. During the process of dynamization charge transfer occurs between succussed and unsuccuded dilution when a succussed potency is mixed with the unsuccussed medium (90% EtOH).

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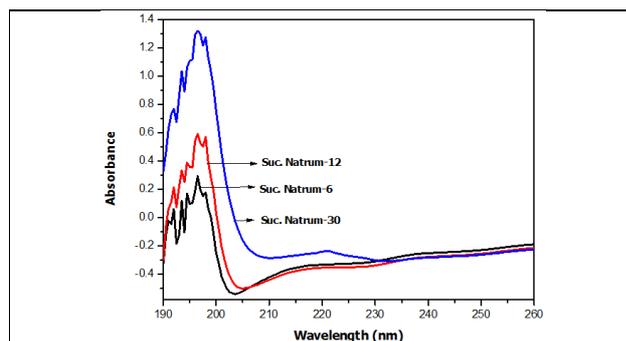


Fig. 1 Electronic spectra of three potencies 6, 12 and 30 cH of *Natrummur* prepared by serial dilution and succussion in 90% EtOH. Baseline 90% EtOH.

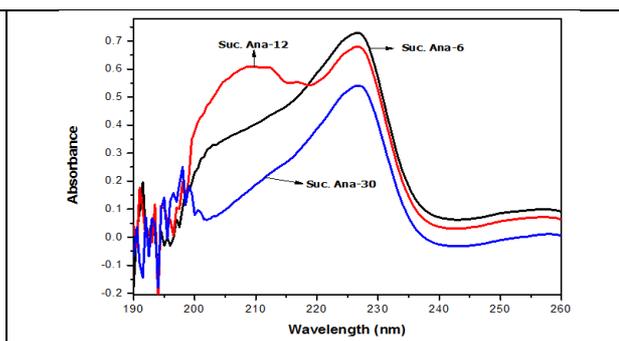


Fig. 2 Electronic spectra of three potencies 6, 12 and 30 cH of *Anacardiumorientale* prepared by serial dilution and succussion in 90% EtOH. Baseline 90% EtOH

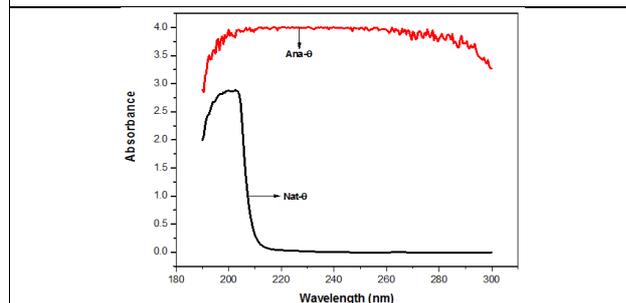


Fig. 3 Electronic spectra of *Natrummur* θ (mother tincture) and *Anacardiumorientale* θ prepared in the laboratory in 90% EtOH. Baseline 90% EtOH

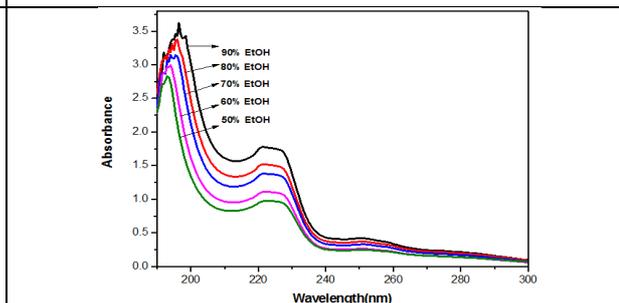


Fig. 4 Electronic spectra of 5 percentages of EtOH. Baseline distilled and de-ionized water.

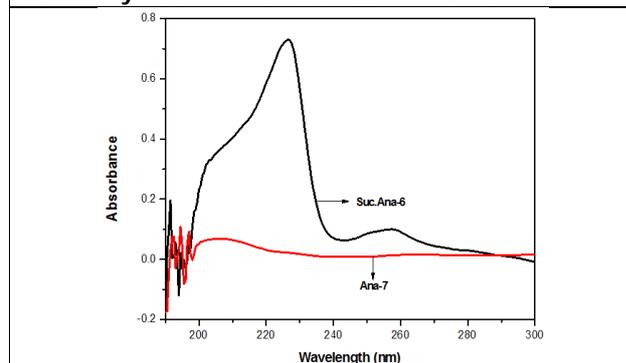


Fig. 5a Electronic spectra of two consecutive potencies 6 cH (succussed) and 7 cH (unsuccussed) of *Anacardiumorientale* in 90% EtOH. Baseline 90% EtOH.

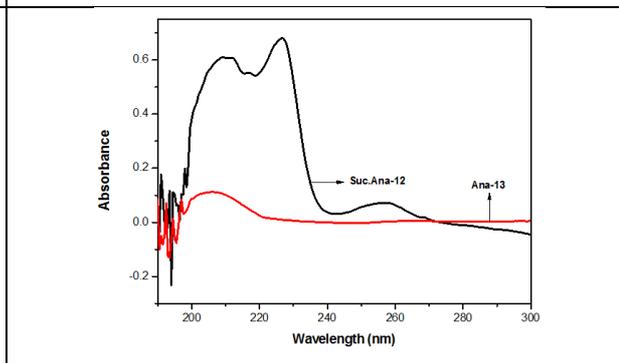


Fig. 5b Electronic spectra of two consecutive potencies 12 cH (succussed) and 13 cH (unsuccussed) of *Anacardiumorientale* in 90% EtOH. Baseline 90% EtOH.





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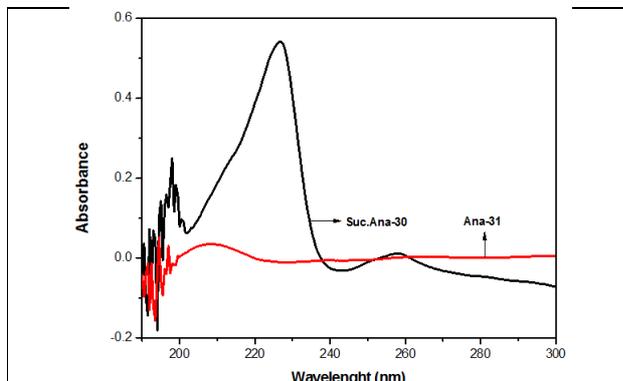


Fig. 5c Electronic spectra of two consecutive potencies 30 cH (succussed) and 31 cH (unsuccussed) of *Anacardium orientale* in 90% EtOH. Baseline 90% EtOH.

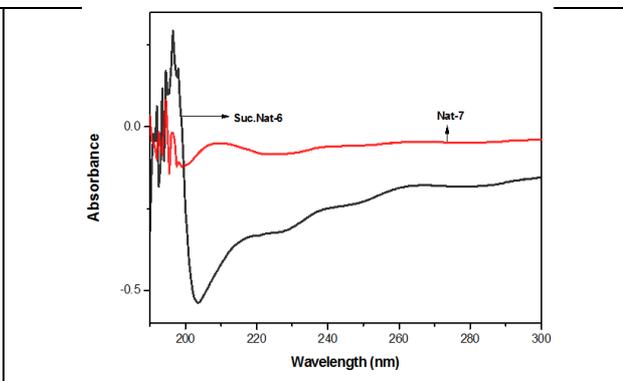


Fig. 6a Electronic spectra of two consecutive potencies 6 cH (succussed) and 7 cH (unsuccussed) of *Natrum mur* in 90% EtOH. Baseline 90% EtOH.

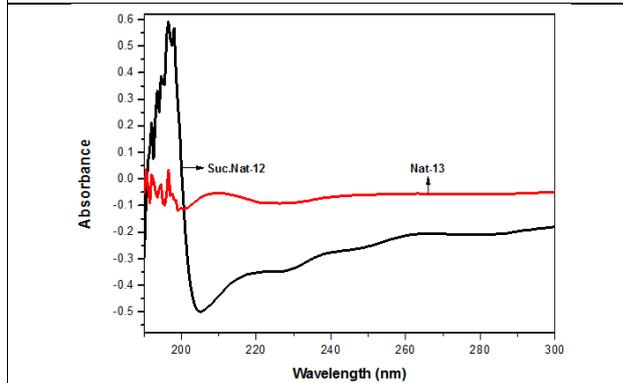


Fig. 6b Electronic spectra of two consecutive potencies 12 cH (succussed) and 13 cH (unsuccussed) of *Natrum mur* in 90% EtOH. Baseline 90% EtOH.

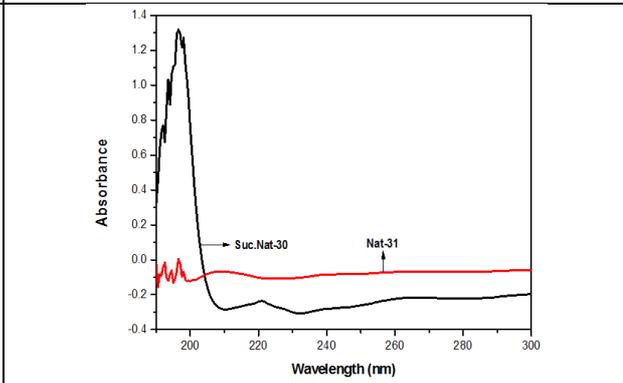


Fig. 6c Electronic spectra of two consecutive potencies 30 cH (succussed) and 31 cH (unsuccussed) of *Natrum mur* in 90% EtOH. Baseline 90% EtOH.





A Comparative Efficacy Study of Bromfenac 0.1% Vs Nepafenac 0.1% in Prevention of Cystoid Macular Edema Following Cataract Surgery- A Prospective Study

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ABSTRACT

A Prospective study was carried out in a tertiary care hospital on a comparative efficacy study of Bromfenac 0.1% and Nepafenac 0.1% in prevention of cystoid macular edema following cataract surgery (Phacoemulsification). 80 patients who underwent cataract surgery with phacoemulsification in the ophthalmology department were collected during the period of six months. A thorough literature review was done on the area to review the past work. From this study, we have concluded that Bromfenac 0.1% was found to be effective than Nepafenac 0.1% in prevention of cystoid macular edema, none of the patients who were subjected to Bromfenac 0.1% developed macular edema when compared with the use of Nepafenac 0.1%. It is considered to be safe and there was no complications were developed in patients subjected to Bromfenac 0.1% following cataract surgery.

Keywords: Cataract, Cytoid Macular Edema, Bromfenac, Nepafenac.

INTRODUCTION

The Word 'CATARACT' has been derived from the Greek word 'Katarraktes' which means 'Waterfall'. This term was coined assuming that an 'abnormal humour' developed and flowed in front of the lens to decrease the vision.

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The present definition of cataract came much later after the understanding of the lens anatomy and of the fact that normal lens is a transparent structure. Clinically, the term cataract refers to an opacification of sufficient severity to impair the vision(1). The World Health Organization (WHO) estimates that there are 20 million people blinded by cataract, which is approximately 51% of all blindness. It has been estimated that the cost of blindness in India is more than four billion dollars every year. Approximately half of this cost is due to cataract. The cataract surgical rate is a simple measure of the delivery of cataract surgery to a population.

Surgical intervention to remove the cloudy crystalline lens is the only available treatment for cataract. Surgery for cataract has been reported for many years, with its first description, called 'couching', dating from about the fifth century before Christ. During the past century, cataract surgery techniques have evolved from Intra capsular cataract extraction (ICCE), to Extra capsular cataract extraction (ECCE), modern Phacoemulsification cataract surgery and Femtosecond Laser Assisted Cataract Surgery (FLACS).Phacoemulsification cataract surgery has developed into one of the most commonly performed surgical procedures around the world and is considered one of the most cost-effective of all health-care interventions. Modern cataract surgery has a success rate of 92% or higher, and yet cataract surgery techniques continue to evolve and improve(2).

Cystoid macular edema (CME) following cataract surgery, also known as Irvine–Gass syndrome, is a well-known cause of poor vision following uneventful cataract surgery(3)(4)(5).The incidence of clinical (symptomatic) pseudophakic cystoid macular edema (PCME) has been greatly reduced because of the advances in surgical techniques (approximately 0.1%–2.3%) including phacoemulsification and small-incision cataract surgery(6). A large retrospective study including 81,984 eyes revealed that the incidence of PCME in eyes without operative complications, diabetes, or risk factors was 1.17%(7). The incidence of clinically significant PCME peaks at approximately 5 (4–12) weeks in a healthy population. The condition is usually self-limiting, and the resolution of symptoms usually occurs within 3–12 months; it may occasionally persist and lead to permanent vision loss.

MATERIALS AND METHODS

A prospective study was carried out in department of ophthalmology over a period of six months from October to March 2020 in a tertiary care hospital of Salem district, Tamil Nadu. The patients are to be selected as per selection criteria and their consents will be taken. Data's were collected from the case sheets of medical records. All demographic data's includes mainly name, age, gender, diagnosis, treatment and follow up was also recorded. The demographic data's were recorded in the data entry form (PROFORMA) and the macular thickness and SLE findings follow up data's were studied and analysed. Out of 80 patients, 40 patients were administered with Bromfenac 0.1% and the other 40 patients were administered with Nepafenac 0.1%(8).

RESULTS AND DISCUSSION

A total of 80 cases of cataract surgery patients were collected and analyzed. The Cataract patients were classified according to their gender to know which group is more prone to the Cataract, from this 43 (54%) were male patients and 37(46%) were female patients, based on age wise evaluation, Majority of patients were affected under the age group of 51-60 which includes 15 females (18.5%) and 13 males (18.2%). This study mainly describes about the comparison of certain Nonsteroidal anti inflammatory drugs (NSAIDS) such as Bromfenac 0.1% and Nepafenac 0.1%. Macular Thickness (MT) in micron Phaco was calculated and tabulated. Patients were analysed for the type of cataract which they were affected. Among 80 cataract patients 75% were affected by Immature Cataract followed by 25% patients were affected by mature cataract. Arafath *et al*(8) study showed that males are more likely getting affected and undergoing cataract surgery.

Table 5. Analysis of Patients Based on Pre-Operative Visual Acuity: Patients were analyzed for preoperative visual acuity which is a routine part of an eye examination to read the smallest letters on a standardized chart or a card held





20 feet's away to determine whether there was a change in vision. The test was done on cataract patients; seem to have 7 as poor visual acuity(8). Table 6. Analysis of Patients Based on Post-Operative Visual Acuity: After the Cataract Surgery, the visual acuity has improved to 6/6 for 75% patients, 6/12 for 5% patients and 6/9 for 20% patients in the 3rd week when compared with 1st week Visual acuity. Figure 2. Analysis of Macular Thickness Patients Based on Post Operative: Patients were analyzed based on the Macular thickness in Post operative Cataract surgery among 40 Patients were administered Nepafenac 0.1% and 40 patients were administered Bromfenac 0.1% Frequent evaluation of Macular thickness Day 7, Day 30, Day 45 after Cataract surgery for determination of efficacy of Nepafenac 0.1 & Bromfenac 0.1%.

CONCLUSION

The comparison of patients with significant macular thickness after administered with post-operative treatment of Bromfenac 0.1% and Nepafenac 0.1% was carried out. The details were calculated among the total number of patients without significant macular thickness and number of patients with significant macular thickness after using Nepafenac 0.1% and Bromfenac 0.1%. In patients who were treated with Bromfenac 0.1% the number of patients without significant macular thickness is 60 and with significant macular thickness is 0. In patients who were treated with Nepafenac 0.1% the number of patients without significant macular thickness is 57 and with significant macular thickness are 3. This proves that the use of Bromfenac 0.1% as post-operative treatment is much effective in prevention of macular edema. From this study, we conclude that Bromfenac 0.1% was found to be effective in prevention of Cystoid macular edema as none of the patients who were subjected to Bromfenac 0.1% developed macular edema. It can be considered to be safe and no complications were developed in patients subjected to Bromfenac 0.1% following cataract surgery.

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Table 1: Analysis of Patients Based on Gender

S.No	Gender	No. of Patients (n=80)	Percentage (%)
1	Male	43	54
2	Female	37	46
Total		80	100

Table 2: Analysis of Patients Based on Age

S. No	Age in years	Male		Female	
		No. of Patients	Percentage (%)	No. of Patients	Percentage (%)
1	20-30	2	2.5	1	1.25
2	31-40	6	7.5	2	2.5
3	41-50	12	15	10	12.5
4	51-60	13	18.2	15	18.5
5	61-70	10	12.5	9	11.25
Total		43	53.7	37	46.3

Table 3: Analysis of Cataract Patients Based on Types of Cataract

S. No	Types of Cataract	Male	Female	Total No. of Patients (n=80)	Percentage (%)
1	Immature	38	22	60	75
2	Mature	9	11	20	25

Table 4: Analysis of Patients Based on the Eye Affected

S. No	Gender	Right Eye(RE)		Left Eye(LE)		Both Eye(BE)	
		No. of Patients	Percentage (%)	No. of Patients	Percentage (%)	No. of Patients	Percentage (%)
1	Male	22	27.5	12	15	7	8.7
2	Female	21	26	8	10	10	12.5
3	Total	43	53.5	20	25	17	21.5

Table 5: Analysis of Patients Based on Pre-Operative Visual Acuity

S No.	Distant Visual Acuity	No. of Patients (n=80)	Percentage (%)
1	6/60.	25	31.25
2	6/36.	19	23.7
3	6/24.	5	6.2
4	6/12.	3	3.7
5	5/60.	7	8.7
6	4/60.	6	7.5
7	3/60.	4	5
8	2/60.	4	5
9	1/60.	2	2.5
10	CFCF	0	0
11	HM.	2	2.5
12	PL+	3	4
Total		80	100





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Table 6: Analysis of Patients Based on Post-Operative Visual Acuity

S No.	Visual Acuity	Visit 1 (Week 1)		Visit 2 (Week 2)		Visit 3 (Week 3)	
		No. of Patients	Percentage (%)	No. of Patients	Percentage (%)	No. of Patients	Percentage (%)
1	6/6.	32	40	48	60	60	75
2	6/9.	28	35	24	30	16	20
3	6/12.	12	15	8	10	4	5
4	6/18.	4	5	0	0	0	0
5	6/24.	2	2.5	0	0	0	0
6	6/36.	2	2.5	0	0	0	0
8	HM	0	0	0	0	0	0
9	CFCF	0	0	0	0	0	0
Total		80	100	80	100	80	100

Table 7: Analysis of Patients Based on Drug Administration

S. No	Drug Administered	No. of Male Patients	Percentage (%)	No. of Female Patients	Percentage (%)
1	Nepafenac 0.1%	23	64	17	38.6
2	Bromfenac 0.1%	13	36	27	61.4
Total		36	100	44	100

Table 8: Analysis of Macular Thickness Patients Based on Pre - Operative

Macular Thickness	Nepafenac 0.1%	Bromfenac 0.1%	Total
249	-	3	3
250	1	1	2
251	3	7	10
252	-	4	4
253	1	5	6
254	2	7	9
255	4	1	5
256	4	4	8
257	3	1	4
258	2	1	3
259	2	2	4
260	2	-	2
261	2	1	3
262	1	-	1
263	1	-	1
264	2	-	2
265	3	-	3
266	1	2	3
267	2	-	2
268	2	-	2
269	1	1	2
270	1	-	1
Total	40	40	80





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Table 9: Analysis of Macular Thickness Patients Based on Post Operative

S.No	Age	Macular Thickness			Macular Thickness		
		Nepafenac 0.1%			Bromfenac 0.1%		
		Day 7	Day 30	Day 45	Day 7	Day 30	Day 45
1	20-30	249	260	255	247	255	247
2	40-50	250	265	258	249	260	250
3	50-60	254	266	256	252	261	252
4	60-70	256	267	259	250	260	255

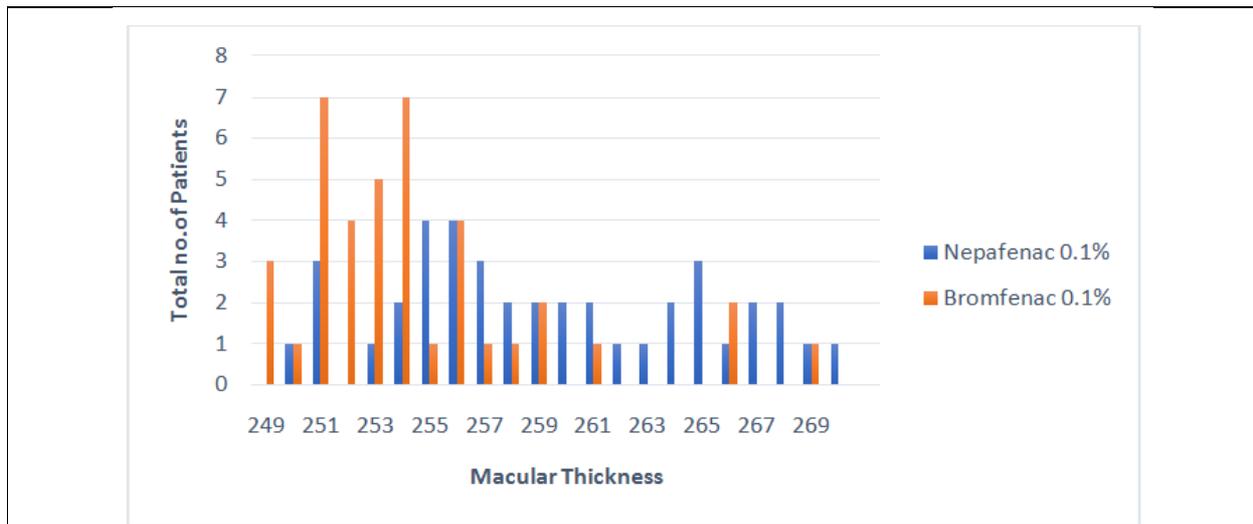


Figure 1: Analysis of Macular Thickness Patients Based on Pre -Operative

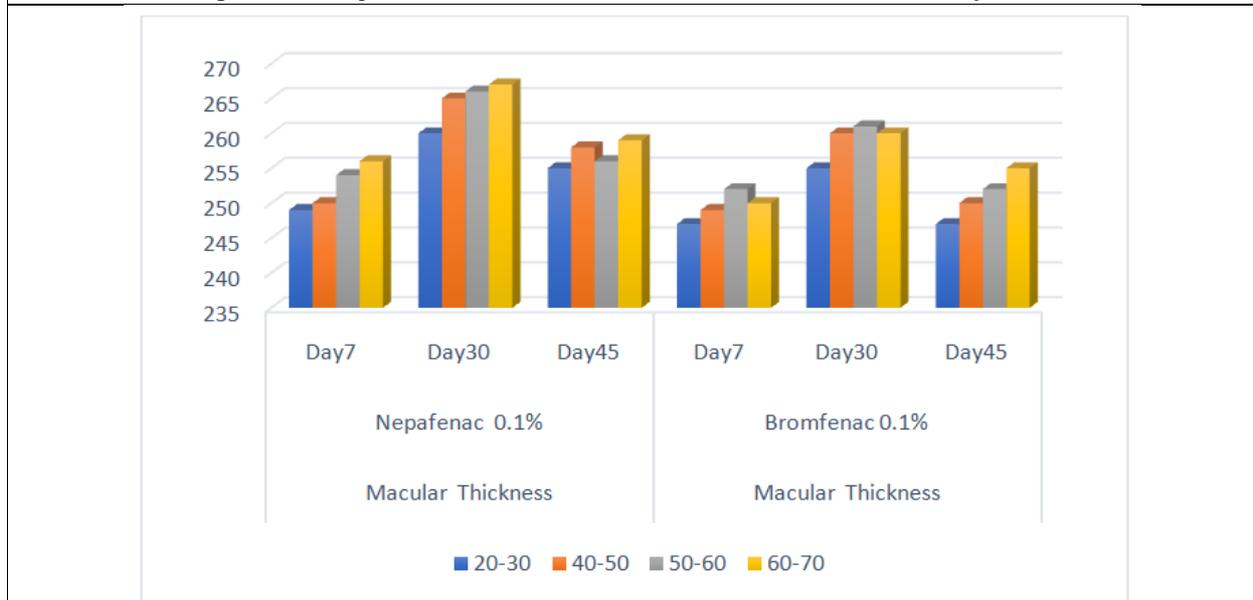


Figure 2: Analysis of Macular Thickness Patients Based on Post Operative





Organic Nutrition of *Kharif* Okra Grown at Sub Tropical Climate of Central Uttar Pradesh

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ABSTRACT

In the present investigation, the performance of *kharif* okra [*Abelmoschus esculentus* (L.) Moench] cv. Kashi Kranti was studied under different organic nutrition treatments viz. Farm yard manure (FYM), poultry manures (PM), Vermicompost (VC), Neem Cake (NC), Azotobacter (AZ) along with recommended dose of fertilizers (RDF) and without any nutrition as control treatments laid out in a randomized block design (RBD) with nine treatments replicated thrice each. The vegetative growth in terms of plant height was observed better with the application of Vermicompost, while, the effect of PM and VC was statistically *at par* for number of leaves production. It revealed that VC recorded the maximum stem diameter and number of branch per plant. VC application increased the flower production followed by poultry manure among the various organic manures resulting the highest fruit yield (per plant and per hectare) under VC treatments followed by PM treatment. Vermicompost application also improved the fruit physical and chemical qualities in respect of fruit length, diameter, weight, vitamin C. Thus, the application of vermicompost followed by poultry manure could be suggested for more production of *kharif* okra at subtropical regions like central Uttar Pradesh.

Keywords: Okra, organic manures, yield, quality, *kharif* okra.

INTRODUCTION

Supply of okra [*Abelmoschus esculentus* (L.) Moench, Family- Malvaceae] throughout the year is a challenge for growers, since, it is mostly grown as spring-summer crop at tropical and sub-tropical areas of the world. It is one of the most popular fruit vegetables which has vitamin A (88 IU), Calcium (66 mg), Potassium (103 mg), Oxalic acid (8 mg), Energy (35 KCal) per 100 g fruit and other mineral nutrients compares favorably with those in poultry, eggs and soybean [1, 2]. Apart from its use as vegetables (mostly pods are cooked), medicinal properties are associated with

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genitro-urinary disorders, spermatorrhoea and chronic dysentery. The root and stems are also used for preparing 'gur' or brown sugar [3] and seeds are used for oil extraction. The demand for its fruits increases during post monsoon period thus, the growers can earn more profit by producing okra as *kharif* crop. Although, some varieties are released as *kharif* crops but, their performance have to be standardized under different condition like manuring through organic nutrition sources and places of cultivation. Organic nutrition promotes the ecological biodiversity, biological cycles, soil health, as well as plant and human health [4]. Organic manuring may also enhances the fruit (pod) quality of okra along with reduced pest insect damage which is a major problem of *kharif* Okra production.

The presence of plant growth promoting principles like beneficial hormones, enzymes and microbes etc. beside plant nutrients improve the soil fertility and productivity. The commonly found organic sources like farm yard manures (FYM), poultry manure, vermicompost along with *Azotobacter* were used in this present experiment to see the performance of okra cv. Kashi Kranti as *kharif* crop at Lucknow subtropical condition.

MATERIALS AND METHODS

The present experiment was executed at Babasaheb Bhimrao Ambedkar University, Lucknow, Uttar Pradesh, India. The soil of experimental field was alkaline in nature (pH 8.2) and had subtropical drier climate. The different organic source of nutrients i.e. Farm yard manure (FYM), poultry manures (PM), Vermicompost (VC), Neem Cake (NC), *Azotobacter* (AZ) were applied on experimental units along with recommended dose of fertilizers (RDF) as positive control (T₁) and without manuring (WM) as control (T₀). The treatments were laid out randomly as per Randomized Block Design (RBD) with 9 treatments and 3 replications. The nutrients were applied during field preparation. Seeds of okra cv. Kashi Kranti were sown at line sowing method (45 cm × 30 cm) on 30th July 2017 due to heavy rain earlier. The agronomic practices were performed as per requirement. The required observations were noted on vegetative growth characters, flowering, fruiting, yield and fruit quality parameters and were statistically analyzed following standard method [5]. The treatments mean effects were compared with each other especially with positive and negative control at 5% level of significance.

RESULT

Plant height was found maximum in the plants treated with application of Vermicompost at 90 days after sowing (DAS), while application of poultry manure also had very good effect in increasing plant height at initial growth stages (30 to 60 DAS). Similarly, the okra plants when treated with Vermicompost and poultry manure produced the maximum leaves per plant. However, the effects were statistically *at par* to poultry manure and vermicompost however, vermicompost produced the highest number of leaves. Very close similarity was also found in case of increase in stem diameter. It was found that vermicompost application (T₄) recorded the maximum stem diameter at 30, 60 and 90 days after sowing, which were very close to the application of poultry manure (T₃) as compared to the other nutrient management practices. Vermicompost also increased number of branch per plant which has very good impact on fruiting and yield of crop. Control plants showed the lowest number of branches per plant while, poultry manure had very good response after vermicompost.

Wide variation in flowering time was also seen due to change in nutrient management practices. It was clear from Table 2 that control plants (without any nutrient application) showed a delay in flowering. Whereas, organic nutrient management (specifically T₄ and T₅) induced flowering earlier as compared to others. However, the delay in flowering due to combined application of vermicompost and FYM along with poultry manure was not clear. Among the various organic manures, vermicompost caused earliest flowering in okra, indicating early fruit harvesting for the market considering the more chance of getting higher profit. The number of flower production was counted as maximum under vermicompost (T₄) treatment at various stages of growth (30, 60 & 90 DAS) followed by poultry manure and *Azotobacter*. Although, treatment effects due to various organic nutrients was not varied significantly.



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But, control plants and even the chemical fertilizer application did not increase the flower production. The similar results also reflected on fruit production. Vermicompost also showed the maximum number of fruits per branch as well as per plant followed by application of poultry manure. The lower fruit production by chemical fertilizer is not clear. The two treatments (vermicompost and poultry manure) both caused early flowering as well as early fruiting in okra. As a result, the highest fruit yield (per plant and per hectare) was recorded under vermicompost treatments followed by poultry manure treatment. Vermicompost increased the fruit length at harvesting time while diameter of fruit was higher under chemical NPK treatment follow by poultry manure and Azotobacter application. Among the fruit quality vitamin C content was statistically *at par* due to vermicompost and poultry manure treatment.

DISCUSSION

Application of vermicompost as well as poultry manure increased the vegetative growth of okra in respect to plant height, number of leaves production, stem thickness etc. The present results are also supported by the work of Alam [6] who stated that organic amendments like vermicompost, poultry manures, cow dung, sheep manure, cake of groundnut, neem, mustard etc. improved plant height, number of branches, number of leaves. Akande et al. [7] also found that poultry manure gave better vegetative growth where applied with rock phosphate. Over all better performance by the application of organic manures might be due to the fact that it conserves soil moisture and improves nutrient utilization by the plants. Nitrogen was more quickly available from poultry manure as compared to other organic manures which suggested that other organic manures should be applied in advance. Jacobson and Swanson [8] reported that poultry manure along with other organic manures increased the availability of soil nutrients as well as biological activity of soil which might helped to increase plant height, number of leaves per leaves etc. similar observation were also reported by Yadav et al. [9] Odeleye et al. [10], Ehteshamul et al. [11], Bhadoria et al. [12].

The yield and yield attributing characters were improved significantly by the application of vermicompost and poultry manure along with FYM and RDF. Thamburaj [13] found that organically produced plants were taller with more number of branches which ultimately increased the photosynthates, yield, number of fruit per plant, average fruit weight were significantly improved by application of poultry manure, vermicompost which increased the total fruit yield of kharif okra. The high vegetative growth leading to balanced C: N ratio which increased the production of photosynthesis area and produced more food resulting more yield. Similar finding were also reported by Alkaff and Hassan [14] and El- Gamal [15].

Similar to the vegetative growth, the fruit yield and yield attributing characters were also increased significantly by the application of vermicompost and poultry manure similarly result was seen by Dademal and Dongale [16]. The fruit diameter was recorded maximum by poultry manure but the average fruit weight was estimated maximum by the application of vermicompost. The acidity was decreased by poultry manure application but improved vitamin C content followed by vermicompost, neem cake, FYM. Bahadur et al. [17] (2006) also reported that total carotenoids increased due to combined use of organic manures. Bhadoria et al.[12] found that organic manure (FYM) increased protein and mineral content in okra fruit compared to commercial chemical fertilizers which supported the findings of present study. The chemical fertilizers increased nitrogen nutrient and thereby increased acidity of fruit as reported by Maji et al. [18].

The positive influence by organic manures was also reported by Alkaff and Hassan [14] who found more sugars, vitamin C content due to organic manures. Vermicompost contains growth promoting hormones along with B group vitamins which produced better root growth than others [19] which might increase the nutrient availability and there by improved fruit quality of okra grown as kharif crop.





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CONCLUSION

The application of Farm yard manure (FYM), poultry manures (PM), Vermicompost (VC), Neem Cake (NC), *Azotobacter* (AZ) along with recommended dose of fertilizers (RDF) had a significant effect on vegetative growth, fruit yield and quality of okra (as *kharif* crop). The results revealed that okra responded well to the application of VC and PM as compared to other sources of organic manures. However, among the different sources of organic nutrients application of vermicompost had a better impact on *kharif* Okra production at subtropical areas of central Uttar Pradesh to get more profit than the *rabi* season production.

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Table 1: Effect of organic nutrition on plant height and number of leaves of okra cv. Kashi Kranti

Treatments	Plant height (cm)			Number of leaves /plant		
	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS
T ₀ - Control	30.42	110.49	124.34	6.76	31.68	36.023
T ₁ - NPK (RDF)	36.50	113.82	131.53	9.52	36.83	43.83
T ₂ - FYM	34.97	110.56	126.42	9.42	37.43	45.768
T ₃ - Poultry manure	38.89	126.57	137.18	13.23	44.85	53.85
T ₄ - Vermicompost	38.76	126.97	149.27	13.56	45.33	53.89
T ₅ - Neem cake	35.41	116.47	135.05	10.85	38.68	45.97
T ₆ -50 % Vermicompost + 50 % FYM	35.82	122.70	138.90	11.29	41.58	50.58
T ₇ - Azotobactor	34.78	115.55	134.51	9.62	37.16	46.01
T ₈ - 25% Vermicompost + 25 % Poultry manure + 50 % FYM	37.61	115.98	130.25	10.02	42.58	50.91
SE m(±)	0.73	1.04	3.59	0.46	1.05	1.17
CD(p=0.05)	2.21	3.14	10.86	1.38	3.17	3.54

RDF –Recommended dose of fertilizers; FYM- Farm yard manure

Table 2: Effect of organic manures on stem diameter and flowering of okra cv. Kashi Kranti

Treatments	Stem diameter (mm)			Number of days taken for first flowering	Number of flowers/plant		
	30 DAS	60 DAS	90 DAS		30 DAS	60 DAS	90 DAS
T ₀ - Control	30.75	74.24	111.93	41.33	1.67	10.33	12.67
T ₁ - NPK (RDF)	32.50	84.27	123.68	35.00	5.00	14.67	16.67
T ₂ - FYM	32.36	82.28	127.42	34.00	5.67	15.00	16.66
T ₃ - Poultry manure	37.47	91.00	129.80	35.00	8.33	17.67	20.33
T ₄ - Vermicompost	37.59	93.06	136.54	33.00	11.66	22.33	20.66
T ₅ - Neem cake	33.54	89.29	126.41	35.66	4.67	17.33	17.66
T ₆ -50 % Vermicompost + 50 % FYM	32.08	83.77	126.72	38.00	9.67	19.33	20.00
T ₇ - Azotobactor	34.55	80.99	125.49	36.33	9.00	19.33	20.33
T ₈ - 25% Vermicompost + 25 % Poultry manure + 50 % FYM	35.02	85.41	129.16	37.00	8.00	18.33	19.66
SE m(±)	0.46	1.15	0.90	1.25	1.50	1.26	1.07
CD(p=0.05)	1.39	3.49	2.73	3.80	4.54	3.82	3.25





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Table 3: Fruiting behaviour of okra cv. Kashi Kranti as influenced by various organic nutrition

Treatments	Number of branch/plant		Numbers of days taken to 1 st fruit formation	Number of fruits/ branch	Number of fruits/ plant		
	60 DAS	90 DAS			30 DAS	60 DAS	90 DAS
T ₀ - Control	2.69	6.72	48.33	4.88	1.87	5.40	10.54
T ₁ - NPK (RDF)	3.11	8.29	45.00	8.93	2.69	9.09	14.96
T ₂ - FYM	3.59	10.17	45.67	11.00	3.67	12.10	19.87
T ₃ - Poultry manure	5.52	11.81	39.33	12.81	4.74	14.50	23.55
T ₄ - Vermicompost	6.46	13.19	39.00	13.89	5.13	16.36	23.90
T ₅ - Neem cake	4.89	11.78	43.00	9.43	2.34	11.87	16.86
T ₆ -50 % Vermicompost + 50 % FYM	4.24	10.62	43.33	10.53	3.65	11.73	16.57
T ₇ - Azotobactor	3.83	9.82	43.33	9.47	2.13	10.87	15.07
T ₈ - 25% Vermicompost + 25 % Poultry manure + 50 % FYM	4.52	11.23	43.67	8.45	3.36	13.23	16.17
SE m(±)	0.669	1.001	0.733	0.65	1.86	3.10	3.58
CD(p=0.05)	2.02	3.02	2.216	1.97	0.62	1.03	1.18

Table 4: Effect of organic nutrition on fruit yield and quality of okra cv. Kashi Kranti.

Treatments	Fruit yield / plant (g)	Fruit yield / ha (q.)	Fruit length at harvesting (cm)	Fruit diameter at harvesting (mm)	Average weight of fruit (g)	Vitamin C (mg/100g)	Moisture (%)
T ₀ - Control	54.33	67.12	6.66	6.43	7.863	13.76	91.83
T ₁ - NPK (RDF)	72.00	76.09	7.07	14.60	8.707	19.15	90.56
T ₂ - FYM	66.00	97.12	8.07	6.95	8.347	20.21	89.44
T ₃ - Poultry manure	83.33	113.75	7.79	14.37	16.00	24.73	90.10
T ₄ - Vermicompost	63.00	116.38	13.38	11.86	17.40	24.66	83.01
T ₅ - Neem cake	69.33	105.02	7.78	12.45	8.85	21.44	90.39
T ₆ -50 % Vermicompost + 50 % FYM	60.66	108.88	7.73	8.89	10.89	19.95	84.58
T ₇ - Azotobactor	69.66	97.77	8.38	14.42	11.07	18.86	89.78
T ₈ - 25% Vermicompost + 25 % Poultry manure + 50 % FYM	64.00	85.66	7.14	11.36	9.85	17.62	89.25
SE m(±)	4.91	3.276	0.41	1.87	0.53	0.95	1.49
CD(p=0.05)	14.87	9.906	1.24	5.66	1.63	2.89	4.51





Covid-19 Updates Predictor

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ABSTRACT

The severity and effect of corona virus has forced researchers into the development of numerous predictive models for COVID-19. But due to lack of important data, many models turn to be less accurate for long-term predictions. Hence in this proposed work, deep learning methods are used to improve accuracy of the predictions made. As an alternative, this research presents a comparative analysis of recurrent networks to forecast the COVID-19 outbreak. RNN and LSTM networks, that can process entire data sequence for forecasts are used. These neural networks are used specifically for the purpose of the timeline and to overcome the difficulties in other models. These models provide live forecasting for confirmed positive cases, details of recovered cases and deaths occurred because of COVID-19.

Keywords: Deep Learning, COVID-19, Recurrent neural network, Prediction, Long short-term memory network.

INTRODUCTION

This research focuses on predicting the outbreak of the novel-corona virus. The outbreak has affected millions of people around the world and the number of infections has been growing at an alarming rate. Machine learning has numerous tools that can be used for visualization and prediction, and nowadays it is used worldwide to study the pattern of COVID-19 spread. One of the main focuses of the study in this proposed work is to apply the popular machine learning methods to analyze and visualize the spreading of the virus country-wise as well as globally during a period of time by considering confirmed cases, recovered cases, and fatalities. In this proposed work, forecasting and prediction is being done using Recurrent Neural Network-LSTM on the Johns Hopkins University's COVID-19 data to anticipate the future effects of the COVID-19 pandemic in the world, India, and some other countries.





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Data Gathering

The data is provided by the Johns Hopkins University Centre for Systems Science and Engineering (JHU-CSSE). It involves three-time series with the count of daily reported confirmed cases, recovered cases, and deaths by country. This dataset is updated automatically on daily basis. In this proposed work, we employed data from 22 January 2020 up to date [9] [10]. Initially, data pre-processing was almost challenging and much time was required because the dataset was not standard and many data cleaning processes were required. The John Hopkins GitHub consists of three files each for Total cases, Death cases, and recovered cases. They include the daily count for almost all the countries. They even include the latitude and longitude values for the countries.

Problem Description

In December 2019, the novel and contagious corona virus COVID-19 outbreak started from the town of Wuhan, China. This also similar to “severe acute respiratory syndrome corona virus 2” abbreviated as SARS-CoV-2 which has a genetic structure close to that of corona virus that caused a similar type of outbreak in the year 2003 [1]. The pandemic has become a major problem to the world and it also seems to continue further. In this report, the LSTM model is explored and applied to the COVID-19 dataset. The LSTM model is used to predict the possibility that the cases in India would start dropping. And also to see the effect of COVID-19 had along with the trends of the cases in India, and a few countries.

MATERIALS AND METHODS

Research Datasets

This research with the aim of predicting COVID-19 involves three data sources. The COVID-19 provides basic details and other detailed insights country-wise. The other data source is the one by John Hopkins University which is a repository containing counts of confirmed cases, counts of dead cases and counts of recovered cases day-wise. This data was used for training the model. The model was trained in such a way to forecast the count on each category: number of positive cases, deaths and recovery count in India. The general workflow of the proposed method is shown in Fig 1.

RNN Model

RNN models are usually being used in the case of sequential time series applications that have temporal dependencies. Though a popular model it shows less accuracy with respect to long-term dependencies data. This issue is overcome by its variant LSTM. This belongs to deep learning's artificial recurrent neural network (RNN) architecture. These networks work by computing mappings between input sequence; $X=(X_1, X_2, \dots, X_n)$ and the output sequence; $y=(y_1, y_2, \dots, y_n)$.

Calculations are done by the following equations:

$$\text{forget gate} = \text{sigmoid}(W_{fg}X_t + W) \quad (1)$$

$$\text{input gate} = \text{sigmoid}(W_{ig}X_t + W_{ht-1} + \text{big}) \quad (2)$$

$$\text{output gate} = \text{sigmoid}(W_{og}X_t + W_{ht-1} + \text{bog}) \quad (3)$$

In the equations (1), (2) and (3) the parameters

$W_{ig}, W_{og}, W_C, W_{fg}$ - denotes the weights and
 $\text{big}, \text{bog}, \text{bC}$ - the bias of the three gates and a memory cell.
 $ht-1$ - units from the prior hidden layers that are responsible for adding element-wise weights.





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LSTM is RNN architecture that is used in deep learning which involves multiple layers of learning. In case of time series data, there is a requirement of a model with sequential processing capacity as sequence dependency exists among the input variables. Few other neural networks like vanilla does not have the power of sequential processing. However, to make it possible RNN can be used where the current input and hidden state obtained from previous timestamp makes forecasting easy. The depth of the model and its complexity makes Stacked LSTM models different from other RNN models. The first step to start with is to make the input suitable for the model. This is done by taking into account 3 lag structures and feature count as 1.

The 80-20 rule of dividing the dataset into training and testing sets was followed and MinMax Scaler was used for normalization. Four datasets are given as input to the stacked LSTM model. The model works with respect to the following equations:

$$fL_t = \sigma(WL_f h_{L-1} + WL_f x_{L-1} + bL_f) \quad (4)$$

$$iL_t = \sigma(WL_i h_{L-1} + WL_i x_{L-1} + bL_i) \quad (5)$$

$$c\tilde{L}_t = \tanh(WL_c \tilde{h}_{L-1} + WL_c \tilde{x}_{L-1} + bL_c) \quad (6)$$

$$cL_t = fL_t \cdot c\tilde{L}_t + iL_t \cdot c\tilde{L}_t \quad (7)$$

$$oL_t = \sigma(WL_o h_{L-1} + WL_o x_{L-1} + bL_o) \quad (8)$$

$$hL_t = oL_t \cdot \tanh(cL_t) \quad (9)$$

When we consider this multilayer network which is fully connected, the output of (L-1)th layer is h_{L-1} . This is intern given as input to the intermediate layer which is the Lth layer. Similarly the output of Lth layer is given as input to the (L+1)th layer. Thus the relationship between subsequent layers is established by this input-output interconnection.

RESULTS AND DISCUSSIONS

Total confirmed cases, deaths and recovered

Fig:4 gives the total count of confirmed positive cases, occurrence of deaths count and people recovered worldwide.

Statistics of Confirmed Cases

Fig 5 shows the details on confirmed cases in India and deaths. The graph shows that there is a fluctuation with upward trend with respect to confirmed cases.

Future prediction

Using LSTM neural network we have predicted the upcoming cases for the next 7 days. This can be calculated with an error of 0.95%. The same can be depicted as shown in Fig.7 below as a graph.

CONCLUSION

The outbreak of COVID-19 has become the talk of almost every country in the world as it has affected world-wide. As a first step of mitigating its effects in India, we propose a prediction model that would help us in taking critical decisions to face the future outbreaks and also the current one by providing key insights on the spread of the disease. From the results it is obvious that though there is an increase monotonically in the count of positive cases and deaths across the world, there is increase in recovery rate too. Further there is a decrease in mortality rate also. With these useful insights, the other countries can be prepared to battle against the disease.





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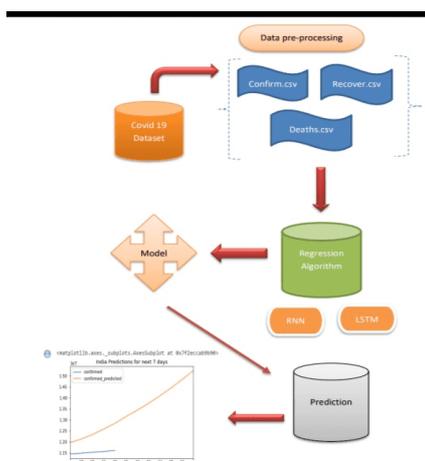


Fig 1: Proposed Workflow





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	country	last_update	lat	long_	confirmed	deaths	recovered
178	US	2021-03-21 19:26:11	40.000000	-100.000000	29810217.000000	542246.000000	nan
23	Brazil	2021-03-21 19:26:11	-14.235000	-51.925300	11950459.000000	292752.000000	10476123.000000
79	India	2021-03-21 19:26:11	20.593684	78.962880	11599130.000000	159755.000000	11130288.000000
142	Russia	2021-03-21 19:26:11	61.524000	105.318800	4407031.000000	93457.000000	4023460.000000
182	United Kingdom	2021-03-21 19:26:11	55.000000	-3.000000	4310171.000000	126393.000000	12170.000000

Fig 2: Total number of cases

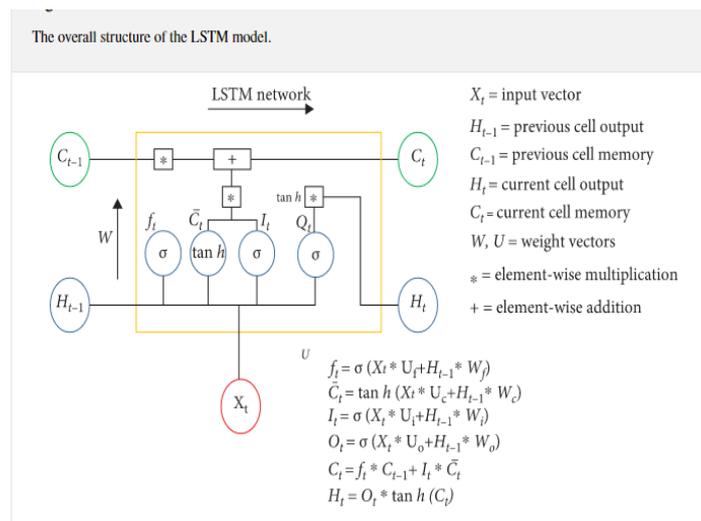


Fig 3: LSTM Network

Confirmed: 123059470 Deaths: 2712819 Recovered: 69706686

Fig 4: World count for Confirmed, Deaths and Recovered Categories.





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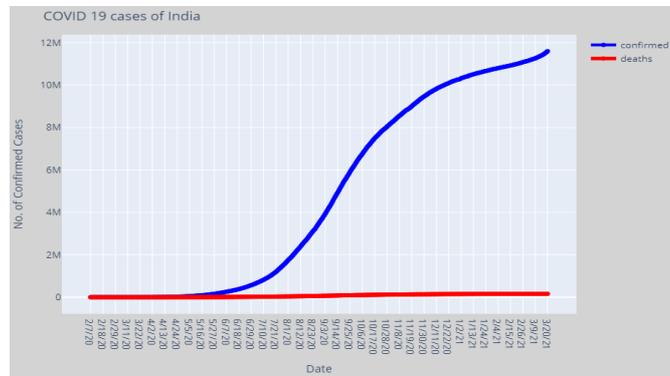


Fig 5: Graphical representation of the World count for Confirmed, Deaths and Recovered Categories.

	confirmed	confirmed_predicted
2021-03-16	11438734.0	1.195933e+07
2021-03-17	11474605.0	1.212138e+07
2021-03-18	11514331.0	1.232645e+07
2021-03-19	11555284.0	1.257775e+07
2021-03-20	11599130.0	1.284071e+07
2021-03-21	NaN	1.315566e+07
2021-03-22	NaN	1.344208e+07
2021-03-23	NaN	1.375644e+07
2021-03-24	NaN	1.409706e+07
2021-03-25	NaN	1.445783e+07
2021-03-26	NaN	1.484643e+07
2021-03-27	NaN	1.525650e+07

Fig 6: Predicted value for next 7 days

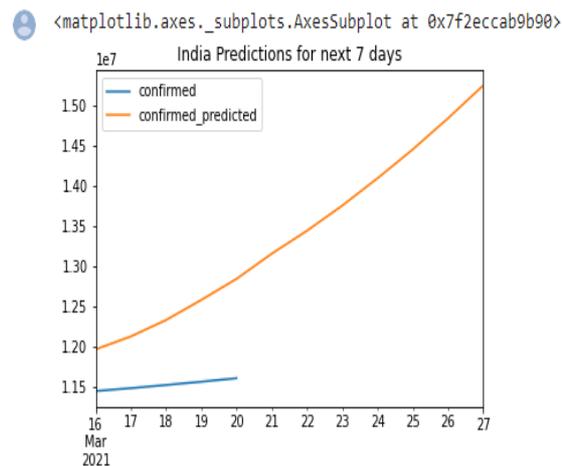


Fig 7: Predictions for next 7 days in India





Isolation and Screening L-Asparaginase Producing Microbial Strains from Marine Soil of Kerala, India

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ABSTRACT

Marine environments are potential sources of novel strains, yielding biomolecules. Nowadays the enzyme L-asparaginase is derived from various bacterial sources. L-asparaginase is a well recognized amino acid degrading enzyme, exhibiting anti-neoplastic activity against lymphoblastic leukemia chemotherapy. Hence attempts are concentrated towards the discovery of new L-asparaginase producers that are serologically different from the earlier literature. As the long term use of these agents lead to allergic reactions, the search for newer asparaginases with novel immunological characteristics are the need of the hour. Marine strains were isolated from different samples from the coastal areas of South India. As the marine isolates seem to possess novel characteristics that can be effectively used by hypersensitive patients and also these halophilic strains are seen to exhibit intra and extracellular L-asparaginase production. A total of 23 strains were obtained, amongst which 17 isolates were positive for the qualitative detection of L-asparaginases. In the present study, a Gram positive bacilli tentatively identified as a Bacillus strain was found to produce 2 IU/ml of extracellular asparaginases. Further studies on the optimization processes for the production of L-asparaginases are in progress.

Keywords: L-asparaginase, Anti-neoplastic, Lymphoblastic leukemia, Marine source, Strains

INTRODUCTION

Chemotherapy is one of the principal modes of treatment for cancer. It is the process of using anticancer drugs to stop cells from dividing and multiplying but there are few curative chemotherapeutic drugs against cancer due to high toxicity, non selectivity, numerous side effects and low activity [1]. Therefore, the search for developing effective anticancer agents for these particular diseases has a great impact on morbidity and mortality of the patients

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thereby saving many lives. Almost 60% of drug approved for cancer treatment are of natural origin. Although marine compounds are underrepresented in current pharmacopoeia, it is anticipated that the marine environment will become an invaluable source of novel compounds in the future, as it represents more than 70% of the biosphere. The marine microorganisms in the coming decades will be the nature's best source of chemicals. Natural products metabolized from microorganisms represent desirable sources for effective therapeutic enzymes [2-5].

Therapeutic enzymes are utilized in the treatment of diseases such as cancer, severe disorders like autism, chronic lung disease and multiple sclerosis but the major potential therapeutic application of enzymes is in the treatment of cancer. Interestingly, therapeutic enzymes have a particular ability to mediate high affinity interactions with unrelated proteins relevant in cancer conferring on it the property. The chemotherapeutic agents include therapeutically important enzymes as L-asparaginase (E.C.3.5.1.1) which degrades the particular amino acid L-asparagine which disrupts DNA in the majority of tumor cells McKnight [6]. The rationale behind L-asparaginase depends upon the fact that tumor cells are deficient in aspartate ammonia ligase activity which restricts their ability to synthesis the normally non-essential amino acid L-asparagine. These leukemic cells depend on circulating L-asparagine. The action of the L-asparaginase does not affected the functioning of normal cells which are able to synthesis enough for their own requirements but reduce the free exogenous concentration and so induces a state of fatal starvation in the susceptible tumor cells.

The enzyme L-asparaginase (L-asparagines amidohydrolase EC 3.5.1.1) has the physiological function of hydrolyzing amide group of the side chain in L- asparagine to produce L-aspartate and ammonia. This spectacular property of the enzyme is utilized in chemotherapeutic treatment of certain kinds of lymphoblastic malignancies, mainly in acute lymphoblastic leukaemia (ALL) and lympho-sarcoma for nearly 40 years [7,8]. In 1963 it was revealed that antineoplastic activity of guinea pig sera was due to the presence of L-asparaginase [9]. Broome's statement was confirmed by partially purifying L-asparaginase from the sera of guinea pig [10]. L-asparaginase activity was also identified from *E.coli* cells as it was demonstrated that *Escherichia coli* steadily produces L-asparaginase under anaerobic conditions [11, 12]. Presence of L-asparaginase was also observed in *Erwinia aroideae* [13]. Later on, L-asparaginase was produced, purified and crystallized from *Proteus vulgaris* [14]. A variety of microorganisms has been shown for their L-asparaginase producing potency, viz. *Enterobacter aerogenes* [15], *Pseudomonas stutzeri* [16, 17], *Pseudomonas aeruginosa* [18], *Serratia marcescens* [19], *Wolinella succinogenes* [20], and *Staphylococcus* species [21].

In this context, current study planned to screening for the 23 marine soil samples, isolation and their characterization by primary, secondary screening and morphological methods to know their L-asparaginase enzyme production.

MATERIALS AND METHODS

Sample Collection

A total of 23 marine soil samples were collected in the sterile container from different places in Kerala (India).

Isolation of Bacteria

Isolation of bacteria was performed by the serial dilution technique, using sea water agar medium (Part A - yeast extract 5.0, peptic digest of animal tissue 5.0, beef extract 3.0, agar 15.0; Part B-sodium chloride 24.0, potassium chloride 0.7, magnesium chloride, 6H₂O 5.3, magnesium sulphate, 7H₂O 7.00, calcium chloride 0.100 and final pH (at 25°C) 7.5±0.2). Morphologically different colonies were selected and obtained the pure culture by repetitive streaking method. Pure culture were maintained on nutrient agar slants and stored at 4°C for further use.



**Pramod and Patil****Primary Screening**

The L-asparaginase producing strains were initially screened by rapid plate assay method, based on their capability to form a pink zone around colonies on agar plates of modified sea water agar medium [22]. The medium was supplemented with 0.005% phenol red dye (prepared in ethanol) and the pH was adjusted to 6.2 using 1N HCl. Plates were then incubated at 37°C for 24-48 hrs. A set of tubes was also run as a control without L-asparagine. The strains having potential for L-asparaginase production were selected on the basis of pink zone formation and retained for further screening.

Secondary Screening

Isolated microorganisms from the previous screening were cultured in liquid media (sea water agar with 1% asparagine) at pH 7.0 in 250 ml Erlenmeyer flasks. Uninoculated medium served as negative control. All experiments for quantitative screening were carried out. After incubation on a rotary shaker (37°C, 120 rpm) for 48 hrs, the culture broth was centrifuged at 10,000 ×g for 10 min, supernatants were collected and enzyme assay was carried out by Nesslerisation [23].

Characterization of Microorganisms

All the 23 selected sample bacterial isolates showing excellent L-asparaginase activity were characterized on the basis of morphological characteristics.

RESULTS AND DISCUSSION

Based on primary screening, 17 strains were found to have potential for L-asparaginase production out of 23 isolates. (Figure 1) ascertain L- asparaginase activity. Amongst the positive strains results of 5 best isolates are shown in Table-1.

Sea water media employed in the present study was incorporated with L-asparagine and phenol red. After completion of the incubation period, pink colored zones around the colonies were observed. Such colonies were picked up for further studies. L-asparaginase producers were identified by the formation of pink zones or haloes around the colonies on the medium. Studies of Lalitha Devi and Ramanjaneyulu [24] reported isolation of L-asparaginase enzyme producing bacterial strains, a total of 132 colonies were screened and isolated from all the samples through serial dilution of the soil samples from different places of Telangana and Andhra Pradesh states, India. Maximum L-asparaginase activity was shown in the sample AD1 (2.0IU/ml), characterizing as Gram +ve rods with 0.9 cm zone of hydrolysis, sample AD3 & PDA exhibited optimum enzyme activity (0.8 IU/ml), characterizing as Gram +ve rods & Gram –ve bacilli with 0.5 cm & 0.6 cm zone of hydrolysis respectively, whereas sample AD2 & DA1 exhibited minimum enzyme activity (0.6 IU/ml & 0.5 IU/ml), characterizing as Gram +ve rods with 0.9 cm & 0.4 cm zone of hydrolysis respectively (Table 1).

In another study of Darwesh et al, [25] screened, isolated and characterized the indigenous L-asparaginase producing bacteria from Egyptian agricultural soils. Resulted several soil bacterial isolates during the screening study and plate assayed for their abilities to produce, biotechnological and environmental important enzyme, L-asparaginase. In that, nine isolates belong to seven genera were proven for producing L-asparaginase i.e. Escherichia (FS-2), Pectobacterium (FS-4), Pseudomonas (FS-6 and GS-2), Bacillus (FS-7 and GS-4), Aeromonas (GS-3), Proteus (GS-5) and Serratia (GS-7). This is in accordance with the work of Gulati et al, [22] who proved that colour transformation was due to L-asparaginase production in the studied sample. Microbial strain exhibiting zone of diameter above 0.9 cm are referred as good L-asparaginase producers, those strains with zone diameter of 0.6-0.9 cm and those having below 0.6 cm zone diameter may be referred to as moderate and poor L-asparaginase producers respectively [26].



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In industrial soil also reported for the diversity of species which are having capacity to produce L-asparaginase and these microbes may be a bacteria or fungi. Microorganisms can produce different types of enzymes which are frequently used in different types of industries for different application for commercial purpose [27]. Mahboobi et al, [28] focused on the application of bioinformatics tools to explore about the *E.coli* model organism due to its potential source of L-asparaginase enzyme which has an anticancer ability.

CONCLUSION

Many strains were isolated from different locations yielding a total of 23 strains, out of which 17 were positive for L-asparaginase production when subjected to rapid plate assay. The results of the best five strains are reported. A gram positive bacillus tentatively identified, emerged as the best strain among all the studied organisms. Further studies on the optimization of physical, chemical, nutritional parameters and molecular characterization are being carried out to know more about potential organisms and their wide range of application in various fields.

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Conflict of Interest

The authors declare no conflict of interest.

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Table 1: L-asparaginase enzyme activity, Gram's characteristic and zone of hydrolysis was shown in the 5 screened samples of marine soils.

SI. No.	Sample	Gram's Characteristic	Zone of hydrolysis (cm)	Enzyme activity/ml
1.	AD1	Gram +ve rods	0.9 cm	2.0IU/ml
2.	AD2	Gram +ve rods	0.6 cm	0.6 IU/ml
3.	AD3	Gram +ve rods	0.5 cm	0.8 IU/ml
4.	DA1	Gram +ve rods	0.4 cm	0.5 IU/ml
5.	PDA	Gram –ve bacilli	0.6 cm	0.8 IU/ml





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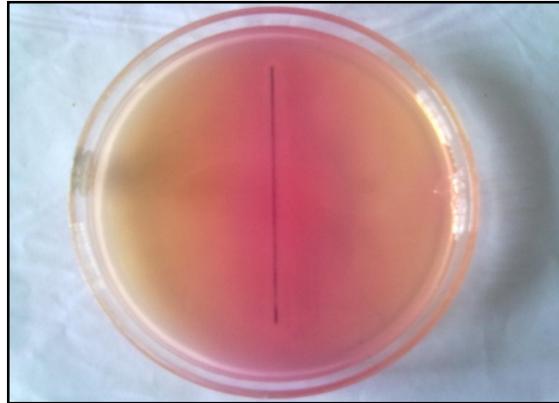


Figure 1: Secondary screening for L-asparaginase enzyme production





Prevalence and Association of Sexual Dysfunction in Female Patients Taking Psychotropic Drugs in A Tertiary Care Hospital

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ABSTRACT

Female sexual dysfunction can be a result of physical and psychological problems. Sexual dysfunction is a common, often unrecognized side effect of treatment with antipsychotics drugs. It is the most bothering symptom and adverse effect, resulting in a negative effect on treatment compliance. Although the incidence of antipsychotic-induced sexual side effects is increasing, only a limited number of researches are done in this area to measure the impact of side effects. Risperidone and Olanzapine have shown the highest sexual dysfunction rates. We randomly assigned 83 patients with the treatment under psychotropic drugs. Based on the CGI – score and FSFI scale we conduct a cross-sectional study with patients to identify the prevalence and association of sexual dysfunction in patients taking psychotropic drugs. The prevalence of SD in female patients using psychotropic in a tertiary care hospital were analyzed in our study. In this study, 83 patients were selected and analyzed. Based on CGI score 1-3, out of 83 patients, 43 patients are having SD. Based on FSFI scale more cumulative value seen in BPAD patients (16.86%) followed by Depression (14.45%) and schizophrenia (12.04%). Based on patients under treatment for more than 6months – 1year (43.35%) were found to have SD.

Keywords : Sexual Dysfunction, Outpatient Department, Medications, Antipsychotics.



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INTRODUCTION

Antipsychotic drugs are highly effective in the treatment of acute psychotic episodes and it equally have the risk of suffering from some of troubling adverse effect. Sexual dysfunction (SD) is not easily disclosed by women and is usually underreported. This is suggested that each year family practitioners saw several women or couples who presented with sexual problems, and the numbers increased when the physician inquired about patients' sexual health [1]. A review article by Baldwin and Mayer's reported that SD in women attending outpatient department (OPD) was between 19% and 50% [2]. In India, for a woman to discuss problems she faces in her sexual functioning is very challenging due to the male dominated society and puritanical mind set. Despite the common occurrence of sexual difficulties among women, very few studies have been done till date in India [3]. SD is a known adverse effect of antipsychotics. Even though SD may occur due to general medical illness or gynaecological illness or psychological illness, or due to the use of various medications [4,5], most of the previous studies have shown that psychotropic medications have led to SD among female patients on those medications [6].

A sexual problem, or sexual dysfunction, refers to a problem during any phase of the sexual response cycle that prevents the individual or couple from experiencing satisfaction from the sexual activity. Antipsychotic medications, sometimes referred to as neuroleptics or major tranquilizers, are prescribed to treat schizophrenia and to reduce the symptoms associated with psychotic conditions such as bipolar, psychotic depression, senile psychoses, various organic psychoses, and drug-induced psychoses. People experiencing psychosis are sometimes, but not always, a danger to themselves and others. Antipsychotic medications have both a short-term sedative effect and the long-term effect of reducing the chances of psychotic episodes. Most drugs are available in oral dosage forms (tablets, dry powder, and capsules), while some can be given in parenteral form (intramuscular and intravenous injections). The CGI actually comprises two companion one-item measures evaluating the following: (a) severity of psychopathology from 1 to 7 (b) change from the initiation of treatment on a similar seven- point scale

The incidence of SD differs with different antidepressants [7]. The overall incidence of SD was 59.1% when multiple antidepressants were considered [8]. Very few studies have examined SD in patients taking tricyclic antidepressants or monoamine oxidase inhibitors [9]. Given the findings that psychotropic cause SD among female patients, and given the Indian context where it is very uncommon for a woman to bring forth the difficulties she is facing in her sexual functioning, the cross-sectional study that led to this article was done with the objectives of ,finding the prevalence of SD among female patients on psychotropic , to study the nature of SD, to compare the prevalence among female patients on antidepressants with the prevalence among female patients on antipsychotics. The understanding gained through the findings would contribute toward improving compliance by enabling treating doctor to address SD as a side effect of psychotropic medications [10]. The CGI actually comprises two companion one-item measures evaluating the following: (a) severity of psychopathology from 1 to 7 (b) change from the initiation of treatment on a similar seven- point scale. The CGI has two components – the CGI-severity, which rates illness severity, and the CGI- improvement, which rates change from the initiation baseline of treatment. CGI-Severity (CGI-S): The CGI-Severity (CGI-S) asks the clinician one question: considering your total clinical experience with this particular population, how mentally ill is the patient at this time? which is rated on the following seven-point scale: 1=normal, not at all ill; 2=borderline mentally ill; 3=mildly; 4=moderately ill; 5=markedly ill; 6=severely ill; 7=among the most extremely ill patients. This rating is upon observed and reported symptoms, behaviour, and function in the past seven days. Clearly, symptoms and behaviour can fluctuate over a week; the score should reflect the average severity level across the seven days.

The CGI-Improvement (CGI-I) is similarly simple in its format. Each time the patient is seen after medication has been initiated, the clinician compares the patients overall clinical condition to the one-week period just prior to the initiation of medication use (the so-called baseline visit). The CGI-S score obtained at the baseline (initiation) visit serves as a good basis for making this assessment. Again, only the following one query is rated on a seven-point



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scale: compared to the patient's condition at admission to the project [prior to medication initiation], this patient's condition is; 1=very much improved since the initiation of treatment; 2=much improved; 3=minimally improved; 4=no change from baseline (the initiation of treatment) 5=minimally worse ; 6=much worse; 7=very much worse since the initiation of treatment.

MATERIALS AND METHODS

A cross-sectional hospital-based descriptive study The psychiatric patient undergoing treatment with antipsychotics, anti-depressant, anti-anxiety, mood stabilizer at Vinayaka Missions KirupanandhaVariyar Medical College And Hospital Salem between November 2018 to April 2019 with the 83 Patients with psychiatric diseases undergoing treatment with psychotropic and the selection criteria are inclusion criteria Married female patients between the age of 18 years and 60 years, Asymptomatic from current psychiatric illness for at least past 1 month, Patients on psychotropic medication during the study, Patient should be treated minimum 6 months, Patient having CGI Score 1-3, Patient who gave informed consent. And the exclusion criteria, Age<18 years and > 60 years, Patients who had SD even before the onset of psychiatric illness, Patient suffering from the systemic illness which may cause SD, Patients on commonly used non-psychotropic drugs which were likely to cause SD.

RESULT AND DISCUSSION

Female patients attending the psychiatry OPD were recruited for the study as per the inclusion and exclusion criteria. Patients included in the study were in remission and were continuously on prescribed psychotropic medications. The diagnosis was made as per the international classification of disease 10th edition Diagnostic criteria for research criteria. This criterion was used to categorize the psychiatric diagnosis of the patients. The type and dosage of the drug were at the discretion of the treating consultant. Based on the CGI-Score, only those patients who were asymptomatic (CGI Score<3) and who were still on psychotropic medications were included in the study, and informed consent was obtained from each patient. Clinical global impression (CGI) scale with the score ranging from 0-7 was used to assess the severity of illness. Patients who scored between 1 and 3 were considered to be asymptomatic from the underlying psychiatric illness and were included in the study. The female investigator collected the required information about sexual functioning and sociodemographic data using the specially prepared proforma. General physical examination and systemic examination were conducted from each patient. A multidimensional self-report instrument for the assessment of female sexual function which consists of 19 – item questionnaire on various aspects of sexual functioning was administered. Each item was scored with values ranging from 0-5. The female sexual function index (FSFI) score with the low cumulative value indicates that they were no SD and a score with a high cumulative indicated that SD was present. The FSFI capital scale was also translated into the local language (Tamil) and the information was gathered. Data were tabulated and were subjected to statistical analysis.

In our study more than half of the persons were illiterates around 59% was able to read and know about their SD, and their treatment complications. Analysis of SD of patients according to educational status was shown in Table No: and Figure No: 1. Depending on the type of illness patients were grouped broadly into, SZ, BPAD, DPN, CAD, MNA, PSYS, and the presence and absence of SD among these were as represented in Table No:3 and Figure No 2. Out of 83 patients, 10 were on Risperidone, 7 were on Thiamine, 17 were on Diazepam, 13 were on THP, 20 were on Hpl, 26 were on SV, 24 were on OLE, 25 were on CLE, 17 were on SRE, and LRE, 10 were on QTE, 12 were on LTM. While analysis combination therapy antipsychotics + benzodiazepine + mood stabilizers are the most commonly used combination therapy. and are represented in Table No: and Figure No:4



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The CGI score for an asymptomatic female patient who fulfilled with exclusion and inclusion criteria was 83. Out of 83 female patients, the prevalence of SD was shown in Table No:6 and Figure No:5. Out of 83 patients, the most commonly prescribed drug is sodium valproate (Mood stabilizer) and clonazepam (Benzodiazepine), olanzapine (Atypical antipsychotics). The most commonly prescribed drugs were shown in Table No: 6 and Figure No:6.

SUMMARY AND CONCLUSION

The prevalence of SD in female patients using psychotropic in a tertiary care hospital in Salem was analyzed in our study. In the present study, 83 female patients were selected and analyzed the prevalence, complications, and treatment strategies followed in Vinayaka Missions Kirubanandha Variyar Hospital Salem. The study group was considered with 83 female patients. 67.45% of the female patient shows the prevalence of sexual dysfunction according to the FSFI scale, 38.54% of the female patient having a high cumulative value of FSFI scale shows more SD.

Assuming the prevalence of SD in different age groups our study shows a marked increase in the prevalence of SD between 31 – 40 (21.09%) and 41 – 50 (25.30%) years. While Veda N shetageri *et al* interpreted that majority of people with SD were found between the age groups of 40-50 years. Our study has revealed that SD was more prevalent in patients who have come with BPAD and depression, According to FSFI scale more cumulative value is seen in BPAD patients (16.86%) followed by Depression (14.45%) and Schizophrenia (12.04%). Out of 83 patients, 37 patients were under treatment for more than 6 months and out of 37 patients, 27 patients (32.53%) were found with SD, and out of 12 patients who have been taking medication for 1 year 9 (10.84%) were found to have SD. Based on this study it has been proved that 95% of patients were illiterate and 33% of patients were literate, among this 27.07% illiterate, and 71% illiterate patients have been found to have SD. According to the study of Veda N. Shetageri *et al*, we also analyzed SD in patients based on CGI scores 1-3. Out of 83 patients, 22 (26.51%) patients are having SD with CGI score 3, and 21 (25.30%) patients having SD with CGI score 2. In Vinayaka Missions Kirubanandha Variyar Hospital in Salem, the most prescribed drugs were sodium valproate (Mood stabilizer), clonazepam (Benzodiazepines), and olanzapine (Antipsychotics). SD is a very common side effect associated with the use of various psychotropic medications, worldwide. Contemporary evidence from our studies demonstrates that SD rates are drug-related rather than drug-class specific and that these rates do vary widely. Mechanisms involved in psychotropic-induced SD are largely unknown or poorly understood by the inability to differentiate whether these effects are drug-induced or due to different inclusion criteria. However, clinicians should continue to ask their patients on psychotropic therapy about any SD complaints using validated questionnaires.

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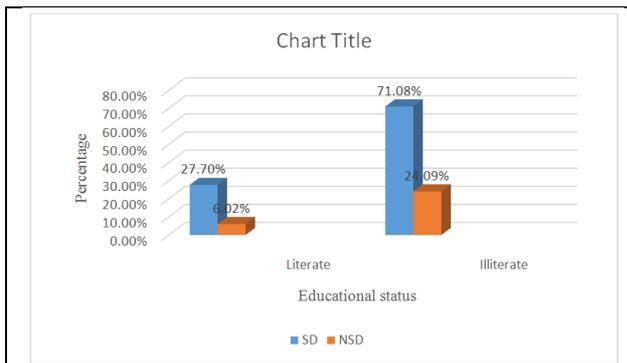


Figure No: 1 Analysis of SD in female patients based on Educational status

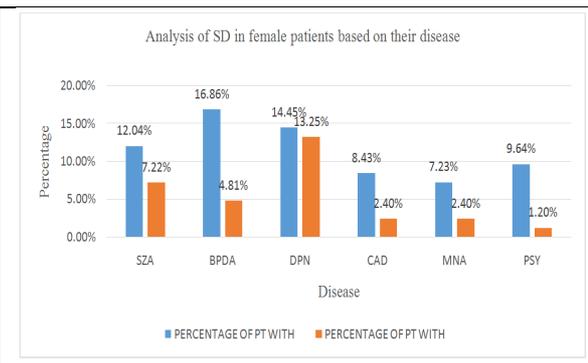


Figure No: 2 Analysis of SD in female patients based on their disease

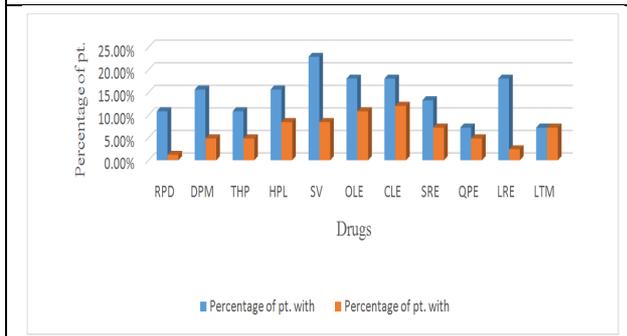


Figure No: 3 Analysis of SD in female patients based on their drugs

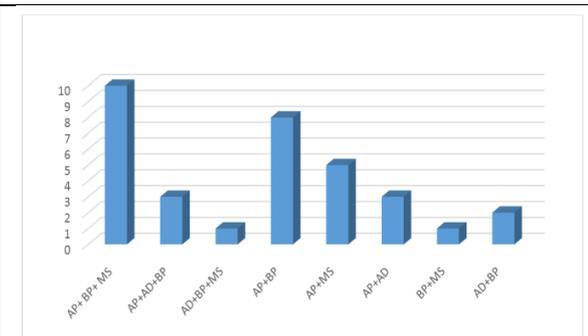


Figure No: 4 Analysis of combination therapy that is given to the patients

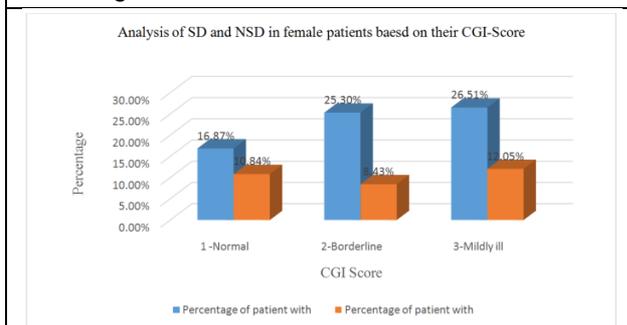


Figure No: 5 Analysis of SD and NSD in female patients based on their CGI-Score

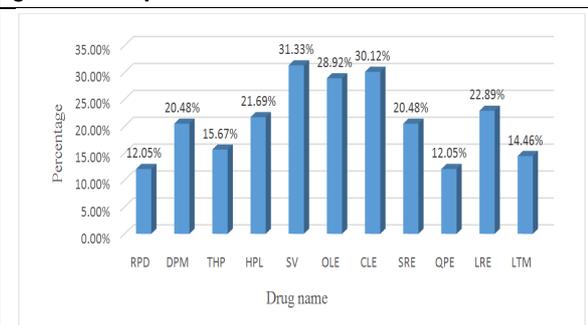


Figure No: 6 Analysis of prescription for most commonly prescribed drugs





A Review on Entrepreneurial Crisis Management during Coronavirus (Covid-19) Pandemic

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ABSTRACT

The on-going Covid-19 crisis has influenced the businesses in an intense way. As we can perceive, the overall effect of the crisis on the businesses has been mostly negative. Perceptibly most business researches and practices have tried to frame policies to negate such negative effects of the pandemic. They have concentrated on making strategies to deal with failure, flexibility, and crisis management among continuing businesses. The challenges posed by the covid-19 pandemic are difficult to handle as they cannot be solved with the existing approaches and needs a new entrepreneurial approach. Rather than a bureaucratic method, the dynamic nature of the crisis demands a quicker approach. In case of uncertainties, what is required is a direct approach. It implies that action must be taken immediately as per the current data and statistics rather than follow a wait and watch approach. It will mean taking a realistic view of the things and understanding the consequences of inaction.

Keywords: Crisis Management, Disaster, Entrepreneurship, Covid-19, Coronavirus, Pandemic, Environment.

INTRODUCTION

The Covid-19 disease which was started in the early 2020 by the novel coronavirus has considerably changed the global society [1]. [No region in the world has remained untouched by the effects of the virus. The virus seems to have not made any discrimination as far its severity has been concerned, between developed and developing



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countries [2]. There have been many instances of health epidemics in human history, but the severity of the covid-19 virus has forced countries to change their perspectives on entrepreneurship and look to it in a new way [3]. Previous coronaviruses mostly remained limited to specific geographical areas such as SARS in North Asia and MERS in Middle East [2]. But the COVID-19 novel coronavirus spread itself at a much faster rate to other parts of the world [2]. This resulted in disruption of global communications between countries and resulted in different regions being shut down [4].

Due to the coronavirus our lifestyle, culture and societal communications have undergone considerable changes [5]. To face the challenges of the pandemic the world has come out with cutting edge medical technologies and others ways of confronting it, which creates ample of opportunities for entrepreneurs [6]. The ability of the entrepreneurs to respond in an innovative way to such challenges will go a long way in creating global influences for entrepreneurs [3]. It is generally believed that entrepreneurs are better poised to face the challenges posed by the pandemic as they are exposed to risks and uncertainties in their businesses on a daily basis [5]. Unlike other pandemics which have a fixed duration the coronavirus pandemic is very uncertain in nature [2]. The uncertainty hangs around the duration for which the virus will remain active across the world. This prevents the policy makers and experts to plan ahead for the future. The overall effect of the pandemic is considered to be negative, as it has caused huge financial difficulties for majority of the countries. But, this represents a challenge as well as an opportunity depending upon the manner in which businesses respond to it [4].

ENTREPRENUERSHIP AND ENVIRONMENT

Perceiving the environment means evaluating the probability of occurrence of some events. Businesses may be impacted more or less depending upon their longevity of survival in an environment [5]. Longer is the survival through continuous activity by the business, more stable are their situations in the environment. However, the longevity may lose its significance with regard to stability if the environment is influenced by any political events. This calls for more cautiousness in selecting business avenues during the covid-19 pandemic [5]. Entrepreneurship involves a properly thought out course of action to exploit an opportunity in the market. This in turn is based on a gap finding exercise on the opportunities that exists in the market. The definition of an entrepreneurial behaviour springs from an intention to be a change maker [7].

An entrepreneur is a person who exploits a business opportunity through some kind of innovation [5]. It means that an entrepreneur is able to see an existing gap in the market that can be filled with some innovative idea. To materialise this entrepreneur needs to innovate any product, process or service which would result in a financial gain [5]. So the entrepreneur always tries to involve in activities which are focussed on innovation. At the same time they also aim to be engaged in profit-seeking activities. In some cases the societal context in which the business is carried out has an important influence on the functioning of the business [5]. It suggests that there may be some pressure from the society to run the business along some specific lines. So the environmental contexts may sometime support or may hinder the functioning of the family businesses. What is suggested is that ways should be found to make the environment supportive to entrepreneurship. Entrepreneurship is related to understanding the ways in which new ideas and opportunities can be recognised [5]. This involves use of creativity as different manners of thinking allow different ideas to emerge. Creativity is the discovery of useful and novel ideas by an individual or small groups of individual who work together [8]. Creativity is an important element as far as confronting the challenges of the covid-19 pandemic is concerned, since it offers businesses a competitive edge in the global marketplace [5].

For successfully dealing with covid-19 crisis an entrepreneurial bent is required while dealing with the crisis and environmental change [5]. The entrepreneurial characteristics required to deal with the crisis include: innovativeness, risk taking capability and better product solutions for the market. There is another dimension to entrepreneurial orientation. This dimension refers to including social, cultural and lifestyle elements [5]. Entrepreneurship, being a socially intertwined activity, has much relevance to social interactions and it suggests that entrepreneurs should



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identify opportunities depending on their capability to use social networks. Social bonds mean the networks of entrepreneurs which are based on social interactions and are based on harmony within social groups. Social bonds often allow entrepreneurs to use social resources for entrepreneurial purposes [5]. It suggests that social group members provide valuable and free advises on business activities. The above characteristics of social entrepreneurship contribute to the making of strategies to deal with the covid-19 pandemic [5].

CRISIS MANAGEMENT

Past research on crisis management is based on disasters which were mostly natural or financial in nature [9]. Some research has been done on health crisis, but the study has been done for crisis led by diseases which were slow in spreading [10]. A crisis is an occurrence that does not happen frequently and has a high degree of uncertainty associated with it and affects the society as a whole [10]. A crisis calls for an urgent action or response to a situation. A crisis can be classified based on the extent of its impact on the society. Such classification may be based on the length, type and magnitude of the crisis. An effective response to a crisis demand good coordination among the concerned stakeholders. Most natural disasters are often seen as a one-off happening depending on particular environmental settings [10]. It implies that although they happen on a continuous basis, their impacts can be mitigated through timely mediations. Technological disasters are often serious in nature owing to the extent of damage caused by them. But their origin is usually known and it becomes possible to deal with them through proper management [10]. In comparison, the health crisis is difficult to handle as they are sporadic and unpredictable in nature. From that perspective health crisis such as covid-19 can be considered as black swan events which are characterised with being shocking, of great importance, and having a major financial effect [6].

The general characteristics of a crisis involve a severe disturbance to activities which happens in a surprising way [10]. Normally there are very low chances of a crisis to happen, but when it does happen, leads to disastrous consequences. During such times there is no enough time available for making informed decisions as the crisis happens very quickly without allowing any time for collection and analysis of information [11]. This does not allow for a proper planning to take place to face the challenges caused due to the crisis. On the onset of a crisis companies must learn the strategies to adapt quickly to the new environment [12]. The impact of the crisis will depend upon how the enterprises perceive them. If the enterprises perceive them as a situation in which something new can be learned, they tend to benefit out of it [13].

The social policies which were enforced by governments of most effected countries such as social distancing and working from home have challenged the businesses for carrying their business activities normally [14]. Most businesses have seen negative effects while few have experienced positive effects. Businesses like supermarkets and technology firms have seen enormous growth in their revenues but have also faced challenges of high demand and supply chain problems [14]. Crises also result in market turbulence due to changes in routines and structures (Williams, Gruber, Sutcliffe, Shepherd, & Zhao, 2017). Businesses that have established specific capabilities according to current market circumstances have had to dramatically re-evaluate their decisions [14]. Few businesses would have been prepared for the current health crises despite having proper risk management and resilience strategies in place. The concept of resilience has been studied in the entrepreneurship literature in terms of understanding how businesses adapt or resist change [12]. Resilience incorporates a sense of innovativeness, in terms of being able to change business activity. In addition, innovative businesses tend to be able to anticipate and then adjust to change in an appropriate way. This enables them to pivot or change direction depending on market need. Crises have had a profound effect on businesses particularly small businesses that rely on weekly projections in order to maintain their market share. The unpredictability resulting from crisis means an increased need for government assistance and support [14].

Crisis management involves avoiding as well as responding to major changes [15]. It is important to be alert in communicating the information regarding a situation as and when it occurs. The need for such quick response is required as solutions to the current problems must be found out while anticipating for the new ones. So there does



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not always exist a best way of dealing with a crisis as it depend on the circumstances [16]. Important societal organisations like government and large corporates should shoulder the responsibility of dealing with any crisis directly due to their size and lager resource base. Nevertheless, the importance of the small businesses cannot be ruled out here because of their quick adaptability to any situation due to their size. For an effective and efficient management of a crisis situation there should be a dedicated team observing the progress [5]. There are four C's of crisis management [11]: causes, consequences, caution, and copying. Causes are particular factors which may occur in an irregular or repetitive way. The cause may have a relation to an incident and has an unexpected result of a particular action. Consequences may relate the environmental impact of the crisis, which may result into smaller or a considerable effect on the society. Caution means the uncertainties and threats involved while progressing in a certain way. It suggests that there can be certain apprehensions while taking a particular course of action. Coping involves the way in which governments, businesses and individuals deal with the event. The above courses of action suggest strategies to handle the changes which apply an entrepreneurial approach.

During a crisis it becomes very difficult for businesses to perceive any benefits and it takes time for them to see their effects and understand from it. Because of the uncertainties s associated with a crisis, enterprises may feel it dangerous to take any actions [16]. It suggests that thought processes towards the uncertainty needs to be managed. There are various ways in which businesses confront a crisis: downsizing, persevering, innovating and exit [17]. Downsizing indicates to the different ways in which the businesses try to reduce their resource expenditures through strategic thinking, which may also indicate a fall in performance for which the resources has been squeezed. Therefore it should be understood that even tough downsizing may decrease the resource cost in the short run, it may pose some problem in the long run. There should be a thoroughly planned strategy in place for dealing with crisis situations instead of quick fix solutions [18]. Persevering would mean a business continuing as usual in the hope of things getting better with passage of time. The business needs to continue in such a manner until its cash flows come back to normal or can be changed. Throughout the crises, the culture and working style of the business does not change with an expectation of things improving in the future. Through this strategy businesses rule out any undesirable effects that may result by making any changes in the culture and working style of the business. Innovations would often mean a new response to the challenges posed by the crisis. Innovation is vital for businesses as it allows businesses to think about unique ways of solving challenges [19] and opens up new avenues of revenues and potential markets. Therefore a crisis such as Covid-19, forces businesses to rethink their current business models and come up with new business models. Such type of self-introspection done by businesses makes them stronger and well prepared for the future. Exit strategy is used by businesses when they decide to withdraw from the markets. Sometimes the businesses may reach at situations where exit from market would be a wiser option so that further financial losses can be prevented. Even though it may be emotionally hard for the businesses to take such steps, it helps them come back with renewed enthusiasm where they reflect the current market conditions in a better way [20].

CONCLUSION

The occurrence of a crisis also causes disturbances in the markets due to changes in structures and routines. Businesses who had built their capabilities based on current market scenarios have to rethink on those strategies. Many businesses were not prepared to face the challenges of the covid-19 pandemic, despite having a strong and flexible risk management strategy. Resilience strategies normally involves innovative strategies through which businesses would be able to foresee challenges age change their course of action accordingly. The covid-19 crisis had a very severe effect on small businesses that depend on weekly forecasts to manage their market share. Such a situation calls for assistance from the government side in terms of both policy as well as financial assistance. Enterprises can respond in a variety of ways to a crisis from decreasing the output to changing their business functionalities. The manner in which enterprises respond will determine how sustainable they will remain in the marketplace. There is a need for the enterprises to be flexible while facing environmental uncertainties. The





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enterprises need to build up capital by anticipating such situations before, during and after crisis situations such as the covid-19. Responding in a flexible way to uncertainties will make these enterprises to adapt to changes and recover quickly.

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Foster Higher Education to Be Socially Responsible in India During the Crisis: A Part of CSR

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ABSTRACT

Impact of the COVID-19 so called disaster imposed educational sector to reframe the curriculum. The data of the study reveals the need of transdisciplinary approach and intermediate courses are to fulfill the gap of affected area in the education sector by leading student to manage the stress, anxiety, depression, health hazards and mental disorder due to less of outgoing activities. The role of higher education institutes is to form a healthy culture and sustainable model to bind the students, faculty, staff and alumni by being socially responsible most important aspect of CSR and ISR (corporate social responsibility and institutes social responsibility). The main objective of this study to generate opportunities for all to overcome adversity and flourish in a fast-changing world with the help social responsibility. This research shows institutional social responsibility towards society with using secondary data. Various institutes, colleges, schools are engaged in conducting several webinars through which students and faculties are developing a new way of learning and creating innovative ideas. At this crucial time, higher education institutes are experiencing a paradigm shift in establishing strategic decision-making system for the future.

Keywords: COVID-19, Pandemic, Higher Educational Institutes, transdisciplinary approach, webinars, Intermediate courses and Curriculum, CSR, ISR.



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INTRODUCTION

In a globalized world Higher education plays a vital role in which it is also a part of a final stage of final learning or tertiary education. A deadly virus COVID-19 has put on hold the world's activities which has traumatized every aspect of life. It has severely impacted higher education across universities, colleges and schools which is a serious concern for a developing nation like India. Because of this pandemic situation students and their education have been disturbed and unable to perform the same activities through which they were engrossing. COVID-19 is an infectious disease caused by severe acute respiratory syndrome Coronavirus 2 (SARS-CoV-2). The virus was first identified in December of 2019 in Wuhan, the capital of China (World Health Organization). It speeded its roots all over the world. The virus primarily dispersed between the people with close connections. Universities and institutes have taken precautionary action to keep them shut till the chronic disease is under screening. The epidemic has brought not only unbearable psychological pressure but also a risk of death from infection (Chen N. et.al., 2020) The continuous spread of the epidemic delays in starting universities, colleges and schools across the country also influences the mental health of the student with the strict isolation measures. However, Universities serving a wide variety of functions are now in complicated situations by virtue of COVID-19. In the changing environment Higher education must identify and face the challenges to diversify the financial resources. When the world is facing different challenges due to a disease which has disturbed the economy. To avoid the losses caused by crisis events have become challenging for universities and colleges to guide the students effectively and appropriately to regulate their emotions (Bao Y. et.al., 2020).

The most important driver of CSR is the actions taken for the formation and Higher education comprises teaching, applied work, research and social services activities of universities. In general terms if we consider it provides education and training through universities, colleges and different elements of institutions. If such deeds are being conducted by corporates it is being called as corporate social responsibility (CSR). Under triple bottom line one must fall under any one category to be responsible for environment, society and people. However, CSR goes beyond a practice to support the business and society for their wellbeing. With the domain of teaching, it includes responsibility and opportunity to initiate in serving for our country through providing critical care and resources. There are diverse grounds for arguing that Higher education will increasingly be important in the community and for the people of the society.

Higher education institutions can take social responsibility and institutes social responsibility (ISR) during this difficult time. The consequences of the pandemic have broadcast the hygiene information and carried out accurate health, making the transdisciplinary approach by research post to understand the crisis of physical, mental, economic and social implications. The local bodies and institutions must effectively deal with the crisis. The situation is demanding higher education must respond and demonstrate the social responsibility by engagement of resources in a significant manner. The commitment of the universities strengthens the community engagement, promotes economic and national development, develops local and global human resources, expands human knowledge through quality research and education for humanity and nation promotes sustainability (Cortese, A.D, 2003).

OBJECTIVE AND METHODS

The study of sample and target population is composed with the college population including students, staff and non-teaching staff. The data collected from various authenticated secondary sources such as published, unpublished papers and articles, newspapers, books and various Government organisations report. Mode of the study is descriptive in nature.

- a) Sustainable future: with the support of Higher education to fight back with COVID-19 issues.
- b) The changing role of Higher education for the society and to be socially responsible.



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- c) Impact of COVID-19 on Higher education.
- d) Institute's contribution in the society for mitigating the consequences.

REVIEW OF LITERATURE

Studies have been conducted (Yarime M. et.al., 2012), on the establishing sustainability science in higher institutions towards and integration of academic development. He believes that sustainability can be set through collaboration of all stakeholders in academics. He discussed in the paper that uniting education and research is a need of practice to fight the sustainability crisis. It is also observed to be a dynamic and a complex process. In research it was found that innovations and learning can be worked through experimenting with the collaboration of industrialists and academicians. Many opportunities can be framed through possible means such as fellowships, scholarships, grants etc. It was a belief that contribution towards sustainability can only occur through rigorous efforts and the best research must be coordinated and explored. (Cao W. et.al., 2020), studied the impact of COVID-19 on college students in China, rest of the world and china are facing the psychological impacts on students, general public, staff, parents, children, older and adults. Based upon the respondent's paper generalizes the anxiety disorder scale through different methods and approaches. It is observed that students have experienced anxiety living in urban and rural areas through multivariate logistic regression analysis.

(Vasilescu R.et.al., 2010), In his research study he highlighted the intrinsic social responsibility conducted by higher education organizations to meet the expectations of their stakeholders (including present student, future student, supporters etc.). This paper aimed to change the conceptual framework of Corporate social University to Corporate social responsibility. He observed in his research that higher education is a lifelong learning for the new society. It benefits the change in many areas such as climate, environment protection, recycling, global inequalities involvement. Paper finding believes that the social involvement starts from a committed society. According to (Singh J. 2020), Coronavirus, a deadly virus had a bad impact on the society. Individually it leads to a stressful state due to social distancing meant to be a precautionary measure, crisis in the economy, fear of losing a job which has badly affected the economic activity. This paper includes the impact on society based upon the secondary information. Schools, colleges, restaurants, universities etc. were suddenly closed and the exams were postponed avoiding the spread of the virus.

Kamlesh Rishi and Dr. Mamta Saxena, (2017), studied about the role of women empowerment and laws in India to help women education. They discussed the women role in the society can be improved through education. History of women reflects many factors which determines the discrimination in education. Under many Act rules are abided to provide proper focus on women as they are meant to be superior. The paper also reflects various convections through current scenarios where women are the bread earner for their family. It needs to reform the laws continuously with time.

Positive Impact of COVID-19 On Higher Education

Higher education serves in many purposes, from which some are emphasized in our culture. Higher education acknowledges young people towards career preparation and explores many options. It primarily serves in gaining skills, training and knowledge in their desired profession. Preparing oneself for a career into practical education benefitted by the college. Statistics enhancement through personal development, better communication, identifying and solving problems through critical skills, realization of passions, young people identify their skills and initiates the sense of accomplishments. People who are employed in higher levels of education are likely to earn more.



**Nisha Singh et al.****Role Of Higher Education In Being Socially Responsible**

The main contribution of higher education is to sustain economic and social development increase year by year. Higher education contributes better to economic growth and development through increasing higher skills and fostering innovations (Robert and Timothy, 2010). It improves the quality of life towards major social and global challenges. This is one kind of intellectual process where universities and development of societies happens on one hand. It raises the skills that hold the higher living standards and well-being by growth performance, prosperity and competitiveness. It enhances the productivity and higher rate of employment growth.

It gives a different opportunity to a person to succeed in the global economy. Universities also give platforms to go with the dynamic process with various programme aimed at preparing on economic demand. The outcome of students attracts the job opportunity by professionals and engages in professional training. Higher education Institutes provides assurance to identify the gap, rebuild yourself, create social programme and gain the right skills relevant to their knowledge which improves productivity and growth. Higher education is a technology and innovation driven force. Global perspective is to contribute by finding the challenges and finding solutions to a big change in the social outcome through health and social engagements. Higher education is also a production of knowledge and research by designing new products that result in advanced technology use. Many institutes focus on retaining by imparting knowledge through training, generating better resources, encouragement of students, strengthen teachers by more exposure and working practices. It is a service to their society by making a better world. Higher education can be achieved through full potential, proactive staff, new challenges making more advancement in science and technology.

Implications on Higher Education

Educational systems worldwide affected by the COVID-19 pandemic, leads to the total closure of schools, colleges and universities. In India it began from 22nd of March,2020 approximately 321 million learners are affected due to COVID-19 and Institutions are in closure response. All boards have announced to cancel their further examinations till the things get on track. Boards are planning and in search to have better learning programme to freak out students from the anxiety level. Closures have affected students, teachers and families have raised economic and social consequences. The impacts are more severe and cause problems in learning. This is directly affecting the economic cost of the families, insecurity and homelessness. However, the government has instantly taken step to prevent everyone from this by suspension.

The data represents about 6 countries (India, Germany, Thailand, France, Indonesia and Brazil) learners are affected badly in all the educational departments. In Fig-1 more than 321 million learners in India including primary, preprimary, pre-primary, secondary and tertiary are facing closures caused by COVID-19. The disruptions severely impacted on interrupted learning across the communities. Most data have been calculated based on closure showcases in the statistics and figures provided by UNESCO. India is one of them which is badly affected by this pandemic. What can be done to mitigate these negative impacts? Schools need to rebuild the resources and learning once again with the new beginning. The new policies will hit hard to support the system to mitigate the problems that have arrived. The experienced of the major teaching interrupted and experiencing the major global recession. Graduates, non-graduates and other staff are severely affected by the COVID-19 pandemic with low paid jobs, temporary positions, unemployment and loss of the current position. This is costly for both the individual (market and labour) and to the society. The closure of colleges and universities interrupts teaching for the student postponed or cancelled and coincides the key assessment period. Consequently, it leads to the inequality of human capital growth for the affected crowds.

The Institute of higher learning in India has necessarily resulted in lower research output compared to China, Malaysia, Mexico, Thailand, Indonesia, and Philippines in Fig.2. In the upcoming market the china colleges were most successful and on high priority due to effective reforms in education funding. Indian institutes should also



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encourage students to educate themselves with the support of non- government sources in the form of tuition fees, profits from schools to sponsor enterprise and consultancies. University finances in India remain badly managed in the public universities they find it difficult to manage with the funds. The universities have enough funds to run and manage but, largely dependent upon temporary staff which leads to discomfort in the quality. There is a need to think about this to make the proper mechanism. And at the same time universities can step up to ensure the education reforms (Sreevatsan A. 2020).

Covid-19 has exposed India's healthcare system and it has also exposed the inadequacy of India's university system. At this time, the world's largest universities are closed and in forefront to battle with the novel coronavirus. This data represents in Figure 3 Government colleges are the backbone of India's higher education system both central and state universities have struggled and faced a crunch in recent years. The faculties and non-faculties staff are more than hundred thousand are not working in the conducive environment due to COVID-19. This is the utmost priority and a major part of the education is with the Government of India where mostly students are related to the rural areas. It is difficult to reach all of them due to lack of resources. Where the private aided and unaided institutions have taken few steps to not lack behind with some of the commitments to research and other co-activities. Researchers are trying to create a model to handle the Indian university system. It is high peak time to think of making education system better to handle the discrepancies (Ghara T. K. 2016).

Development of A Policy Framework By Including Online Classes

In addition to provide support for the creation of an appropriate policy framework. We noted that responsibility of Higher education regarding the consequences have changed now there is a need of equilibrium considering a proportion about "education". Virtual education to impart in the policies widespread to utilize the desired quality and engage them in marketable skills to adopt, to create, to build the potential significantly. There should be a provision when the whole human activity becomes nought for some time for creating a lot of natural opportunities to reinforce and heal itself becomes a social responsibility of a citizen. To fight with pandemics our public health system sets up an opportunity to be powerful. Government interventions plays a fair role for sudden orderings and emergencies which needs to be accountable. COVID-19 crisis is a real time demonstration of the worsened inequalities that exist in all parts of the world when everything was closed and encouraged for social distancing. Social distancing needs to be incorporated for better hygiene, nature and keeping other disasters are in concern. Creating an atmosphere, place, moment and a time to connect with history through entertainment venues helps to see the value and importance of life lessons and natural resources in our lives and understands how behavior can positively impact the spaces (Arkorful, V. and Abaidoo, N. 2015).

Prompt Actions

During the lockdown period it is most challenging to prevent the corona infection. In India 37 million students and more than 2 million faculties / staff can be engaged by Higher Education Institutions through immediate measures. Firstly, the student and faculty/staff should spread the awareness of the health and hygiene factors in their neighbourhoods and in the community where they live. Maintaining social distance, staying indoor, wearing masks when moving out and washing hands with soap for 20 seconds to kill the virus etc. are the several factors guided by the state and central government through videos, posters and several other methods to spread the message to keep us safe.

The Government of India has announced so many schemes to not panic with the sudden problem. Many of the migrants are moving to their home places due to the sudden loss of employment, lack of food, shelter and medical facilities. All governments have declared welfare packages to the daily wage earners, landless workers, small and marginal farmers in rural area, the aged, construction workers, vendors, poor women and to the other community through PMGKY (PM Garib Kalyan Yojana) by providing funds, work, free LPG gas, in addition to 15 kg rice or wheat, grains etc. More than 800 million poor people will be the beneficiaries including other sectors MSMEs (micro, small and medium enterprises), MNRGA (Mahatma Gandhi National Rural Employment Guarantee Act) (Singh R.





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2020). This situation has resulted in sudden panic, fear and isolation amongst people. Many are living in different places away from the family, some of them are quarantined in their shelters due to their travel history or being in touch with the COVID-19 patient, with limited social connections. Many people are facing depression, anxiety, stress due to the problems occurring to them. It is an urgent need for them to counsel and provide help to this new condition. Many organisations have already provided helplines numbers to support them and their families, neighbours and local communities.

Universities, Ngo's, and higher education institutes should have a possible plan when colleges would open, they must engage students into teaching and research activity forming a new venture to collaborate with rural and urban communities. Curriculum should be reframed including activities related to the communities and neighbourhood's current situation connecting with a field study component. Engage students in identifying the role of the people who served to the poor people with different means. Must understand the fact that it is not only the Governments and relevant agencies duty to support vulnerable and poor families. Universities should undertake multi- disciplinary approach in studies. Innovate solutions for both rural and urban communities, skilled frontline workers who practice for public health to keep them safe and secure. Disaster management institutes and agencies to showcase their preparedness for any future situations. Further, frontline worker's responsibilities are to keep them sanitized and spread awareness by communicating actively. The pandemic changes the existing knowledge systems and provides a strong message to use the resources appropriately by saving water, conserving food, electricity etc. This is to create sustainable livelihoods in future too by acquiring and employing people is the only appropriate solution.

Activities That Have Been Conducted During COVID-19?

Higher education institutes have lots of hurdles in finding the new mechanism of learning platform and integrity where, across the country have been shut down with effect of Covid-19. With the help of the system and support addressing the student to involve their efforts in social responsibility. In recent years' government launched the community engagement through Unnat Bharat Abhiyan i.e. (UBA 2.0) steps towards making the higher education institutes socially responsible. It was launched by the Ministry of Human Resource Development (MHRD) in 2016. With this programme universities undertake local communities through district authorities and panchayats to identify the current problem and make the changes in the existing one by articulating the solutions by developing new technologies. Higher education institutes inculcate teaching and research as a basic fundament is to encourage students and staff to come out with different mechanisms to fight with this pandemic disaster. India is one of the biggest populated countries where around 80 crore people earn daily wages. Higher education of India includes approximately 42000 colleges under university grant commission (UGC), more than 1000 universities, surpassing 10000 professional and technical institutions under All India Council for Technical Education (AICTE), nearly 37 million students and 2 million faculties / staff are a part of this system. When, Covid-19 created a severe impact on the economy system is tried to raise ways to fight.

This crucial time realized the integrity and fill the gap in the education of the student. The institutions have perpetually adopted different online platforms and open book examinations for upcoming sessions. Various institutes like Dayalbag educational Institute (DEI) opened a platform where they can "earn while you learn and learn while you earn" by various activities, involving and contributing to the college premises in their extra time to not struggle from the payment of the college fees. Also, many universities in rural area started "Vidyavani programme" through broadcast on radio to make villagers about the major priority without internet connections. Government is continuously trying to make healthcare infrastructure is better for rural communities with these facilities. Universities are learning methods to adopt the Mahatma Gandhi approach learning by doing which emphasizes on practical work.



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DISCUSSIONS

Universities in India must look for practical approaches that not only be included in curriculum also, inculcated in the students to help the community by solving the problems through various start-ups, using technology in building their skills for societal challenges. HEIs should also think about integrate the people from mathematician, biologist, Humanitarian, philosophers, architectural etc. Local communities must be equipped to fight with any kind of disaster. Transdisciplinary research also engages students, researchers, parent's policy makers and local communities to interact with the challenges and begin the innovations (Wiek A. et. al., 2012a and 2012b). The urge of calling Undergraduates and postgraduates from any other field or the students from the school. Faculties are also encouraged to get this type of research, content, projects in the studies which is also a part of evaluating performance assessment. Imposing things from above is counterproductive for Higher education to reorient the curriculum to connect with the needs and challenges of the society. Mental health issues during COVID- 19 are a step to include in disaster plans prior to pandemic situations. Universities also, open the counselling for mental health issues on a low cost or a free of cost to help the community engagement. Creating a belief that serving the society should be a culture to make the generation ready for the uncertainties called a disaster. In the paper "The critical role of Higher Education in creating a sustainable future" by Anthony D. Cortese (March-May 2003 P-18), discussed the sustainability through Integrated approach (Fig.4.) and the need of research. To understand how graduates, postgraduates and researchers can be connected through a same curriculum at one platform.

Higher education institutes in India plays a vital role to make the better society by its contribution in education, learning, research with integrating all the areas all together with creating the leaders in a sustainable society. This could be the best when all brains are imparted together to bring something new. The best practices will improve learning better inside and outside by higher education for the society. The phenomena are to affect the leaders who are necessarily the most interdisciplinary and long-range thinking is connected to the decision-making structure. For the planners and educationists, it is very important to think from the responsibility side to make the world sustainable.

Concluding Comments

Social responsibility practices play a powerful role in fostering higher education. To build the capacity of institutions that fosters CSR practices too by educating and creating the demand for those practices. The purpose of this research is to identify the consequences on Higher Educational Institutes in India caused by the pandemic COVID-19 severely impacting the life of the individuals on a whole. Many countries are facing the same unprecedented shutdowns and emergencies declared in the region and India is one of them containing many people in the education sector. We are from one of the developing economies and society who are mentally and physically stressed and economically ill. The significant steps are being taken by the institutes showing their responsibility towards them in the situation arrived. The traditional knowledge across the globe for sustainable development fall under CSR and ISR, benefits to the innovation, values and technology is largely a cause of humanity.

To continue with the academic learning students must be engaged with a new process of learning which will know their potential. Also, this is providing a better time to regain, rebuild and construct ourselves accordingly. People need to be engaged in positive additional sources to control with the management in this novel pandemic. It is identified that only few Institutes can access E-learning which will decline the demand for International higher education is also expected. The pandemic has transformed the old chalk and duster method with the technology E-learning solutions. Immediate measures are required to mitigate the effects of the pandemic on internship programs, research projects and on the job offers. The crisis also gives an opportunity to develop effective educational practices which is required to train the young minds. It will also ensure the overall progress of India by developing skills and productivity.



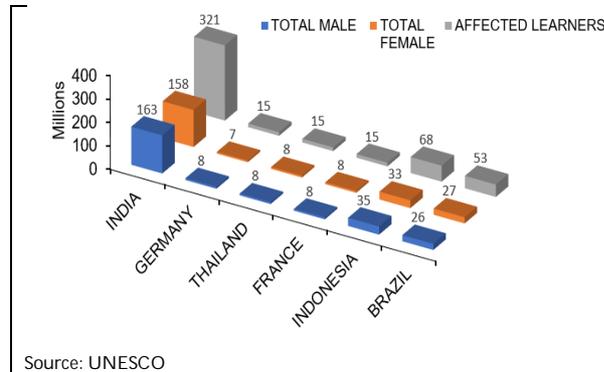
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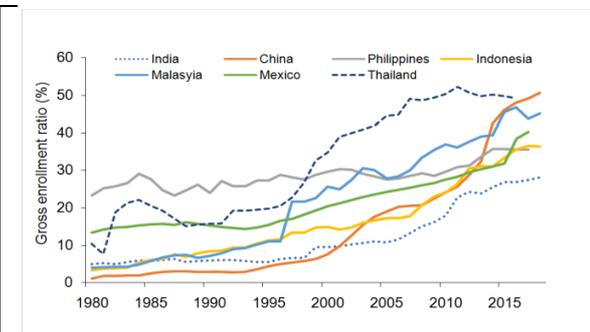


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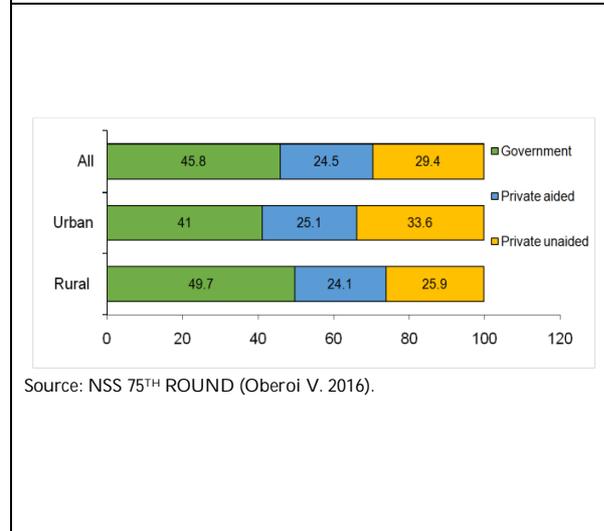
Source: UNESCO

Fig. 1. Data reflects global monitoring of schools and tertiary education closure caused by COVID-19.



Source: UNESCO

Fig. 2. Global data of 40 years shows gross enrollment ratio (%) in the tertiary sector which reveals that India is lagging in college enrollment in the emerging market



Source: NSS 75TH ROUND (Oberoi V. 2016).

Fig. 3. Percentage distribution of students by the type of institutions as of 1 January 2018 in India

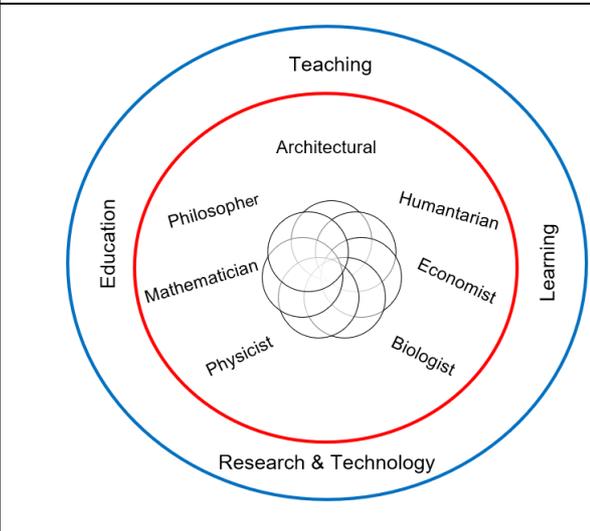


Fig. 4. Higher education model for sustainable creation





Perception of Cervicogenic Headache in Neck Pain Population– A Questionnaire Survey

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ABSTRACT

Cervicogenic headache is a type of unilateral headache that is mainly of cervical origin. It affects both male and female though female are more prone to this type of headache. With increasing hours of sitting in computers either for work or recreation there is a neglect on posture which leads to constant strain in upper neck region. And with this new normal of work from home has landed many people in a pathetic scenario of muscle imbalance in upper cervical region. Hence there is a rise in incidence and prevalence of cervicogenic headache among general public. Though the available treatment options are plenty still the access to such treatments are minimal. This is mainly due to the lack of awareness among public about the treatment available for cervicogenic headache. Hence a survey study was conducted to identify the potential risk factors, associated factors and prevalence in the Salem district population. The survey was conducted online through a questionnaire that was self-designed for this study which was an extract from already existing headache questionnaire. 389 participants participated in the survey. The results of the survey had shown minimal accessibility to physiotherapy treatment for cervicogenic headache. The survey showed higher prevalence of headache among female population (65.8%). And 73.9% of participants reported the first incidence of headache around 30 -40 years of age which shows the primary cause may not be due to degenerative changes in cervical spine. The results of the survey analysis make the authors conclude that though the age of occurrence of headache starts as early as 30 years. Hence the authors recommended to create more awareness on this aspect for the benefit of the general public.

Keywords: Cervicogenic headache, Questionnaire, Survey, Neck pain, Physiotherapy.



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INTRODUCTION

Cervicogenic headache is one of the most common clinical condition that affects the general population to a larger extent. Of all the types of headache cervicogenic headache has a common occurrence. It is defined as a pain perceived in head but the location of primary source is in the neck [1]. It is characterized by unilateral headache that is known by referring pain from soft or hard cervical structures to occipital, temporal, frontal and sometimes pre-orbital regions [2-4]. The global prevalence of cervicogenic headache is estimated to be 0.4% - 2.5% in general population and affects women 4 times more than men [5,6]. The Indian data shows a 1 year very high prevalence of 14.7% in South India with explanations lying in cultural, lifestyle and environmental factors with observed associations with female gender and rural dwelling[7]. With this high prevalence the public are still unaware of the treatment options available and hence choose to live with pain. The predominant reason is the lack of knowledge and poor awareness of the available resources. Headache foist a serious unrecognizable burden on the sufferer which includes personal suffering, poor quality of life and financial strain. The constant fear of another episode of pain leaves them in anxiety and depression. This study aims at address the insight into the cervicogenic headache, its associated factors and the treatment options available. An online survey was conducted and a questionnaire was designed from already existing valid tools.

METHODS

A survey analysis was done from July 2020 to September 2020 during the first wave of covid-19 in India. Due to the pandemic situation and to reach more participants online mode was chosen. A set of 12 questions were framed for this study which were extracts from already existing headache questionnaires. And as this survey did not involve any rating a separate validity and reliability was ruled out. The questions were mainly close ended with four optional answers and certain questions allowed the participant to choose multiple answers. The major criteria for participation in the survey was anyone who suffered from cervicogenic headache previously and who were willing to participate in the survey without any expectation. The authors created questionnaire file which was circulated through social media platforms like Whatsapp, Facebook, Instagram and through email address of the patients collected from various clinic and hospitals. But the participation was purely on individuals concern. Basic demographics i.e Age, Gender, Occupation were collected. The bias was reduced as far as possible and the answers were scrutinized by senior therapists. The questionnaire is given in table 1.

STATISTICAL ANALYSIS

The results of the study were displayed as percentages as the data were nominal in character.

RESULTS

A total of 389 participants had participated in the survey of which 311 were taken into final consideration. 78 responses were excluded as 32 were incomplete and 16 were answered without interest (responses were clicked as same option for all or many answers) and 30 were from medical field as there could be a bias in answering due to their knowledge of the disease. Hence after careful scrutinization only 311 responses were taken into consideration. The average mean age of the participant was 34.65 with male 34.54 and female average age being 34.61. The survey showed higher prevalence of headache among female population (65.8%). And 73.9% of participants reported the first incidence of headache around 30 -40 years of age which shows the primary cause may not be due to degenerative changes in cervical spine. 0.9% of the participants between 50 -60 years of age reported their first incidence of headache. The headaches occurring before each menstrual cycle is termed as menstrual headaches and is reported 2 days before menstruation which might even last till the last day of the cycle. These headaches are usually migraine-type, but may be cervicogenic as well [8,9]. 5.2% of participants reported headache precipitated before their



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menstrual cycle. 17.4% of participants reported sleep deprivation as one of the major precipitating factor. About 50% of the participants reported admix of several treatment options available they chose to do nothing which shows their lack of awareness the treatments can do.

DISCUSSION

The study aimed to analyze the knowledge of the disease that they undergo and availability of treatment options for headache and identifying the primary medical fraternity they choose for their treatment. The study was limited to people who had access to smart phone and to technologically sound population alone. Out of 12 questions, the first four questions address the occurrence of age, frequency of headache and longevity of one episode of headache. The common age of occurrence was identified as early as 30 years and as late as 50 years of age. The next three questions aimed at finding the character of pain and area of involvement. The eighth and ninth question aimed at identifying their mental well-being and social life while the tenth question identified the precipitating factors. The eleventh question assessed their quality of life. The last question identified the primary health care provider accessed for cervicogenic headache. The answers showed that still many are unaware of the treatments available and choose to suffer from pain or neglect it. Certain questions are represented in charts below.

CONCLUSION

The results of the survey analysis make the authors conclude that the though the age of occurrence of headache starts as early as 30 years, many are unaware of the treatment options available and much more field work is needed to make them access physiotherapy treatment for cervicogenic headache as frontline option.

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Table 1 Cervicogenic Headache Questionnaire

1. Around what age did you have the first episode of headache?
 1. 20 -30 years
 2. 30-40 years
 3. 40-50 years
 4. 50-60 years
2. How long have you been suffering from headache?

Less than a month

 1. 1 – 3 months
 2. Less than 6 months
 3. More than 6 months
3. How often do you get headache?
 1. Almost daily
 2. Once a week
 3. Atleast twice a week
 4. Once a month
4. How long do you have a single episode of headache?
 1. Less than minutes
 2. For hours together
 3. Atleast a day
 4. More than a day
5. How does the headache usually begin?
 1. Gradually
 2. Suddenly
 3. Varies
 4. Cannot tell in specific
6. How would you describe your pain?
 1. Stabbing
 2. Throbbing
 3. Burning
 4. Dull aching
7. What is the common area of occurrence
 1. Either side
 2. Both sides
 3. Back of head
 4. Base of head in neck region
8. Do you have any of the following before each episode of headache?
 1. Mood swings
 2. Food cravings
 3. Neck pain
 4. Blood pressure alterations
9. How does your headache affect your family and social life?
 1. Not much
 2. Badly
 3. Very much
 4. Devastating
10. Which of the following precipitates/aggravates your headache?
(You can tick multiple answer)
 1. Strong smell/certain odor





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- 2. Loud sound
 - 3. Bright light/ multicoloured running lights
 - 4. Stress/ fatigue
 - 5. Menstrual cycle
 - 6. Too much of screen time
 - 7. Sleep deprivation
 - 8. Travelling
 - 9. Exercise
 - 10. Too much of caffeine/alcohol
11. How would you rate your overall health because of headache?
- 1. Excellent
 - 2. Good
 - 3. Average
 - 4. Poor
12. Whom do you consult first for your headache?
- 1. Physician
 - 2. Neurologist
 - 3. Physiotherapist
 - 4. None

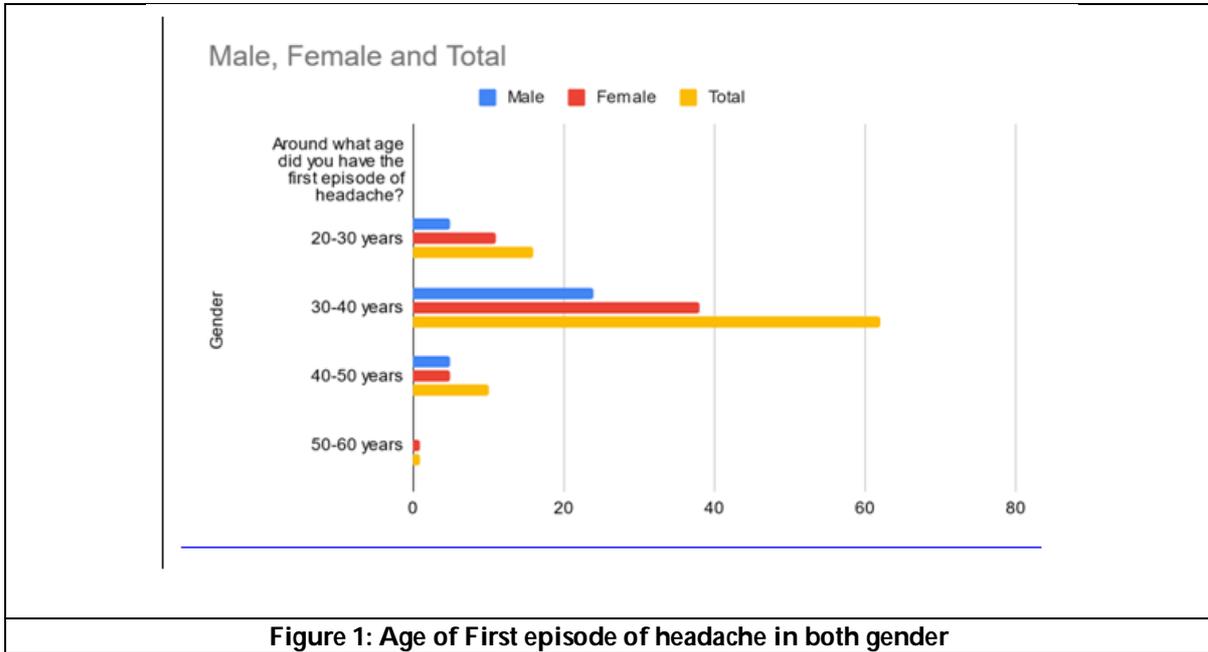


Figure 1: Age of First episode of headache in both gender





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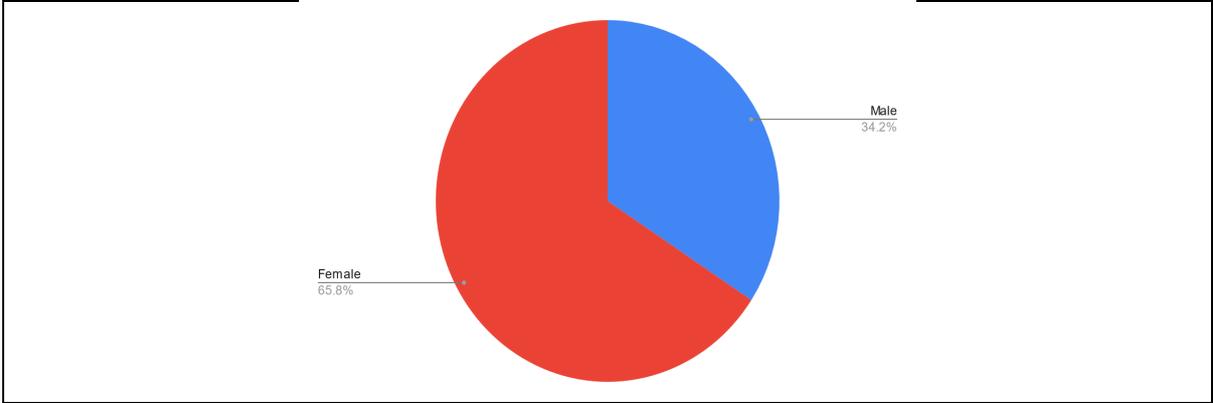


Figure 2: Gender Ratio

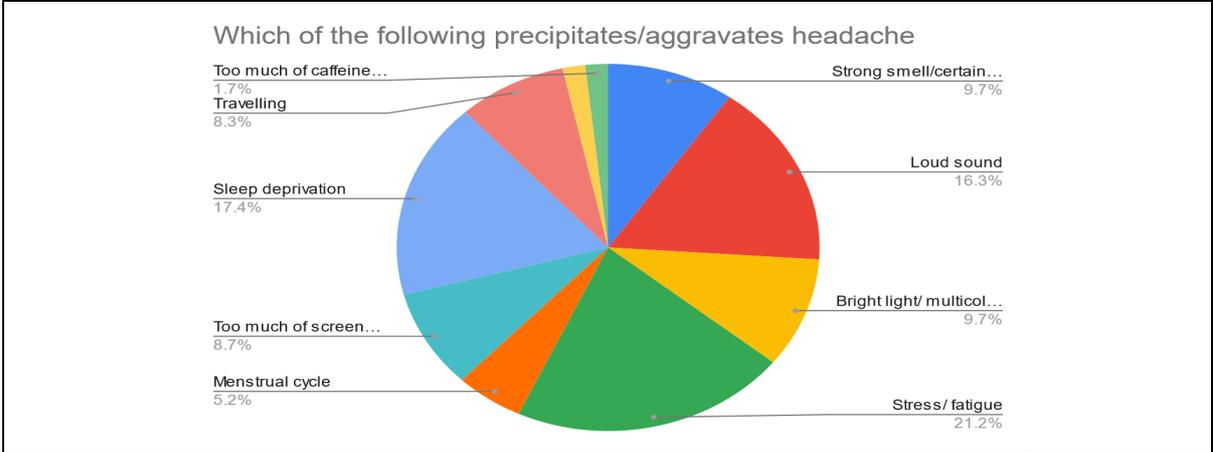


Figure 3: Factors aggravating the Headache



Figure4: Consultation for Headache





Determination of Caffeine in Raw and Roasted Coffee Beans for Three Different Types using HPLC Device

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ABSTRACT

There are many studies that have been conducted to find out There are many Studies conducted on coffee beans to see the effect of roasting, but all of these studies were for only one type of raw coffee. This study was conducted for three types of raw coffee: Hariri coffee, Berry coffee and Khawlania coffee with different roasting degrees (0,10, 20, 40, 60 and 90 degrees Celsius) To determine the caffeine content and know the effect of heat on it. An HPLC_UV device was used for this study and the wavelength was set at 272 nm. The linearity of the method was checked from 10 to 100 mg/L, and the correlation coefficient was 0.999 using VP-ODS chips. packet column with water: methanol (70: 30 V/V). The high-performance liquid chromatography method for determining caffeine levels was validated and found that roasting coffee in all cases increased the level of caffeine in all coffee samples 13 mg/L raw and 37.67mg/L for roasted coffee. It can also be concluded from the result that coffee beans .

Keywords: caffeine, coffee beans, coffee roasting, HPLC.

INTRODUCTION

Recently, it has been reported that consumers of caffeinated beverages are on the rise due to overpopulation and improper and long working hours. [1]. Coffee is one of the most exported from developing countries, and caffeine represents the quality of coffee [2, 3] .Caffeine use is prevalent among people who work hard for long hours [4]. These effects have been proven by research showing that caffeine abuse in its various forms (leads to increased attention) [5]. Many manufacturers market caffeine in pill form [6], claiming that the use of caffeine is sufficient caffeine content varies widely from around 13ppm to over 38ppm in certain types of coffee. This difference to coffee depends largely on the type of coffee even within a particular bush, and differences in concentration and method of



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preparation used [7]; Barry and Khulania coffee contain less caffeine. The world's main source of caffeine is the "coffee bean" (coffee seed) [2,3], used to make coffee. Caffeine is an alkaloid from the methylxanthine family of coffee beans [2]. Gallbladder. chemical formula $C_8H_{10}N_4O_2$, its systematic name is 5-,3,1-trimethylxanthine and its chemical formula is shown below. In pure caffeine in the form of white lumps, Odorless, soft, sparkling needles of powder molecular weight 194.19 g, melting point 236°C, the point at Premium Caffeine 178 at barometric pressure, pH 6.9 solution, 1% specific gravity, 1.2 volatility, 0.5% vapor pressure 760 mmHg at 0 °C 178 In water, 2.17 % vapor density 6.7°C Solubility Sources. the solvents currently available are chloroform, dichloromethane, ethyl acetate, etc. Caffeine: It increases heart rate, dilates blood vessels, and raises levels of free fatty acids and glucose in the plasma. It is considered an effective medicinal substance, and acts as a mild central nervous system stimulant depending on the quantity. 8], improve cardiac performance, increase heart rate. Caffeine is one of the main additives to soft drinks. Plus, caffeine - a group of naturally occurring diterpenes in coffee beans. Coffee is chemically one of the most complex consumables, as it contains many substances. Methylene chloride is used to strip caffeine from high levels of conventional coffee (but can also be dangerous under certain conditions. It can cause fainting, dizziness, and headache if inhaled) .Decaffeination is a common term in the current modern world for improving caffeine contents in various sources. In this study, dichloromethane is used to decaffeinate raw and roasted coffee. Samples were taken from different types of coffee (Hariri, Berry, Khawlania).at different roasting degrees (0, 10, 20, 40, 60, 90 ° C) and analyzing its caffeine content using high-performance liquid Chromatography. Various studies have shown that the spectrophotometer and HPLC using degreasing methods have shown satisfactory accuracy.

For caffeine quantification, chromatographic (HPLC) methods are still considered state-of-the-art techniques [9]. [10] and near-infrared reflection spectroscopy (NIRS) [11,12]; liquid chromatography-mass spectrometry [13]; Gas Chromatography - Mass Spectrometry / Flame Ionization Detection - (GC [MS / FID) ; Ion Chromatography [(IC)] [14]; Gas Chromatography With Sensitive Detection System Nitrogen And Phosphorous Detection System [GC-NPD) [15] X-ray Spectrophotometry Fourier transform infrared (FT-IR) [16] However, the UV-visible spectrophotometric method is available due to its ease of testing, low cost and excellent results in the detection of caffeine [17]. (In this study, an HPLC-UV device was used to estimate caffeine levels in three types of raw and roasted coffee "Harry, Berry and Khawlania" at different temperatures from 10 ° C to 90 ° C, where the study proved that the temperature directly affects the percentage of caffeine..)

MATERIAL AND METHOD

The coffee collected was Hariri coffee, Berry coffee and Khawlania coffee. The coffee beans were collected from the local market of the Riyadh city, Kingdom of Saudi Arabia.

Sample preparation

Roasting coffee beans

All raw coffee samples were prepared. the roasting temperature for all samples ranged from (0°C to 90°C) which was determined Based on the physical examination of the outer color of the grain, which is the most commonly used in the coffee roasting industry. After roasting, the grains are cooled to room temperature.

Grinding and storage

The roasted coffee beans have been finely ground using an electric coffee grinder and kept in a closed plastic bag before analysis.

Prepare the standard solution

Standard samples were prepared at concentrations (90,70,50,30,10) ppm by serial dilution of standard substance (caffeine 1mg freebase/1ml methanol) lipomed company.



**Maha Abdallah Alnuwaiser****Caffeine analysis**

Preparation of raw and roasted coffee samples:

0.25g of raw and roasted coffee samples were weighed and transferred to 25ml Volumetric flasks and water supplement up to the distilled mark and left at room temperature for 24 hours. Caffeine was extracted by liquid-liquid emulsification by dichloromethane at a volume of 1:1 three times and the filtrate were left at room temperature until completely dry. Then the extract was taken with 25 ml of high purity methanol and injected into an HPLC-UV.

Instrument

Chromatographic results were obtained and processed by Shimadzu Corporation, Japan. Injector Model SIL 20A/20AC, injector with a 10 µl injection loop. The class column used was ShimPak. VP-ODS (with an inner diameter of 4.6 mm and a length of 250 mm) Twenty was adjusted at 35°C ± 1°C. The mobile phase used was a mixture of water: methanol (70: 30 V/V) with the flow rate of 1 ml/min. The LC system used was isocratic, which consists of LC-20AB isometric pump model, a vacuum degasser and a UV detector.

RESULTS AND DISCUSSION

The caffeine retention time was 5.64 minutes, With a relative standard deviation, RSD = 0.6%. Therefore, in standard solution, where the HPLC method provides constant retention times. Caffeine concentrations in standard Solutions. Good linearity results are shown. The calibration data are summarized in the table below. The calibration graph is also shown in the figure five of the calibration formulas below. 10ppm to 90ppm. The calibration curve is then generated according to the response obtained. The calibration graph was created using a 10-injection loop.

Determination of Caffeine Content in Roasted and Raw Beans: A validated method was used to determine caffeine levels in real coffee samples From roasted and raw coffee. The caffeine result in the coffee berry content is 13.55ppm for coffee in raw coffee beans and between 15.33 ppm and 21.33 ppm. Roasted coffee. The result of caffeine in coffee hariri content of 17.49 ppm for coffee in raw coffee beans between 20.65 ppm and 37.67 ppm Roasted coffee. The result of caffeine in coffee khawlania content of 13 ppm for coffee in raw coffee beans between 14.94ppm and 21.20 ppm Roasted coffee. Figure 3 shows the color scheme obtained from the study the highest concentration of caffeine was obtained in the roasted samples as the caffeine concentration increases with the degree of roasting.

Caffeine content mg/L of coffee samples Berry, Harari and Khawlania raw and roasted. This is consistent with the findings of several other studies that caffeine content increases during the roasting process. Raising the temperatures of all coffee samples and this increase has a significant difference. This indicates that the caffeine content of the roasted coffee samples collected from the three sources is greater than the content of the raw coffee samples shown in Tables (1, 2, 3). And figure 3 above.

CONCLUSION

From the above, Harari coffee has a higher level of caffeine than Berry Khawlania. The study also showed that roasting coffee beans can increase the caffeine content of coffee beans. The caffeine contents in all roasted coffee samples were higher than those in raw coffee beans. High-performance liquid chromatography was used to determine the caffeine level in coffee samples and the effect of roasting on the caffeine content was also studied. The results of this study showed.





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Table 1: Results of caffeine content in Hariri coffee sample

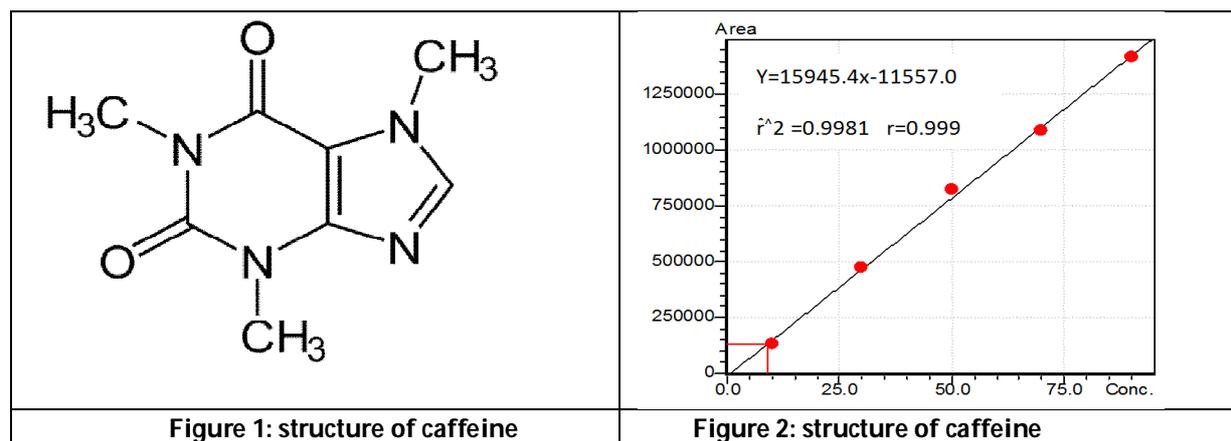
Sample name	roasting degree C°	Caffeine concentration (ppm)
hariri	Zero	17.49
hariri	10	20.65
hariri	20	28.64
hariri	40	28.73
hariri	60	28.88
hariri	90	37.67

Table 2: Results of caffeine content in Berry coffee sample

Sample name	roasting degree C°	Caffeine concentration (ppm)
Berry	Zero	13.55
Berry	10	15.33
Berry	20	17.85
Berry	40	19.96
Berry	60	20.87
Berry	90	21.34

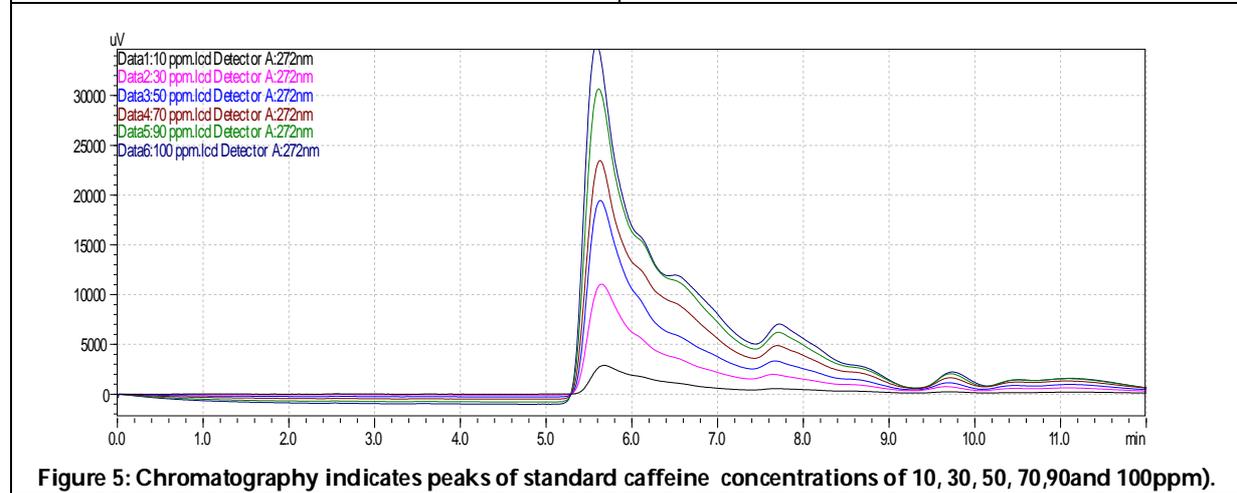
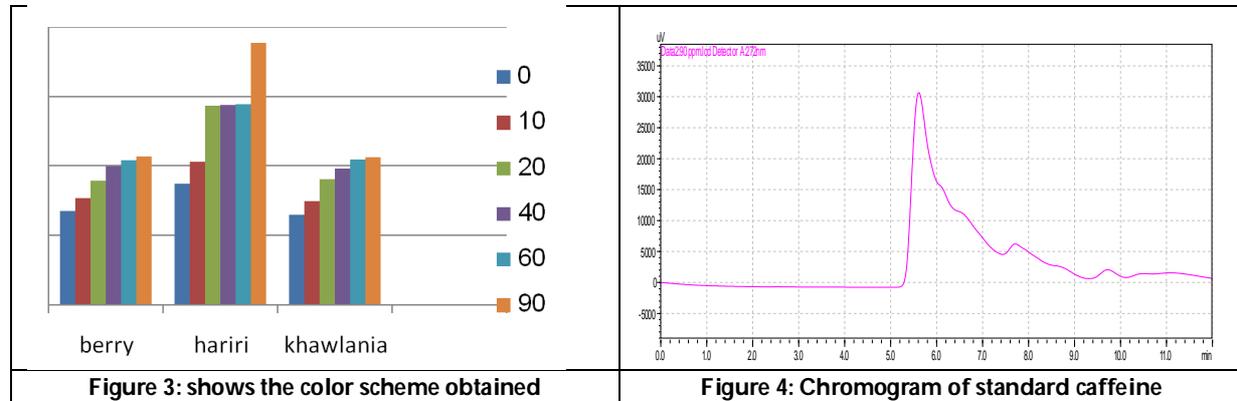
Table 3: Results of caffeine content in khawlania coffee sample

Sample name	roasting degree C°	Caffeine concentration (ppm)
khawlania	Zero	13
khawlania	10	14.94
khawlania	20	18.04
khawlania	40	19.64
khawlania	60	20.98
khawlania	90	21.20





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Synthesis and Characterisation of Acrylated Epoxidised Resin From Canola Oil

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ABSTRACT

Vegetable oils have triglycerides of higher molecular weight unsaturated fatty acids, which are easily generated into epoxy fatty acids. In this study the epoxidation of canola oil has been carried out using peracetic method. Further, an epoxy acrylated resin was synthesised from the epoxidised canola oil (ECO) by using acrylic acid and triethylamine was used as a catalyst. The acrylation of epoxidised canola oil (AECO) is done by introducing acrylic acid which is transformed into oxirane groups of the epoxidised canola oil. The obtained acrylic resin was studied by physicochemical properties and characterised by FT-IR and NMR analysis. Polymers have been used for various consumer applications including packages, circuit boards, furnishings and adhesive sealants.

Keywords: Canola oil, epoxidation, acrylation, physico-chemical properties, FT-IR and NMR.

INTRODUCTION

Vegetable oils are essentially triacylglycerols which account for more than 95% of total oil. They also enclose small quantities of diacylglycerols, phospholipids, tocopherols, free fatty acids, etc [1]. Vegetable oils are one of the most abundant biorenewable materials, their inherent biodegradability and low toxicity formulate promising starting material for polymer synthesis. Vegetable oils are composed of triglyceride molecules consist of three fatty acid chains combined with glycerol through ester linkage. The length of fatty acid ranges from 8to22 carbon, and some of





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them have chemical functionalities such as hydroxyl groups, epoxide groups and unsaturation [2]. The composition of oil varies with the source and depends on factors such as climatic conditions, soil type, maturity of plant and variety. The physicochemical properties of oils are directly related to their lipids and glyceride composition [3]. A number of seed oils have been used for the synthesis of various polymeric resins like polyester, epoxy, polyurethane, polyesteramide, etc [4]. Vegetable or plant oils are used in many industries include, pharmaceuticals, animal feeds, baked foods, canned foods, chewing gum, condiments and confectioneries, beverages, soft drinks, cosmetics, soaps, adhesives, insecticides, paints, paper and textile processing industries [5]. The canola oilseed is a Canadian rapeseed belonging to the Brassica family, whose name is a trademark that comes from the contraction of “Canada” and “Ola” for oil low acid. For hundreds of years, it has been one of the most important sources of edible oil [6]. Rapeseed is a bright yellow colour, grown in European Union, United States, Canada, Australia, China and India. It is an important oil crop species and its cultivation has significantly increased over recent years [7].

The contents of the major fatty acids in the obtained crude oils were 58.86% - 59.34% oleic, 19.83% - 20.10% linoleic and 9.33%- 9.47% linolenic acid respectively [8]. Iodine value is proportional to the degree of unsaturation. Hence, higher iodine values correspond to oils rich in polyunsaturated fatty acids whereas oils with low iodine value have a lower degree of unsaturation. Generally, oils that are rich in saturated fats may raise blood cholesterol and increase the risk of heart disease, while unsaturated fatty acids have been reported to exhibit health benefits [9,10]. Epoxy is a type of ether containing highly active three membered rings in which two carbon atoms linked to one oxygen atom forming an oxirane ring and is widely being considered and used in a large range of applications from engineering to medical fields [11]. Acrylated triglyceride involves the oxidation of unsaturated vegetable oils with singlet oxygen to form hydroperoxides by a pathway similar to the auto-oxidation of vegetable oils. The hydroperoxides can be converted into secondary allylic alcohols, which can be additionally reduced to saturated alcohols. Both the saturated and unsaturated alcohols are simply functionalized acrylate groups. The acrylated triglycerides can be free radically polymerized in the presence of varying amounts of pentaerythritol tetraacrylate, providing a promising route to bio-based polymeric networks [12].

MATERIALS AND METHODS

Materials

Canola oil was purchased from local market. The chemicals Acetic acid (glacial), Hydrogen peroxide (30%), sulphuric acid (Merck), Acrylic acid, Triethylamine (Sigma-Aldrich) were used for the acrylating the epoxy resin.

Methods

Physicochemical properties of specific gravity, viscosity, saponification value and iodine value were determined by various standard methods. Structural functional group was determined by FT-IR and NMR spectroscopy.

Synthesis of epoxidised canola oil

Canola oil was placed in a 500ml three neck flask equipped with a Leibig's condenser, mechanical stirrer and ground joint thermometer. Canola oil was mixed with glacial acetic acid and few drops of sulphuric acid. Then hydrogen peroxide solution was added drop by drop through a dropping funnel with continuous stirring for about 1 hour. The reaction mixture was refluxed with constant stirring for about 9 hours maintaining the temperature at 160°C. The epoxidised canola oil was separated and washed with warm water to remove the remaining glacial acetic acid present in the prepared epoxidised canola oil resin.

Synthesis of acrylated resin from canola oil

The epoxidised canola oil was acrylated using acrylic acid and triethylamine were taken in a three necked round bottom flask. The reaction mixture was again refluxed for about 2 hours at 160°C to produce yellowish brown viscous liquid. The product was cooled and dried vacuum oven at 80°C for about 45 minutes.





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RESULTS AND DISCUSSION

Determination of physico-chemical properties

The data of physicochemical properties of canola oil, epoxidised canola oil and acrylated canola oil resin are shown in table 1.

Spectral analysis

FT-IR spectral analysis of canola oil

FT-IR spectra of canola oil (CO) shows a maximum absorption at 3008.95 cm^{-1} due to the presence of non conjugated unsaturation of linoleic acyl groups. The peaks observed at 2927.94 & 2854.65 cm^{-1} indicates the symmetric stretching of aliphatic $-\text{CH}_2$ groups. A very strong and sharp absorption of band at 1747.51 cm^{-1} attributed to the $\text{C}=\text{O}$ stretching of ester carbonyl group. The other peaks are 725.23 cm^{-1} , 1165 cm^{-1} & 1462.04 cm^{-1} corresponding to the $\text{C}-\text{C}$ bending of saturated C atoms, $\text{C}-\text{O}$ stretching of ester group & $\text{C}-\text{H}$ bending of unsaturated alkane groups.

$^1\text{H-NMR}$ spectral analysis of canola oil

$^1\text{H-NMR}$ spectral analysis of canola oil shows that the characteristic peaks at δ 0.95-0.99 ppm corresponds to the protons of terminal methyl group. Peaks at δ 1.26-1.30 ppm indicates the protons of all internal $-\text{CH}_2-$ groups present in the fatty acid chains. The peak at δ 1.61-1.68 ppm are for the protons of $(-\text{CH}_2-)$ group attached next to the above terminal methyl group. The intensity of signal at δ 2.02 ppm and δ 2.75 ppm attributed to the allylic protons of $(-\text{CH}_2)$ and hydrogen of two double bonds $(-\text{CH}=\text{CH}-\text{CH}_2-\text{CH}=\text{CH}-)$. Characteristic peaks at δ 4.13-4.31 ppm shows the presence of glycerol backbone and olefinic protons of the $(-\text{H}-\text{C}=\text{C}-\text{H}-)$ moiety appears at δ 5.25-5.34 ppm.

FT-IR spectral analysis of epoxidised canola oil (ECO)

FT-IR spectra of epoxidised canola oil shows the disappearance of absorption band at 3008.95 cm^{-1} shows $\text{C}=\text{C}$ has been used for the epoxidation reaction. The appearance of a band around 855.32 cm^{-1} , which is not seen in pure oils, is characteristic of the formation of epoxy groups confirmed the success of epoxidation. The epoxy resin also shows $\text{C}=\text{O}$ triglyceride ester group at 1745.78 cm^{-1} .

$^1\text{H-NMR}$ spectral analysis of epoxidised canola oil (ECO)

The $^1\text{H-NMR}$ spectral analysis of epoxidised canola oil shows the peak intensity for the protons of unsaturated double bonds significantly decreased after epoxidation, and new peaks appears at δ 2.92 ppm indicates the formation of epoxide ring. The peak at δ 3.38 ppm shows the $-\text{CH}-$ hydrogen between two epoxy groups. The allyl hydrogen of canola oil at δ 2.02 ppm is shifted to δ 1.46 ppm.

FT-IR spectral analysis of acrylated canola oil resin

FT-IR spectrum of acrylated canola oil resin reveals that the 3429.43 cm^{-1} shows opening epoxide of $-\text{OH}$ group. The peak observed at 1739.79 cm^{-1} corresponds to the $\text{C}=\text{O}$ of the acrylated compound. Another different absorption bands at 1660.52 & 988.64 cm^{-1} indicates the presence of stretching vibration of $-\text{C}=\text{C}-$ groups and stretching of $-\text{CH}=\text{CH}_2-$ (acrylate group) respectively.

$^1\text{H-NMR}$ spectral analysis of acrylated canola oil resins

The $^1\text{H-NMR}$ spectra of acrylated canola oil resin shows the peak at δ 5.09-5.40 ppm corresponds to the incomplete acrylation. After acrylation, the formation of three protons of the acrylate esters have been confirmed by the peak at δ 5.71-5.96 ppm. The peak at δ 1.31-2.81 ppm indicates the presence of aliphatic side chain. The strong peak at δ 1.31 ppm is attributed to the long chain (more than five methylene groups) in the resin.



**Sindhuja and Sangeetha****CONCLUSION**

Vegetable oils are expected to be renewable inexpensive resources in the development of polymers. Edible oil such as canola oil has been used for the synthesis of acrylated resin. This study concluded that the specific gravity of epoxidised oil and acrylated resin (ECO) & (ACOR) higher than parent oil. Performance of high specific gravity is due to the change in molecular weight, polarity and intermolecular forces. Saponification value is a measure of the average molecular weight or chain length of the fatty acids present in the oil and resin. The iodine and saponification value of epoxidised oils and acrylated resin lower than the parent oil. Addition of acrylate groups to the epoxidised oil (ACOR) shows high viscosity and molecular weight than oils and epoxidised oil. Synthesis of epoxidised oil and acrylated resin showing good rate of conversion have been confirmed by FT-IR and ¹H-NMR spectral analysis.

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Table 1. physicochemical properties of canola oil, epoxidised canola oil and acrylated canola oil resin

Properties	Canola oil (CO)	Epoxidised canola oil (ECO)	Acrylated canola oil resin (ACOR)
Colour	Light yellow	Yellow	Brown
Specific gravity	0.919	1.03	1.19
Viscosity (at 30°C)	77.31	0.05	110.31
Iodine value	121.824	24.745	52.029
Saponification value	189.618	146.982	124.54
Molecular weight	878	924	1103

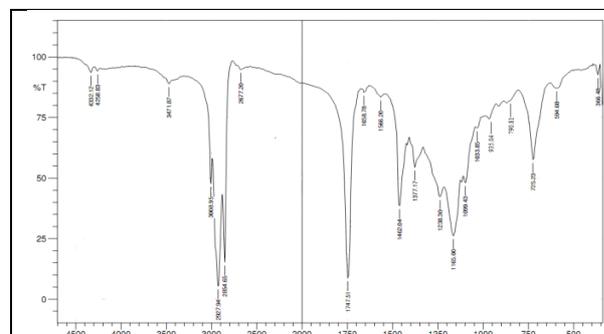


Figure 1 FT-IR spectral analysis of canola oil

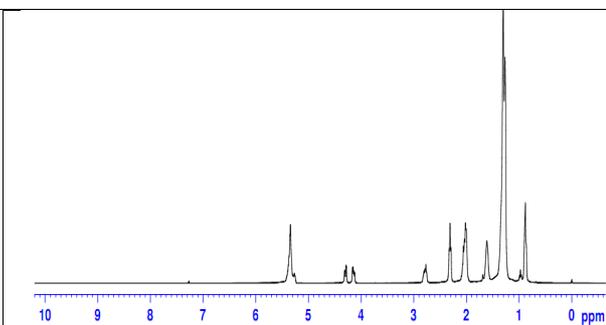


Figure 2 1H-NMR spectrum of canola oil (CO)

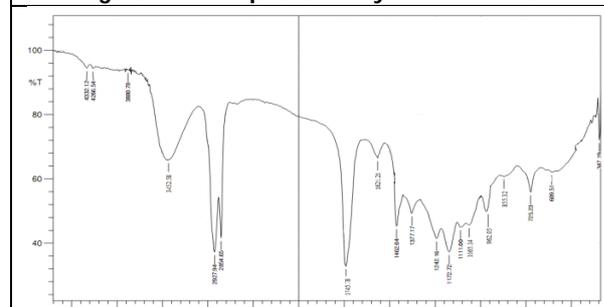


Figure 3 FT-IR spectrum of epoxidised canola oil (ECO)

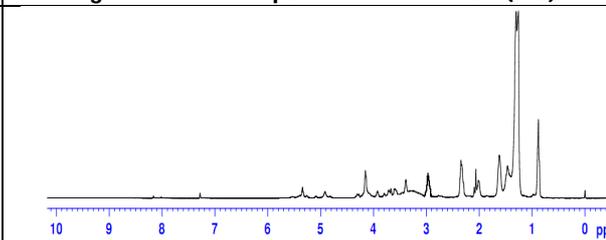


Figure 4 1H-NMR spectrum of epoxidised canola oil (ECO)

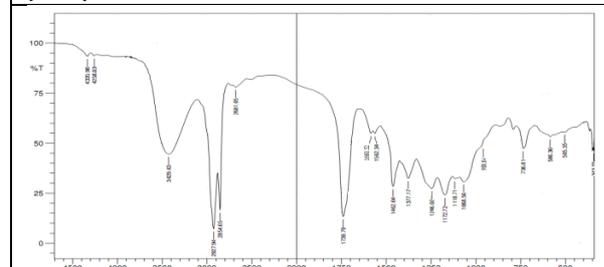


Figure 5 FT-IR spectrum of acrylated canola oil resin (ACOR)

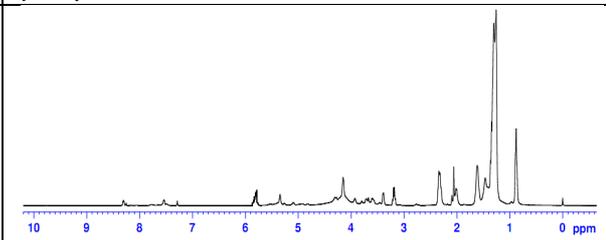
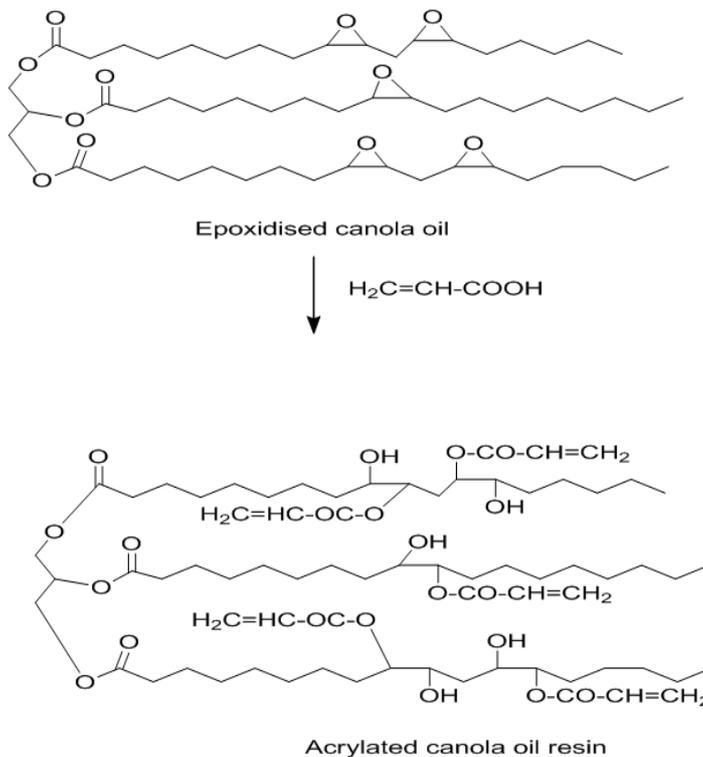


Figure 6 1H-NMR Spectrum of Acrylated Canola Oil Resin (ACOR)





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Scheme 1. Formation of acrylated canola oil resin (ACOR)





Instituting an Income Generating Project for Drafting Technology in Surigao State College of Technology: A Feasibility Study

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ABSTRACT

The research aimed to ascertain the Income Generating Project (IGP) institutionalization in the Drafting Technology of Surigao State College of Technology during the academic year 2014-2015. It delved the profile of the respondents and the entrepreneurial aspects to determine the validity of an Income Generating Project (IGP). Significant differences in the perception of the respondents were one of the factors identified in the study. The study used the descriptive developmental research design. One hundred twenty-seven respondents did the normative survey through a researcher-made questionnaire. Data were analyzed using frequency count, central tendency, Single-factor ANOVA, and the Scheffe test. Significance level tested at $\alpha=0.05$. Most of the respondents were first-year college students in the Bachelor of Science in Industrial Technology (BSIT) curriculum. The majority of the instructors had master's degree units in their graduates' studies. Most of the community clientele preferred the making of architectural plans. The second was T-shirt printing, and the third was making sanitary plans, electrical plans, and blueprinting. However, instructors chose architectural plans while the student and community clientele rated very much feasible in the management, technical, marketing, financial, and socio-economic aspects. Moreover, instructors rated moderately feasible, and the community has the highest mean perception. In conclusion, the respondents perceived very much feasible. As to recommendations, the school administrators requested to support the Drafting Technology Programs fully, and drafting instructors must upgrade their skills. Parents as stakeholders are encouraged to support the IGP plan for institutionalization in areas where it is feasible.



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Keywords: Income Generating Project (IGP), Drafting Technology, Descriptive Research, feasibility, Perceptions

INTRODUCTION

Background and Rationale

The Philippine government plans to reduce all government agencies' Maintenance Operating and Other Expenses (MOOE) allotment circulated in the Department of Budget and Management (DBM) budget circular. It's a kaleidoscope for every agency to maximize resources and start pegging for funds that could sustain its programs through projects that could serve as income-generating through its linkages with the government of the private sector utilize its resources from within. The Higher Education Modernization Act (HEMA) of 1997, as amended in 2016 or Republic 8292, provides schools to generate enough income through more effective utilization of their existing resources to sustain their operations. With their technical capability and meager resources, the institution can operate as a corporation and interface entrepreneurship in instruction, research, extension, production, and training programs. This allows students to experience and see for themselves the operation and management of income-generating projects (IGP) in their schools. Having hands-on training in school may encourage them to put in their projects after graduation.

Tensie Whelan and Carly Fink (2016) believe that embedded sustainability efforts positively impact business performance. Drawing from our research and our colleagues' research in this area, we have created a sustainability business case for the 21st-century corporate executive. Moreover, the study's concern is also to provide concrete examples of how sustainability benefits the bottom line. Gabriela Boldureanu *et al.* (2020) mentioned that the vital element for any country aiming to be competitive in the knowledge-based global market is generally viewed as promoting economic growth, creativity, and innovation in entrepreneurship. This perspective has led to enhanced interest in developing an educational program that encourages and fosters entrepreneurship. Moreover, Yemini (2010) and Barba (2018) mentioned the importance of integrating entrepreneurship education into higher education in 21st-century universities. They added that it would become essential engines of technological development and economic growth. Furthermore, engaging in different entrepreneurial innovations purposely for income generations or Income Generating Projects (IGP) will improve the fiscal autonomy of academic institutions.

To respond to the challenges mentioned above, the Surigao State College of Technology (SSCT) has started its income generation. SSCT provides their students with school uniforms, P.E. uniforms, the printing of School ID, automotive servicing, refrigeration, air-conditioning repairs, and other services. The current administration continues to encourage all faculty members, together with their students, to engage in Income Generating Projects as a practical application for their knowledge & skills development and at the same time to augment their income. The Drafting Technology Program of SSCT has its potential to generate revenue. The establishment of IGP in the said program is believed to be a mechanism upon which the students' conceptual development is applied and enhanced in the real world of work. In this concept, the researcher opted to describe the viability of establishing Income Generating Projects in the Drafting Technology Program of SSCT. Likewise, this study aims to assess the students' respondents' profile, the instructors, Community Clientele, and its Perception of the Feasibility of the Income Generating Project (IGP) and the formulation of an Income Generating Project's business plan for the Drafting Technology Program of the SSCT. In this way, the administration and respondents are guided on what viable Income Generating Projects are suited for the program.

Theoretical Framework

The Guidebook on Income Generating Projects published by Central Luzon State University (CLSU) emphasized that the implementation of income-generating projects(IGP) is significant and relevant. Thus, IGP supplements the budget of the school. The income can be used to employ. Hire additional project personnel; purchase supplies,



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materials, and equipment; and improve facilities needed for instruction, research, extension, production, training, and productive activities. Based on the foregoing concepts, the schematic diagram is depicted in Figure 1. As shown in the diagram, are the profile of the students respondents profile; the instructors' respondents profile; Community Clientele; Perception as to Feasibility of the Income Generating Project(IGP) and the formulation of an Income Generating Project's business plan for the Drafting Technology program of SSCT.

METHODOLOGY

The study used a descriptive design, especially the normative survey. This method was deemed appropriate because the study involved collecting data that concerns the current status of the subject and describing the nature of Drafting Technology instructions. It looks at the significant variations in the respondents' perceptions on the feasibility level of the Income Generating Project (IGP) of Drafting Technology program of SSCT Surigao City Campus. The expected output of the study is the viability of establishing an income-generating project in the Drafting Technology program. Moreover, an added outcome of the study is the proposed Income Generated Project Plan for Drafting Technology program.

RESULTS AND DISCUSSION

A total of 101 students were the respondents of the study. As shown from Table 1, out of 101 students' respondents, 71 were males, and 30 were females. There were also 71 student respondents who were 19 years old and below; 29 were 20-24 years old, and only one was 25-29 years old. It shows that most of the students respondents were 19 years and below. As to the curriculum of the student respondents, 8 were taking BSIE, 64 were taking BSIT, and 29 from the TT curriculum. This findings reveal that the majority of the respondents were from the BSIT curriculum. Likewise, 96 of the respondents were first-year college students, and 5 were third-year college students. The results implied that most of the respondents were in the first-year college.

Table 2 shows the profile of instructors' respondents. It is shown that 8 respondents were males, and 2 were females. It gleaned that most of the instructors' respondents were males. On the highest educational attainment of the respondents, data shows that 1 respondent was a college graduate, 6 respondents were Master's degree units' earner, 1 respondent with a full-pledged Master's degree holder, and 2 were full-pledged Doctorate holders. As to the number of years in service in SSCT, 1 respondent with 6 to 10 years in service, 1 respondent with 11 to 15 years, 5 respondents served for 16 to 20 years, while 3 respondents within 21 to 25 years in service. These results have shown that most of the College of Technology instructors with teaching experience or services ranged from 16 to 20 years. However, 2 of the respondents had 4 to 5 hours of teaching load per week, while 1 respondent with 16 to 21 hours of teaching load per week, and 7 respondents with 22 hours of teaching load per week. As to the instructors' teaching assignment, 7 were drafting teachers and 3 were non-drafting teachers.

Table 3 presents the community clienteles' profile. It showed in Table 3 that 13 respondents of the community clienteles were males and 3 were females. These results implied that the majority of the respondents of community clientele were males. As to their age, 3 respondents were below 19 years old, 2 respondents were 20 to 24 years old, and the majority or 11 respondents were 25 to 29 years old. On the highest educational attainment of the respondents, 2 respondents were post-secondary graduates, 1 respondent was fourth-year College, 11 were college graduate, and followed by 1 respondent was graduated with MA, and 1 with a doctorate holder. These results have shown that most of the community clienteles were college graduates. As to the status of ownership, 6 were private owners, and 10 worked in the government-owned agencies.

Table 4 shows the preferred drafting services offered for IGP in the Drafting Technology in SSCT. As shown in Table 6, the demand for drafting services requires competitive skills and designs, which demand customers' satisfaction



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and contentment. When these preferred drafting services were rank, architectural plans was rank first, then followed by the second preference of T-shirt printing, and the third were making sanitary plans, electrical plans, and blue-printing.

The overall mean in Table 5 shows that all the respondents perceived that management, marketing, financial and socio-economic aspects as very feasible while the technical part was moderately feasible. These data also revealed that institutionalizing income-generating projects for Drafting Technology was feasible and could be managed and sustained by the instructors and the community clientele. On the technical aspect, the respondent recognized the latest technological application on the drafting services identified. It is expected that technology is fast changing and these services are affected. Moreover, instructors and community clientele were given room for technological advancement on the skills applicable to the drafting services identified. Selma Kalyoncuoğlu (2017) pointed out that the entrepreneurs who introduced creative and innovative business ideas in economic development, which constitute the cells of the economy, are extremely valuable for countries in terms of their technology and innovation policies. These entrepreneurs are essential building blocks of countries' economies. Thus, instituting Income Generating Project in SSCT is timely and would ensure additional revenue in its coffers.

The data in Table 6 reveals a significant difference in the respondents' perception of the management with a p-value of 0.00. It implied that the null hypothesis of no significant difference in the management aspect is **rejected**. On the contrary, the respondents' perception of the technical, marketing, financial and socio-economic aspects does not significantly vary. Hence, the null hypothesis of no significant difference is **accepted**. Moreover, the community clientele has the highest mean perception of the feasibility of the IGP among other groups of respondents, as revealed in the Scheffe Test (Table 7).

Findings

On the basis of the data gathered, the following findings are formulated:

1. A total of 101 students were the respondents of the study. Out of 101 student respondents, 71 were males, and 30 were females. 71 student respondents were 19 years old, and below, 29 respondents were 20-24 years old, and only 1 respondent was 25-29 years old. It shows that most of the student respondents were 19 years and below.
2. On the curriculum, 8 students were taking BSIE, 64 respondents, or the majority, were taking BSIT, and 29 from the TT curriculum. Likewise, most of the student respondents were first Year College with 96 respondents and 5 respondents for third-year college.
3. The majority of the instructors' respondents were male, 8 respondents, followed by 2 female respondents. Moreover, 6 or majority of the respondents were Master's degree units' earner, 1 respondent with a full-pledged Master's degree holder, and 2 were full-pledged Doctorate holders. On the number of years in service of SSCT, most of the COT instructors with teaching experience or services ranged from 16 to 20 years. Likewise, most of the respondents were having 22 hours of teaching load per week, and 7 out of 10 respondents were drafting teacher/instructor, and the rest were not drafting teacher/instructor.
4. As to the community clientele, 13 or majority of the respondent were male, and 3 respondents were female. Similarly, 11 or most of the clientele's respondents' age were in the range of 25-29 years old, and most of them were college graduates. Likewise, 10 of the respondents were worked in a government-owned agency, and the rest were the private owner.
5. As to the preferred drafting services offered, architectural plans were ranked first, followed by T-shirt printing, sanitary plans, electrical plans, and blue-printing.
6. On the client perceptions, the majority of the respondents perceived that management, marketing, financial and socio-economic aspects as very feasible while the technical part was moderately feasible. Moreover, the study revealed that institutionalizing income-generating projects for Drafting Technology was feasible and could be managed and sustained by the instructors and the community clientele.



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7. The Analysis of Variance shows high significance in the respondents' perception of the management with a p-value of 0.00. Moreover, the respondents' perception of the technical, marketing, financial and socio-economic aspects does not significantly vary. Likewise, Scheffe's post hoc test for significance also shows that the community clientele has the highest mean perception of the feasibility of the IGP among other groups of respondents.

CONCLUSIONS

Based on the findings, the following conclusions are drawn:

1. The making of architectural plans is the preferred drafting service.
2. Students and community clienteles perceived that the Income Generating Project (IGP) was very feasible, particularly in management, technical, marketing, financial and socio-economic aspects. However, instructors' respondents perceived the Income Generating Project (IGP) as moderately feasible particularly in management, technical, and financial aspects. In contrast, the marketing and socio-economic aspects were perceived as very much feasible.
3. The community clienteles have the highest set of perceptions of the Income Generating Project (IGP).
4. The Income Generating Project (IGP) of Drafting Technology in Surigao State College of Technology is very feasible.
5. A proposed Income Generating Project Plan for Drafting Technology should be devised for Institutionalization in SSCT.

Recommendations

In the light of the above findings and conclusions, the following recommendations are offered:

1. School Administrators are requested to fully support the Drafting Technology Programs through review of its curricular structure, making it responsive to the needs of the community clienteles, students, instructors, and the populace of Surigao in general.
2. Instructors must upgrade their drafting skills to keep pace with technological applications for drafting technology by sending them to seminars, training workshops, and other related skills enhancement activities.
3. Educational planners and researchers may conduct study and research to establish Income Generating Project Plans in other technology areas that are feasible for income generation.
4. As stakeholders, parents are encouraged to support the IGP plan for institutionalization in areas where it is feasible.
5. Income Generating Projects should be established in the Drafting Technology Program to maximizing the use of its available resources to strengthen both instruction and income generation.

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Table 1. Profile of the Students' Respondents

Variables	Frequency	Percentage (%)
Sex		
Male	71	70.30%
Female	30	29.70%
Age		
19 below	71	70.30%
20-24	29	28.72%
25-29	1	00.79%
Year Level		
1 st Year	96	95.05%
3 rd Year	5	04.95%
Curriculum		
B.S. Industrial Education	8	07.92%
B.S. Industrial	64	63.37%
Technology	29	28.71%
Trade Technical		

Table 2. Profile of the Instructors' Respondents

Variables	Frequency	Percent(%)
Sex		
Male	8	80%
Female	2	20%
Highest Educational Attainment		
College Graduate	1	10%
With Master's Degree Holder	6	60%
Full-Pledged Master's Degree Holder	1	10%
With Doctoral Degree units	-	-
Full-Pledged Doctoral Degree	2	20%
Number of Years of Teaching Experience		
0-5 years	1	10%
6-10 years	1	60%
11-15 years	5	10%
16-20 years	3	20%
21-25 years		





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Teaching Load		
4-15 hours	2	20%
16-21 hours	1	10%
22-up	7	70%
Teaching Assignment		
Drafting Teacher	7	70%
Non-Drafting Teacher	3	30%

Table 3. Community/Cientele's Profile

Variables	Frequency	Percent (%)
Sex		
Male	13	81.25%
Female	3	18.75%
Age		
19 below	3	18.75%
20 to 24	2	12.5%
25 to 29	11	68.75%
Year Level		
Post Secondary (1 st year)	2	12.5%
Fourth Year College	1	6.25%
College Graduate	1	6.25%
MA/MBA/MPA	1	6.25%
Doctoral Degree	1	6.25%
Type of Ownership		
Private	6	37.5%
Government	20	62.5%

Table 4. Preferred Drafting Services Offered for Income Generating Project (IGP) in the Drafting Technology

Drafting Services	Community	Rank	Instructors	Rank	Total	Rank
1. Architectural Plans	14	1	10	1	24	1
2. Structural Plans	7	6	6	9	13	7
3. Sanitary Plans	8	4	6	9	14	4.5
4. Electrical Plans	8	4	6	9	14	4.5
5. Blue Printing	8	4	7	4.5	15	3
6. Miniature Model	5	9.5	8	2	13	7
7. Topographic Drafting	5	9.5	7	4.5	12	10
8. T-shirt Printing	11	2	7	4.5	18	2
9. Billboard Lettering	6	7	6	9	12	10
10. Charcoal Printing	5	9.5	7	4.5	12	10
11. Oil Painting	5	9.5	6	9	13	7
12. Others (Please Specify)	4	12	3	12	7	12





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Table 5. Feasibility of the Income Generating Project (IGP) of Drafting Technology as rated by the Group of Respondents.

Aspects	Students			Community/Cientele			Instructors			Overall		
	M	SD	QD	M	SD	QD	M	SD	QD	M	SD	QD
Management												
A.1 Supervisor	4.45	0.79	VMF	4.50	0.82	VMF	4.6	0.7	VMF	4.52	0.77	VMF
A.2 Drafting Staff	4.58	0.65	VMF	4.50	0.63	VMF	3.80	1.23	MF	4.29	0.84	VMF
A.3 Quality Controller	4.30	1.00	VMF	4.06	0.68	MF	4.20	0.65	MF	4.19	0.78	MF
Average	4.44	0.81	VMF	4.35	0.71	VMF	4.20	0.86	MF	4.33	0.79	VMF
Technical												
B.1 Pre-inspection Area	4.24	0.94	VMF	4.63	0.62	VMF	4.30	1.06	VMF	4.39	0.87	VMF
B.2 Working Area	4.39	0.96	VMF	4.50	0.63	VMF	3.60	1.35	MF	4.16	0.98	MF
B.3 Quality Control Area	4.27	0.97	VMF	4.19	0.66	VMF	3.90	0.99	MF	4.12	0.87	MF
B.4 Packaging Area	4.00	1.10	MF	4.13	1.20	MF	3.95	0.96	MF	4.03	1.09	MF
Average	4.22	0.99	MF	4.36	0.78	MF	3.94	1.09	MF	4.17	0.95	MF
Marketing												
C.1 Professionals	4.39	0.76	VMF	4.31	0.60	VMF	4.20	1.32	MF	4.30	0.89	VMF
C.2 Construction Owner	4.24	0.91	VMF	4.31	0.70	VMF	4.30	0.67	VMF	4.28	0.76	VMF
C.3 Other Government Agency	4.18	0.88	MF	4.94	0.77	VMF	4.50	0.71	VMF	4.21	0.79	VMF
C.4 Others who want to avail drafting services	4.25	0.81	VMF	4.44	0.51	VMF	4.30	0.71	VMF	4.33	0.68	VMF
Average	4.26	0.84	VMF	4.25	0.65	VMF	4.33	0.85	VMF	4.28	0.78	VMF
Financial												
D.1 Salary of workers/Personnel	4.46	1.02	VMF	4.31	0.87	VMF	3.90	0.99	MF	4.22	0.96	VMF
D.2 Utility Bills	4.18	0.94	MF	4.25	0.68	VMF	4.40	0.97	VMF	4.28	0.86	VMF
D.3 Supplies sand Materials	4.57	0.84	VMF	4.38	0.72	VMF	4.00	1.05	MF	4.32	0.87	VMF
D.4 Equipment	4.51	0.80	VMF	4.13	0.50	MF	4.10	0.99	MF	4.25	0.76	VMF
D.5 Maintenance and Repair	4.33	0.40	VMF	4.25	0.68	VMF	4.16	0.84	MF	4.25	0.81	VMF
Average	4.41	0.90	VMF	4.26	0.69	VMF	4.11	0.97	VMF	4.26	0.85	VMF
Socio-Economic												
E.1 Students												
a. Enhance their knowledge and skills	4.69	0.58	VMF	4.56	0.51	VMF	4.80	0.42	VMF	4.69	0.50	VMF
b. Acquire and develop their entrepreneurial skills	4.62	0.63	VMF	4.38	0.50	VMF	4.80	0.33	VMF	4.60	0.49	VMF
Average	4.66	0.60	VMF	4.47	0.51	VMF	4.80	0.39	VMF	4.64	0.50	VMF
E.2 Teachers												
a. Enrich and upgrade their knowledge and skills	4.66	0.59	VMF	4.69	0.48	VMF	4.70	0.48	VMF	4.68	0.52	VMF





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b. Enrich and upgrade their entrepreneurial skills	4.59	0.62	VMF	4.64	0.50	VMF	4.75	0.42	VMF	4.66	0.51	VMF
Average	4.63	0.60	VMF	4.66	0.49	VMF	4.73	0.45	VMF	4.67	0.52	VMF
E.3 Clientele to avail drafting services												
a. Modern drafting techniques	4.74	0.58	VMF	4.50	0.73	VMF	4.70	0.67	VMF	4.65	0.66	VMF
b. Highly skilled worker	4.59	0.72	VMF	4.31	0.70	VMF	4.50	0.97	VMF	4.47	0.80	VMF
c. Low cost charges	4.25	0.99	VMF	4.13	0.81	MF	4.57	0.72	VMF	4.31	0.84	VMF
Average	4.53	0.76	VMF	4.31	0.75	VMF	4.59	0.79	VMF	4.48	0.77	VMF

Table 6. Difference on the Perceived Feasibility of the Income Generating Project (IGP) when Grouped by Respondents.

ANALYSIS OF VARIANCE									
INDIVIDUAL VARIANCE	SS		MS		df		F	p	Decision
	Effect	Error	Effect	Error	Effect	Error			
Management	12.41	70.448	6.205	0.568	2	124	10.921	0.000*	Reject Ho
Technical	01.04	77.334	0.52	0.624	2	124	0.834	0.4367	Accepted Ho
Marketing	0.021	47.162	0.011	0.380	2	124	0.028	0.9725	Accepted Ho
Financial	0.712	59.402	0.356	0.479	2	124	0.743	0.4778	Accepted Ho
Socio-Economic (Student)	0.755	33.30	0.378	0.269	2	124	1.406	0.2489	Accepted Ho
Socio-Economic (Instructor)	0.138	33.311	0.069	0.269	2	124	0.256	0.7743	Accepted Ho
Socio-Economic (Community)	0.684	44.841	0.342	0.378	2	124	0.4068	0.4068	Accepted Ho

Table 7. Scheffe Test on the Difference of the Perceived Feasibility of Income Generating Project (IGP) when Grouped by Respondents.

Scheffe Test: Variable A			
	Instructor	Community Clientele	Students
	M=4.200	M=4.35	M=3.5248
Instructor		0.8793	0.0288
Community Clientele	0.8793		0.0004
Students	0.0288	0.0004	





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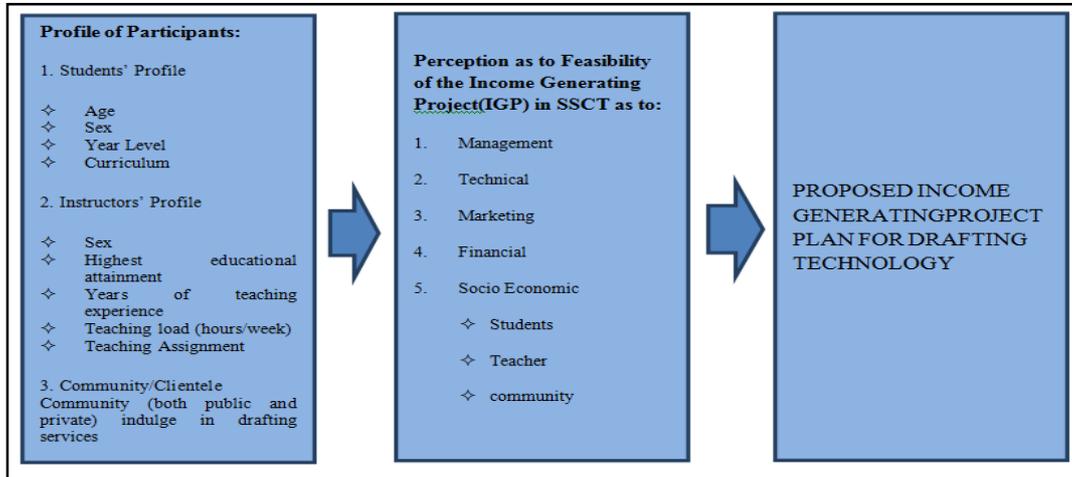


Figure 1. Schematic Diagram of the Study





Effect of Physiotherapeutic Intervention Protocol in Improving Functional Mobility and Reducing Falls among Geriatric Patients

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ABSTRACT

The purpose of the study is to evaluate the effect of physiotherapeutic intervention protocol in improving functional mobility and reducing falls among geriatric population at risk in Salem district. 40 samples between age group 60-70 years who can walk without walking aids and were receiving some physiotherapy treatment were selected from geriatric population of Salem district. They were grouped into 2 groups by single blinded randomised control trial. Group A received the newly framed physiotherapeutic intervention protocol which were a compilation of handpicked exercises from already tested protocols. Group B received conventional physiotherapy exercises (cardio respiratory conditioning, strength conditioning and balance training). Both the groups were treated once a day, 3 times a week for first 2 weeks under the supervision of physiotherapist followed by 4 weeks of tailor made home exercise program. A pre test measurement of timed up and go test (TUG), Gait velocity (GV), Berg Balance Scale(BBS) and Falls efficacy scale(FES) were done. By end of 2 weeks and 4 weeks the tests were repeated. The result of the study showed significant improvement in the functional mobility and reducing the fall rate in both groups. But the result of Group A was more significant and the results were attained earlier.

Keywords: Falls; Fall Prevention; Exercise in Elderly; Balance; Gait in elderly; Geriatric exercise

INTRODUCTION

Fall is one of the major issues that lead to various disabilities especially in geriatric population. The falls are mainly domestic and occasionally due to automobile accidents in old age. There is a fall Every 11 seconds for elderly adult and they visit an emergency room for injuries related to fall and the mortality rate is one in every 20 minutes (1) The

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effects of frequent fall ranges from broken bone to head injury causing medical and psychological problems reducing the quality of living in the geriatric population. Graceful ageing and SAIL (Stay Active and Independent for Life) is the right of every elderly adult with an estimated increase in geriatric population from 76.6 million in 2006 to 173.1 million in 2026. (2) There is a need for understanding that many of these problems need lifelong drug therapy, physiotherapy and rehabilitation on long term (3). Ageing in developing countries like India is exponentially increasing because of the impressive gains the society has made in the last few decades in terms of increased life expectancy. With such rise in elderly population's proportion the demand for holistic care will grow for sure. By 2025, the geriatric population in India is expected to grow 840 million [4]. It is predicted that the proportion of Indians who are aged 60 and above is expected to rise from 7.5% in 2010 to 11.1% in 2025. When projected in exact numbers this is a jump from 91.6 in million elderly in 2010 to a whopping numbers of 158.7 million in 2025 [5]. Ageing is commonly associated with progressive deterioration of physical and mental health and wellbeing [6,7], increased morbidity and social depend [6], and coexistence of other comorbidities [8]. These are the predisposing factors responsible for one of the commonest and serious geriatric problem which is "falls". In the old population 33% face with fall at least once in every year, and almost half of them would be having recurrent falls [9,10]. As an individual ages, the rate of falls exponentially increase even up to 60% [9,11]. There is a need to find a strategy to reduce the frequency of fall in elderly. The predisposing factors like weakness, arthritis, gait deficit, balance deficit, hearing and visual deficits, depressions, medications and environmental conditions such a poor light and slippery surfaces are identified as potential risk factors. Hence there is a need to instigate and find the effects intervention programme to geriatric population that can contribute in improving the health and wellbeing and also prevent fall. Hence we performed a study to compare the effect of conventional balance exercises along with problem based physiotherapy and newly framed physiotherapeutic intervention protocol along with problem based physiotherapy in improving functional mobility, balance, agility and reducing falls among geriatric patients.

METHODS

All geriatric people within the age group of 60 to 70 years in Salem who walk without walking aids, receiving physiotherapy treatment were the target population. The study excluded amputees, patients unable to walk at least 50 meters in a single stretch, recent stroke (< 6 months), progressive neurological disorder, unstable medical conditions or severe cognitive impairment, severe degenerative or inflammatory conditions that may limit the ambulation. The study was performed initially at the community and health care delivery centres from selected areas of Salem district where the initial two weeks of orientation were provided followed by home based exercises for 4 weeks. The study is a Single blinded Randomized control trial which was performed over a period of 18 months, from 01.04.2019 to 01.03.2020 and 1.06.2020 to 31.01.2021. Stratified sampling design was used by dividing the district of Salem into different taluk as strata and further on. A total number of 40 size was selected for the study using sample size calculation formula for two groups with 10% increased sample size from the estimate to meet out the drop out [12]. The samples were randomly assigned into the two groups namely group A and group B, using random table method. An opaque cover was used for concealment of the samples. The sampling was performed by a blinded physiotherapist. Group A received the newly framed physiotherapeutic intervention protocol which was designed especially for this study, which was a compilation of handpicked exercises from already tested protocols that suits the target population giving due considerations to the geographical, socio economic and cultural barriers [14-17]. Group B received conventional physiotherapy (cardio respiratory conditioning, strength training and balance training [13] apart from problem based physiotherapy).

The intervention provided to group A was specially designed for the geriatric population keeping in mind their social barriers. The protocol was designed using balance and strength/power exercises keeping in mind the lack of feasibility to sophisticated equipment. Our exercises can be performed using the individual's own body weight or performed using a commonly available low-cost exercise tools like small dumbbells or weights, elastic or resistance bands and unstable surfaces like foam or beach sand. The main problem with such arrangement was intensity



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control for strength or power, particularly, when teaching exercises using body weight. This is feasible when the strength training machines were used. Borg rating of Perceived Exertion (PE) scale was employed in the current study to regulate the intensity during training.[1] The individual fitness levels determined the intensity of the exercises using PE in the range of 10 and 16 points (mild to hard). A tailor made exercise and exercise intensity was used which was ramped based on the exertion levels on order to stress the neuromuscular system. The intensity of exercises will be gradually ramped up by the physiotherapist either in personal visit or via phone calls.

The intervention was provided once a day 3 times a week (on alternating days) for 2 weeks. Later home based exercises protocol were provided to the participants which was tailor made from the already educated exercises to patients of both the groups to be performed every day at home for 4 weeks. The 4 outcome parameters used for the study were TUG test, GV, BBS and FES scale- International. The outcome measures were used before the commencement of the intervention, at the end of 2 weeks of home based exercises and at the end of 4 weeks of home based exercise programme (i.e. 6 weeks from the commencement of study intervention including the 2 weeks of physiotherapist supervised training). The outcome measures will be performed by blinded evaluators who are physiotherapist with post-graduation and with minimum 5 years experience in the field of geriatric patients. At every week end the patients were monitored and motivated by the physiotherapist to perform the exercises consistently and to do them in the correct pattern as taught by the therapist.

STATISTICAL ANALYSIS

Within-group analysis for the parametric scores (timed up and go test, gait velocity) was done using ANOVA and a post HOC analysis was done using Dunns test. Within-group analysis for the non - parametric scores (timed Berg Balance scale and Mobility Interaction Fall chart) was done using Kruskal Wallis analysis of variance on ranks and a post HOC analysis was done using Dunns test. Between-group analysis for the parametric scores (timed up and go test, gait velocity) was done using independent sample t-test. Between-group analysis for the non- parametric scores (timed Berg Balance scale and Mobility Interaction Fall chart) was done using Mann Whitney test.

RESULTS

A total number of 40 subjects were accounted for the study results. The demographic details of the subjects are displayed in table 1. Chi square analysis was done to find out the homogeneity of the population at the Baseline for age and gender differences which revealed that there was no significant difference with a p value of 0.734 and 0.823 respectively. Between group analysis was done between the pre-test values of group A and group B for all the four outcome measures which revealed that there was no significant difference between the two groups at baseline with the t value of 0.074 and p value of 0.921 timed up and go test, t value of 0.107 and p value of 0.791 for velocity, z score of -1.452, p value of 0.146 for Berg balance scale and z score of -0.722 find the P value of 0.471 for falls efficacy scale International. This clearly states that the groups were similar at the time of commencement of intervention. There was no significant difference in the gained in the first post test value of timed up and go test (t=8.731, p= 0.893) but there was a significant difference in the second post test value (t= 20.013 and p=0.034). The post-test analysis of gait velocity clearly showed that there was a significant difference between the groups in first post test (t= 7.66 and p=0.007) but there was no significant between the second post-test analysis (t=15.567 and p=0.065). In the analysis of berg balance scale there was a significant difference between the two groups in both post-test 1 (z=7.098 and p=0.001) and post-test 2 values (z=10.747 and p= 0.001). In the analysis of falls efficacy scale International, the same trend was seen (z= 3.035 and p= 0.002) and (z=8.402 and p= 0.001). In the within-group analysis there was a significant difference among both the groups with a P value of 0.001. The post hoc analysis of TUG and GV are displayed in the table 2 and 3. The within group progression of BBS and FESI are shown in figure 1 to 4.



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DISCUSSION

This study was carried out in the district of Salem which is one of the industrial districts of Tamil Nadu and host more number of geriatric patients. In this study a stratified sampling technique was adopted to represent most number of areas in the district. The study was performed by three researchers out of which one was blinded to the study and was used for randomisation and applying the outcome measures. [18] There by the bias was avoided. The study was intended to find effects of a newly framed physiotherapeutic exercise protocol in managing geriatric problems like balance, functional mobility and agility that leads to reduction in fall. The exercise protocol designed for the study has the following salient feature. There is a use of high intensity exercises, using walking very sparingly as it's the main activity during which fall happens. The intervention incorporates agility training using simple household gadgets for exercises at the same time giving a variety of exercises to individuals. Strength/power interventions were progressed from single joint activity to multiple joint activity, isometric muscle function to dynamic or isotonic muscle function, and short lever arm with mechanical advantage to long lever arm with less mechanical advantage and slow repeated exercises to fast exercises [19]. The detailed exercises are given in appendix. The study results show that the protocol was very effective in improving the balance, functional mobility and gait velocity. There was a sustained improvement and a steady improvement as shown in figure 1 and 2. The conventional exercise was also effective but the physiotherapeutic intervention protocol was significantly superior to it. Because of the improvement in the balance, gait and functional ambulation there was a significant reduction in the fall rate as well.

CONCLUSION

Both the conventional and physiotherapeutic intervention protocol exercises were effective in the bringing about a better improvement in the balance, gait velocity, functional mobility and also in reduction of susceptibility to fall. The physiotherapeutic intervention protocol exercises brought about better improvement than the conventional exercises and also the changes were brought about sooner.

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APPENDIX

Newly framed exercise protocol

Guidelines for heavy resistance strength training	
Exercise variables	Recommendations
Intensity	Defined by level of difficulty, fatigue and number of repetitions
	Beginner: 12 – 13 RPE (somewhat hard)
	Advanced: 14 – 16 RPE (hard)
Quality	Technically correct movement
	Maximal range of motion
Speed of movement, contraction velocity	2 s concentric muscle contraction, 2 s eccentric muscle contraction (ratio 1:1)
Sets	2 – 3 (at home 3 sets)
Frequency	2 group sessions per week and 1 session alone at home (alternating strength / power and balance training)
Repetitions	Beginner: 10 – 15 (moderate resistance until muscle fatigue)
	Advanced: 8 – 12 (high resistance until muscle fatigue)
Rest	2 min. between sets
Guidelines for muscle power training	
Exercise variables	Recommendations
Intensity	Defined by level of difficulty, fatigue and number of repetitions
	10 – 13 RPE (light to somewhat hard)
Quality	Technically correct movement
	Maximal range of motion





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Speed of movement, contraction velocity	Concentric contraction as fast as possible Approx. 1 s concentric muscle contraction, approx. 2 s eccentric muscle contraction (ratio 1:2)
Sets	2 – 3 (at home 3 sets)
Frequency	2 group sessions per week and 1 session alone at home (alternating strength / power and balance training)
Repetitions	8 – 10
Rest	2 min. between sets

Static steady-state, reactive, and proactive balance exercises

Balance(static)	Exercise variables	Recommendations
Steady-state	Base of support	Stable to instable: bipedal – semi-tandem – tandem – one leg stance
	Position of feet	i.e., lateral or medial weight shift, on heels or toes, toe angle in or out
	Surface	i.e., from soft to hard (e.g., grass to concrete), from stable to instable (e.g., concrete to sand)
	Sensory input	Impede vision or hearing
	Dual-/Multi-tasking	Additional motor task – additional cognitive task – additional motor and cognitive tasks
	Speed of movement	Decrease or increase of execution speed (i.e., upper arm movements)
	Equipment	Use of i.e., free weights, elastic bands, balls
Reactive	Controlled perturbations applied by therapist	Reaction to external thread (push or pull) varying in speed, amplitude and direction on ankle, hip, trunk or shoulder level
Proactive	ADL	Combination of steady-state (static) balance tasks with mobility in daily life (e.g., standing up from a chair while reciting a poem and holding a cup of water)

Guidelines for dynamic steady-state, reactive, and proactive balance exercises

Balance (dynamic)	Exercise variables	Recommendations
Steady-state	Base of support	Stable to instable: normal gait – narrow gait – overlapping gait – tandem gait (Figure 3)
	Position of feet	i.e., lateral or medial weight shift, on heels or toes, toe angle in or out
	Surface	i.e., from soft to hard (e.g., grass to concrete), from stable to instable (e.g., concrete to sand)
	Sensory input	Impede vision or hearing
	Dual-/Multi-tasking	Additional motor task – additional cognitive task – additional motor and cognitive tasks
	Speed of movement	Decrease or increase of execution speed (walking speed)
	Equipment	Use of i.e., free weights, elastic bands, balls
	Direction	Forwards – backwards – to the left or right – diagonal
	Rhythm	Slow – fast – intermittent slow and fast





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Reactive	Controlled perturbations applied by therapist	Reaction to external thread (push or pull) varying in speed, amplitude and direction on ankle, hip, trunk or shoulder level
Proactive	ADL	Combination of steady-state (dynamic) balance tasks with mobility in daily life (e.g., walking upstairs backwards while counting backwards aloud from 50 minus 2)

Table 1 – Demographic data of the participants

Factor	Group A	Group B
Age	68.2 (4.7)	66.8(3.6)
Sex	Male – 52 Female -20	Male – 46 Female - 26
BMI	30.2	29.8
Location	Rural – 14 Urban – 08	Rural – 16 Urban – 04

Table 2 – Within group analysis of TUG

Timed up and go test				
Groups	(I) Tests	(J) Tests	Mean Difference (I-J)	Sig.
A	Pre test	Post test 1	-2.31944*	.000
		Post test 2	-4.50972*	.000
	Post test 1	Pre test	2.31944*	.000
		Post test 2	-2.19028*	.000
	Post test 2	Pre test	4.50972*	.000
		Post test 1	2.19028*	.000
B	Pre test	Post test 1	-.42361	.117
		Post test 2	-.79167*	.000
	Post test 1	Pre test	.42361	.117
		Post test 2	-.36806	.209
	Post test 2	Pre test	.79167*	.000
		Post test 1	.36806	.209

Table 3 – Within group analysis of GV

Gait velocity				
Groups	(I) Test	(J) Test	Mean Difference (I-J)	Sig.
A	Pre test	Post test 1	-.10889*	.000
		Post Test 2	-.23264*	.000
	Post test 1	Pre test	.10889*	.000
		Post Test 2	-.12375*	.000
	Post Test 2	Pre test	.23264*	.000
		Post test 1	.12375*	.000
B	Pre test	Post test 1	-.04736*	.000
		Post Test 2	-.10806*	.000
	Post test 1	Pre test	.04736*	.000
		Post Test 2	-.06069*	.000
	Post Test 2	Pre test	.10806*	.000
		Post test 1	.06069*	.000





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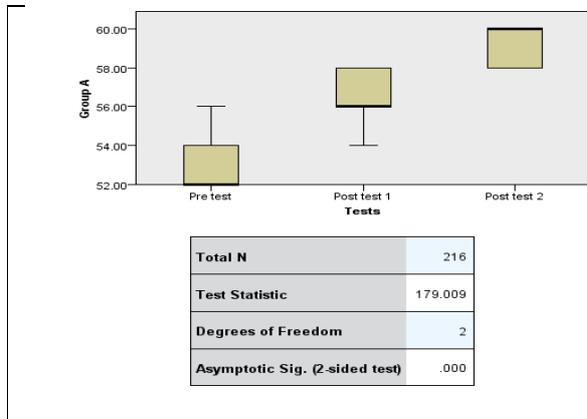


Figure 1 – Within group performance group A in BBS

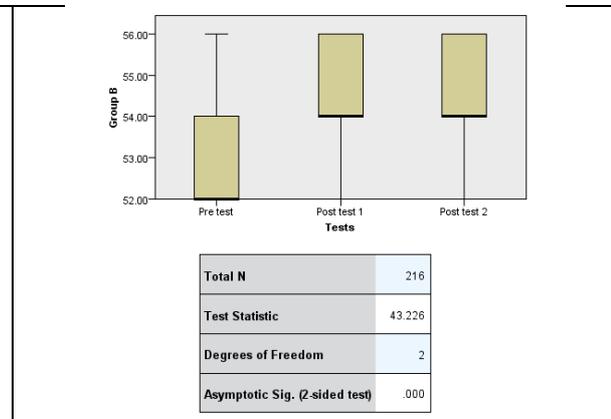


Figure 2 – Within group performance group B in BBS

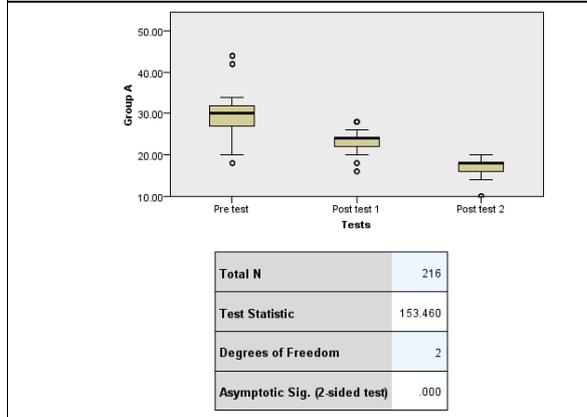


Figure 3 – Within group performance group A in FESI

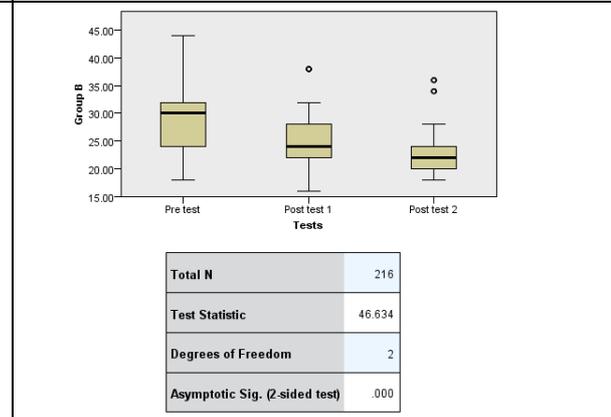


Figure 4 – Within group performance group B in FESI





Hydro Chemistry and Quality of Ground Water from Paraipatti Pond Area at Dindigul District

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ABSTRACT

An attempt has been made to evaluate the extent of pollution of ground water in and around Paraipatti Pond located in Dindigul to Palani bypass Road at Dindigul district. Ground water analysis at nine different sites at four directions reveals that the water quality parameters are higher than the permitted level. As per CPHEEO standard specifically high turbidity, high TDS and higher Electrical conductivity values indicate that the water cannot be used for domestic purpose. The adjoining groundwater sources are mostly affected and the water becomes very salty with very high TDS. Hence the polluted water is suggested to water treatment using Reverse Osmosis System.

Keywords: Pollution, Surface water, Water quality assessment, CPHEEO Standard, RO System.

INTRODUCTION

Water is a major natural resource, one of the big three: land, water, and air. Water is used in many ways [1-2]. As a nourishes of plant and animal life, a bearer of food, a prime element of industrial processes, and a medium for transportation. The importance of water can be put into perspective by the fact; that a significant portion of the earth's surface is water. When our planet is viewed from space, the dominant blue colour makes water appear to be an abundant resource. The reality is that 97% of the earth's water is salty, and the majority of the under 3% that is freshwater is locked in glaciers and polar ice caps [3-5]. Worldwide population growth (and associated food production) as well as increases in industrialization and consumptive lifestyles create ever increasing demands on the planets relatively finite sources of freshwater [6-7]. To ensure a global water resource to meet the demands of the future, immediate improvements are need in techniques for water conservation, collection, storage, treatment, and reuse [8-9].



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Water that contains a lot of calcium and magnesium is said to be hard. The hardness of water is expressed in terms of the amount of calcium carbonate-the principal constituent of limestone-or equivalent minerals that would be formed if the water were evaporated [10-12]. Water is considered soft if it contains 0 to 60 mg/L of hardness, moderately hard from 61 to 120 mg/L, hard between 121 and 180 mg/L, and very hard if more than 180 mg/L. Very hard water is not desirable for many domestic uses; it will leave a scaly deposit on the inside of pipes, boilers, and tanks. Hard water can be softened at a fairly reasonable cost, but it is not always desirable to remove all the minerals that make water hard. Extremely soft water is likely to corrode, metals although it is preferred for laundering, dishwashing, and bathing [13-14]. In recent years, the growth of industry, technology, population, and water use has increased the stress upon both our land and water resources. Locally, the quality of ground water has been degraded [15-16]. Municipal and industrial wastes and chemical fertilizers, herbicides, and pesticides not properly contained have entered the soil, infiltrated some aquifers, and degraded the ground-water quality. Other pollution problems include sewer leakage, faulty septic-tank operation, and landfill leachates. In some coastal areas, intensive pumping of fresh ground water has caused salt water to intrude into fresh-water aquifers [17]. The intensive ground water pumping can cause salt-water intrusion in coastal aquifers. In recognition of the potential for pollution, biological and chemical analyses are made routinely on municipal and industrial water supplies. Federal, State, and local agencies are taking steps to increase water-quality monitoring. Analytical techniques have been refined so that early warning can be given, and plans can be implemented to mitigate or prevent water-quality hazards [18].

SCOPE AND OBJECTIVES FOR THE STUDY

The quality of water in the Paraipatti Pond, near palani road bypass in Dindigul District is to be studied due to the continuous discharge of sewage and industrial effluents in to the pond without any treatment. Due to the percolation, the pond water seep in to nearby water sources like bore well and well are completely polluted. Hence the study of ground water quality around the pond is polluted.

OBJECTIVE

To Study the Physico-Chemical parameters in the Paraipatti Pond, near palani bypass in Dindigul District. To evaluate the ground water quality in the wells and bore wells around the Pond. To treat the contaminated ground water using Reverse osmosis technology in order to reduce the total dissolved solids (TDS) in the ground water.

MATERIALS AND METHODS**CHOICE OF THE STUDY AREA**

Tanneries and houses are located around the Paraipatti Pond. It is located on Palani road of Dindigul. The Pond is in the Municipal limit. People living in and around the pond are depending on ground water and well water. People are using the around pond as a swimming pool. The pond water and the ground water were taken for the study.

CONTAMINATION OF THE PARAIPATTI POND

During the monsoon and post monsoon seasons, many industries discharge the industrial effluents without any treatment in to the pond. Many, Houses are continuously discharging waste water in to the pond. The polluted pond water seep into the ground water, Due to percolation the polluted water the quality of ground water in and around the Paraipatti Pond is affected very much. The ground water is saline and unfit for drinking purpose. But the people have to depend on the ground water only. On seeing the suffering of the people in and around the pond a sincere and serious attempt was made to find the ground water quality and also to suggest a suitable remedy for water treatment of using water reverse osmosis technology.

METHOD OF SAMPLING AND ANALYSIS OF WATER QUALITY PARAMETERS

Water samples from the Paraipatti Pond and the wells and bore wells on all directions in and around the Pond were collected from the sampling sites in a clean polythene bottle. Dissolved oxygen (DO) was analyzed immediately after



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collection at the site using DO meter. Water samples were brought to the laboratory for analyzing the physico-chemical parameters like Electrical Conductivity (EC), Total dissolved solids (TDS), pH, Alkalinity, Total Hardness (TH), Nitrate (NO_3), Chloride (Cl), Fluoride (F), Sulphate (SO_4) and heavy metals like Iron, Manganese and Chromium were determined according to CPHEEO standard methodology (Table 1). The samples were collected during pre monsoon months.

RESULT AND DISCUSSION**WATER QUALITY**

The results of various water samples for the various physico-chemical analysis from various sites in the Paraipatti Pond are presented and discussed. The variation in the various physico-chemical characteristics of ground water quality by the seepage of the effluents from the sewage and various industries including tanneries, gives the overall picture of the physico-chemical parameters of all the samples the given in table 2.

SENSITIVE PARAMETERS

TDS, hardness, calcium, magnesium, chloride and pH are taken as sensitive parameters to indicate the water pollution by industrial effluent from various sources. The reports given by the people about the utility of water in the past and at present for drinking as well as for agricultural purposes reveals that the water at present is highly polluted and becomes unfit for drinking purpose. The investigator personally communicates with the people in the study area who are living there for more than 25 years. People reveal that the land and water usage pattern are affected very much. Many lands were used for agricultural purpose. Now it becomes unfit for agricultural use due to high salinity accompanied by crop failures. The effect of chemicals in the industrial effluents affects cultivable lands due to use of polluted water for irrigation. The polluted water retards plants growth and productivity. It is found that the cultivable land is converted into house plots and industries. It causes damage to the environment in the study area.

The water for drinking is not available for the people. So the people have to bring the water from municipal water supply. The level of water pollution by the chemical industries surrounding the because of high degree of water pollution pond has gone up to the highest level and threatens the people. Physico-chemical analysis of various water samples collected at the study area after subjected to reverse osmosis plant (Table 3). Sensitive parameter like TDS, calcium, chloride, magnesium, nitrate, fluoride, turbidity, taste are compared with before and after treatment of water. The water after subjecting to reverse osmosis treatment was tested and is found to be within the Permissible limit. Hence it is suggested to all the residents of Paraipatti pond area people to install domestic reverse osmosis plant in order to convert the available ground water for domestic use.

CONCLUSION

In the present study was carried out to assess the magnitude of the pollution problem Paraipatti Pond at Dindigul district. Nine water samples were analyzed as per CPHEEO standard and the some of the ground water sample in and around the pond were found excess the permissible limit except pH, F^- , Mn^{2+} , Fe^{2+} , Cr^{3+} . The ground water samples showed deviation from water quality standards indicating ground water contamination. Hence the polluted water is subjected to water treatment using reverse osmosis system. Almost all the samples collected from various sampling sites from S1 to S9 are subjected to water treatment using reverse osmosis plant. The treated water collected from reverse osmosis plant after treatment is analyzed as per a pH procedure for drinking water standard. The water becomes suitable for domestic purpose with a low TDS of 50 mg/l. People in the study area were advised to go for R.O treatment plant convert the well water and bore water for domestic use.



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Table 1. Drinking water standards as per Central Public Health Environmental Engineering Standard (CPHEEO STANDARD)

Parameters	Unit	Acceptable	Cause for Rejection
Odour	-	Unobjectionable	Objectionable
Turbidity	NT	1	10
Total Dissolved solids (TDS)	mg/L	500	2000
Electrical Conductivity (EC)	µs/cm	Nil	Nil
pH	-	7.0 to 8.5	< 6.5 or > 9.2
Alkalinity total as CaCO ₃ (TA)	mg/L	200	600
Total hardness as CaCO ₃ (TH)	mg/L	200	600
Calcium as Ca ²⁺	mg/L	75	200
Magnesium as Mg ²⁺	mg/L	≤ 30	150
Sodium as Na ⁺	mg/L	Nil	Nil
Potassium as K ⁺	mg/L	Nil	Nil
Iron as Fe ²⁺	mg/L	0.1	1.0
Manganese as Mn ²⁺	mg/L	0.05	0.5
Chromium as Cr ³⁺	mg/L	Nil	Nil
Nitrite as NO ₂ ⁻	mg/L	Nil	Nil
Nitrate as NO ₃ ⁻	mg/L	45	>45
Chloride as Cl ⁻	mg/L	200	1000
Fluoride as F ⁻	mg/L	1.0	1.5
Sulphate as SO ₄ ²⁻	mg/L	200	400
Phosphate as PO ₄ ³⁻	mg/L	Nil	Nil

Table: 2 Variation of Physico-Chemical Parameters in different water sample Results

Parameters	S1	S2	S3	S4	S5	S6	S7	S8	S9
EC (µs/cm)	885	901	959	1004	895	1120	1340	1057	987
TDS (mg/L)	692	754	1267	2436	796	3486	3900	2982	1692
pH	7.36	7.48	7.61	7.82	7.39	7.29	7.43	7.51	7.46
TA (mg/L)	120	117	132	164	302	276	360	242	136
TH (mg/L)	290	302	285	620	324	1000	942	987	268
NO ₃ ⁻ (mg/L)	19	21	12	26	31	62	18	56	41
Mg ²⁺ (mg/L)	26	14	15	17	21	22	8	10	15
Fe ²⁺ (mg/L)	0.16	0	0	0	0.11	0	0	0	0
Mn ²⁺ (mg/L)	0	0	0	0	0	0	0	0	0
Cr ³⁺ (mg/L)	0	0	0	0	0	0.0016	0.0014	0	0.0012
Cl ⁻ (mg/L)	80	96	140	262	124	442	870	660	102
F ⁻ (mg/L)	0.1	0.1	0.9	0.8	0.7	0.7	0.5	0.3	0.2
SO ₄ ²⁻ (mg/L)	18	12	71	15	114	18	130	120	78





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Table:3 After RO Treated water as per Central Public Health Environmental Engineering Standard (CPHEEO STANDARD) in different water samples

Parameters	Unit	RO Treated	Acceptable
Total Dissolved solids (TDS)	mg/L	50	500
pH	-	7.1	7.0 to 8.5
Alkalinity total as CaCO ₃ (TA)	mg/L	25	200
Total hardness as CaCO ₃ (TH)	mg/L	75	200
Calcium as Ca ²⁺	mg/L	50	75
Magnesium as Mg ²⁺	mg/L	Nil	≤ 30
Sodium as Na ⁺	mg/L	Nil	Nil
Potassium as K ⁺	mg/L	Nil	Nil
Iron as Fe ²⁺	mg/L	Nil	0.1
Manganese as Mn ²⁺	mg/L	Nil	0.05
Chromium as Cr ³⁺	mg/L	Nil	Nil
Nitrite as NO ₂ ⁻	mg/L	Nil	Nil
Nitrate as NO ₃ ⁻	mg/L	Nil	45
Chloride as Cl ⁻	mg/L	Nil	200
Fluoride as F ⁻	mg/L	Nil	1.0
Sulphate as SO ₄ ²⁻	mg/L	Nil	200
Phosphate as PO ₄ ³⁻	mg/L	Nil	Nil





Urban Public Transport Infrastructure Policies and Programmes – A Case Study of India

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ABSTRACT

India has been witnessing rapid urbanization over last two decades. India's urban population has increased from 286 million to 377 million between 2011 and 2011. It has been projected that India's urban population will increase to 590 million by 2030 and 875 million by 2050. The country will have seven mega cities by 2030. This will result in substantial increase in the demand for transport infrastructure and other services. Further, contribution of urban areas to country's Gross Domestic Product (GDP) is approximately 63 percent and it may grow to about 70% by 2030. The urban areas set to become supreme driver of the country's economic growth in future. However, in order to realize full potential of urban areas, India needs to make ambitious investments in the urban transport sector and give adequate space to private sector players. An earlier estimate claims that USD 97 billion were required to be invested by 2030 in urban transport sector in India for inclusive and sustainable growth and development of cities and towns. Apart from mobilizing finances, it is high time for the Government to have sharper focus on several areas of this sector to achieve its true potential and to make our cities and towns globally competitive. The changes are evident from several progressive interventions by Government in the recent past. In this context, this paper discusses in detail about existing policy framework, institutions, and challenges in urban transport sector. Further, it has been attempted to see how the country is prepared to achieve the targets under 11 of Sustainable Development Goals (SDGs) to achieve inclusiveness, sustainability and resilience in urban transport sector.

Keywords: Urbanization, Transport Infrastructure, Sustainable Development Goals (SDGs)





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INTRODUCTION

India has a very large and diverse transport sector. The urban areas of India continue to play an important role in the economic growth of the country. At present, 31.14% of country's population lives in cities and towns, up from 25.73% in 1991 (MoHUA, 2019). The United Nations have projected that; India's urban population will increase to 40% by 2030 and 58% by 2050. Further, urban areas together contribute approximately 63% of India's Gross Domestic Product (GDP), which will further increase to 75 percent by 2030 (Gupta, 2019). The demand for good transport infrastructure and services in India has been felt since early 1990s. Despite of several positive reforms in policies and new programmes in last two decades, India has a major challenge today to meet the demand from urban areas. Therefore, this sector needs sharper attention to become a key driver of country's economic growth and socio-economic development. The demand of transportation infrastructure is mainly driven by population growth, increased economic activities and rise in private motorized transport etc. The demand in several instances has outpaced road capacity. The seriousness of urban transport problems can be identified by experiencing the traffic congestion, traffic safety, environmental degradation and pollution in most of the Indian towns and cities. It is noteworthy to mention that India has the 2nd largest urban system. The share of public transport in cities with population sizes over 5 million is 50-60 percent against the desirable share of 70-85 percent (Krishna et al., 2019). Similarly, for cities having 1-2 million population, the share of public transport is 60 percent against the desired share of 60 percent. A study compiled the data of population growth vis-a-vis motor vehicle growth in 6 metro cities between 1981 to 2001 reported that motor vehicles increased by 8 times during this period against population growth of 2 percent (Lohia, Gol). This shows the demand for improved urban transport system in the country. Thus, India needs to invest more in the urban transport system. An earlier estimate claims that USD 97 million were required to be invested by 2030 in urban transport sector in India in order to keep pace with the rising demand.

Literature Review

Lohia, S.K, has discussed in detail on the demand for transportation infrastructure in India and how the Government is responding to the increased demand from urban areas of the country. He briefly presented the policies and programmes of Government of India pertaining urban transport sector. Sriraman, S has reviewed the National Urban Transport Policy and advocated for some progressive changes in the policy level approach towards urban transportation landscape. He also provided an overview of economic, social and cultural aspects of urban living and the importance of understanding these issues. IIHS in the research paper on 'Urban Transport' discussed in detail about rural transport problems, existing policies and institutions and challenges for the country to meet future demands.

Singh, S. K has studied the trend of vehicular growth and transport infrastructure availability in the cities and towns and discussed in detail about urban transport problems including congestion, pollution, and road accidents. Pucher, J., Koratyswaropam, N., Mittal, N and Ittyerah, N have made in-depth analysis of available data and policies pertaining to India's transport system and travel behavior. Dhudhat Shehzad U. and Modi, Mauni, N have discussed in detail about various risk factors influencing operation and maintenance of urban transportation infrastructures in India. This paper further discusses how and when the risk factors to be identified for cost-effective management, operation, and maintenance various transportation infrastructure projects including roads and bridges. Baidur, D has done a case study on Bangalore Metropolitan Region's urban development and highlighted the transport demand/supply, existing strategies and institutional structure for planning, development and management of urban transport system. Mohanty, N., Sarkar, R., and Pandey, A have discussed in detail how land acquisition pose a major challenge for urban transport infrastructure projects in India. Rye, T has stressed on the need of parking management strategy for sustainable transportation and livable cities. Krisha, P., Singh, M., Tandon, M.C., Raghavan, N., Sikdar, P.K, Chandra, S have highlighted the engineering aspects of urban transportation infrastructure projects in India.





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METHODOLOGY

This research work was done through an extensive desktop review of secondary literatures (research journals, working papers, policy documents, news blogs etc.) relating to the topic, analysis of data of census, 2011 and annual reports of Government. This was followed by interaction with selected stakeholders (academia, experts, consultants etc.) to consolidate and validate the key findings.

KEY FINDINGS AND DISCUSSION

Policies/Programmes

In the last two decades, the Government has taken several reformative measures to create an enabling ecosystem for making the urban transport sector demand driven and resilient. In the sixth Five Year Plan, the Planning Commission underlined the role of transportation sector for country's economic growth. However, it was only in the 11th Five Year Plan, urban transportation problem was highly emphasized and the need of institutional and financial provision was prioritized. It also proposed productivity and efficiency enhancement of urban transportation systems by augmenting capacity and allocating funds. The 12th Five Year Plan has developed a long term vision to address urban transportation issues. Apart from others, it stressed on finding out options for private sector participation. The National Urban Transport Policy (NUTP), introduced in 2006, has underlined the need for coordinated planning, land use integration, equitable allocation of road space, innovative financing mechanism, investment in IT and capacity building to achieve sustainability in urban transport sector. In 2014, Government had to make some amendments in NUTP for addressing the changing demands. It stressed on integrated land use and transport planning, creation of comprehensive mobility plans and public transport and Non-Motorized Transport plans. It also developed guidelines for creating multi modal sustainable urban transport systems. Although, NUTP supported integration of land use and transport, but it is considered to be touching upon the generalities associated with it (Sriraman, 2012).

Launched on December, 2005, Jawaharlal Nehru National Urban Renewal Mission (JNNURM) is the largest national urban initiative to encourage reforms (Lohia, GoI). Major focus had to be given to urban infrastructure and service delivery mechanisms, community participation and accountability of ULB's/Parastatal agencies towards citizens (JNNURM, GoI). It has made provision of central financing assistance to ULBs for improving the urban transport system. It has brought reforms for better urban transport planning and management made conditional to the sanction of urban transport projects (IHHS, 2014). Among others, formulation of a comprehensive mobility plan, setting up of Unified Mass Transit Authority, transit oriented development policy, parking policy are the key ones. This programme aimed at improving the public transport system in larger cities through funding of public transport buses, development of comprehensive city mobility plans and supporting city transport infrastructure projects (Baindur, 2011). However, it has been found that the JNNURM funded projects lacked effective monitoring and verification mechanisms (IHHS, 2014). This programme was also criticized for lack of attention to mixed land use, resettlement of slums, developing links to urban periphery etc. (Chotani, 2010).

The present Government's Smart Cities Mission and Atal Mission for Rejuvenation and Urban Transformation (AMRUT) are being considered to be largely successful in addressing many of the challenges in urban sector. Under the Smart Cities Mission, the Government unveiled a complete new plan to upgrade 100 cities into smart cities with a funding of \$8 billion. This initiative focuses on core infrastructure service in urban areas. The key idea of smart cities is the alliance of public services with an integrated public transport system. Information Technology had a major role to play in both integrating and automating these services. The central government has allocated Rs 48,000 crore to the mission over five years. That amounts to an average of Rs 96 crore per city per year (Deka, 2019). As on Jan 2020, the value of tendered smart city projects was over ₹1,66,000crores, the value of work orders issued is about ₹1,25,000 crores and the value of all completed projects is more than ₹27,000 crores. An additional 1000





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projects amounting to ₹32,500 crore have been tendered and 1000 projects amounting to ₹ 36,000 crore grounded during last one year (PIB, GoI).

Launched in 2015, AMRUT was designed for 500 cities for project based approach to ensure basic infrastructure services in the cities. The Mission focuses on the development of basic urban infrastructure and increasing the amenity values. It stresses on reduction of pollution by switching to public transport or constructing facilities for non-motorized transport (e.g. walking and cycling). Under AMRUT, States/UTs and concerned ULBs used to select, design and implement the projects. Projects amounting to ₹78,910 crores have been grounded under AMRUT as on January 2021 (PIB, GoI). The National Transit Oriented Development Policy follows a comprehensive approach to create sustainable mobility options in cities and covers various aspects of transport policy and practice, including finance and urban planning (Ponkshe, 2020). This promotes city densification along mass transit corridors through vertical construction, Non-motorised Transport Infrastructure, development of street networks in the influence zone of transit corridors etc. Since its formalisation in 2017, the NTOD guidelines have been incorporated in the plans of several smart cities. In an analysis of the smart city, city development and master plans of 17 cities across India researchers found several applications of the NTOD (MoHUA, 2020).

Institutions around urban transportation sector

Urban transport is a vast system and thus it requires several functions to be performed in a well coordinated manner. However, existence of multiple institutions at central, state and ULB level often lack desired coordination and implementation support to various programmes. At the Central level, Ministry of Urban Development is the nodal agency for planning and coordination of urban transport systems. At the state level, Transport department and Urban Development department are the key institutions responsible for urban transportation planning and coordination. In several states, land use planning is done by a separate department. At the various geographic and administrative levels, there are government departments and private actors that have major stakes in creating policies for urban citizens. The largest budgetary allocation and political power rest in the hands of the MoRTH, along with the Ministry of Urban Development, NITI Aayog, and various state and local transport corporations and road development corporations. A significant part is played by the different implementation agencies, such as local, national and international contractors or vendors, consulting firms and donor agencies. Technical and research institutions and advocacy organisations play a role in the formulation of such policies, and building consensus among the different stakeholders for their implementation. Each of the actors or agencies is continuously influencing the actions of other agencies (IIHS, 2014). The vertical and horizontal coordination among various agencies/institutions are often a major challenge for successful implementation of the Government programmes.

Key challenges

There is absence of a legislation that thoroughly covers urban transport requirements in Indian cities (IIHS, 2014). There is need of integrated policy approach instead of having several policies focusing on specific areas of intervention. As India has started monitoring the progress made under the SDG indicators through NITI Aayog's 'SDG India Index' initiative, it is imperative for the country to develop clear guideline for developing a sustainable public transportation system (Singh, 2016). The allocation of fund under various programmes is not sufficient to achieve the desired outcomes. For example, it has been estimated that the Smart Cities Mission requires investments worth \$150 billion over the next few years to succeed, estimating that \$120 billion could come from the private sector. So far, under public-private partnership model, the total investment through this model amounts to 53 per cent of the total funding of Rs 41,022 crore expected from this source (Deka, 2019). Similarly, many ULBs are struggling to mobilize finances for implementing AMRUT projects. In 2019-20, Government of Karnataka had to borrow 400 crores for 16 ULBs of the state to implement AMRUT projects (Joshi, 2019). Land acquisition is a major challenge for urban transport infrastructure projects in India. Land acquisition has been identified as the reason behind delay infrastructure projects 70 percent of cases (Mohanty, et al., 2009). Litigation in land acquisition projects is also a major impediment.





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It has been highlighted by researchers that there is lack of common standards for design, operation and maintenance of transport infrastructure in India. Although, there are existing standards for road construction and metro systems, these are not compulsorily used during design and construction of such projects (Dhudhat and Modi, 2018). Further, there are no common standards for design, operation and maintenance for mass transit technologies such as metro, light rail, mono rail and Bus Rapid Transit Systems (IHHS, 2014). The space in cities, both above and below ground, needs to be surveyed and accurately mapped in the digital mode, and to make these maps available to planners and the engineering organizations for designing feasible projects (Krishna et al., 2019). The road space in Indian cities is largely insufficient. The area occupied by roads and streets in Class I cities (population > 100,000) in India is only 16.1 percent of the total developed area, against 28.19 percent in case of United States. Interestingly, even in Mumbai, the commercial capital of India, the percentage of space used for transportation is far less when viewed in comparison to its counterparts in the developed world (Singh, 2005).

In recent past, serious concerns of safety have emerged during service phases of urban infrastructure. Many of the accidents and collapses in structures have happened during the construction phase (Krishna et al., 2019). Some of the recent events include Bhubaneswar flyover collapse, Kolkata flyover collapse etc. Safety during construction needs to be ensured not only for workers but also for road users. In India, growth of vehicles is much faster than population growth. For example, total number of registered vehicles has jumped from 55 million in 2001 to 142 million in 2011 (MoRTH, GoI, 2013). On the other side, the growth of physical infrastructure is not at par with the growth in demand. For example, the urban road length has reportedly increased from 252,001km to 411,840km between 2001 and 2011. The percentage rate of growth of registered vehicles per million population in the last decade was 219% against an increase of 124% of urban road infrastructure per million. There has been substantial decrease in road space (from 0.18 km per vehicle to 0.01 per vehicle) in the last few decades, leading to high levels of congestion in all cities (Dhudhat & Modi, 2018).

The substantial increase in private-vehicle ownership has resulted in increased congestion problems in cities. On Indian roads, the average speed of a vehicle is just 17-19km/h between 9:00 and 21:00, with the slowest times is observed in the evening hours. In major Indian cities, the average speed of traffic is just 17-23km/h while the average cycling speed is 15-16kmph (Singh, 2016). There has been on street parking issue in all Indian cities (Rye, 2010). The smaller compact Indian cities have serious parking issues. The road length used for on-street parking in Delhi is 14 percent whereas, in Surat, it is 60 percent. Indian cities are suffering from severe air pollution. The Indian cities vary in terms of concentration and severity of air pollution (Kamyotra et al., 2012). Air pollution reportedly has become the fifth leading cause of death in the cities of India. The average total death in a year in Indian cities due to air pollution is around 6.2 lakhs (Roychowdhury, 2013). Further, the death due to road accidents in Indian cities was around 1.5 lakh in 2015; this is about 400 deaths per day. It is estimated that the economy lost around 3% of GDP (1999-2000) due to road mishaps (MoRTH, GoI).

India's preparedness towards achievement of SDGs

As per the report of United Nations, India is being considered to be a better performer of the Millennium Development Goals (MDGs). Therefore, there is expectation that India will do better in achieving Sustainable Development Goals (SDGs). Urban transport systems directly contribute to five targets on road safety (Target 3.6), energy efficiency (Target 7.3), sustainable infrastructure (Target 9.1), urban access (Target 11.2) and fossil fuel subsidies (Target 12c). Two of the targets under SDG 11 stipulates that as sustainable city safe, affordable, accessible and sustainable transport and create green and public spaces for all by 2030. The improvement in urban transportation system will lead to improved access to education, health and employment, thereby contributing in poverty eradication. The Government of India's Smart Cities Mission and AMRUT initiative are largely in line with the targets set under the SDGs. However, there are serious issues in India in integrating the SDG targets with the current policies and priorities. In order to achieve the SDG targets, India needs to foster global and regional partnerships, make desired changes in legal and institutional framework, infuse latest technologies and establish a robust monitoring mechanism to monitor the progress under various indicators.

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CONCLUSION

It is high time for India to formulate a policy or guideline on Sustainable Urban Transport infrastructure to address many of the issues affecting urban transport sector. The NITI Aayog's SDG India matrix will assist policy formulation to a great extent. Given the fact that the urban transport infrastructure demand in India is rapidly growing and in the coming years, the funding requirement will be more for improving Indian transport infrastructure and other systems, Governments need to give adequate space to private sector players to finance new infrastructure projects. This will help in utilizing more public funds for executing projects to promote pedestrian and cycling infrastructure. The number of PPP based transport infrastructure projects to be increased to avoid financing related issues. Further, Professional Engineers to be given adequate training and exposure for planning and designing urban structures that caters to traffic need and ensure safety and sustainability with added focus on aesthetics. It has been suggested to use maximum possible prefabrication and ensure minimum disturbance to underground services and existing traffic while executing the projects.

It is highly essential to set up common standards for design and construction of new roads to accommodate the needs of buses, cyclists, and pedestrians. The new roadways shall be planned in such way that it will provide bus lanes to speed up public transport as well as cycle paths and walkways to improve safety for non-motorists. Pucher et al. (2005) has also highlighted the need for change in designing the road ways in urban areas. The various risk factors that influence the urban transport infrastructure project design, construction and maintenance need to be identified and used judiciously. The allocation of fund to management parties/stakeholders needs to be linked to these risk factors. There is need for much better vertical and horizontal synergy among different transport departments/agencies for effective coordination of transport and land-use policies. Demand for investment in IT is increasingly more in urban transport sector in India. It would assist to a great extent in traffic management, minimizing road accidents, improving public transport services, parking management, safety and security of public and monitoring of transport networks. India can make enormous progress in dealing with urban transport infrastructure by making changes in existing policies and adopting a holistic approach.

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Preliminary Phytochemical Screening, Quantitative Estimation of Total Phenols, Total Flavonoids and Anti-oxidant Activity of Leaves of *Plumeria pudica* Jacq.

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ABSTRACT

The present study investigates the qualitative and quantitative analysis of the major bioactive constituents of ornamentally and medicinally important plant *Plumeria pudica* Jacq. (Family- Apocynaceae) in its methanol and chloroform extract of leaves. Carbohydrates, alkaloids, tannins/phenols, flavonoids, glycosides, terpenoids, proteins, fats and steroids were found in the methanolic leaf extract while chloroform leaf extract showed the presence of carbohydrates, alkaloids, fats, glycosides and steroids which proves that the polar methanol extract has high efficiency for extracting more amount of secondary metabolites in the plant sample as compared to the non-polar chloroform extract. Quantitative analysis were also conducted to determine the amount of phenols and flavonoids in the plant leaf extract. The methanolic leaf extract of *Plumeria pudica* reported total phenol and total flavonoid content to be 248.33 ± 3.33 mg GAE/g of sample and be 108.33 ± 1.67 mg QE/g of sample respectively. Antioxidant activity was determined by DPPH radical scavenging assay. IC_{50} value obtained by DPPH activity for *Plumeria pudica* Jacq. crude extract was found to be 491.124 ± 1.97 μ g/ml. The results suggest that *Plumeria pudica* Jacq. has promising antioxidant activity and could serve as potential source of natural antioxidants. However, this plant can be more explored for its different pharmacological potencies present within it.

Keywords: Phytochemicals, phenolics, flavonoids, *Plumeria pudica* leaf extract, antioxidant, DPPH assay.



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INTRODUCTION

Traditionally, plants are considered as the vital source of medicines and plays a major role in the health of the overall community. Also, the biological effects of secondary metabolites of the plant on human have been known for along time [1]. Various parts of the plant such as bark, leaves, fruits, flowers, roots are known to possess important therapeutic properties due to the presence of diverse bioactive metabolites. Some ornamental plants are planted primarily for aesthetic purposes in home gardens. Many plants such as *Jatropha curcas*, *Catharanthus roseus*, *Plumeria alba*, *Plumeria pudica*, *Anthurium andraeanum*, *Teucrium fruticans* L., *Leucojum aestivum* L., *Hibiscus rosasinensis*, *Nelumbo nucifera* offer their decorative value in addition to the therapeutic benefits. Apocynaceae is a large family of tropical trees, shrubs and vines with most species producing white latex which are known for several biological and pharmacological activities such as cardioprotective, hepatoprotective, neuroprotective, anti-inflammatory, anti-cancer and anti-malarial properties. *Plumeria pudica* is one of the less explored ornamental flowering plant which may prove to have some vital secondary metabolites and various biological properties. This plant belongs to the family Apocynaceae is commonly known by the names such as Nagchampa [2], wild Plumeria, white frangipani, lei flowers (the ones used for making garlands) [3]. *Plumeria pudica* is common in tropical and subtropical regions [4] and it's native to Colombia, Mexico [5], Panama and Venezuela [6, 7]. Plant height can reach up to 5 to 8 feet of shrub or tree. The leaves are alternate, surrounded by the branch and the edge. The white flowers with a yellow center have five petals and bloom in clusters like a bouquet. That is why it is called as a "bridal bouquet" [2]. The leaf shape is like a violin or a spoon and appears dark green in color [3]. Some reports suggests that *Plumeria pudica* is known to be anti-allergic, laxative, carminative plant that also possesses cytotoxic, anti-microbial, anti-inflammatory, anti-ulcer, anti-leprosy, diuretic and anti-ascites properties [5], rheumatism, diarrhea, hysteria and dieresis [8]. The root bark is sharp, bitter, laxative and is used in the treatment of cancer and leprosy [5]. This plant is found in huge amount in north eastern Brazil, where its latex is used by the poor people for the treatment of skin diseases and tooth pain [9]. In Ayurveda, the *Plumeria* oil (warming oil) is used for treating anxiety, fear, tremors and insomnia [3].

MATERIAL AND METHODOLOGY

Collection of Plant material

The fresh leaves of *Plumeria pudica* were collected from a local nursery located in Gandhinagar, Gujarat state. The leaves were washed using distilled water and air dried for 5-6 days. After drying, the leaves were crushed into a slightly coarse powder with the help of a grinder and stored at room temperature in air tight bottles until further use.

Plant Extraction process

The plant extract was prepared by following the maceration technique i.e. cold extraction method. In the conical flasks, dried leaf powder was dissolved in the two solvents (methanol and chloroform) in the ratio of 1:10 g/mL. The mixture was further subjected to the orbital shaker for 24 hours. Each mixture was separately filtered into the petri-plates using Whatman filter paper-1. The solvents were then allowed to evaporate naturally and further stored at low temperature. The percentage yield of both the polar and nonpolar extracts was calculated using the formula, % yield = (weight of dry extract / weight of plant powder) × 100.

Chemicals Required

Chemical reagents like Potassium iodide, Dragendorff's reagent, Bismuth carbonate, Sodium iodide, Glacial Acetic acid, Sodium iodide, Sodium acetate crystals, Bismuth nitrate, HCL, Methanol, Ferric chloride, Lead acetate, Acetic anhydride, conc. Sulphuric acid were locally purchased from India. Other reagents such as Fehling solution (A and B), Ninhydrin solution, Benedict's solution, and Quercetin used were purchased from Finar chemicals. Folin Ciocalteu reagent and DPPH of Sigma-Aldrich Co., Germany were taken into the use during the study.



**Chavda Rutuba et al.****Preliminary Phytochemical screening**

1mg/mL concentration of stock solution was prepared for both the methanol and chloroform plant extract separately. Several bioactive compounds such as alkaloids, flavonoids, steroids, volatile oils, glycosides, reducing sugars, tannins, saponins were tested using the stock solutions. The qualitative phytochemical screening was performed by following the protocols given by [10,11].

Alkaloids

- Mayer's test:-2-3 drops of Mayer's reagent was added to 1 mL of plant extract. White creamy precipitates show the presence of the alkaloids.
- Wagner's test:-Take 1mL of plant extract and add few drops of Wagner's reagent. A reddish brown precipitate shows the presence of the alkaloids.
- Dragendorff's test:- 2 mL of Dragendorff's reagent was added to 1mL of plant extract. Appearance of yellow precipitate confirms the test as positive for the alkaloids.
- Hager's test:-Add few drops of Hager's reagent in to 1mL extract of plant. Yellow precipitates show positive result for the alkaloids.

Carbohydrates

- Molish's test:-2-3 drops of Molish's reagent was added to 2 mL of plant extract. Violet ring formation indicates the presence of the carbohydrates.
- Benedict's test:-1mL of plant extract and 1mL of Benedict's reagent was kept for boiling in water bath for 2 minutes. If colored precipitates appear then it shows the presence of the sugar.
- Fehling's test:-Take 1mL of plant extract and add 1mL of Fehling A and B solution then boil the mixture in the water bath. The presence of red precipitates suggests the carbohydrates occurrence.
- Barfoed's test:- 1 mL of plant extract and 1 mL of Barfoed's reagent was added and the test tube was kept in the water bath for 2 minutes. Red precipitates reveals the presence of the sugar.

Glycosides

- Borntrager's test:-3 mL of chloroform was added in 2 mL of plant extract and shaken, two separated layer of chloroform was seen and then 10% ammonium solution was added. Pink color suggests that the glycosides are present in the plant extract.
- Keller-Killani test:-2 mL of plant extract was taken and 1mL of glacial acetic acid, 2 drops of ferric chloride solution and 1mL of conc. Sulphuric acid were added in it. Upper surface of the mixture was red brown and the lower was blue green in color which indicates the occurrence of the glycosides.

Proteins

- Millon's test:-Few drops of Millon's reagent were added to 2mL of the plant extract. Appearance of white precipitate reports the presence of the proteins.
- Biuret test:-2 mL of plant extract was taken with 1 drop of 2% CuSO_4 along with the pellet of KOH was added to the test tube. Pink color of ether layer indicates the positive result for the protein test.

Phenolics and Tannins

- Ferric Chloride test: To 2mL of plant extract, 2 drops of 5% ferric chloride was added. Appearance of dark green color reveals the presence of the phenolic compounds.
- Lead acetate test:-Take 2mL of plant extract and add 0.5 mL lead acetate solution to it. White precipitates show the positive result for the phenols.
- Folin Ciocalteu test:-Add 2mL of plant extract and 1 mL of Folin Ciocalteu reagent, if blue green color appears then the extract reports the presence of phenols in it.



**Chavda Rutuba et al.****Flavonoids**

- Alkaline reagent test:- 1mL of plant extract was taken in the test tube and 3mL of 2% of NaOH was added, a yellow color appears. Then add few drops of dilute H₂SO₄ solution to it. It turns colorless showing the presence of the flavonoids.
- Lead acetate:- Take 1 mL of plant extract in the test tube and add few drops of 10% of lead acetate. Yellow precipitate indicates the presence of the flavonoids

Saponins

- 20mL of distilled water was added to 1 mL of the plant extract and shaken well. A layer of foam suggests the presence of the saponins.

Fixed oils and Fats

- Spot test:-Few drops of plant extract were pressed between the filter paper. If it leaves oils stain on the filter paper, then it confirms the presence of the fixed oils.

Steroids

- Libermann Burchard's test:-1mL of plant extract, 2-3 mL acetic anhydride and conc. sulfuric acid (side by side of the test tube) were added. Violet or green coloration shows the presence of the steroids.
- Salkowaski's test:-Take 2 mL of the plant extract and shake with the chloroform, then add conc. sulfuric acid from the side wall of the test tube. Red color indicates the presence of the steroids.

Cardiac Glycosides

- 2mL of the plant extract was taken in the test tube with 1mL of pyridine and 1mL of 20% sodium nitroprusside were added. Appearance of pink or red color reveals the occurrence of cardiac glycosides.

Terpenoids

- Copper acetate test:-To 2mL of the plant extract, 1-2 drops of copper acetate were added in the test tube. Green precipitates suggest the presence of the terpenoids.
- Salkowaski's test:- To 2mL of the plant extract, add 2mL chloroform and 3mL conc. H₂SO₄ in the test tube. The formation of red brown color at the interface of the two layers indicates the terpenoids presence in the sample.

Quantitative Phytochemical analysis**Total Phenol Content**

The total phenol content was determined using Folin- Ciocalteu phenol method. The stock solution was made with the concentration of 0.2mg/mL. To the stock solution, Folin- Ciocalteu reagent was added along with 20% Na₂CO₃ and it was incubated for 30 minutes in dark. After 30 minutes, the absorbance was taken at 765nm by Spectrophotometer. This process was done in replicates of three to avoid any errors. To obtain the calibration curve, gallic acid was used as a standard phenol and it was used in place of stock solution [12]. The total phenol content of the extract was determined in terms of milligrams of gallic acid equivalent (GAE) per gram of sample (mg GAE/g of sample) using the below equation,

$$GAE = C \times V/M$$

Where, C = concentration of gallic acid obtained from the calibration curve in mg/ml

V = volume of the extract solution in ml

M = Weight of the extract in g

Total Flavonoid Content

The total flavonoid content of the plant extract was found by using aluminium chloride colorimetry method. 0.2mg/mL stock solution of the plant extract was prepared and 100µL 10% AlCl₃, 100µL of 1M CH₃COOK and 4.8mL distilled water (D.W.) were added and shaken well. The incubation of 30 minutes was given to the solution. The



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absorbance was measured at 415nm wavelength by using spectrophotometer [13]. The same method was followed by using Quercetin as a positive control. The whole experiment was performed in triplicates to minimize the errors. The calibration curve was obtained using quercetin, and from the equation and regression value we can calculate the total flavonoid content of the sample in terms of milligrams of quercetin equivalent (QE) per gram of sample (mg QE/g of sample). The formula to find quercetin equivalent of plant sample is as follows, $QE=CxV/M$

Where,

C = concentration of quercetin obtained from the calibration curve in mg/ml

V= volume of the extract solution in ml

M =Weight of the extract in g.

Antioxidant activity using DPPH radical scavenging assay

DPPH (2, 2-diphenyl-1-picrylhydrazyl) (0.004%) is a predominant reagent used for performing the antioxidant activity. This method is more reliable than other methods for antioxidant property. The natural antioxidant, ascorbic acid was used as standard to compare the antioxidant property with that of the plant sample. To the stock solution (0.2mg/mL), 2 ml DPPH was added and the mixture was shaken well and incubated for 30minutes in dark. DPPH is a photosensitive compound so all precautions were taken to avoid any light penetration while performing the experiment. The reduction of DPPH was measured at 517nm wavelength by Spectrophotometer. Ascorbic acid was used as a positive control and same procedure was followed with it. The antioxidant activity of the plant extract was determined in terms of IC₅₀ value which can be calculated from the graph [12]. The percentage inhibition (%) for standard as well as plant sample can be calculated by using the formula,

$$\text{Inhibition (\% I)} = [(A_{\text{Control}} - A_{\text{sample}}) / A_{\text{Control}}] \times 100$$

A_{Control}: Absorbance of the control

A_{sample}: Absorbance of the sample

STATISTICAL ANALYSIS

All the experiments were performed in the triplicates to minimize the errors. Each value is represented as mean ± standard error (S.E.). The IC₅₀ calculation and other statistical analysis were performed using the Graph Pad Prism 7.0 Windows Software.

RESULTS**Yield value**

In order to quantify the phytochemicals in relation to the crude extract, the yield value is utilized. The yield value of the non-polar chloroform plant extract was obtained to be 46% and that of the polar methanol plant extract was 70%. The following formula was used to calculate the yield value of the plant extracts.

$$\% \text{ yield} = (\text{weight of dry extract} / \text{weight of plant powder}) \times 100$$

Results for Preliminary Phytochemical analysis

The two solvents, methanol and chloroform were tested in order to study the phytochemical extraction efficiency of the polar and non-polar solvent respectively. The qualitative phytochemical screening showed that the alkaloids, carbohydrates, glycosides, oils and fats, cardiac glycosides, steroids were present in both methanolic and chloroform plant extracts (Table:1). While, tannins/phenols, flavonoids, terpenoids, proteins were found only in the methanolic plant extract which proves that the polar methanol extract has high efficiency for extracting more amount of secondary metabolites in the plant sample as compared to the non-polar chloroform extract.



**Chavda Rutuba et al.****Quantitative Phytochemical analysis
Results for Total Phenolic Content**

Total phenolic content in the methanolic leaf extract of *Plumeria pudica* was determined using the Folin-Ciocalteu method. The standard gallic acid was used as a positive control and standard calibration curve (Figure:1) was obtained from which the following equations were derived,

$$y = 0.004x - 0.097$$

$$R^2 = 0.989$$

From the above equations, the total phenolic content of the sample was evaluated as 248.33 ± 3.33 mg GAE/g of sample. The higher phenolic content reveals the plants potency of having more biological activities in it.

Results for Total Flavonoid Content

Total flavonoid content in the methanolic leaf extract of the plant was examined using the aluminum chloride method. The standard calibration curve (Figure:2) was obtained by using the quercetin as a positive control.

The following equations were derived from the standard graph,

$$y = 0.0128x + 0.116$$

$$R^2 = 0.991$$

From the above equation, the total flavonoid content of the plant sample was calculated and obtained to be 108.33 ± 1.67 mg QE/g of sample.

Results for Antioxidant radical scavenging activity by DPPH assay

The DPPH stable free radical method is simple, fast and sensitive for testing the antioxidant activity of the particular compound or the plant extract. DPPH radical scavenging ability of the extract not only depends on the form of the plant, but it also relies on the extraction procedure. The oxidized form of DPPH is absorbed at 517nm [14]. In order to form a stable diamagnetic molecule, DPPH must accept an electron or hydrogen radical. A reduction in DPPH radical absorbance is shown by color changes from purple to yellow. This shows how antioxidant has reacted with the solution to deal with the free radicals. The percentage of inhibition is used to determine the antioxidant activity of the extract, and their ability to suppress the free radicals in this analysis. The IC₅₀ value shows the concentration of the sample required to inhibit 50 % of the free radicals. If the IC₅₀ value is low, the antioxidant activity of extract is said to be high [15]. In the current study, the IC₅₀ value of the standard, ascorbic acid was found to be 133.422 ± 0.464 µg/mL and the IC₅₀ value of the plant extract was evaluated to be 491.124 ± 1.97 µg/mL (Figure:3).

DISCUSSION

Plumeria pudica is a plant that is used to cure a wide variety of diseases. Pharmacognostic criteria and requirements must be defined before a raw medicinal product can be used in any herbal pharmacopoeia [5]. In the present study, the yield of methanolic leaf extract of *Plumeria pudica* is reported to be 70% and the chloroform leaf extract as 46%. While in *Plumeria obtusa* and *Plumeria rubra*, yield of methanolic flower extract was found to be 55.56% and 44.44% respectively [16]. This shows that the percentage yield of methanolic extract of *P. pudica* is higher than that of *P. obtusa* and *P. rubra*. Phytochemical analysis indicated the presence of alkaloids, flavonoids, phenolic compounds, saponins, proteins and carbohydrates in the methanolic leaf extract of *Plumeria acuminata* [17]. Whereas, the methanolic flower extract of *P. obtusa* and *P. rubra* possessed flavonoids, saponins, tannins and phenolic compounds as the secondary metabolites [16]. The methanolic leaf extract of *P. obtusa* showed the occurrence of alkaloids, saponins, glycosides, tannins and carbohydrates [18]. The flower benzene extract of *P. obtuse* reported the presence of alkaloids, steroids, triterpenoids, proteins, amino acids, carbohydrates, volatile oil, fatty acids [19]. *P. alba* flower showed various concentration of saponins, flavonoids, tannins, steroids, volatile oil and phenolic compounds [20]. Shri was *et al.* [21] investigated various phytochemicals present in the methanolic leaf extract of *P. pudica* and



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reported the occurrence of carbohydrates, glycosides, proteins and amino acids, flavonoids, steroids whereas, the current study reveals that the methanolic leaf extract of *P.pudica* possess alkaloids, carbohydrates, glycosides, oils and fats, cardiac glycosides, steroids, tannins/phenols, flavonoids, terpenoids and proteins present in it. This proves that the methanolic extract has more efficiency in extracting more number of secondary metabolites. As *P.pudica* possess higher phytoconstituents than *P.obtusa*, this provides more research opportunities to explore several biological activities of the plant. Flavonoids have antioxidant properties and the ability to protect cells from cellular oxidation, damage and carcinogenesis. They have cancer-fighting and anti-inflammatory properties as well as significant influence on the gastrointestinal tract and heart disease [22]. The total phenolic content and total flavonoid content of methanolic leaf extract of *P.alba* was found to be 89.7 mg GAE/g and 74.7 mg QE/g of sample respectively [23]. While, the present study reveals that the methanolic leaf extract of *P.pudica* has total phenolic content as 248.33 ± 3.33 mg GAE/g of sample and total flavonoid content as 108.33 ± 1.67 mg QE/g of sample. *P.pudica* show high constitution of phenols and phenolic compounds which imply that they may be used as anti-microbial agents [24]. Antioxidants are present in the form of phenolic compounds such as flavonoids, phenolic acids and to copherol [25]. *P.pudica* leaf extract showed prominent free radical scavenging activity by using DPPH assay, which could be due to the presence of phenolic compounds and flavonoids. This study focused to find the antioxidant potential of the methanolic leaf extract of *P. pudica* plant by following the DPPH assay and reported the IC₅₀ value to be 491.124 ± 1.97 µg/mL. Khaing *et al.*[26] in their study stated that the roots of *P. alba* possesses the antioxidant property within it with the IC₅₀ value of 36.144 µg/mL. Antioxidant activity indicates that it can be used as the antimicrobial agent and can be tested for other biological properties like pain reliever, cancer, apoptosis, anti-inflammation, anti-atherosclerosis, cardiovascular protection and improvement of endothelial function as well as inhibition of angiogenesis and cell proliferation activities [24].

The main objective of this study was to explore the preliminary phytochemicals present in the plant along with the quantitative assessment of total phenolic and total flavonoid content present in the plant. This study also focused on the antioxidant potential present in the leaves of plant and showed prominent results. The current work proves that the leaves of *Plumeria pudica* can be of great value for the use in pharmaceuticals and phytotherapy. The plant examined contained several therapeutically essential phytochemicals like alkaloids, phenols, flavonoids, proteins, steroids, carbohydrates and glycosides. The higher concentration of phenolic compounds and the important linear relationship between the concentrations of phenolic compounds and antioxidant activity suggested that this plant possesses the strong antioxidant property. However, more research is needed to isolate and characterize vital bioactive compounds from the different parts of the plant and evaluate its therapeutic values. That being a core reason behind selecting this plant as it is still quite unexplored and holds a huge potential that could yield plant-based drugs for curing many ailments in the future. This plant provides many research opportunities to explore various biological activities both *in-vivo* as well as *in-vitro* and can work as a potent drug in the future.

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Table: 1 Preliminary Phytochemical Analysis of Methanolic and Chloroform Leaf Extracts of *Plumeria pudica*

Test	Result	Methanol leaf extract	Chloroform leaf extract
Alkaloids			
Mayer's test	White creamy Precipitates	+	-
Wagner's test	Red brown Precipitates	+	+
Hager's test	Yellow Precipitates	+	+
Dragendorff's test	Orange Precipitates	-	+
Carbohydrates			
Molish's test	Violet ring	+	-
Benedict test	colored precipitates	+	+
Fehling's test	Red Precipitates	-	+
Barfoed's test	Red Precipitates	-	-
Glycosides			
Borntrager's test	Pink color	-	-
Keller-Killani test	Upper -red brown lower-blue green	-	-
H ₂ SO ₄ test	Violet- green color	+	+
Proteins			
Millon's test	White Precipitates	+	-
Biuret test	Pink color of ether layer	-	-
Phenols/ tannins			
FeCl ₃ test	Dark green color	+	-
Lead acetate test	White Precipitates	+	-
FolinCiocalteu test	Blue green color	+	-
Flavonoids			
H ₂ SO ₄ test	Yellow color disappear	+	-
Lead acetate test	Yellow Precipitates	+	-
Terpenoids			
Extract + copper acetate	Green Precipitates	+	-
Extract+chloroform+H ₂ SO ₄	Forms a layer (red brown color)	-	-
Cardiac glycosides			
Filtrate + pyridine+ sodium nitroprusside	Pink or red color	+	+
Steroids			
Salkowaski's test	Red color	-	-
Liebermann Burchard's test	Violet or Green color	+	+
Saponins	Two layer forms	-	+
Fixed oils and fats (Spot test)	Fixed oils	+	+

('+' sign indicates the presence of the phytochemicals while '-' sign indicates the absence of the phytochemicals in the plant extract)





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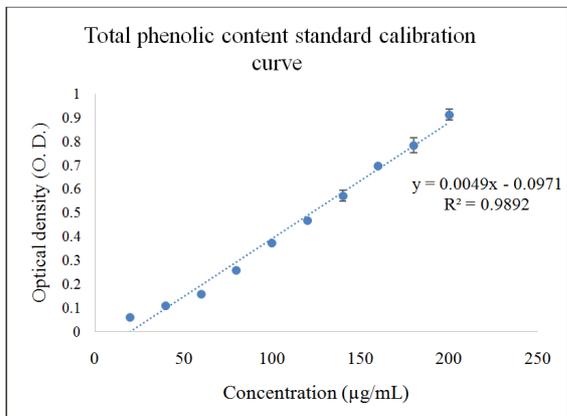


Figure 1: graph showing the standard curve of Gallic acid for total phenol content

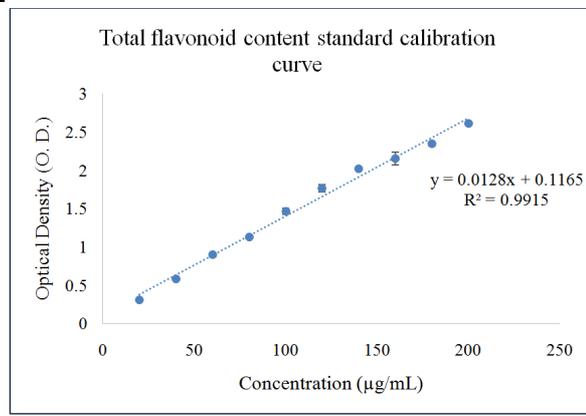
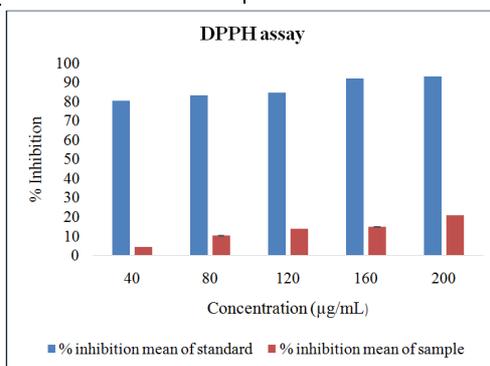


Figure 2: graph showing the standard curve of Quercetin for total flavonoid content



■ -Shows the percentage inhibition for the standard, ■ -Shows the percentage inhibition for the plant sample

Figure 3- graph showing the comparison of percentage inhibition between the standard- ascorbic acid and the plant sample to depict the antioxidant potential of methanolic leaf extract of the plant *Plumeria pudica*





Utility of Body Mass Index, Waist to Hip Ratio and Waist Circumference in Determining Percentage Body Fat among Female of 30 - 40 Years of Age – A Cross Sectional Study

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ABSTRACT

To detect the ability of body mass index (BMI), Waist to hip ratio (WHR) and waist circumference (WC) in predicting the percentage body fat (PBF) among female in the age category of 18-22 years. 86 sedentary females aged between 30 and 40 years (30.20 ± 0.8) with BMIs up to 18.5 (29.8 ± 5.8) were selected through a community visit programme from July 2018 to January 2019. The subjects were assessed for various anthropometric values like body weight, height, and hip and waist circumference. PBF was gathered using bioelectrical impedance analysis (BIA) performed with Bodystat analyser. The analysis showed that the correlations ranged from maximum of 0.756 for BMI, and 0.738 for waist and a minimum of 0.506 for WHR index. The important result of our research was the fact that WHR is relatively inapplicable for estimating body fat. Thus this study recommends BMI as a comprehensive tool in determining percentage body fat and a better prognostic tool in the management of obesity as far as determining the risk associated with obesity.

Keywords: obesity, body mass index, Waist to hip ratio, waist circumference, and percentage body fat..



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INTRODUCTION

Obesity had been a major global concern across all age group and race since 1980 and has become the most commonly seen non communicable diseases. Over 1 fourth of the world population is been now grouped as either overweight or obese (Global Burden of Disease Study 2015). Obesity negatively affects almost all physiological activities of the human body and thus contains an obvious public health hazard. It also multiplies the threat for further development of numerous disease conditions, that involves diabetes mellitus [Singh GM et al, 2013], cardiovascular disease (Czernichow S et al, 2011), even several categories of cancers [Lauby - Secretan B et al, 2016], musculoskeletal disorders [Anandacoomarasamy A, et al, 2008], and also poor mental health [Anstey KJ, et al, 2011], all these has an negative effect on the quality of human life, work efficiency, and healthcare value. Usage of standard outcome measures to categorise an individual as normal, overweight and obese becomes imperative. When it comes to the management of obesity the major hurdle is finding the normal range of body weight. There are many disputes and controversies regarding the usage of standard outcomes like body mass index (BMI), waist to hip ratio (WHR) and total body fat percentage.

The WHR is considered to be more reliable not only in reflecting the trunk obesity but also in determining to what extent the individual is vulnerable to obesity related diseases like diabetes and hypertension. This is because WHR can gauge the truncal adipocytes which are proved to be a vital metabolically active exocrine organ which is involved in the secretion of inflammatory mediators which are responsible for chronic diseases into the systemic circulation.(Kern PA et al 2001 and Vozarova B et al, 2001)past literature have shown that WHR is a preferred predictor of the risk associated with myocardial infarction, better than BMI. (Yusuf S, et al, 2005). WHR has been proved to be a better predictor than BMI in ischemic cerebrovascular accidents, diverticular disease and overall mortality. (Winter Y et al, 2008 and Price GM et al, 2006)literature that examined the relation between body built or constitution and orthopaedic surgical outcomes utilise BMI, but none used WHR. To sum up there is a good amount of controversy in using both BMI and WHR in terms of predicting percentage body fat (PBF) and vulnerability to chronic diseases. The utility of these scales differ from different population. For instance the BMI may not a preferred tool in prediction obesity among athletes and paediatric population. So in this study we tried to evaluate how well BMI, WHR, WC performed in predicting the PBF among female in the age category of 18-22 years from the selected locations of Salem district, India.

MATERIAL AND METHODS

Subjects

A population of 86 sedentary females aged between 30 and 40 years (30.20 ± 0.8) with BMIs up to 18.5 (29.8 ± 5.8) were selected through an community visit programme organised by Vinayaka missions hospital from July 2018 to January 2019. We had excluded five volunteers, three with very low PBF and three with extremely high PBF. All participants were examined in a community hall where informed consent was taken as a signed declaration of agreement to participate in the cross sectional study. The study was approved by the institutional ethic committee of Vinayaka mission university, Salem, India. The participants who had inflammatory or metabolic diseases like diabetes mellitus, thyroid dysfunction, and other endocrine dysfunctions, carcinoma or autoimmune diseases.

The participants were screened for the anthropometric values like body weight (using electronic bathroom scale) that was calibrated before weighing every subject. Participant's height was recorded using stadiometer that was corrected to the nearest 0.5 cm. Waist circumference was defined as the narrowest diameter measured between the xiphoid process and the iliac crest. Hip circumference was defined as the largest diameter measured over the greater trochanters corrected to an accuracy of 0.5 cm. using these values the BMI and WHR was calculated. PBF was gathered using bioelectrical impedance analysis (BIA) performed with Bodystat analyser (1500 MDD; Bodystat, Isle



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of Man, UK). All the anthropometric measures was analysed by two physiotherapists who were trained in obesity management for at least 5 years.

Statistical analyses

The Pearson correlation coefficient was performed to assess the association between PBF and BMI and WHR. The independent t-test was used to find the difference between two non-independent Pearson correlations and Bonferroni correction of significance levels was also calculated. Central tendency and dispersion used for the study was mean and standard deviation. The significance level for the study was set as 0.05 with a confidence interval of 95%.

RESULTS

Anthropometrical characteristics of the 86 subjects are summarised in Table 1. To select an ideal surrogate for measuring the adiposity, we assessed the correlation between percentage body adiposity (which was measured using bioelectrical impedance analysis) and other easily measured variables namely BMI, waist circumference and WHR (Table 2). The analysis showed that the correlations ranged from maximum of 0.756 for BMI, and 0.738 for waist and a minimum of 0.506 for WHR index. Figures 1–3 displays the relationship between BIA and BMI, BIA and WHR, and BIA and waist circumference respectively.

DISCUSSION

There are many tools available to evaluate BPF, which is the major index in obesity management and wellbeing. BMI, WHR and WC are commonly used not because of its accuracy but for the ease with which it can be measured and administered at low cost and time. These scales are also welcomed my patients who can do it domestically without the need of sophisticated equipment. But the usage of these tools have been heavily scrutinised in the past. These scales have shown a lot of variations and limitations in different ethnicity, sex and age groups. The ability of detecting chronic disease was also disputed. Hence in this study we assessed the ability of these three main outcomes in detecting PBF among the South Indian population in a specific district from Tamil Nadu. Out of all professionals who work with obesity the nutritionists tend to investigate and take interest in a new outcome tools, according to recent literature. There are many tools like Body Adiposity Index (BAI) evolving in the effort to predict PBF only to be proved insufficient indicator of BPF and were no as accurate as DXA or electrical bioimpedance, BMI and WHR.

Body fat mass is often difficult to estimate through BMI index or the new tools like BAI index because of two reasons. Firstly, age is not considered in these body fat mass methods, as there are evidences that proves that body fat mass would be vary significantly for a young woman in at the age of 20's compared to aged female or geriatric female. This issue can be resolved using charts (diagrams) which utilise different age categories. Secondly, in tools like BAI, accurate hip circumference measurement is often a tough task, as this is measured manually and hence subject to error. It is proved in the literature that there is a poor inter ratter reliability for these scales. (Pazhoohi, et al, 2012) In addition, apart from the connection between BMI at above 25 and lesser risk of chronic diseases, there is also a connection between higher BMI and life span. This complicates the determination of optimal range of normal fit BMI within the standard range of 18.5–24.9. When comparing the tools that use weight and height (like BMI) in assessing the PBF, tools that use anthropometric parameter (measurement of waist and hip circumference) like WHR and WC fail mostly because of the influenced of sex. The female morphology differs from the male which results in the misinterpretation. It has been documented already that abdominal obesity and abdominal adiposity are associated with increased risks of cardiovascular diseases, hypertension, diabetes etc., compared to body fat allocation in the thighs gluteal region and back. Geliebter et al. in 2013 indicate that the tool that used anthropometric values were not as effective as tools that used body weight much similar to the current study. However usage of anthropometric scales was proved effective in two ethnic groups which are the Mexican



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Americans and African Americans population (Bergman et al. 2010), but not in the Caucasian women. (Lopez et al. 2012). The important result of our research was the fact that WHR is relatively inapplicable for estimating body fat, among the tested population which was in line with study by Pavel Suchanek et al in 2012.

CONCLUSION

Based on the results of our study and the previous results from various ethnical and age category we conclude that the WHR and WC method are not a universally valid index and cannot replace BMI index in the tested Indian population; they may provide inaccurate estimation of body fat percentage and thus mislead in detecting obesity risks. Thus this study recommends BMI as a comprehensive tool in determining percentage body fat and a better prognostic tool in the management of obesity as far as determining the risk associated with obesity.

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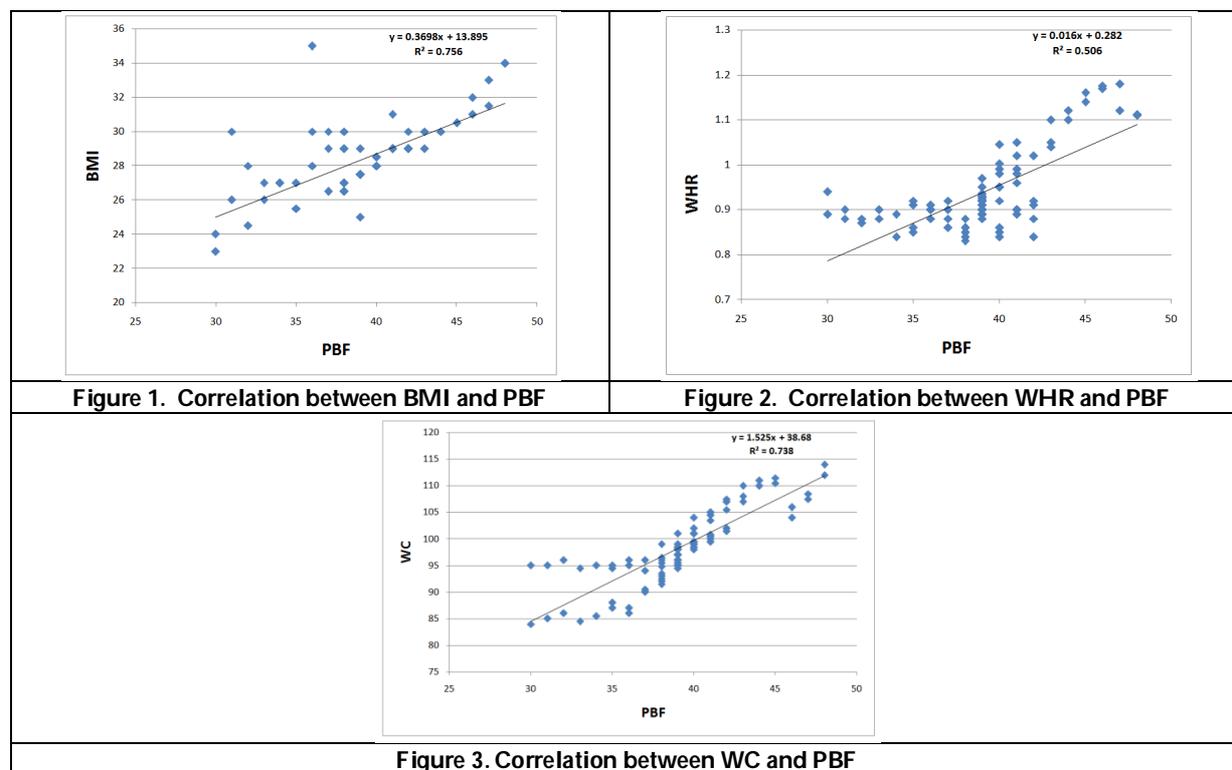
Tab. 1. Characteristics of the study participants (mean ± SD)

N=86	Mean (SD)
Age, years	30.20±0.8
BMI kg/m ²	27.6±1.9
Weight, kg	82.4±12.58
Waist, cm	96.5±11.0
Hip, cm	108.8±7.7
Waist-to-hip ratio	0.83±0.20
Percental body fat, %	38.4±6.2

Tab. 2. Corporal correlation between PBF from BAI and BMI, waist circumference and WHR.

N=86	PBF (39.08±3.88)
BMI, kg/m ²	0.756
Waist, cm	0.738
Waist-to-hip ratio	0.506

Pearson correlation with Bonferroni correction of significance levels





Promoting Growth & Resilience of Businesses During and After the Coronavirus (Covid -19) Pandemic – A Review

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ABSTRACT

At the outset of 2020, the world economy was hit with uncertainties due to the coronavirus pandemic. This emergent issue impacts the entrepreneurial world severely as it ultimately influences social problems like food shortage, crashing share prices and delays in export and import etc. This unforeseen pandemic has caused production disruptions in both developed as well as developing countries alike. It is a crisis situation for entrepreneurs, particularly new entrepreneurs. So entrepreneurs are required to make regular use of technology for taking business decisions including marketing decisions, as they are no longer in physical contact with their teams and stake holders. Various strategies can be framed at various levels to deal successfully with the crisis like policy level, technological interventions and at entrepreneurial level itself.

Keywords: Resilience, Growth, Businesses, Entrepreneurship, Covid-19, Coronavirus, Pandemic

INTRODUCTION

Much non-pharmaceutical mediation like lock downs and social distancing has been enforced by the governments in many countries, to contain the spread of the virus [1]. This has resulted in a sharp and unexpected decrease in the economic activities like production, trade and investment, across the globe [2]. IMF had forecasted a contraction of around 4 per cent in world economy [3], while the OECD forecast was 6 per cent shrinkage in world economy [4].



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Now, almost all businesses across all industries are prone to losses or reduced revenues due to the COVID-19 pandemic [5]. Many businesses, especially the start-ups are shutting businesses due to withdrawal of orders from consumers, and retailers have increased the prices of products to cover the losses caused due to the COVID-19 pandemic [6]. Situations like financial slumps resulting out of lock downs due to the pandemic, frequently lead to monetary difficulties for businesses. To tide over such difficult times businesses need to maintain their liquidity positions [7]. The pandemic resulted in a serious financial distress that affected most of the businesses and their revenues due to disturbed supply chains, contracted demand, and an unreliable environment [8].

MITIGATING THE CHALLENGES POSED BY COVID -19

Previous works on entrepreneurship shows that dealing with failure and risk, is a normal thing for entrepreneurs as they confront it on a day to day basis [9]. So it can be well expected from entrepreneurs to adjust their businesses as per the new challenges posed by COVID-19[10]. Many new opportunities can be exploited by entrepreneurs as a response mechanism to a crisis [11]. Such responses may also include faster innovation and discovery of substitute products and services [12]. There will be some short term opportunities arising out of the crisis like development of hygiene and digital work solutions. The long term opportunities are still not clear, but there will surely be some broader opportunities that will arise as a response to the crisis [10].

Technology as a medium of transforming businesses

We know that technology is changing the face of the current century, with its ever increasing importance as the days go by [13]. Technological up gradation in the science area is transforming the market and the entrepreneurship arena [14]. Technology now has the ability to transform not only our personal life but also build new and innovative business structures [15]. Technology has now gained more importance in the business world when compared to human actions as they are able to operate seamlessly, efficiently with much lower room for errors [16]. [Entrepreneurs will also feel less pressurised by working from home with help of technology. Automation with the help of technology reduces cost and improves efficiency. There exists a great possibility of providing massive quantities of information within a limited time frame, with the use of cutting edge technologies such as data mining and deep-learning algorithms [6].

Entrepreneurship and Crisis-Management

The COVID-19 pandemic and the associated lockdowns in economies across the world has given rise to a situation which is unique and has no documented evidence in entrepreneurship literature. However, there is a stream of research dedicated to entrepreneurship and crisis-management [17]. This body of research can provide two important insights into dealing with a pandemic situation such as COVID-19. The first insight is about the ways in which entrepreneurship can respond to crisis situations [18]. The second insight is about what actions the entrepreneurs can take for survival in crisis situations [19] and the associated barriers to it [20]. Talking about the first insight on entrepreneurial crisis management, it stresses not only on the capability of a business to continue functioning throughout a crisis, but also on the resources that were gathered before the crisis as well as during the aftermath of the crisis [21]. Crisis management techniques are being used to foster flexibility during a crisis and are of huge importance during the COVID-19 pandemic. They are used to reduce the impacts of a crisis [22] and if done properly, can enable quick restoration of functionality of organisations affected by a crisis [21].

Implications for policy makers

While crisis management on the micro level is largely the task of entrepreneurs themselves, policymakers are called upon to support entrepreneurs in their endeavours to deal with crises such as COVID-19, meaning that policymakers conduct crisis management on the macro level as they aim to strengthen the resilience of businesses, including start-ups, and to support their individual crisis management actions [10]. To put it differently, at a micro level, crisis management is the responsibility of the entrepreneurs, but it is the policy makers who are expected to deal with policy matters at the macro level to support efforts of the entrepreneurs in their fight against the COVID-19 crisis. It



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is very much expected that the repercussion of the lock down due to COVID-19 will be seen differently for different regions depending on their coping strategies [10]. Some businesses will benefit from their entrepreneurial capability where as some others will not. So which businesses will benefit during this crisis will depend upon how innovative their entrepreneurs can be. However, from a policy making standpoint, it would not be correct to depend only on entrepreneurial efforts to overcome the economic damage caused due to the pandemic. It would be better for the policy makers to make efforts to provide sufficient resources to innovative enterprises to deal with the damages caused by the pandemic [10]. The most popular policy measures used to boost the economic activity of the businesses during COVID19 are to provide short-term aid and to strengthen their capital base by reducing interest rates on loans and improving their availability [10]. But, some argue that if the governments succeed in providing short term relief to troubled business, in a way that is conforming to long-standing goals of “promoting health, equity, and environmental protection” [23], the COVID -19 pandemic might even contribute towards building a better future [10].

BOUNCING BACK TO THE NORMAL

The question which needs attention is that what kind of capability does each country should possess to bounce back to normal after the COVID-19 pandemic? There may be permanent reduction in entrepreneurship and innovation in some countries due to the pandemic. Such countries will remain more vulnerable to the shocks of even the future pandemics [24]. On the other hand, a situation of zero-sum politics may also prevail in some countries as an aftermath of the pandemic [25], where authorities play a blame game of responsibilities and democracy gets a back seat resulting into numerous conflicts within the country. There exists also a possibility that the gap of inequality between individuals and the countries is going to get wider and wider. It is not clear at this point of time that whether the countries will be able to avoid such a scenario or not. There are some broad principles, which if adhered to may provide a context to negate the negative effects that are inflicted upon countries as due to the COVID-19 pandemic [1]. Some of these broad principles [1] are discussed briefly in paragraphs below.

Decentralisation

The ultimate expectation of entrepreneurs in the current phase of the pandemic is that all business should get back to normal functioning as soon as possible. But for this to happen, first the spread of virus has to be checked. This in turn, requires people to meet with each other for analysing the information and framing efficient and robust responses to the new information. Decentralised responses suggest to minimal errors in decision making unlike responses taken under centralised decision making [26]. These advantages of decentralisation can be extended to entrepreneurs to mitigate the economic consequences due to lock downs. So, decentralised responses are one of the important approaches to provide support to entrepreneurs for recovery from the negative effects of the pandemic. Decentralised data collection from different geographical regions and their analysis by a diverse team of scientists offers a better picture of the status and nature of the virus. Such kind of analysis is very helpful in understanding the spatial variations in the nature and impact of the virus. Similar to health impact, the economic impact has also been very heterogeneous [27] due to the pandemic. Some local areas have suffered severe economic losses, whereas adjacent areas were comparatively better off. This calls for a decentralised approach in distributing financial assistance to these areas by selecting decentralised channels of distributions such as state and local governments as well as the network of banks [1].

Democratisation

There is a popular belief that autocratic leadership may be best suited for dealing with a pandemic situation such as COVID-19. Supporters of this view often point towards China’s method of handling the pandemic [28]. But, the truth is that democratic countries are better suited to deal with such crises situation due to their decentralised setup, efficient information flow and error correcting mechanisms [1]. Error correcting mechanisms such as trial and error method is very important for a country while dealing with the consequences of a pandemic. Another reason can also be attributed to democracies as against autocracies which make it easier for democracies to deal with crisis situations like COVID-19. The reason being, that countries with a democratic setup encourage individualism and distinctive



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behaviours [1]. So countries which encourage individualism and distinctive behaviour are most likely to come up with innovative solutions for the problems created by the crisis, like working under restrictive norms, there by resulting in fewer entrepreneurial failures and reduced unemployment rates, when compared to autocratic setups. Empirical evidence also indicates that democracies are better suited to deal with pandemics than autocracies, in terms of health as well as economic recoveries. An interesting study analyses the relationship between the stringency of imposition of lockdowns and the degree of restrictiveness of mobility within the country [29]. The study points out that even though autocracies have implemented the lock downs more strictly, democracies have been more successful in restricting travel within their countries [29]. A case in point may be Germany, where the severity of imposition of lock down was moderate, but the deaths due to the Covid-19 have been comparatively less.

Demand

The lock down steps initiated by the government as a response to COVID-19 meant shops to shut, manufacturing units stopping production and global value chains coming to a standstill. Covid-19 has brought about a huge supply side shock. Consumers started stocking up on necessities anticipating a shortage and many governments started putting restrictions on export of medicines and medical equipment, fearing disturbances in supply of critical inputs [1]. The Covid-19 restrictions resulted not only in supply side shocks but also demand side shocks. Demand side shock resulted from reduced spending by the consumers as a result of losing their income as a result of lock downs. Closure of a huge number of enterprises is as an example when supply side shocks results into demand side shocks. When the enterprises are shut down, their workers lose their jobs and incomes, resulting into demand side shocks. This has many negative consequences like workers losing their contact with entrepreneurs, need for entrepreneurs to start from scratch and workers' need to find new jobs etc.

The government's hand of support for the enterprises should come in the form of efforts to increase the aggregate consumer demand and taking steps to prevent enterprises from shutting down their businesses [1]. But the question remains that how the government would be able to help with these issues. The first step would be to decrease the severity of lockdowns. As long as the blanket lock down measures continues, the losses of the businesses would continue to occur and many businesses would be forced to shut down. So the governments should aim at gradual phasing out of the blanket lockdowns with smart lockdown measures.

Distribution

The pandemic has brought with itself a severe income disparity both between individuals and countries in relation to the deteriorating market concentrations [1]. Many reasons can be attributed to such adversative distributional consequences. One of the reasons is that, to what extent a sector or industry is directly hit by the pandemic? Industries where direct human interaction is imperative are affected more adversely than other industries [30]. The second reason relates to the sizes of the enterprises. Micro, small and medium enterprises were affected severely due to their low resource base and lack of lobbying capacity with the government. And it is a known fact that most of the government fundings are routed to large corporates. Thus it can be expected that the income disparity between the large and small enterprises will widen further with the progress of the pandemic. A third reason may be attributed to the fact that how quickly and effectively the enterprises shifted their functions to the work for home mode with the aid of online technologies.

It is practical to think that all entrepreneurs cannot move their work to the online mode due to their lack of exposure to technology and the nature of work involved. The fourth reason is the ability of a sector to automate [1]. The pandemic has necessitated for the business functions and task to be automated and carried out from home [31].





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CONCLUSION

How the entrepreneurs respond to a crisis situation is majorly decided by aspects such as entrepreneurial culture and knowledge diversity. These aspects cannot be developed in the short run and are the result of constant efforts for nurturing entrepreneurship. For instance, the flexibility of health systems of different states is the deciding factor in state's ability to respond to the COVID-19 crisis. So the countries which have made efforts to make their health systems flexible are in a better position to take off with their pre-crisis level activities more rapidly than others.

Most of the policy measures taken to deal with damages caused due to the pandemic would be successful, if they are aptly supported by positive features of an entrepreneurial ecosystem. Encouraging investors to provide growth capitals in spite of the crisis will go a long way in providing businesses with short-term liquidity as well as facilitating in their future recovery.

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Arbuscular Mycorrhizal Fungi on Cadmium Chloride (CdCl₂) Tolerance in Black gram (*Vigna munga* (L.) Hepper.

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ABSTRACT

A present research work was carried out to determine the effect of Cadmium Chloride on seed germination and seedling growth of black gram (*Vigna munga* L.). The seeds were treated under control (without treatment) 2.5, 5, 7.5, 10 and 12.5g of Cadmium Chloride (CdCl₂) concentration solutions individually. Each treatment was replicated thrice in a randomized block design. Observations were complete on root and shoot length, fresh and dry weight of seedling. Vigour index of black gram (*Vigna munga* L.) at 15, 30, 45, 60 and 75 days of intervals. Among the results gradual increase in Cadmium Chloride (CdCl₂) concentration under different treatments significantly leads to inhibition of seed germination and other growth parameters. Percentage of phytotoxicity showed an increasing trend with gradual increase in lead concentration for the Black gram seedlings. Maximum inhibition in all growth parameters and morphological parameters were recorded.

Keywords: Cadmium Chloride (CdCl₂), Black gram, Vigour index, Morphological parameters.



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INTRODUCTION

The dictionary explains pollution as the presence in our introduction into the environment of a substance which has harmful or poisonous effects. Environmental pollution occurs when pollutants contaminate the surroundings which brings about changes that affect our normal life style adversely. Pollutants are the key elements or components of pollution which are generally waste materials at different forms, pollution disturbs our ecosystem and the balance disturbs our ecosystem and the balance in the environment with modernization and development in our lives pollution has reached its peak, giving rise to global warming human illness. Environmental pollution occurs in different forms, air, water, soil, radioactive noise, heat/thermal and light every form of pollution has two sources of occurrence the point and the non-point sources. The point sources are easy to identify, monitor and control whereas the non-point sources are hard to control.

Pollutants contaminate the surroundings which brings about changes that affect our normal life style adversely. pollutants are the key elements or components of pollution which are generally waste materials at different forms, pollution disturbs our ecosystem and the balance disturbs our ecosystem and the balance in the environment with modernization and development in our lives pollution has reached its peak giving rise to global warming human illness. Rapid industrialization and other developmental activities with geochemical alterations posed a major threat to our environment. Among these myriad of environmental pollutants, chromium, cadmium, lead and mercury, merit a special attention due to their potential health hazard on human as well as wild life. Leather industry is one of the major industries that discharges many toxic pollutants like chromium, sulphide, phenolic compounds and other minerals salts, dyes, solvents *etc.*, chromium contributes a major share to the hazardous nature of tannery effluents. Cadmium Chloride is released in the environment from chemical fertilizers, animal wastes, sewage sludge and by different industrial processes, such as electroplating, leather, tanning, paint, textile and wood preservation

MATERIALS AND METHOD

The seeds Black gram (Variety CO 4) were obtained from Tamilnadu Agricultural University (TNAU), Coimbatore, Tamilnadu, India. The uniform seeds are selected for the experimental purpose. Source of Cadmium Chloride (CdCl_2) stock solution prepared by dissolving the molecular weight of (Cadmium Chloride) and different concentrations *viz.*, (Control, 2.5, 5, 7.5, 10, 12.5 and 15 g) of the solution were prepared freshly at the time of experiments. The pods were filled with 5kg of garden soil, Black gram seeds were sown in the pods and one set of pod irrigated with normal tap water was maintained as the control

Germination study was conducted with Black gram seeds treated with Cadmium Chloride. The seeds of Black gram were surface sterilized with 0.2 per cent of HgCl_2 for two minutes and they were thoroughly washed with tap water. The seeds arranged in plastic cup filled with garden soil and they were treated with different concentrations of Cadmium Chloride. The control set was maintained by using tap water. Three replicates were maintained for each treatment. On the 15, 30, 45, 60, 75, DAS the germination percentage, shoot length, root length, total leaf area, seedling fresh weight, and seedling dry weight were taken. From these data, the following values of vigour index, and percentage of phytotoxicity were calculated.

Germination percentage

The number of seeds germinated in each concentration was counted on the 15th day and the germination percentage was calculated by using the following formula

$$\text{Germination percentage} = \frac{\text{Number of seeds germinated}}{\text{Total number of seeds sown}} \times 100$$



**Karuthamma et al.,****Shoot and root length (cm/seedling)**

Twenty seedlings were taken from each treatment and their shoot length and root length were measured by using a cm scale and the values were recorded.

Total leaf area

The total leaf area was calculated by measuring the length and width of the leaf as described by Yoshida *et al.* (1972). Where

Leaf area (cm²) = K × Length × Breadth

K = Kemp's constant (for dicot leaves 0.66)

Fresh weight (g/seedling)

Ten seedlings were collected from each treatment and their fresh weights were measured with the help of an electrical single pan balance.

Dry weight (g/seedling)

The same seedlings used for fresh weight were kept in hot air oven at 80°C for 24 h. Then, the seedlings were taken from the oven and kept in desiccators for some time. Their dry weights were taken by using an electrical single pan balance.

Vigour index

Vigour index of the seedlings was calculated by using the formula proposed by Abdul-Baki and Anderson (1973).

Vigour index = Germination percentage × Length of seedling by using the formula proposed by Chou *et al.* (1978).

RESULTS AND DISCUSSION

The seed vigour index of Black gram were recorded on 15,30,45,60 and 75 DAS after seed sowing which are given in Table1. The vigour index of Black gram with effect of Cadmium Chloride was observed in 2.5g.As compare to others all treatment concentrations. The lowest vigour index was observed in 12.5g of Cadmium Chloride concentration. Shoot length of Black gram plants was presented in Table 2. Among Black gram plants the highest shoot length was recorded in 2.5g of Cadmium Chloride concentration. With comparison of other concentration of Cadmium Chloride. The lowest shoot length was recorded in 12.5g of Cadmium Chloride concentration. The effect of lead on the root length Black gram plants was shown in Table 3. The maximum root length was observed in 2.5g of Cadmium Chloride concentration compare to other concentration solution. The minimum root length was observed in 2.5g of Cadmium Chloride concentration. The effect of lead on the fresh weight and dry weight of Black gram plants is shown in Tables 4,5. The Black gram plants were shown in better result in all analyzed parameters compare to other concentration.

The present study the morphological parameter of Black gram, seedling growth and fresh weight, dry weight, root length ,shoot length and vigour index of Black gram seedlings increased in with treatment of Cadmium Chloride, and then it decreased at level of chromium and cadmium treatment. Reduction in seed germination percentage and growth at higher concentrations of metals might be due to the higher amount of toxicity, which caused changes in the osmotic relationship of the seed and water. Heavy metal contamination of soil and water is a serious problem for ecosystem which poses strong negative effects on plant growth and development (Kabata, 2001). Many authors reported inhibition Seed germination by heavy metals where as at 100% of effluent concentration decrease in length of root and shoot was recorded at 10, 15, 20, 25 and 30 days. Inhibition of seed germination may be due to high level of dissolved solids, which enrich the salinity and conductivity of the absorbed solute by seed before germination (Tantrey and Agnihotri, 2010; Heidari and Sarani, 2011; Gubrelay *et al.*, 2013). The study reported Rout *et al.* (2000) that the seed germination was reduced 25% with the treatment of 200 mM Cr concentration. The heavy metal stress could be assigned to the accelerated breakdown of stored nutrients in seeds and alteration of selection permeability properties of cell membrane. However, Wu *et al.* (2008) mentioned that the seedlings of *Citrus tangerine* and *Poncirus trifoliata*



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importantly higher shoot and root dry weights, plant height, leaf area, leaf number per plant, and stem diameter with the influence of mycorrhizal (AM). Further, studies reported inhibition of seed germination by the heavy metal (Neogyet al., 2002; Cavusoglu and Yalcin, 2010). Further study (Amnaet al., 2015) mentioned that fresh and dry biomass of plant reduced when the application of heavy metals with comparison of control plant. During the heavy metals treatment, biomass of plant was reduced. It might be changes in biochemical processes taking place at cellular and molecular level (Shanker et al., 2005).

Many authors reported inhibition seed germination by heavy metals (Farooqiet al., 2009; Tantrey and Agnihotri, 2012; Heidari and Sarani, 2011; Gubrelayet al., 2013). The study reported Rout et al. (2000) that the seed germination was reduced 25% with the treatment of 200 mM Cr concentration. Moreover, mycorrhiza can facilitate Cr toxicity and influence plant growth in Cr polluted soil (Davies et al., 2001). Shafiqet al. (2008) during the seed germination, the heavy metal stress could be assigned to the accelerated breakdown of stored nutrients in seeds and alteration of selection permeability properties of cell membrane. Similar results were observed that the reduction of biomass in several crops were detected by Singh et al. (2013); Hosseiniet al. (2007); Kamel (2008) and Farooqiet al. (2009). Kumariet al. (2011) observed that the plant fresh weight were reduced with the influence of cadmium treatment in *Vignamungo L.* Hatata and Abdel-Aal (2008) result revealed that the reduction in the fresh and dry weights of root and shoot, leaf area, and leaf are among the most sensitive responses to Cd exposure and are the indices for stress responses like other physiological reactions.

Muhammad et al. (2008) announced that *L. leucocephala* seedlings demonstrated a slow reduction in dry weight with increment in treatment of cadmium, which was clear in the poor development of roots and elevated parts. Fresh and dry weights of plant were reduced with increasing concentration of cadmium. Many researchers (Balestrasse et al., 2003; Dell'Amico et al., 2008) experimentally revealed that the with treatment of cadmium. Cheng and Huang (2006); Kumari et al. (2011) and Hirve and Bafna (2013) observed that the decrease of plant fresh weight under cadmium treatment in *Vigna mungo*. Similar result was also observed in *L. leucocephala* (Muhammad et al., 2008). In addition to the plant growth reduction might be the Cd toxicity affects on plant roots and also it inhibit the plant photosynthesis under heavy metals stress (Zhang et al., 2018). Heavy metal contamination is one of essential elements, which impact the germination conduct of any plant (Lalitha et al., 1999). It has been accounted for that *Catharan thusroseus* with 500 µM CdCl₂ delivered hindered development with diminished leaf zone, biomass, chlorophyll add up to number of leaves and sterility (Pandey et al., 2007). Seed germination is the main physiological process influenced by Cr treatment, the capacity of a seed to sprout in a medium containing Cr would be demonstrative of its level of resistance to this metal (Peralta et al., 2001).

Similar results were observed that the reduction of biomass in several crops were detected by Singh et al. (2013); Kumari et al. (2011) observed that the plant fresh weight were reduced with the influence of cadmium treatment in *Vigna mungo L.* Hatata and Abdel-Aal (2008) result revealed that the reduction in the fresh and dry weights of root and shoot, leaf area, and leaf are among the most sensitive responses to Cd exposure and are the indices for stress responses like other physiological reactions. Muhammad et al. (2008) announced that *L. leucocephala* seedlings demonstrated a slow reduction in dry weight with increment in treatment of cadmium, which was clear in the poor development of roots and elevated parts. Fresh and dry weights of plant were reduced with Increasing concentration of cadmium. Many researchers (Balestrasse et al., 2003; Dell'Amico et al., 2008) experimentally revealed that the with treatment of cadmium. Cheng and Huang (2006); Kumari et al. (2011) and Hirve and Bafna (2013) observed that the decrease of plant fresh weight under cadmium treatment in *Vigna mungo L.* Similar result was also observed in *L. leucocephala* (Muhammad et al., 2008). The present study the seed germination percentage, seedling growth and fresh weight, dry weight, no of leaf, total leaf area, number of root nodules of cow pea seedlings increased in with treatment of AMF and then it decreased at high level of chromium and cadmium treatment. Reduction in seed germination percentage and growth at higher concentrations of metals might be due to the higher amount of toxicity, which caused changes in the osmotic relationship of the seed and water. Many authors reported inhibition Seed germination by heavy metals (Farooqiet al., 2009; Tantrey and Agnihotri, 2012; Heidari and Sarani, 2011; Gubrelayet al.,





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2013). The study reported Rout *et al.* (2000) that the seed germination was reduced 25% with the treatment of 200 mM Cr concentration. Moreover, mycorrhiza can facilitate Cr toxicity and influence plant growth in Cr polluted soil (Davies *et al.*, 2001). Shafiq *et al.* (2008) during the seed germination, the heavy metal stress could be assigned to the accelerated breakdown of stored nutrients in seeds and alteration of selection permeability properties of cell membrane. However, Wu *et al.* (2008) mentioned that the seedlings of *Citrus tangerine* and *Poncirus trifoliata* importantly higher shoot and root dry weights, plant height, leaf area, leaf number per plant, and stem diameter with the influence of mycorrhizal (AM). Further, studies reported inhibition of seed germination by the heavy metal (Neogy *et al.*, 2002; Cavusoglu and Yalcin, 2010). Chlorophyll content and magnesium uptake as it forms an important part of chlorophyll molecule (Karuthamma *et al.*, 2019)

CONCLUSION

The present investigation has been carried out to find out the effect of Cadmium Chloride seed germination, seedling growth, morphological parameters, of Black gram plants. The Black gram seeds were obtained from the Tamil Nadu agricultural university Coimbatore. The Cadmium Chloride salts were used for the treatment purpose. The germination percentage, seedling growth and fresh weight, dry weight, root length, shoot length of Black gram seedlings increased in with Cadmium Chloride concentration and then it decreased at high level of Cadmium Chloride treatment. Reduction in seed germination percentage and growth at higher concentrations of metals might be due to the higher amount of toxicity, which caused changes in the osmotic relationship of the seed and water.

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Table 1. Effect of Cadmium chloride on vigour index of different varieties of Black gram (*Vigna mungo*(L.)

Cadmium treatment	Vigour index				
	15	30	45	60	75
Control	636.4±19.09	817.8±24.53	648±19.44	900±27.0	619.2±18.57
2.5mg kg ⁻¹	891.8±26.75	1041±31.24	874±26.22	1173±35.21	902±27.07
5mg kg ⁻¹	494±14.82	564.4±16.93	391±11.73	722.4±21.67	445.2±13.35
7.5mg kg ⁻¹	426.4±12.79	652.5±19.57	764.4±22.93	217.6±6.528	163.8±4.914
10mg kg ⁻¹	252±7.56	319.5±9.585	201.6±6.048	384.8±11.54	255.6±7.668
12mg kg ⁻¹	144±4.32	198.4±5.95	153.6±4.068	252±7.56	208±6.24





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Table 2. Effect of Cadmium chloride shoot length of Black gram (*Vigna mungo*(L.)

Cadmium treatment	Shoot length(cm plant ⁻¹)				
	15	30	45	60	75
Control	7.4±0.22	9.4±0.28	7.2±0.22	10.0±0.30	7.2±0.22
2.5mg kg ⁻¹	9.8±0.29	11.2±0.34	9.5±0.29	12.1±0.36	9.6±0.26
5mg kg ⁻¹	6.1±0.18	6.8±0.20	4.6±0.14	8.4±0.25	5.3±0.16
7.5mg kg ⁻¹	8.4±0.25	8.4±0.25	8.4±0.25	8.4±0.25	8.4±0.25
10mg kg ⁻¹	3.6±0.11	4.5±0.13	2.8±0.08	5.2±0.16	3.6±0.11
12mg kg ⁻¹	2.4±0.07	3.2±0.10	2.4±0.0	3.6±0.11	3.2±0.10

Table 3. Effect of Cadmium chloride on root length of Black gram (*Vigna mungo*(L.)

Cadmium treatment	Root length(cm plant ⁻¹)				
	15	30	45	60	75
Control	3.4±0.10	3.4±0.10	3.4±0.10	3.4±0.10	3.4±0.10
2.5mg kg ⁻¹	3.4±0.09	3.4±0.11	3.6±0.11	5.2±0.16	3.7±0.11
5mg kg ⁻¹	3±0.09	2.4±0.07	3.0±0.09	4.0±0.12	3.0±0.09
7.5mg kg ⁻¹	3±0.09	2±0.06	2.7±0.08	3.4±0.10	2.6±0.08
10mg kg ⁻¹	2.5±0.09	1.6±0.05	2.3±0.07	2.8±0.08	2.0±0.06
12mg kg ⁻¹	2.1±0.06	1.2±0.04	2.0±0.06	2.0±0.06	1.7±0.05

Table4. Effect of Cadmium chloride on fresh weight of Black gram (*Vigna mungo*(L.)

Cadmium treatment	Fresh weight (mg g ⁻¹ fr.wt)				
	15	30	45	60	75
Control	5.7±0.17	5.1±0.15	5.7±0.17	8.1±0.24	6.8±0.20
2.5mg kg ⁻¹	7.2±0.22	7.2±0.22	7.2±0.22	7.2±0.22	7.2±0.22
5mg kg ⁻¹	4.2±0.13	4.0±0.12	4.8±0.14	7.2±0.22	5.1±0.15
7.5mg kg ⁻¹	3.0±0.09	4.1±0.12	4.1±0.12	5.4±0.16	4.2±0.13
10mg kg ⁻¹	2.4±0.07	3.4±0.10	3.0±0.09	3.4±0.100	3.0±0.09
12mg kg ⁻¹	0.8±0.02	2.0±0.06	2.0±0.06	2.8±0.08	1.5±0.04

Table 5. Effect of Cadmium chloride on dry weight of different varieties of Black gram (*Vigna mungo*(L.)

Cadmium treatment	Dry weight (mg g ⁻¹ dr.wt)				
	15	30	45	60	75
Control	1.9±0.057	1.7±0.051	1.9±0.057	2.7±0.081	2.26±0.068
2.5mg kg ⁻¹	2.4±0.072	2.4±0.072	2.4±0.072	2.4±0.072	2.4±0.072
5mg kg ⁻¹	1.0±0.03	0.83±0.025	1.36±0.041	1.8±0.054	12.6±0.378
7.5mg kg ⁻¹	1.4±0.042	1.33±0.04	14.4±0.432	2.4±0.072	1.7±0.051
10mg kg ⁻¹	0.8±0.02	0.56±0.017	1.13±0.034	1.00±0.03	1.00±0.03
12mg kg ⁻¹	0.26±0.008	0.2±0.006	0.66±0.02	0.93±0.028	0.5±0.015





Development and Validation of Analytical Method for the Estimation of Linagliptin by UV – Spectroscopy in Pharmaceutical Preparations

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ABSTRACT

A simple, accurate, specific UV Spectrophotometric method has been developed for the estimation of Linagliptin in pure and pharmaceutical dosage forms as per ICH guidelines. The optimum condition for the analysis of the drug Linagliptin has been established. Linagliptin exhibiting absorption at 292 nm obeyed Beer's law in the concentration range from 1 to 6 µg/ml in 0.1M HCl. The lower limit of detection (LOD) was found to be 0.482µg/ml and the limit of quantification (LOQ) was found to be 1.462 µg/ml. The regression equation was found to be $y = 0.0499X + 0.068$ with regression coefficient of 0.9949. The recovery study of the proposed method was performed at three different levels i.e., 50%,100%,150% and recovery was found to be $100.89 \pm 1.0413\%$. The precision of the method was found to be $101 \pm 1.447\%$. Ruggedness and Robustness were performed and there is no significant differences were observed in the study. The sample solution was stable up for 2h. The proposed method was simple, sensitive, accurate, precise and easy for routine quality control analysis.

Key words: Linagliptin, Spectroscopy, Estimation.

INTRODUCTION

Linagliptin is a white to yellow colored, crystalline solid, which is soluble in methanol, hydrochloric acid, sparingly soluble in ethanol and very slightly soluble in Isopropanol. Its chemical name is 8-[(3R)-3-aminopiperidin-1-yl]-7-but-2-ynyl-3-methyl-1-[(4-methyl quinazolin-2-yl) methyl] purine-2,6-dione with the molecular weight of 472.5 g/mol. The molecular structure of the compound Linagliptin is presented in Figure 1. Linagliptin is indicated for use in hypoglycemic agents. There are many pharmaceutical preparations available for Linagliptin from different



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manufactures. Hence it is needed that accurate and simple method for its quantitative determinations. Linagliptin was analysed by UV spectroscopy [1-7], Fluorimetry[8-9] and HPLC [10-12]. There is no method reported for the estimation of Linagliptin in HCl. Hence the aim of the present work was to develop simple, accurate and selective UV method using HCl as solvent for the estimation of Linagliptin in pure as well as pharmaceutical preparations. Our developed method is superior than the method developed by Sarif et al.,2017 even though UV spectroscopic method using water as solvent. Our method gives better absorbance and obeys Beer's Lambert Law at the lower range of 1-6 µg/ml and compare to 10-40 µg/ml of the competitive method.

MATERIALS

Instruments

The instruments used for the development process are UV-Visible spectrophotometer (Systronics 2202), Sonicator (Brason 2510) and Electronic balance (ADAIR – Precisa 92 SM-202A).

Chemicals

Linagliptin has been obtained as gift sample from Industrial Estate, Bangalore which was used as such for further analytical development. Formulations were purchased from the local pharmacies and used for analysis. Water (distilled water) and 0.1M HCl used in analysis were AR grade

METHODS

Preparation of stock solution

50 mg of Linagliptin was accurately weighed and transferred into a clean 50 ml volumetric flask. To that 10 ml of 0.1 M HCl was added, shaken for about 10 min till complete solubilization occur. The volume was made up to 50 ml with 0.1 M HCl to obtain the final concentration to 1 mg/ml.

Determination of Absorbance maxima

An appropriate aliquot portion of 1ml of Linagliptin from the standard stock solution was transferred to 50 ml of volumetric flask. 10 ml of 0.1 M HCl was added and the volume was made up to 50 ml with 0.1 M HCl to obtain concentration 4 µg/ml of Linagliptin. Drug solution was scanned in UV visible spectrophotometry to determine absorbance maxima.

Validation of the proposed method

The proposed method was validated according to the International Conference on Harmonization (ICH) guidelines [13].

Linearity and range

An appropriate aliquot portion of 1, 2, 3, 4,5, 6 ml of Linagliptin from standard stock solution were transferred to 100 ml of 6 different volumetric flasks, and 25 ml of 0.1 M HCl was added, mixed well and made up to the volume with 0.1 M HCl to obtain the concentration 1, 2, 3, 4, 5, 6 µg/ml of Linagliptin. The absorbance of the resulting solutions was measured at 292 nm. The calibration curve was constructed by plotting drug concentration versus absorbance.

Precision

10 Tablets were weighed accurately and crushed into fine powder by using mortar and pestle. An accurately weighed quantity of tablet powder about 70 mg (equivalent to 2 mg of drug) was weighed and transferred into 50 ml volumetric flask. To that 10 ml of 0.1M HCl was added and sonicated for 3 min. Then the volume was made up with 0.1 M HCl up to 50 ml. The above solution was filtered. From the filtrate, 5 ml was pipetted out and transferred into



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another 50 ml volumetric flask, diluted and made up to the volume with 0.1 M HCl and mixed well. The absorbance was measured at 292 nm using UV- visible spectrophotometer. The above stated procedure was repeated for 6 times.

Accuracy

Preparation of stock solution

25 mg of pure drug of Linagliptin was weighed and transferred to a 25 ml clean volumetric flask. 10 ml of 0.1M HCl was added to the above solution and ensure the complete solubilization, the volume was made up the mark with 0.1 M HCl.

Method

An accurately weighed quantity of tablet powder equivalent about 2 mg of drug was transferred to 50 ml of 3 different volumetric flasks. To that 10 ml of 0.1 M HCl was added and sonicated for 3 min. To that 1 ml of stock solution (1mg/ml) 50%, 2 ml of stock solution (2 mg/ml) 100%, 3ml of stock solution (3 mg/ml) 150% were added and mixed well then the volume was made up to the mark with 0.1 M HCl. The resulting solutions were filtered by using Whatmanfilter paper. From the filtrate 5 ml was pipetted out and transferred to another 50 ml volumetric flask and mixed well. The volume was made up to the mark using 0.1M HCl. The absorbance was measured at 292 nm using UV-visible spectrophotometer. The above stated procedure was repeated for 3 times at 50% ,100% and 150%.

Limit of Detection (LOD) and Limit of Quantification (LOQ)

The Limit of detection (LOD) is defined as the lowest concentration of an analyte that an analytical process can reliably differentiate from back-ground levels. The Limit of quantification (LOQ) is defined as the lowest concentration of the standard curve that can be measured with an acceptable accuracy, precision and variability in this study. LOD and LOQ were determined based on the standard deviation of the response and the slope of the corresponding curve using the following equations.

$$\text{LOD} = 3.3 \text{ s/m}; \text{LOQ} = 10 \text{ s/m}$$

Where “s” the noise of estimate, is the standard deviation of the absorbance of the sample and “m” the slope of the related calibrations graph.

Ruggedness

Ruggedness is a measure of reproducibility of test results under normal, expected operational conditions from analyst to analyst. Ruggedness is determined by the analysis with same aliquots by different analyst.

Robustness

The Robustness of analytical procedures is a measure of its capacity to remain unaffected by small, but deliberate variations in method parameters and provides an indication of its reliability during normal usage.

Stability of the sample solution

The sample solution was prepared at 4 µg/ml concentration and the absorbance was measured at 292 nm with regular interval up to 3h.

RESULTS AND DISCUSSION

Determination of absorption maximum

Absorption spectrum was taken from 400 nm to 200 nm. From the spectrum it was found that at 230 nm and 292 nm, the pure drug solution at the concentration of 4 µg/ml in 0.1M HCl give two peaks (absorption maxima). From that 292nm was used as absorption maxima for estimation of the drug. The spectrum was presented in Figure 2.



**Hariharan et al.,****Linearity and range**

Calibration standards for Linagliptin covering range of 1 to 6 µg/ml was prepared and serial dilutions were made with 0.1 M HCl. The absorbance of all resulting concentrations were measured and the data presented in table 1. The graph is plotted between the concentration and absorbance was plotted in Figure 3. The regression equation was found to be $y = 0.0499x + 0.068$. The correlation coefficient (R²) of the standard curve was found to be 0.9949.

Precision

The precision was carried out and the results were presented in table 2 at 292 nm. The values obtained in the repeatability (precision) shows that there is no significant difference in the precision value. Hence that developed method can be used to analyze the Linagliptin in pharmaceutical formulation. There is no evidence of interference of excipients with Linagliptin. The mean precision value was found to be $101.19 \pm 1.45\%$. The value was obtained from 99.18 to 102.9.

Accuracy

The recovery study was carried out and from the data presented in table 3, in which, the Drug-Excipients Interactions and Drug-Solvent Interactions has not been observed. Hence the developed method is accurate. The percentage recovery was found to be $100.89 \pm 1.04\%$.

LOD and LOQ

The LOD and LOQ were determined and the LOD was found to be 0.482 µg/ml and the LOQ was found to be 1.462 µg/ml.

Ruggedness

The Ruggedness study was carried out as described 3.8 and the results were presented in table 4.

Robustness**Absorbance at Different Strength of the Solvent**

The concentration of solvent was slightly modified from 0.05 M to 0.15 M and the resulting solution (4 µg/ml) absorbance was taken. It does not give any deliberate variations in absorbance. The data obtained from the study are presented in the table 5.

Absorbance at Different Wavelength

Slight difference with wavelength was selected and the absorbance was measured. It does not give any deliberate variations in the absorbance. Data obtained from this study was presented in the table 6.

Stability of the sample solution

The prepared sample solution was stable up to 2h. After 2 h the absorbance was significantly increased this may be due to ionization property of the drug. The data is presented in table 7.

Validation profile

Performing replicate analysis of the standard solutions was used to assess the accuracy, precision and reproducibility of the proposed methods. The selected relevant calibration curves to determined and presented in the table 8.

CONCLUSION

UV-visible spectrophotometric method for quantifying Linagliptin in pure and pharmaceutical formulation has been developed and validated. The assay is precise, accurate and linear over the concentration range from 1-6 µg/ml at 292





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nm. The Precision was found to be $101.0 \pm 1.4477\%$. The Percentage of drug recovered by this method is $101.89 \pm 1.0413\%$. The LOD and LOQ were found to be $0.482 \mu\text{g/ml}$ and $1.462 \mu\text{g/ml}$ respectively. The method is simple and suitable for determination for Linagliptin in pure and pharmaceutical preparations.

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Table 1: Linearity and range of Linagliptin

S. No.	Concentration($\mu\text{g/ml}$)	Absorbance
1.	1	0.151
2.	2	0.102
3.	3	0.155
4.	4	0.193
5.	5	0.241
6.	6	0.308





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Table2: Precision study of Linagliptin by Spectrophotometry

S. No.	Weight of the tablet powder(mg)	Absorbance	Drug content present(mg)	Percentage found (%)
1	71.0	0.174	4.95	99.18
2	70.0	0.170	5.057	101.15
3	72.5	0.185	5.146	102.93
4	70.0	0.178	5.14	102.8
5	71.0	0.178	5.07	100.55
6	72.0	0.181	5.02	101.19
MEAN				101.19
S.D				1.444

Table 3: Accuracy study of Linagliptin with 0.1M HCl at 292 nm

S.No	Percentage level	Sample weight (mg)	Drug in the tablet powder (mg)	Pure drug added (mg)	Total drug content (mg)	Absorbance	Amount found (mg)	Amount Recovered	Percentage recovery (%)
1	50	70.0	5	1	6	0.210	6.09	101.10	50
2	50	71.0	5	1	6	0.212	6.127	102.10	50
3	50	68.0	5	1	6	0.199	5.92	98.70	50
4	100	72.0	5	2	7	0.250	7.02	100.20	100
5	100	72.5	5	2	7	0.257	7.17	102.0	100
6	100	71.0	5	2	7	0.248	7.06	100.9	100
7	150	71.0	5	3	8	0.285	8.120	101.51	150
8	150	70.0	5	3	8	0.280	8.09	101.15	150
9	150	70.0	5	3	8	0.278	8.03	100.43	150
MEAN									100.89
SD									1.0413

Table 4: Ruggedness of Linagliptin with 0.1 M HCl

S. NO	Analyst -1	Analyst-2
1	0.118	0.120
2	0.123	0.121
3	0.120	0.119

Table 5: Absorbance at Different Strength

Wavelength	Strength of HCl	
	0.05M	0.15M
292 nm	0.112	0.114





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Table 6: Absorbance at Different Wavelength

Wavelength	292nm	
S. No.	291 nm	293 nm
1	0.123	0.121
2	0.122	0.122
3	0.121	0.123

Table 7: Stability of the sample solution

S. No.	Wavelength	Absorbance				
		Initial	After 30 min	After 60 min	After 120 min	After 180 min
1	292 nm	0.193	0.192	0.192	0.194	0.236

Table 8: Validation profile of Linagliptin with 0.1M HCl at 292 nm

Parameters	Observation at 292 nm
Linearity range ($\mu\text{g/ml}$)	1-6
Precision (%)	101 ± 1.4477
Accuracy (%)	100.89 ± 1.0413
50%	100 ± 1.747
100%	101 ± 0.973
150%	101 ± 0.549
LOD($\mu\text{g/ml}$)	0.482
LOQ($\mu\text{g/ml}$)	1.462

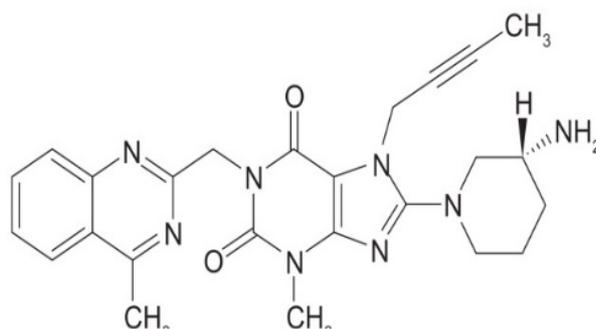


Figure 1. Chemical structure of Linagliptin





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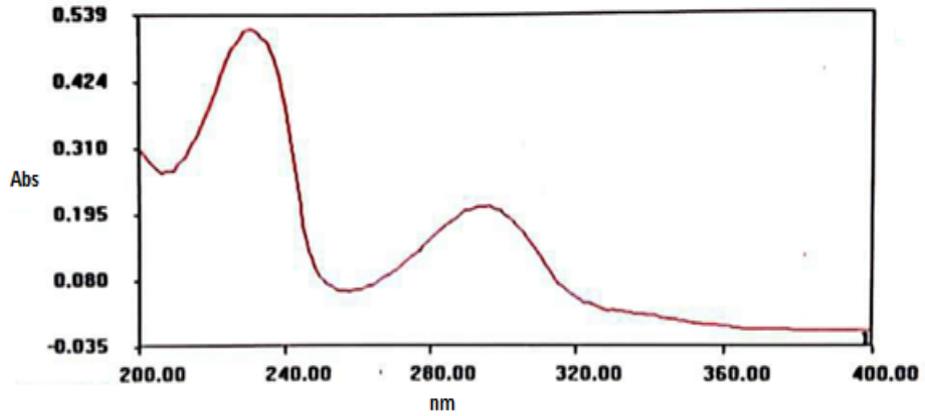


Figure 2. UV Absorption spectrum of Linagliptin with 0.1 M HCl at 292nm

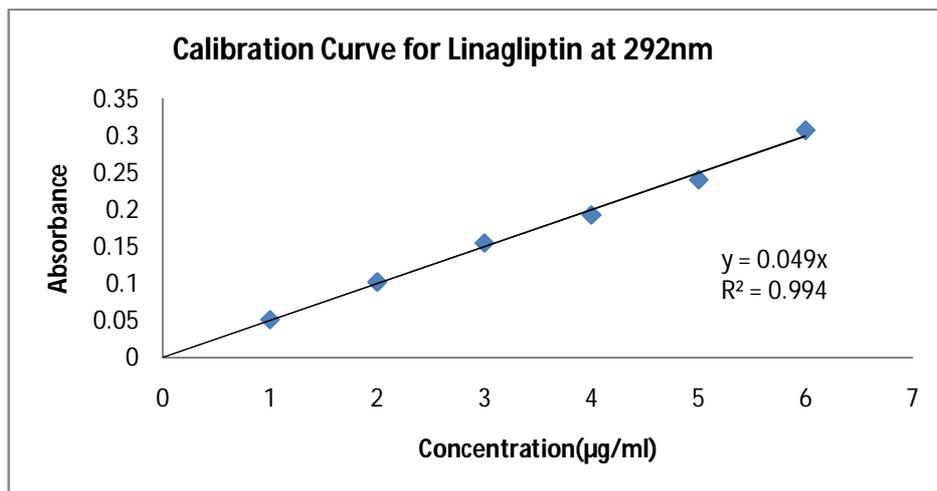


Figure 3. Linearity and Range of Linagliptin in 0.1 M HCl at 292 nm





Menstrual Health: A Key to Betterment of Adolescent's Future Reproductive Health

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ABSTRACT

Adolescence is the transition period from childhood to mature adult in which adolescent girls undergo lots of physical, physiological, psychological and social maturity. Attainment of menarche is the most important event that every adolescent girl experiences in this period. Insufficient information and lack of preparedness predisposes them to anxiety, diffident, confusion which results in faulty health practices. This article intended to aware the adolescent girls on menstrual health for betterment of future reproductive health. Menstruation is a monthly regular rhythmic natural physiological phenomenon that occurs during girl's adolescent period. It is considered as an indicator of women's health. The first menstruation is known as menarche and is influenced by hormonal changes in every woman. Menstruation occurs as a result of uterine & ovarian cycle in female reproductive system. Majority of girls have one or other menstrual problems including delayed, irregular, painful or heavy menstruation. Hygiene during menstruation is an inevitable part of women's health. The adolescent girls can choose materials as menstrual absorbent according to availability, their economical status, comfort and their perceived benefits, etc. A balanced diet with lots of fresh fruits and non starchy vegetables is recommended during entire adolescent period and for good menstrual health. Adequate sleep wake up cycle and regular exercise can reduce menstrual complaints and helps to maintain better menstrual health. Menstruation is a cyclic event and hence dealing with it hygienically is vital. Early identification of menstrual abnormalities and prompt treatment can help to reduce future problems in reproductive health.

Key words: Menstruation, Menstrual cycle, Menstrual hygiene, Menstrual Health





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INTRODUCTION

Menstruation is one of the most important changes during adolescent period. It occurs in a regular rhythmic pattern every month and persists as a normal physiological phenomenon from menarche to menopause. About 75% of girls experience various problems associated with menstruation including delayed, irregular, painful and heavy menstrual bleeding, which are often the leading cause for the physician office visits by adolescents [1]. It is considered as an indicator of women's health [2].

MENSTRUATION

Menstruation is the normal, healthy shedding of blood and tissue from the uterus that exits the body through the vagina [3]. Menstruation is also called a girl's/woman's period, menstrual bleeding, menses & catamenia [4,5]. The commencement of first period termed as menarche, usually begins between 12 and 15 years of age [6]. The term Eumenorrhea denotes a normal, regular menstruation that lasts usually 3 to 5 days but may extend up to 7 days [7].

The menstrual cycle that is the interval between the first day of one period and the first day of the next is usually between 21 to 45 days in young women and 21 to 35 days in adults with an average of 28 days. The average blood loss of 20–80 ml during menstruation is considered normal [8]. The menstrual cycle is a regular natural change that is governed by hormonal changes in the female reproductive system [9]. During each menstrual cycle, the changes that occur in the follicles of the ovary is termed as ovarian cycle and the changes that takes place in the endometrial lining of the uterus is termed as uterine cycle.^{[10],[11]} Both cycles divided into three phases.

The ovarian cycle [10,12] consists of

- **Follicular Phase** – Started when gradually increasing amounts of **estrogen** stimulates the discharges of blood (menses) flow to stop and the uterine lines thickens. During this phase, under the influence of a complex interaction of hormones (FSH & LH), the one or occasionally two follicles begin to mature & dominant after several days with mature ovum.
- **Ovulation** - Approximately 24–36 hours after the luteinizing hormone (LH) surges, in mid-cycle the ovulation occurs with rupture of dominant follicle and release of an oocyte.
- **Luteal Phase** - The oocyte survives only for 24 hours or less without fertilization. After ovulation, the remains of the dominant ovarian follicle transformed into a corpus luteum that produces increased amounts of progesterone. The increased progesterone prepares the uterine lining for potential implantation of an embryo to establish a pregnancy. If fertilization or implantation does not occur, the corpus luteum begins to shrink. This causes a sharp fall in both progesterone and an estrogen level that produces shedding of uterine lining in a process termed **menstruation**.

The uterine cycle [11,13] is divided into

- **Menstruation** – Uterine cycle starts with menstruation and in general it serves as a sign that a woman is not a pregnant. It contains blood, endometrial tissues and unfertilized egg.
- **Proliferative phase** – In the uterine cycle, it act as a second phase where the increasing amount of secretion of estradiol and estrogen by mature ovarian follicle stimulates the uterine endometrium to grow, to proliferate and to develop into a spongy layer. At the same time, the crypts in the cervix produce cervical mucus by estrogen stimulation.
- **Secretory phase** – is similar to the luteal phase of the ovarian cycle. The progesterone from corpus luteum prepares the endometrial layer to be receptive to the blastocyst implantation. It becomes supportive for the early pregnancy by increased blood flow and uterine secretions and reduced contractility of the smooth muscle in the uterus; it also has the outcome of lifting the woman's basal body temperature.

MENSTRUAL DISORDERS

Prevalence of menstrual problems is high among adolescent girls. This is evidenced by the findings of research studies conducted among adolescent girls in different regions which revealed that 30.1% of abundant blood loss [1],





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67.3% of premenstrual symptoms, [42] 70 - 93% of dysmenorrhoea, [43,44,45] 31% of menorrhagia, and 27% of irregular menstruation [42] and it was reported that the majority, 84.8% of girls has one or other menstrual problems [14]. These menstrual abnormalities of adolescent girls are positively associated with lifestyle factors of girls including their eating behaviour, quality of diet, exercise and sleep.

The common menstrual problems that occur in adolescents are as follows: [15]

- **Oligoovulation**- Infrequent or irregular ovulation
- **Anovulation** - Menstrual flow occurs in the absence of ovulation as in the case of incomplete follicular development, sudden drop in estrogen levels or in withdrawal bleeding, perimenopause period and in women with polycystic ovarian disorder.
- **Hypomenorrhea**- Very less (<10ml) blood flow.
- **Polymenorrhea** - Regular but too frequent cycle or with intervals of 21 days or less cycle
- **Metrorrhagia** - Frequent but irregular menstruation
- **Menorrhagia** - Abnormal uterine bleeding that is characterized by sudden heavy flows or amounts greater than 80 ml or prolonged menstrual bleeding.
- **Menometrorrhagia** - Profound menstruation that occurs frequently and irregularly
- **Oligomenorrhea** - Menstrual cycles occurs with intervals of over and above 35 days
- **Amenorrhea** - Absence of menstruation from three to six months when the female is not being pregnant during reproductive years. There are two types of Amenorrhea. In Primary amenorrhea, the menstruation does not begin at puberty. In Secondary amenorrhea, there is a regular menstrual period which become increasingly abnormal and irregular or absent as part of the normal course of life such as in pregnancy, during breast-feeding or as a result of medications or as a result of medical problems [16].
- **Dysmenorrhea** - is an occurrence of severe, frequent menstrual cramps and pain associated with menstruation. It may be a primary dysmenorrhoea caused by chemical imbalance in the body or secondary dymenorrhoea caused by other medical conditions. Dysmenorrhic symptoms consist of lower abdomen pain, low back pain or pain radiating down the legs, tiredness, weakness, fainting nausea, vomiting, diarrhea, and headache [17].
- **Premenstrual Syndrome (PMS)** - Any unpleasant or uncomfortable symptom that takes place temporarily few hours to many days before menstruation and disappears completely when menstruation begins. The types and intensity of symptoms vary from individual to individual. The most common symptoms of PMS include psychological symptoms (depression, anxiety, irritability), Gastrointestinal symptoms (bloating), Fluid retention (swelling of fingers, ankles and feet), Skin problems (acne), Headache, Vertigo, Fainting, Muscle spasms, Heart palpitations, Allergies, Infections, Vision problems, Eye infections, Decreased coordination, Diminished libido (sex drive), Changes in appetite and Hot flashes, etc. Severe form of PMS is termed as Premenstrual Dysphoric Disorder (PMDD) which affects approximately 3%-8% of women in reproductive age that requires immediate medical treatment [18,19].

MENSTRUAL HYGIENE

The cleanliness measures followed during menstruation is known as menstrual hygiene and is an inevitable part of women's health [19]. Menstrual Hygiene Management (MHM) is defined as the women or adolescent girls are using clean menstrual management materials to absorb or collect blood that can be changed in privacy as often as necessary for the duration of the menstruation period, using soap and water for washing the body as required and having access to facilities to dispose of used menstrual management materials [20,21].

Materials used to soak menstrual blood

The criteria for selection of materials as menstrual absorbent is based on the availability, their economical status, comfort and their perceived benefits, etc. The most commonly used materials to collect menstrual blood are as follows:



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Clean cloth: These are cut pieces of clean clothes fit in the panty area or several layers of cotton rags sewed on top of each other to absorb menstrual blood. After each use, the clothes must be washed thoroughly and hung in a private but sunny place to dry. They should not be shared with others [22].

Disposable Pads or sanitary napkins: Disposable pads are worn externally to the body in the underwear to absorb menstrual flow. Sanitary napkins manufactured by multinational companies are available in the market. In the recent times, Self Help Groups have started manufacturing sterile, low cost sanitary napkins which is available locally even at the village level. High quality and highly subsidized sanitary napkins are being made available to the adolescent girls in rural areas by Accredited Social Health Activists (ASHAs) under National Health Mission in India [23]. Pads have a plastic lining to reduce the spill of blood. If a girl uses pads, she needs to bury them deep in the ground or burn or incinerate them after use. Napkins are not to be left in the garbage pile or flushed down the toilet, as they would cause blockage [24].

Reusable Pads: Reusable pads used with help of, underwear, held in place to absorb menstrual flow. They are made from diverse natural or synthetic materials. After each use, they are washed, dried and re-used for approximately one year [25].

Tampons: Tampons are absorbent materials made from cotton or rayon that are kept inside the vagina to soak up menstrual flow [25].

Menstrual cups: It is a small, flexible funnel shaped either single use or reusable cup made up of rubber, silicone, latex, or elastomeric material that need to be inserted into vagina to collect menstrual blood flow and should be emptied every 4-12 hours depending on the blood flow [26].

GENERAL HYGIENIC MEASURES

The normal general routine hygiene is helpful in ensuring good health for the girls. These coupled with specific menstrual hygiene measures is essential to be clean and free from microbes. The general menstrual hygiene managements are:

- Bathing twice a day is preferable. When not possible, bathe at least once daily.
- Taking a warm water bath ensures some relief to the aches and pains during menstruation.
- It is mandatory to change the sweat drenched undergarments regularly.
- It is sensible to wear cotton panties than synthetic ones as synthetic ones do not absorb moisture and heat, making it a breeding ground for bacteria.
- Change of napkins regularly every 4-8 hours or as soon as feels uncomfortable is recommended to avoid infection & discomfort and while going out, remember to take napkins to change.
- Wash the genital area after each use of the toilet and also after urination. Use mild non irritating soap when needed. Washing the external genitalia from front to back manner is fundamental to prevent infection. The area between the legs should be kept dry otherwise soreness and chaffing may develop.
- Some amount of body odour is natural but regular bathing, washing and changing of napkins will ensure that it is not noticeable [27].

NUTRITION AND MENSTRUAL HEALTH

It is evidenced that in India, 70.3% of girls having regularly junk foods and 79.20% of girls not having a healthy diet were the victim of menstrual irregularities, 71.18% of girls with skipping breakfast had higher prevalence of dysmenorrhoea and higher 78.94% of PMS was found among participants with less physical activities/work [34]. During menstruation, girls suffer from loss of appetite. However, skipping food or eating less than normal requirement weakens the body. It is necessary to take iron rich food to compensate for the blood loss and to prevent anemia [29],[33]. Taking citrus fruits or vegetables before taking iron rich foods enrich its absorption [30]. Caffeine



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and tannin tend to decrease iron absorption by the body and tea, salty snacks, deserts and sweet fruit juices should be avoided or kept in minimal consumption to reduce risk of PMS [31, 32]. A balanced diet with lots of fresh fruits and non starchy vegetables is recommended during entire adolescent period [33]. Cut down or reduce intake of salt during menstruation to reduce bloating and fluid retention. Reducing consumption of high-fat, high calorie/sugar foods may decrease PMS symptoms by converting estrogen into its inactive form [34]. Taking calcium rich diet during adolescent period helps to alleviate some of the symptoms associated with PMS [35].

ACTIVITY AND MENSTRUAL HEALTH

Menstrual abnormalities affect girl's daily activity and quality of life in general. The findings of research studies reported that 31.6% girls had trouble in their daily life activities due to menstrual problems [14] and the quality of Life of dysmenorrhic women was poor than normal women [45]. Measures to overcome are keeping consistent sleep wake up schedule to control excessive fatigue or insomnia [36]. Performing a simple to moderate exercise like brisk walk helps in releasing of endorphins that make to feel free from some symptoms of PMS like mood disturbance, fatigue, cognitive dysfunction and bloating and helps to keep fresh [37]. Systematic review & metaanalysis on menstrual hygiene management among adolescent girls in India revealed that 19-30% of school absenteeism among adolescent girls [41]. Physical discomfort, stomach and back pain during menstruation, lack of facilities to change blood soaked materials, fear of blood stain on clothes and restrictions imposed by parents, family members and society during menstruation causes one or more days of school absenteeism among adolescent girls.

HEALTH SEEKING BEHAVIOR

Majority of adolescent girls had poor knowledge, practice and negative attitude on menstruation in India and many parts of the world. Reviews reported that 68.3% of adolescent girls had poor knowledge on menstruation, 60.3% of girls had poor menstrual hygienic practices [47], and the majority 78.4% girls had negative attitude about menstruation [48]. The reason for this may be shyness, reluctant to have open free talk about menstruation to parents, teachers and significant others, social restrictions and not having health seeking behavior on matters related to menstrual complaints. Hence it is essential to explore better ways of imparting awareness on natural process of menstruation, alleviating myths and misunderstanding on menstruation, removing the barriers to seek health care for good menstrual health among adolescent girls.

CONCLUSION

Menstruation is a cyclic event and hence dealing with it hygienically is vital. Unclean and unhealthy management result in reproductive tract infections and urinary tract infections. Preexisting social taboos and cultural restraints, inaccessibility of materials & economic constrains, lack of privacy and water supply along with limited access to reproductive health services are the factors which create greater challenges to adolescent girls in managing menstruation. Early identification of menstrual abnormalities and prompt treatment reduces future problems in reproductive health of adolescent girls. Hence adolescent girls need to have an understanding of menstruation pattern and the factors that may attribute in menstrual disorders in order to compact them effectively and efficiently. Awareness creation on lifestyle changes to have healthy practices on dietary pattern, hygiene, adequate sleep and health seeking behavior are necessary for the betterment of reproductive health among adolescent girls.

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Conflict of interest

No conflict of interest



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Equitable Common Neighbour Equitable Domination in Graphs

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ABSTRACT

The concept of equitability can be traced to the paper titled “Equitable coloring” by W.Meyer. In that paper the cardinalities of the color class should differ by at most one. Later Prof. E. Sampath Kumar introduced the idea of degree equitability. Two vertices are degree equitable if their degrees differ by at most one. Based on this idea several papers were published. Equitable domination has been defined and studied. Anwar Alwardi et al. gave importance to common neighbourhood of pairs of vertices. Several papers were published by them on common neighbourhood domination, injective domination and injective equitable domination. In this paper equitable common neighbour of pairs of vertices are considered and equitable common neighbour equitable domination is introduced and studied.

Keywords: Domination, equitable domination, common neighborhood domination,
2010 Mathematics subject classification: 05C69.

INTRODUCTION

Graph theoretical terminologies not given here can be founded in [5, 7, 9]. Let $G = (V, E)$ be a simple graph. The neighbourhood of a vertex v , denoted by $N(v)$, is the set of all vertices adjacent to v in G . If v is a vertex of G then the integer $deg(v) = |N(v)|$ is said to be the degree of v in G . The minimum and maximum degree among all vertices of G are denoted by $\delta(G)$ and $\Delta(G)$, respectively. A vertex of degree one in a graph is called a pendent vertex or an end vertex. A support is the unique neighbour of an end-vertex.

A set $D \subseteq V(G)$ is a dominating set in G if for every vertex $v \in V(G) - D$, there exists a vertex $u \in D$ such that $uv \in E(G)$. The domination number of a graph G , denoted $\gamma(G)$, is the cardinality of a minimum dominating set of G . The concept of equitability was originally conceived in proper colouring of vertices where the cardinalities of any two colour classes differ by at most one [12]. E. Sampathkumar initiated the concept of degree equitability in the

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vertex set of a graph. Two vertices are said to be degree equitable if their degrees differ by at most one. A subset D of $V(G)$ is called an equitable dominating set of G if for any v in $V - D$, there exists u in D such that u and v are adjacent and degree equitable [2, 6, 11]. A subset D of V is called a common neighbourhood dominating set if for every v in $V - D$, there exists a vertex u in D such that u and v are adjacent and u and v have atleast one common neighbour. The minimum cardinality of such a dominating set is called common neighbourhood domination number of G and is denoted by γ_{cn} [3].

Definition 1.1 : Let G be a simple graph. A subset $S \subseteq V(G)$ is called an equitable common neighbour equitable dominating set (ecne-dominating set) if for every vertex $u \in V - S$ there exists $v \in S$ such that u and v are equitable (not necessarily adjacent) and have an equitable common neighbour. The minimum (maximum) cardinality of an equitable common neighbour equitable dominating set is called an equitable common neighbour equitable domination number of G and is denoted by $\gamma_e^{ecn}(G) (\Gamma_e^{ecn}(G))$.

Remark 1.2: The property of an equitable common neighbour equitable domination is super hereditary.

γ_e^{ecn} of some standard graphs

1. $\gamma_e^{ecn}(P_n) = \begin{cases} \left\lceil \frac{n}{3} \right\rceil + 1 & \text{if } n \equiv 2,3 \pmod{6} \\ \left\lfloor \frac{n}{3} \right\rfloor & \text{if } n \not\equiv 2,3 \pmod{6} \end{cases}$
2. $\gamma_e^{ecn}(C_n) = \begin{cases} \left\lceil \frac{n}{3} \right\rceil + 1 & \text{if } n \equiv 2 \pmod{6} \\ \left\lfloor \frac{n}{3} \right\rfloor & \text{if } n \not\equiv 2 \pmod{6} \end{cases}$
3. $\gamma_e^{ecn}(K_n) = 1$
4. $\gamma_e^{ecn}(K_{m,n}) = \begin{cases} 2 & \text{if } |m - n| \leq 1 \\ m + n & \text{if } |m - n| \geq 2 \end{cases}$
5. $\gamma_e^{ecn}(K_{1,n}) = n + 1, n \geq 3$
6. $\gamma_e^{ecn}(W_n) = \begin{cases} 1 & \text{if } n = 4 \\ n & \text{if } n \geq 5 \end{cases}$
7. $\gamma_e^{ecn}(D_{r,s}) = \begin{cases} 1 & \text{if } r = 1, s = 0 \\ 2 & \text{if } r = 1, s = 1 \\ 4 & \text{if } r = 2, s = 0,1 \\ r + s + 2 & \text{if } r, s \geq 2 \end{cases}$
8. $\gamma_e^{ecn}(K_{a_1, a_2, \dots, a_n}) = 2r$, where r is the number of equitable partition of a_1, a_2, \dots, a_n
9. $\gamma_e^{ecn}(K_m(a_1, a_2, \dots, a_n)) = \sum_{i=1}^m a_i + 1$

Definition 1.3 : A subset $S \subseteq V(G)$ is called an ecne-independent set if no two vertices in S are equitable and have an equitable common neighbour. Clearly, this property is hereditary.

Remark 1.4 : Any maximal ecne-independent set is a minimal ecne-dominating set.

Results on $\gamma_e^{ecn}(G)$

Definition 2.1: Let $S \subseteq V(G)$. The ecn private equitable neighbour of $u \in S$ denoted by $pn_e^{ecn}(S, u)$ is defined as

$$pn_e^{ecn}(S, u) = \left\{ \begin{array}{l} v \in V: v \text{ and } u \text{ have a common equitable neighbour and for any, } \\ w \in S - \{u\}, v \text{ and } w \text{ do not have an equitable common neighbour} \end{array} \right\}$$





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Proposition 2.2: Let $S \subseteq V$ be an ecne-dominating set of G . S is a minimal ecne-dominating set if and only if for any $u \in S$, $pn_e^{ecn}(S, u) \neq \varphi$.

Definition 2.3: Let $u \in V(G)$. The ecne-neighbourhood of u denoted by $N_e^{ecn}(u)$ is defined as $N_e^{ecn}(u) = \{v \in V : u \text{ and } v \text{ are equitable and have an equitable common neighbour}\}$. The ecne-degree of a vertex is defined as $deg_e^{ecn}(u) = |N_e^{ecn}(u)|$. The maximum, minimum ecne-degree of G are denoted by $\Delta_e^{ecn}(G), \delta_e^{ecn}(G)$ and defined as $\Delta_e^{ecn}(G) = \max\{deg_e^{ecn}(u) : u \in V\}$ and $\delta_e^{ecn}(G) = \min\{deg_e^{ecn}(u) : u \in V\}$.

Definition 2.4: A vertex $u \in V$ is called an ecne-isolate of G if u and v have no common equitable neighbour in G for every $v \in V(G) - \{u\}$.

Remark 2.5: Every equitable isolate is an ecne-isolate but not the converse.

Remark 2.6: Any ecne-dominating set contains all ecne-isolates of G .

Remark 2.7: If u is an ecne-isolate, then $\delta_e^{ecn}(G) = 0$

Remark 2.8: If $\delta_e^{ecn}(G) \geq 1$, then G has no ecne-isolates and hence $\gamma_e^{ecn}(G) \leq \frac{n}{2}$

Proposition 2.9: For any simple graph G with no ecne-isolates, $\left\lceil \frac{n}{1+\Delta_e^{ecn}(G)} \right\rceil \leq \gamma_e^{ecn}(G) \leq n - \Delta_e^{ecn}(G)$.

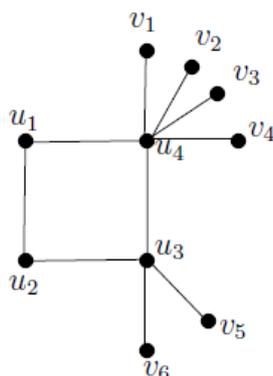
Example 2.10: When $G \simeq P_n$, $n \equiv 0, 1 \pmod{3}$, $\Delta_e^{ecn}(P_n) = 2$ and hence $\left\lceil \frac{n}{1+\Delta_e^{ecn}(G)} \right\rceil = \left\lceil \frac{n}{3} \right\rceil = \gamma_e^{ecn}(P_n)$.
When $G \simeq C_4$ and $G \simeq C_5$, $\Delta_e^{ecn}(C_4) = \Delta_e^{ecn}(C_5) = 2$ and hence $\gamma_e^{ecn}(C_4) = 2 = n - \Delta_e^{ecn}(G)$ and $\gamma_e^{ecn}(C_5) = 3 = n - \Delta_e^{ecn}(G)$. Thus, the equality holds in Proposition 2.9.

Proposition 2.11: For any graph G with n vertices, $\gamma_e^{ecn}(G) = n$ if and only if every vertex in G is either an equitable isolate or an ecne-isolate of G .

Example 2.12: The above result holds for, $K_{1,n}$, $n \geq 3$

Remark 2.13: There exists a graph G in which a vertex u is not an equitable isolate but u is an ecne-isolate of G .

Example 2.14



G
Here $\gamma_e^{ecn}(G) = 10 = |V(G)|$. In the above graph G , u_1 and u_2 are not equitable isolates but both are ecne-isolates.





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Theorem 2.15: A graph G has a unique minimal ecne-dominating set if and only if the set of all ecne-isolates forms an ecne-dominating set.

Proof. Suppose G has a unique minimal ecne-dominating set, say D . Let S be the set of all ecne-isolates of G . Then $S \subseteq D$. Suppose there exists $u \in D - S$. Then u is not an ecne-isolate. Therefore, $V - \{u\}$ is an ecne-dominating set. Thus, there exists a minimal dominating set $D_1 \subseteq V - \{u\}$, which contradicts that D is unique. Hence $S = D$. Conversely, if the set D of ecne-isolates of G form an ecne-dominating set, then any ecne-dominating set of G contains D . Therefore, G has a unique minimal ecne-dominating set.

Theorem 2.16: For any (n,m) - graph G , $\gamma_e^{ecn}(G) \geq n - m$

Proof. Let D be a γ_e^{ecn} -set of G . Since every vertex in $V - D$ has equitable common neighbour with some vertex of D , $m \geq |V - D|$. Therefore, $|D| \geq n - m$.

Theorem 2.17: Let G be a graph without ecne-isolates. Then, the complement of a minimalecne-dominating set is also an ecne-dominating set.

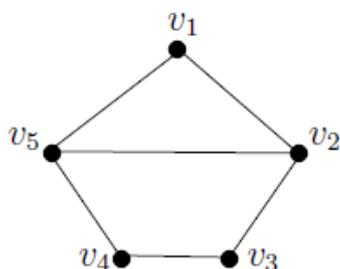
Corollary 2.18: If G has no ecne-isolates, then $\gamma_e^{ecn}(G) \leq \frac{n}{2}$

Definition 2.19: Let $u \in V(G)$. $e_{eq}(u)$ is the maximum set of vertices u_1, u_2, \dots, u_k such that $u_1 u_2 \dots u_k$ is a path such that u_i and u_{i+2} have u_{i+1} as an equitable common neighbour in G . The maximum (minimum) value of $e_{eq}(u)$ is called equitable diameter (equitable radius) of G and denoted by $diam_{eq}(G)(r_{eq}(G))$.

Theorem 2.20: Let G be a simple graph. $\gamma_e^{ecn}(G) = 1$ if and only if there exists a vertex $u \in V(G)$ such that u is equitable with every other vertex of G and $N(u) \subseteq N_e^{ecn}(u)$ and $e_{eq}(u) \leq 2$.

Proof. Suppose $\gamma_e^{ecn}(G) = 1$. Then there exists $u \in V(G)$ such that u is equitable with every other vertex of G and for any u and v , have a common equitable neighbour. Suppose u and v are adjacent. Then they have an equitable common neighbour and so $N(u) \subseteq N_e^{ecn}(u)$. Suppose u and v are not adjacent, let w be the equitable common neighbour of u and v . Then, $e_{eq}(u) \leq 2$. Conversely, suppose u satisfies the hypothesis. Then for any $v \in V(G)$, u and v are equitable. Since $e_{eq} \leq 2$, either u and v are adjacent or u and v are at a distance 2. Since $N(u) \subseteq N_e^{ecn}(u)$ any adjacent vertex of u has a equitable common neighbour with u . Suppose u and v are not adjacent. Then $e_{eq}(u) = 2$ and there exists $w \in V(G)$ such that u and v have w as an equitable common neighbour. Therefore, $\gamma_e^{ecn}(G) = 1$.

Example 2.21



G

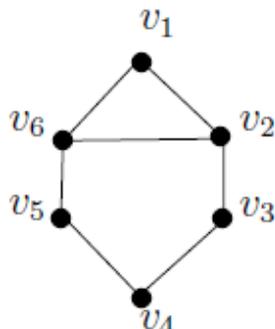
For the above graph G , $\gamma_e^{ecn}(G) = 1$, and $\{v_1\}$ is an ecne-dominating set. Clearly v_1 is equitable with v_2, v_3, v_4 and v_5 . Since v_2 and v_5 have equitable common neighbour with v_1 , $\{v_2, v_5\} \in N_e^{ecn}(1)$. Therefore, $N(1) \subseteq N_e^{ecn}(1)$. Also, $e_{eq}(v_1) \leq 2$, since v_3 and v_4 are at distance 2 from v_1 and $\{v_1, v_2, v_3\}$ and $\{v_1, v_5, v_4\}$ are ecne-paths.





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Example 2.22



H

For the above graph H, $\gamma_e^{ecn}(H) \geq 2$. Also the vertex v_1 is equitable with all other vertices, $N(1) \subseteq N_e^{ecn}(1)$ but $e_{eq}(v_1) \geq 3$, since $v_1v_2v_3v_4$ is an ecne-path. Note that if v_1 and v_3 or v_1 and v_5 are made adjacent in the above graph H, then $\gamma_e^{ecn}(H) = 1$ and $\{v_1\}$ is an ecne-dominating set.

Theorem 2.23: If $diam_{eq}(G) \leq 3$, then $\gamma_e^{ecn}(G) \leq \Delta_e^{ecn}(G) + 1$.

Proof. If $diam_{eq}(G) = 1$, then $G \cong K_n$ and $\Delta_e^{ecn}(G) = n - 1$. Hence, $\gamma_e^{ecn}(G) = 1 < n = \Delta_e^{ecn}(G) + 1$. Suppose, $diam_{eq}(G) = 2$ or 3 . Then the set of vertices v , $(deg_{ecn}(v) = \Delta_e^{ecn}(G))$ and which have equitable distance 1, 2 or 3 from v is an ecne-dominating set of G of order $\Delta_e^{ecn}(G) + 1$. Therefore, $\gamma_e^{ecn}(G) \leq \Delta_e^{ecn}(G) + 1$.

Theorem 2.24: For any graph G such that G and \bar{G} have no ecne-isolates, $\gamma_e^{ecn}(G) + \gamma_e^{ecn}(\bar{G}) \leq n$.

Proof. Suppose G has an ecne-isolated vertex. Then $\gamma_e^{ecn}(\bar{G}) = 1$ and $\gamma_e^{ecn}(G) \leq n$. Therefore, $\gamma_e^{ecn}(G) + \gamma_e^{ecn}(\bar{G}) \leq n + 1$. A similar result holds when \bar{G} has an ecne-isolate. Let G and \bar{G} have no ecne-isolated vertex. Then $\gamma_e^{ecn}(G) \leq \frac{n}{2}$ and $\gamma_e^{ecn}(\bar{G}) \leq \frac{n}{2}$. Therefore, $\gamma_e^{ecn}(G) + \gamma_e^{ecn}(\bar{G}) \leq n$.

Theorem 2.25: If G and \bar{G} have no ecne-isolates and if $\gamma_e^{ecn}(G) \cdot \gamma_e^{ecn}(\bar{G}) \leq n$, then $\gamma_e^{ecn}(G) + \gamma_e^{ecn}(\bar{G}) \leq \lfloor \frac{n}{2} \rfloor + 2$.

Proof. Since G and \bar{G} have no ecne-isolates, $\gamma_e^{ecn}(G) \leq \frac{n}{2}$ & $\gamma_e^{ecn}(\bar{G}) \leq \frac{n}{2}$. Clearly, $\gamma_e^{ecn}(G) \geq 2$ & $\gamma_e^{ecn}(\bar{G}) \geq 2$. If $\gamma_e^{ecn}(G) = 2$ or $\gamma_e^{ecn}(\bar{G}) = 2$, then $\gamma_e^{ecn}(G) + \gamma_e^{ecn}(\bar{G}) \leq \frac{n}{2} + 2$. Suppose $\gamma_e^{ecn}(G) \geq 4$ & $\gamma_e^{ecn}(\bar{G}) \geq 4$. Since $\gamma_e^{ecn}(G) \cdot \gamma_e^{ecn}(\bar{G}) \leq n$, $\gamma_e^{ecn} \leq \lfloor \frac{n}{\gamma_e^{ecn}(\bar{G})} \rfloor$ and $\gamma_e^{ecn}(\bar{G}) \leq \lfloor \frac{n}{\gamma_e^{ecn}(G)} \rfloor$. Therefore, $\gamma_e^{ecn}(G) + \gamma_e^{ecn}(\bar{G}) \leq \lfloor \frac{n}{4} \rfloor + \lfloor \frac{n}{4} \rfloor \leq 2 \lfloor \frac{n}{4} \rfloor < \frac{n}{2} + 2$. Suppose $\gamma_e^{ecn}(G) = 3$ or $\gamma_e^{ecn}(\bar{G}) = 3$. Then, $\gamma_e^{ecn}(\bar{G}) \leq \lfloor \frac{n}{3} \rfloor$, that is $\gamma_e^{ecn}(G) + \gamma_e^{ecn}(\bar{G}) \leq 3 + \lfloor \frac{n}{3} \rfloor$. Since $\gamma_e^{ecn}(G) = 3 \leq \lfloor \frac{n}{2} \rfloor$, $n \geq 6$. Therefore, $\gamma_e^{ecn}(G) + \gamma_e^{ecn}(\bar{G}) \leq 3 + \lfloor \frac{n}{3} \rfloor \leq \lfloor \frac{n}{2} \rfloor + 2$.

Equitable common neighbourhood dominating parameters

Definition 3.1: Let $S \subseteq V(G)$. If $epn_{ecn}(S, u) \neq \emptyset$, for any $u \in S$, then S is called an ecne-irredundant set of G .

Remark 3.2: The property of ecne-irredundance is hereditary.

Theorem 3.3: Any minimal ecne-dominating set is a maximal ecne-irredundant set.

Proof. Let S be a minimal ecne-dominating set. Then S is an ecne-irredundant set of G . Suppose for any $u \in V - S$, $S \cup \{u\}$ is an ecne-irredundant set. Then, $pn_{ecn}(S \cup \{u\}, u) \neq \emptyset$. Since S is an ecne-dominating set, there exists $v \in S$ such that u and v have a common equitable private neighbour. Since $pn_{ecn}(S \cup \{u\}, u) \neq \emptyset$, there exists no $w \in (S \cup \{u\}) - \{u\} = S$ such that u and w have equitable common neighbour, which is a contradiction. Thus, S is a maximal ecne-irredundant set of G .





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Definition 3.4: The minimum (maximum) cardinality of a maximal ecne-irredundant set of G is denoted by $ir_e^{ecn}(G)$ ($IR_e^{ecn}(G)$).

Remark 3.5: $ir_e^{ecn}(G) \leq \gamma_e^{ecn}(G) \leq \Gamma_e^{ecn}(G) \leq IR_e^{ecn}(G)$

Proposition 3.6: For any graph G , $\frac{\gamma_e^{ecn}(G)}{2} < ir_e^{ecn}(G) \leq \gamma_e^{ecn}(G) \leq 2ir_e^{ecn}(G) - 1$

Definition 3.7: The minimum cardinality of an independent ecne-dominating set of G is denoted by $i_e^{ecn}(G)$.

Remark 3.8: $\gamma_e^{ecn}(G) \leq i_e^{ecn}(G)$

Definition 3.9: The maximum cardinality of an independent ecne-set of G is denoted by $\beta_e^{ecn}(G)$.

Remark 3.10: $ir_e^{ecn}(G) \leq \gamma_e^{ecn}(G) \leq i_e^{ecn}(G) \leq \beta_e^{ecn}(G) \leq \Gamma_e^{ecn}(G) \leq IR_e^{ecn}(G)$

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Assessment of Land use and Land Cover Changes in the Granite Mining Area of Krishnagiri District, South India using Remote Sensing Data

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ABSTRACT

Mining practices like granite quarries has associated with the various environmental problems during the exploration, blasting, transporting and the disposal of waste rock. Appraisal of land use and land cover changes in and around the granite quarries is one of the important tasks in order to trace the impacts on ecosystems such as land degradation, loss in biodiversity, pollution of water resources and degradation of scenery. Land use refers to man-made agricultural practices, construction of buildings and other activities. Land cover denotes naturally covered land units such as forest cover, barren land, outcrops and water bodies etc., In the present context, an assessment has been made in the context of the land use and land cover changes in the site of granite quarries in Krishnagiri District, South India using remote sensing techniques. In the first step, the Landsat satellite data procured for the year 1973, 1981, 1991, 2001, 2011 and 2018. The six decadal of images were classified using supervised classification and subsequently change detection was applied to measure the land use and land cover changes. Next, the normalized difference vegetation index (NDVI) was used to highlight the dynamics in vegetation cover around the quarry site. The granite quarries resulted in the development of water ponds within the quarries. Likewise, there are significant losses in vegetation and bare land. NDVI results has shown the variability in mean NDVI values in different time period. The trend of overall mean NDVI values showed that the most of the granite quarry site had retain the vegetation cover. Over all, less vegetation cover was observed 1981. The results revealed that the environmental assessment sustainable development and continuous monitoring in and around the granite quarry is warranted in the mining district. The mining industry has evolved significantly and allows for improved mapping and monitoring environmental impacts related to mining activities.



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Key words: Landsat data, land use and land cover changes, granite quarries, environmental impact, Krishnagiri District.

INTRODUCTION

Mining of natural resources generally create the environmental impacts on surface water, groundwater, vegetation, agricultural land and other resources (Paull et al., 2006). Bonifazi et al. (2003) conducted a study to determine the capability of remote sensing to monitor abandoned limestone quarries. The study proved remote sensing to be an effective tool for monitoring such quarries and for surveying their evolution over time. The land use and land cover change of an area is an outcome of natural and socio-economic aspects and their operation by the human in time and space (Lambin et al., 2003). Since the launch of the first Earth Resources Technology Satellite in 1972 (ERTS-1, later renamed Landsat 1), there has been significant activities related to mapping and monitoring environmental changes caused by anthropogenic pressures and natural processes (Treitz and Rogan, 2004).

Increases in human-induced land use and land cover changes have called for the need to monitor and quantify environmental changes (Pierre and Sophie, 2016). Mining activity is amongst anthropogenic factors that lead to environmental degradation. This activity has resulted in many organizations implementing systems aimed at monitoring and managing environmental impacts of surface mining operations (Latifovic, 2005; Demirel et al., 2011). Borana et al., (2014) have analysed land use and land cover changes associated with sandstone quarries in the city of Jodhpur in India using Landsat data over a period of 10 years, and showed considerable land cover changes due to mining activities. As a result, remotely sensed data have become a useful tool to complement ground-based environmental monitoring methods that are otherwise confined to point, grid or traverse-based measurements (Lillesand et al., 2014; Rawat and Kumar, 2015). Land use and land cover (LULC) changes are mostly influenced by increase in population growth in the system economic growth, and physical factors including topography, slope condition, soil type, and climate (Setegn et al., 2009; Yalew et al., 2016).

Mouflis et al. (2008) assessed the visual impacts of marble quarry expansion from 1984-2000 on the landscape of Thasos island, North East Greece. The study estimated various landscape metrics before and after quarrying activities in the study area. Koruyan et al. (2012) examined the areal expansion of marble quarries and the change in vegetation around Mugla region from 2001-2009 using remote sensing. Tewabe and Fentahun (2020) has assessed land use and land cover change detection using remote sensing in the Lake Tana Basin, Northwest Ethiopia. The result indicated that in the last 32 years period, agricultural land and residential areas had significantly increased in the basin. Campbell and Wynne (2011) discussed the accuracy of remotely sensed images are of great concern to prospective users of LULCC maps. Information about the degree of accuracy of the data presented in a LULCC map is needed to ascertain its authenticity.

Nithya and Arulselvi (2019) explained the pattern classification technique to assess land use and land cover changes in Granite Quarry area of Dharmapuri and Krishnagiri District of Tamil Nadu. Thakur et al (2020) has been discussed land use and land cover change detection through geospatial analysis in an Indian Biosphere reserve. Hao et al (2021) have discussed land use and land cover change detection and spatial distribution on the Tibetan Plateau. Mishra et al (2020) have explained the land use and land cover change detection using geospatial techniques in the Sikkim Himalaya, India. Moeletsi and Tesfamichael (2017) have been assessed the land cover changes caused by granite quarrying using remote sensing studies. The vegetation cover decreased by 1308 ha in area while 18.3 ha base land was lost during the same period. This study demonstrated the utility of remote sensing to detect changes in land cover within granite quarries. Spruce et al (2020) mapped land use and land cover change in the lower Mekong basin from 1997 to 2010. The change map regionally showed a 4% decrease in agriculture and a 4% increase in deciduous and evergreen forests combined, though deforestation hot spot areas also were evident.



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Jensen et al. (2012) reported that post classification comparison is one of the more commonly used change detection methods. Also termed the delta classification technique, the post classification comparison method has the advantage of not requiring that remote sensed data be acquired and then processed into a digital change map. Post classification change map datasets are also relatively easy to calculate and yield “from to” change information that resource managers can usually understand (Wang et al., 2009). However, the accuracy of this method depends heavily on the accuracy of the two input LULC map datasets. The accuracy of a post classification comparison derived change map dataset can approximate the product of the accuracies of the 2 input LULC digital maps (e.g., each map scaled on a 0 to 1 floating point scale) (Coppin et al., 2004). The present study is mainly aimed at evaluating the impact of Granite mining in part of Krishnagiri district on the surrounding environment within 50 kilometers radius of mines using remote sensing techniques.

Granite Mining district

Krishnagiri district is bound by Vellore and Thiruvannamalai districts in the east, state of Karnataka in the west, the state of Andhra Pradesh in the north and Dharmapuri District in the south. The altitude in the district is range from 300m to 1400m above the mean sea level. The study area located in between 11°12'N and 12°49'N latitude, 77°27'E to 78°38'E longitude. The Krishnagiri district covers an area of 2978 km² (Fig.1). The important crops of Krishnagiri District are paddy, maize, ragi, banana, sugarcane, cotton, tamarind, coconut, mango, groundnut, vegetables and flowers. The district has an excellent scope for agri-business. The revenue blocks in the district are Bargur, Hosur, Kaveripattinam, Kelamangalam, Krishnagiri, Mathur, Shoolagiri, Thally, Uthangarai and Veppanapalli. Hosur is one of the most industrialized places in the state, is located in this district. In Krishnagiri district, quarry leases are being granted for granite in private patta lands. Rough stone and earth quarry leases are being granted in government and patta lands under Tamil Nadu Minor Mineral Concession Rules 1959. The Public Works Department is operating sand quarry in riverbeds of the study area. A state-owned corporation called Tamil Nadu Metals and Mineral Ltd is also carryout quarry and mining activities in government lands. It is ascertained that nearly 27,000 workers are being engaged in quarry activities in the district.

Krishnagiri District is endowed with vast rock formations and stone hills, making it an ideal hub for granite quarrying operations. In view of its geology (Fig.2), there has been an emergence of several quarrying companies and activities within the district in recent years. Raw materials from granite quarrying sites are utilized by customers within these regions and beyond for various construction activities. Furthermore, the Krishnagiri District is rapidly urbanizing and its accelerated sprawl is gradually leading towards conversion of forest lands into larger manmade environment. The migration of many settlers from the remaining districts within the state as well as from other parts of the country has put enormous pressure on land space coupled with rise in population. The increase in demand for land space for constructing residential or commercial facilities has made land acquisition, sole prerogative of the highest bidder. In many cases, land close to granite sites are a seriously encroached upon by desperate land seekers at the expense of environmental protection. Co-existing of quarry activities and human settlements posing environmental and health risk to the communities.

METHODOLOGY

Quarries were sampled based on their spatial coverage and the distance between them. A total of thirty two quarries were sampled around the study area. A minimum distance of 1 km between quarries was specified when sampling in order to avoid an overlap of samples that may compromise independence of each sample. Granite quarries were located using geographical positioning system (GPS) coordinates acquired from the minerals data base of Council for Geoscience and by using Google Earth TM. After acquiring coordinates, Google Earth TM was used to verify the locations as well as to digitize quarry boundaries. Google Earth™ offers Digital Globe images at spatial resolution of 0.5 m and has been used as a source of reference data in remote sensing analysis (Hu et al., 2013; Singh et al., 2015). Landsat images were collected from the United State Geological Survey (<http://earthexplorer.usgs.gov/>) for six





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decades such as 1973, 1981, 1991, 2001, 2011 and 2018 and details are given in Table 1. Attempts were made to use images acquired during the wettest months between December and March when vegetation is denser; however, the unavailability of suitable images necessitated the use of images outside of this time window. In general, both March and April are generally known as high vegetation vigour months in the summer rainfall regions of the study area. The brief methodology adopted in the present study is shown in Figure 3.

Image processing

Images were radiometrically calibrated by converting Digital Numbers (DN) to Top-of-Atmosphere (TOA) reflectance. Following radiometric calibration, multispectral image was created by combining all bands. A preliminary comparison between supervised and unsupervised classification showed confusion in differentiating between granite quarries from other mines as well as built-up land using the latter approach; therefore, supervised classification was applied in the study. A total of 50 randomly selected points were used to assess accuracy of classes created from the March 2018 image by using Google Earth™ as reference data. Commonly used classification statistics, including overall, producer's and user's accuracy were quantified for the accuracy assessment. Furthermore, kappa statistic was calculated using Equation 1 (Landis and Koch, 1977). Post classification change detection method was performed following accuracy assessment.

Radiometric Calibration

The Landsat images were radiometrically calibrated using absolute calibration method. This method enables comparison of images acquired at different times from different sensors (Chander et al., 2009). Data were calibrated at initial stage in converting the Digital Numbers (DNs) to at-sensor spectral radiance. The second step involved converting at-sensor spectral radiance to exoatmospheric Top of Atmosphere (TOA) reflectance using equations adopted from Chander et al., 2009.

Image Classification

Supervised classification method was adopted to classify multispectral images in the study area. Supervised classification depends on the user defined training set to identify areas on the image that are known to each land use and land cover category. The most common algorithm used for supervised classification is the maximum likelihood classifier (MLC) algorithm (Sun et al., 2013) which was used in this study.

Post-classification

Post-classification technique involves classification of each of the images independently, followed by a comparison of the corresponding pixel labels to identify areas where changes have occurred (Singh, 1989; Deer, 1995). Post-classification method was applied on the multispectral images to quantify land cover changes around the 40 digitized granite quarries.

Accuracy Assessment

Accuracy assessment is necessary to measure the degree of correctness in image classification (Foody, 2002). It is considered to be the most important step in land cover change detection studies (Congalton and Green, 2008). Error matrix was used to evaluate the classification accuracy. Error matrix is a square of array numbers set out in rows and columns which express the number of samples allocated to each land cover feature relative to reference data. Accuracy assessment in this study was evaluated using reference data obtained from Google Earth™. A random set of 189 points were overlaid on Google Earth™, the name of each class was then recorded using visual interpretation of features on Google Earth. The recorded class names in the reference data were then compared to classes generated from Landsat using supervised classification. An error matrix was then generated and subsequently, overall, producer's and user's accuracies were computed. Kappa coefficient is a common technique used in accuracy assessment to measure the difference between the actual agreement and chance agreement in the error matrix (Congalton and Green, 2008). The results of kappa ranges from -1 to +1 where positive one indicates perfect



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agreement, zero indicates change agreement while a negative value indicates less than chance agreement (Fleiss and Cohen, 1973; Viera and Garrett, 2005).

Change Detection

In land use and land cover (LULC) investigations, the purpose of change detection is to detect and define location of changed areas when comparing images from different times and to measure the amount of change (Singh, 1989). There are various methods of change detection such as image differencing, image regression, vegetation index differencing, post classification comparison, image rationing etc. (Mas, 1999; Lu et al., 2004). This study used post classification and normalized difference vegetation index change detection methods to evaluate land cover changes in and around granite quarries.

Land-cover classification scheme

In order to prepare the LULC map from satellite imageries, a classification scheme which defined and considered in the mapping. The number of LULC classes are preferred based on the requirement of a specific project for a particular application (Arora and Mathur, 2001; Saha et al., 2005). Eight major LULC classes were chosen for mapping the entire study area such as water body, crop land, fallow and, built-up land, forest land, soil, rock & boulder land (bare land), range land and mining (Table 2).

LULC change detection

LULC map of 2018 was re-sampled on 30 m to match the spatial resolution of all the classified maps thereafter; post-classification change detection technique was used for analyzing the changes. In the last few decades, many change detection methods have been developed viz; image differencing, post classification change matrix, comparison technique and principal component analysis (Lu et al., 2004). Change matrix presents important information about the spatial distribution of changes in LULC (Shalaby and Tateishi, 2007). Change matrix show the land cover changes in each decade was generated from classified images of 1973 to 1981, 1991 to 2001, 2011 to 2018 (Fig.4) and a change matrix was generated from 1988 to 2017 to assess the overall changes in LULC classes between 1973 and 2018 (Table 2).

NDVI change detection

Vegetation is one of the most important components of the hill area ecosystems. It is the land cover in term of plant biomass. The Normalized Difference Vegetation Index (NDVI) is calculated as the difference between near-infrared (NIR) and visible (VIS) reflectance values normalized over the sum of the two (Lillesand and Kiefer 2002);

$$NDVI = \frac{NIR - R}{NIR + R} \dots \quad (1)$$

Vegetated areas will generally yield high values for NDVI because of its relatively high near-IR reflectance and low visible reflectance. In contrast, clouds, water and snow have larger visible reflectance than near-IR reflectance. Thus these features yield negative index values. Rock and bare soil areas have similar reflectance in the two bands and result in NDVI near zero. The NDVI values estimated and further classified in a spatial context to prepare NDVI map for all the six years for understanding the accurate vegetation change and its density (Fig.5). The map is interpreted with quarries by means of interpretative potential to establish causal relationship of vegetation cover and environmental circumstances.

Field survey and accuracy assessment

A field survey was conducted for ground verification of doubtful areas with the help of GPS and local guides in different parts of watershed covering all the LULC classes. Due to mountainous topography, rough terrain and steep slopes, few areas were not accessible.



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RESULTS AND DISCUSSION

The results of accuracy assessment are shown in the Table 3. The results of classification obtained from Landsat data revealed a substantial strength of agreement of classification with kappa of 0.71 and an overall classification accuracy of 75%. Producer's accuracy showed that water bodies were classified correctly. The error matrix however, showed a certain degree of confusion between classifications of some classes. Granite quarries, which is the main class of interest in this study, yielded moderate producer's accuracy, and was mainly confused with exposed rock formation, built-up land and bare land due to similar spectral properties. User's accuracy for granite quarries showed that only one reference point was misclassified as other mining areas. Distribution patterns of land cover within granite quarries and surrounding areas using Landsat imagery revealed major changes in the land cover between 1973 and 2018.

The pattern inland cover types from 1973, 1981, 1991, 2001, 2011 to 2018 show increases in water bodies and granite quarries, and decreases in bare land as well as crop land. No quarry lakes were observed in 1973 and 1981. Even though water bodies were not clearly visible inside granite quarries in the classified images due to map scale shows that there was an increase in water bodies within granite quarries from 1973 to 2018 (Fig.6). The increase in granite quarries from 1991 to 2018 (14 sq.km to 43sq.km) is significant. Bare land increased from 1973 to 1981. Vegetation cover inside granite quarry boundaries gradually decreased from the year 1973 to 2018. There was no change in water bodies from 1973 to 1981, while the year 1998 and 2015 shows development and increase in water bodies within granite quarry boundaries. Increase in granite quarrying activity in the years 1991, 2001, 2011 and 2018 revealed significant change in land cover within granite quarries. The year 2018 revealed significant increase in water bodies within granite quarries which form as a result of expansion in quarries. There was also a significant loss of vegetation and bare land due to substantial increase in granite quarrying activity (Fig.7).

Normalized Difference Vegetation Index (NDVI) was computed to distinguish between amounts of vegetation in the study area. NDVI is aimed at separating healthy green vegetation from all other features (such as soil moisture, man-made features and water) and therefore any feature with prominent vegetation would yield high NDVI value. Figure 8 shows comparisons of mean NDVI values within digitized granite quarry boundaries for the year 1973, 1986, 1998 and 2015 using Landsat data. High mean NDVI values are observed in the year 2018 indicating the presence of green vegetation. Quarry No. 1 was sampled for closer statistical observation of changes in NDVI values over acquired time series data. Data acquired in 1973 and 2018 was resampled to 30 m spatial resolution for consistent comparison

Comparison of mean NDVI values used to assess the presence or absence of vegetation cover within granite quarries revealed variability across all granite quarries over Landsat time series. The overall mean NDVI values trends showed that most granite quarries had the highest Vegetation in 1991, followed by 1973, 2018 and the year with least vegetation over was 1981 (Table 4). Analysis of NDVI pattern based on individual pixels within quarry No. 1 over acquired time series data revealed that more pixels had high positive NDVI values in the year 1973 and 1998 indicating dominance of green vegetation cover while the year 1986 and 2015 had more pixels with low NDVI values (Fig.9).

CONCLUSION

The aim of this study was to quantify land cover changes caused by granite quarries located selected boundary of Krishnagiri district, Tamil Nadu, India. The use of Landsat data was chosen for this study due to mainly the availability of archival data at no cost. The overall classification accuracy was 85% (kappa coefficient of 0.71). The study revealed a significant increase in granite quarries from the year 1973 to 2018. Increase and expansion in granite quarries resulted in an increase in accumulation of water bodies within granite quarries. There was also a substantial decrease in crop land and barren land due to the quarry activity. The increase of vegetation cover (high NDVI)





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surrounding the granite quarry site has indicated that the mine owners maintaining some better vegetation cover and mine restoration and management work. Although Landsat was able to measure land cover changes in the study area, there were misclassifications due to spectral similarities. Another limitation encountered during the study was inability of Landsat to detect small water bodies within granite quarries. Recommendations that can address these limitations in the future is the use of high spectral resolution data such as hyperspectral remote sensing which is able to distinguish between features with similar spectral properties. Another recommendation is the use of high spatial multispectral resolution data that is able to detect small features such as water bodies within granite quarries. Site specific field inspections are needed to verify actual ground situation and mine management processes.

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Table 1. Landsat data used in the study

Image date	Sensor	Spatial resolution	Processing
27/02/1973	Landsat 1 Multispectral Scanner	80 m	LM01_Level 1_TP
22/05/1981	Landsat 3 Multispectral Scanner	80 m	LM03_Level 1_TP
16/03/1991	Landsat 5 Multispectral Scanner	30 m	LT05_Level 2_SP
04/03/2001	Landsat 5 Thematic Mapper	30 m	LT05_Level 2_SP
12/02/2011	Landsat 8 Operational Land Imager/Thematic Infrared Sensor	30 m	LT05_Level 2_SP
03/03/2018	Landsat 8 Operational Land Imager/Thematic Infrared Sensor	30 m	LC08_Level 2_SP

Table 2. Land use and land cover distribution in Krishnagiri district

LULC class	1973		1981		1991		2001		2011		2018	
	a	b	a	b	a	b	a	b	a	b	a	b
Water	18	0.60	21	0.71	22	0.74	27	0.91	31	1.04	104	3.49
Crop land	258	8.66	266	8.93	271	9.10	286	9.60	293	9.84	302	10.14
Fallow	1232	41.37	1224	41.10	1210	40.63	1190	39.96	1182	39.69	1178	39.56
Built-up land	70	2.35	98	3.29	126	4.23	167	5.61	193	6.48	308	10.34
Forest land	654	21.96	648	21.76	634	21.29	613	20.58	596	20.01	550	18.47
soil, rock & boulder land	136	4.57	132	4.43	125	4.20	115	3.86	102	3.43	98	3.29
Range land	610	20.48	589	19.78	576	19.34	560	18.80	549	18.44	395	13.26
Mining	0.00	0.00	0.00	0.00	14	0.47	20	0.67	32	1.07	43	1.44

a = area in square kilometer; b = area percentage





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Table 3 Land use and land cover change detection in study area during year 1973 to 2018.

Percentages	W	FL	CL	RL	F	SR	BL	Row Total	Class Total
Unclassified	0	0	0	0	0	0	0	0	0
W	18.28	0.419	0.268	0.318	28.175	0.848	6.944	100	100
FL	0.27	16.249	62.244	0.01	0.007	1.534	0.026	100	100
CL	17.352	29.388	15.188	3.501	0.661	11.96	4.053	100	100
RL	10.995	16.836	15.369	14.677	1.677	37.905	38.353	100	100
F	41.467	34.463	6.491	69.643	30.928	44.476	35.877	100	100
SR	4.351	0.406	0.022	7.294	38.022	0.917	0.737	100	100
BL	7.285	2.24	0.418	4.557	0.53	2.361	14.011	100	100
Class Total	100	100	100	100	100	100	100	0	0
Class Changes	81.72	70.612	37.756	30.357	61.978	62.095	85.989	0	0
Image Difference	390.759	7.133	-26.921	17.986	-29.987	-15.348	30.268	0	0

Table 4 Statistical analysis of the NDVI

NDVI	Min	Max	Mean	Stdev
1973	-0.54286	0.64949	-0.08180	0.04515
1981	-0.60000	0.43537	-0.02739	0.04740
1991	-0.11156	0.45829	0.15880	0.06211
2001	-0.08995	0.49437	0.16069	0.05548
2011	-0.10005	0.46613	0.18950	0.05694
2018	-0.11655	0.22396	0.03055	0.02796

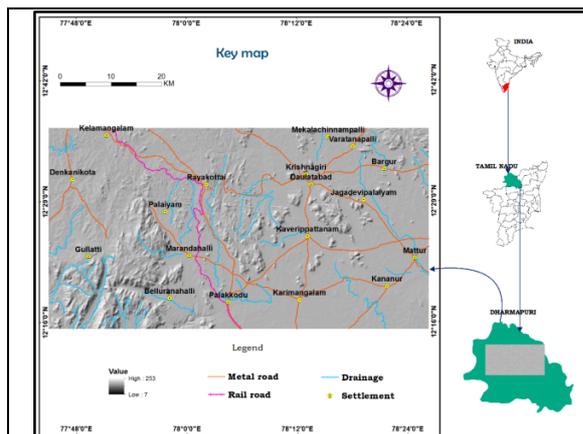


Figure 1 Location map of Granite mining district Krishnagiri in the state of Tamil Nadu

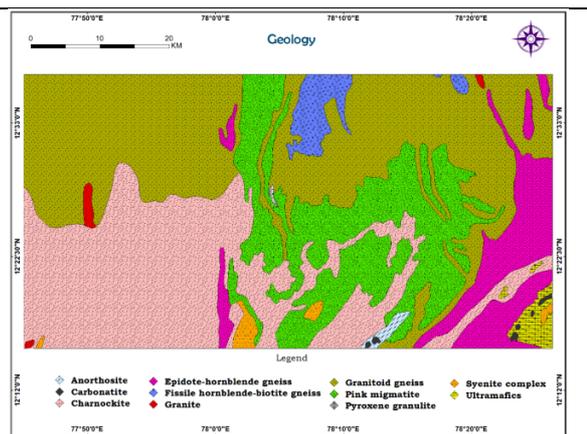


Figure 2 Geological settings of the study area





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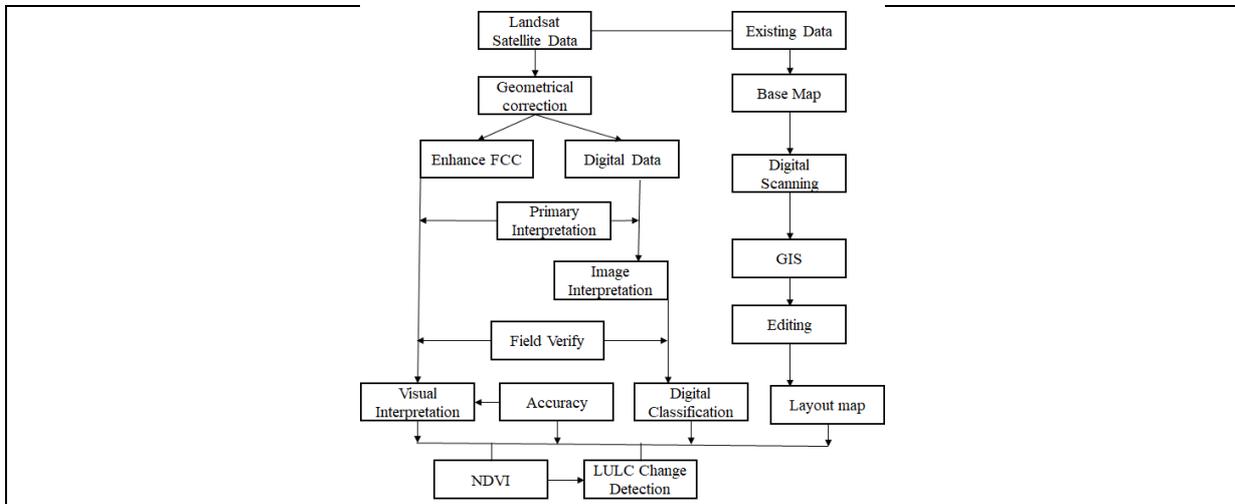


Figure 3. Methodology adopted in the present study

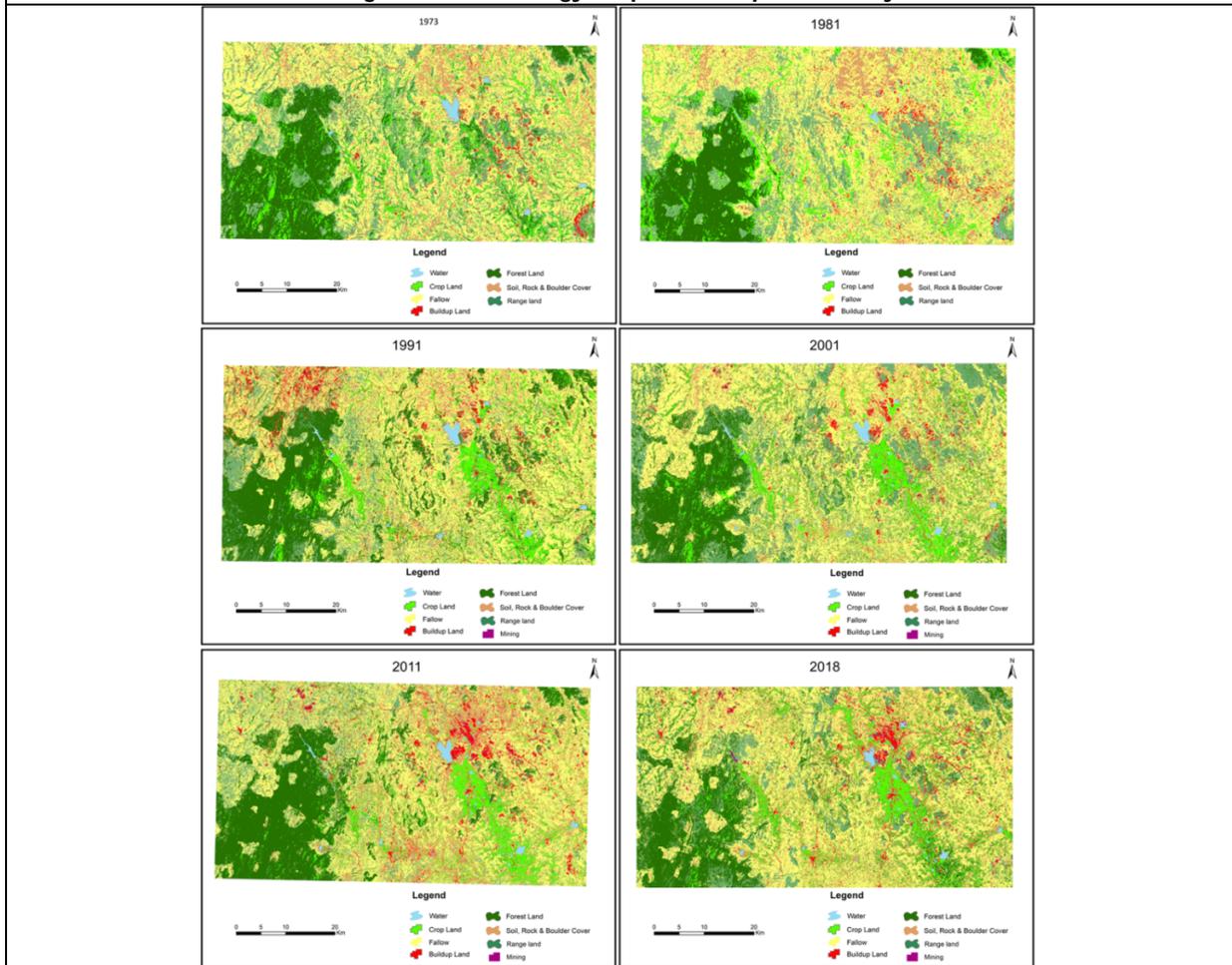


Figure 4 Land use and land cover of six decades in the study area Krishnagiri





Suresh et al.,

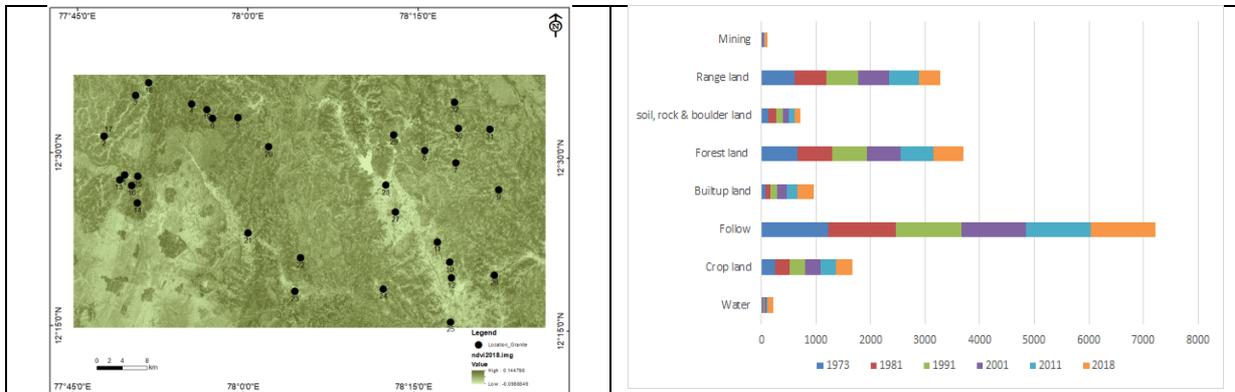


Figure 5 Normalized Difference Vegetation Index (NDVI) show the quarry locations in the study area.

Figure 6 Stacked bar chart is used to compare parts of a whole across categories use it to show how segments of a whole change over time



Figure 7 Land use and land cover change detection in the six decades





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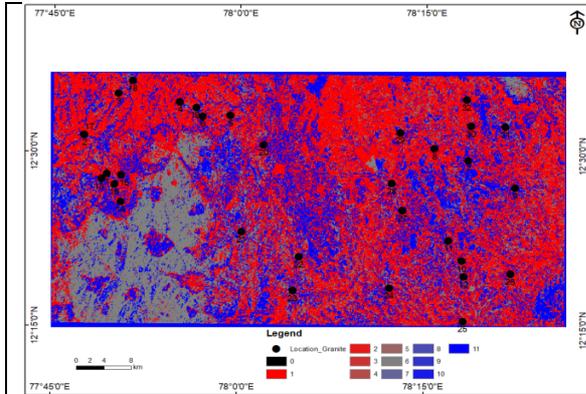


Figure 8. NDVI change detection and quarries. The black color show unclassified value, red color combination are show positive changes, blue color combination show negative changes and gray color show no changes in NDVI.

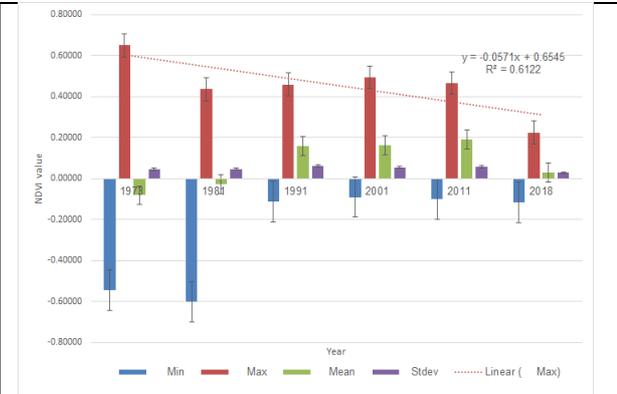


Figure 9. Clustered column show the NDVI change statistical analysis in the study area.





A Reliable Fast and Ideal Traffic Aware Secure Routing Protocol based on Multi-Hop Cross Site Leaping for Efficient Packet Transmission in WSN

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ABSTRACT

Fast Transmission in Wireless medium possess on node selection routing and unicasting the wireless sensor networks of the traditional secure aggregation system, the node broadcast it to all its neighbors as compared to what it contained. However, due to the rigorous network environment surrounding the nodes, many researchers usually take a different approach from traditional networks. Wireless sensor networks (WSN) are currently used in a variety of applications and will be used in more applications in the future. However, wireless sensor networks tend to be more unreliable than wired networks. In this paper, proposes. A Reliable fast and ideal traffic aware secure routing protocol (RTASR) based on multi-hop cross site leaping for efficient packet transmission in WSN. Group-based fast proximity detection algorithm (GBFA) solves these problems. By bearing neighboring information in the beacon pocket, the node knows some potential neighbors in advance. This allows fast discovery to pick up the most energy-efficient neighbors to speed up energy efficiency and reduce network communication load, and actively nodes to verify that this dynamic neighbor is a true neighbor. The simulated results show that the proposed scheme reduces the loss of bandwidth in comparison to routing mechanisms that extend the life of the network.

Keywords: Traffic aware routing, node bouncing, cross site verification, multi hop verification, data collection, secure routing, packet flow.



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INTRODUCTION

Today, many of valuable data that can be considered confidential through the circulation of the network (budget, credit card number, marketing data, etc.), many. Security, because these data cannot be read or altered by a third party. It will be very important, human services that are provided are always available and only permitted (confidentiality, integrity, responsiveness) there to here. Wireless network security is the process of designing, implementing and ensuring the safety of wireless sensor networks. It includes coverage of wireless computer networks and network security is a subset. The communication medium, hackers traffic / packets will not be able to see the content. The wireless network detection and prevention system also enables wireless network security by alerting wireless network administrators when a security breach occurs.

Populated tributary nodes in the WSN can collect information and / or analyze them more closely to preprocess base knots (sinks). The nodes themselves are forced to self-organize and adjust their behavior to the current network conditions resulting in frequent topological changes in the unmanned and are. The sensor is generally defined as the communication and computing power of only the power and memory knot. The sensor communicates with the device, which can detect and cause damage. Fast, high-efficiency sensors can be improved and improved at the present time to improve energy consumption when designing sensors with less data during a weather challenge. Precautions must be taken against the attack. Broadcast information is often used by wireless sensor networks. These attacks can cause security flaws Security management and substantiation contrivances that recognize the sensor nodes to each other. By changing the location of a fixed topology, because you cannot create mobile sensor nodes need to be made secure routing.

Routing the security mechanism can be a complex problem, the security mechanisms cannot be simplified in terms of packet transitions power efficiency and computational complexity. The attacks now control the flow of data traffic is routed to the source and destination nodes. For example, packets can be sent, thus causing delays in non-optimal routes, or where they are missing, lost packets can be sent. In addition, an attacker could create network congestion routing loops. WSN will be able to reflect on the information gathered from network to network attacks to cause waves. We are security threats, intrusions and attacks, figures from the waves and knowing that they can help narrow safety data, safety-related data to define the data. The development of this technology, security, architecture and protocol design issues need to address the challenges. Important wireless web network with state-of-the-art research, such wireless coverage, network capacity, manageability, and continues to prove that continue to be open to important issues such as network security. Various types of security data General WSN applications. Depending on the different diagnostic methods, the general feeling of safety data from certain data (eg, received signal strength indicator, acknowledgment message, etc.), and other special data protection, there are some data (for example), but not specifically require a fingerprint to be extracted.

Related work

We, referring to security, there are a number of terms very important. Risk is defined as the accidental or the future of the exhibition of information as a result of the bad operation of the wrong design of the hardware or software [1]. Vulnerability indicates when the operation of the software and / or hardware component failure exposes system that penetrates. We start from here, it is possible to define the attack as an event for the excellent operation of the system, if it is successful, you will not be able to. If the attack is successful, we gain access to the file or program without detection or control is gained to the computer, we are dealing with penetration. Many wireless sensor network security in the real world (WSN) applications on the main issue [2] [3]. This study focuses on the defense mechanisms of the two specific types of attacks that have occurred in the implementation of the network. Unwanted packets are sent to the service unavailable, so the services are being denied proper sensor nodes "denial of service" (DOS) attacks. Wireless sensor spots of storing sensitive information on rivals in an attempt to get the "passive information gathering" attacks [4].



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Wireless Sensor Networks (WSN) environment monitoring application in many fields and the environment is an integral part of the collected data. Large-scale, self-organizing, dynamic topology and tight resources, however, their unique characteristics of wireless sensor networks are very vulnerable to attack [5] [6]. It is proposed to effectively detect a variety of WSN attacks on numerous systems. Wireless Channel The key generation of years is a way to achieve confidentiality based on private key in the physical layer, using a wireless communication medium to create private key in public channel [7]. Wireless sensor networks can reduce network capacity and longevity and vulnerabilities to various malicious security attacks. This makes the cluster routing protocol with multiple nodes and cluster heads even more important [8] [9]. The idea is, through legitimate access point, you have to "fool" the part of the legitimate device to associate with this access point.

In order to enterprises and small and medium-sized enterprises to sustainable maintenance and competitiveness, it has become familiar with the benefits of a robust security platform. Intellectual property and proprietary information is a very valuable asset for these companies [10], it has penetrated into various fields of the national economy, such as health care, and closely are related to the daily life of people. Nevertheless, wireless network security, mainly in the following aspects, there still is one of the factors that hinder its popularity [11] [12]. In summary, the wireless network security problem, carriers, mobile node terminal, and is caused by release of dynamically changing network topologies. Security threats to the node terminal of the wireless network is mainly as follows. The attacker, via a wireless network in order to implement the attack, was connected to the attack of the network, seeking to implement management denial-of-service attacks, and the legitimate users, unauthorized access to network resources pretend wireless network control rights to the attack of the target network via [13]. By reducing, additional technology to enhance security and regular receiver, the security gap between the eaves dropper. Scrambled information bits SNR despite the still small value, and has a low bit error rate.

New technology, very little amount of such latency, such as the reduction of power consumption in the communication, there are a number of requirements [14] [15]. The detected malicious node is blacklisted by the sensor node, the proposed stop communication to and from the node / As, where not where protocol blacklist Safety [16]. For any wireless network technology, it has been considered one of the most important factors for security obtain a large approval. Method for detecting a variety of attack is studied intensively, have been reported in the literature, they none WSN in-depth on the collection and data analysis of security data to detect the mainstream of attack of the It does not provide a review [17].

Excellent choice and will computing power for the security physical layer to prevent much in eavesdropping attack for wireless sensor networks and energy [18]. However, some of them, routing consider to design a security mechanism from the system architecture view. The lack of a methodology for managing security be reliable. The complexity of the security requirements in a strange situation, will lead to the misplacement of duplication of security mechanisms and security features [19]. Network based security used in this form of speed and fast packet transition with verified hop, is a security gap, such as the many previous works, which is the maximum ambiguous used as a measurement for the security. The complexity of the calculations in cryptography, gives the advantage of physical layer security technology [20]. An attempt was made to achieve both of such reliability and security, such as the still high computing power and the probabilistic encryption and channel recognize and encryption requires energy, but there are several encryption technology.

MATERIALS AND METHODS

With the increasing use of wireless communication in sensor networks, security issues in the network have become increasingly important and the focus of the present study has changed. Cyber security has always been the main focus of companies at the same time. However, many companies' current security systems have low accuracy and security situation predictions with longer response times. While new types of attacks, such as advanced persistent





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threats, continue to emerge, major threats are becoming the security of corporate networking. Experts such as cloud computing and big data informatics in many fields in recent years have begun trying to integrate these technologies into security environment awareness for enterprise networks. Due to the complexity of data dependencies in enterprise security data warehouses, traditional modeling methods affect the effectiveness of network security incident analysis to streamline data and meet the high requirements. A Reliable fast and ideal traffic aware secure routing protocol based on multi-hop cross site leaping for efficient packet transmission in WSN. In order to achieve the above objectives and avoid network partitioning, parameters are taken into account at high residual power, link quality, constant, and minimum hops nodes in order to select the optimal path to the algorithm. Taking into account the above parameters can improve the security standard on route verification to improve network efficiently and balanced energy consumption.

As for the high residual energy, the high residual energy state would then drive the transport load after the node selection and extend the lifetime of the WSN. Figure 2 shows the Ideal traffic aware secure routing on multi-hop cross site leaping (ITASR). By distributing network security analysis, it essentially involves the following steps: First, it should collect as much information as possible about the distribution network, including switching angles and voltage switches including the voltage swing, and second, the power outage including the current security status of the system's security code. So the sender can understand the state of the current system. Thirdly, the load forecast is predicted, based on the available data, as a benchmark for the future of the powerhouse's catalog, such as its current benchmark. It is the SA of the distribution network that analyzes the security analysis process. There are three stages that meet the definition. Therefore, the security SA is not the same. Basic content of the distribution network.

Cross site Routing

This Cross site Routing turn reduces the energy consumption that the relay nodes extend to their network through packet verification protection; the aim is to minimize the use of control packets over wireless sensor networks. The proposed cross-layer verifier the recover site of transmission the route has been developed to provide information and analytics modeling to achieve these simulation results of the enterprise by optimizing energy consumption, demonstrating better performance and improved power efficiency in wireless sensor networks.

Algorithm

Step 1. Compute the nodeG(Ver as tran node, Erf as refrelect node),

Region cross route Rcs= {(vr1, vr2), (vr2, vr3), . . . ,(vr i, vri+1)},

Step 2. forgeneralize the node pf packet transmission for js= 2 to sr secondary

Relay Js → S ++ response node

Step 3: if (js= 2 and vjpacket access on relay authentication)

Arrange node vrwith the relay authentication : Else Terminate (vj, vj+1, . . . , vsi+1) to terminate

End if

5: for related hop access h = srto jr

Allow the packet to transfer on realy node

RI++

Wither alter mean time T access

Return RI → G; End For

End for

The DSR (distance vector Routing) protocol and routing algorithms include many beneficial routing protocol foundations. For example, when all nodes are almost static compared to each other, the DSR-sized path control packets overlap with the coordinate reaching zero. Similarly, if an intermediate node is unable to restart it, it





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immediately connects to the network at other points in the forward packets and does not significantly affect the routing. Therefore, the advantages are routing-based open source. DSR is primarily designed for ad hoc wireless networks with no self-organizing and self-configuring existing infrastructure or administration.

Reliable access Node selection

By the reliable protection on transmission node selection important with the presence of a few hostile nodes can lead to reconciliation of the paths, and as a result, the network has to rely on time and new routing innovation communication cycles. This imposes arbitrary delays before establishing a non-corrupted path, and imposes excessive transmission overhead on continuous broadcast requests. In particular, deliberately routing messages will eventually cause the node to experience a denial of service (DOS). This type of project vulnerability protects combatant and acquisition surface information.

$$\text{Target group of access node } Tg = (s + D)^n = \sum_{i=0}^{l++} \binom{n}{G} \text{Hop}^k \text{RL}^{n-k}$$

Where s represent source D represented destination on the form of l value node deployment for reliable access RL with K authentication using Group validation to secure the packet transmission .These will send M packets with backpressure routers and random nodes associated with the site. The Back Pressure Routing algorithm occurs when the traffic value from the current node is used to determine the next hop. In this way, our packets are routed with less congestion and faster transmission and this will result in fewer packets. Since time and time again, traffic at a particular stage is often considered a single node, because different paths have been taken

Multi hop leaping

The reactive routing protocol relies on a multiple hop transmission rating to transmit each packet. In directive to find a way out of a network, a reactive routing calculates the path and demands of the protocol and returns the path and floods the network. Using active protocols to navigate the sensor networks and refresh tables can be very costly as it can have very low data rates. On the contrary, the reaction method is optimal in such cases. It is a communication environment where a large ad hoc network can be extended and mobile nodes are attached to the emergency system, usually working as a team and participating in a collaborative manner.

Algorithm

Initialize network parameters NP on Route MLhp

Step 1 Create regional group node List of Transmission Path

If MLhp → Gnl == exit

Step 2 Create new random map region sector

For each verifying packet flow Gnl-authentication

Packet pt == allows sum of realy node

Hop cout ++ as Gnl

Return Gnl

End For

Step 3 Verify the packet header passed by the eah node realy on Hop

Step 4 Selective sink St → Passes node Begins

Check whether already node terminate access Packet

If yes got reject and date route table

Else

Update the routing table Node resembles.





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End If .

Step 5 If they Compute the authentication on Hop Wait for the T time for Node response

Else

If the packet is not destined for the current node to Jump close relay node,

Check for the destination node and transmit the packet Group header

Return Node passé

End if

This effectively spreads information across mobile displays. This limits the discovery of low overhead routes in the area created by possible paths through the scope of route discovery packets. These methods are made possible by using bandwidth and location information. The packets are sent by reorganizing the controls using the path. Therefore, this algorithm is an excellent choice for parcel transmission in our network year.

Ideal traffic aware routing

The Traffic prediction is important for fast and efficient transmission, this Ideal traffic aware routing mainly designed for three types of qubits that transmit data and control the special relationship between qubits and qubits called flexibility arranged flexible quantum frames. Each displacement quantum group has a different quantum law. It's hard to guess the exact content of a quantum frame with an attacker. In addition, the quantum verification algorithm is based on determining whether the special relationship transmitted data packet is quantum safe or not. By the non-ideal state this can change the behavior of sending packets to destroy special relationships and investigate random attack I will reject the packet to send to the receiver, though the special relationship is broken.

Packets distributed in this form can always be moved toward the sink. So, if the opponent is only asking for direction from the source of the receiver, one possibility is that the pocket has taken other paths to stay safe and free from the black hole. These will send packets with backpressure routers and random nodes associated with the site.

Algorithm

Step 1: Initialize WSN Multi hop assigned nodes $M_n \rightarrow \{M_{n1}, M_{n2}, \dots\}$

Compute Relational transmission path verification.

If (check route table == remainMns)

Trans mission begins

Else terminate route $\rightarrow T1$

Route Table $RT \leftarrow T1$ update

Return Acknowledge root Node

End If

Step: 2 compute the packet transmission P_t on each relative link RL

Verify the distance routing on closes t Node If node response

Step 3 Neighbor relative weightage == access close node

Step 4 : Split the packets on Relay verification to pass the packet

Step 5: For each packers on next hop verification speed terms on active node

For each referential v_n as trasn node of u_n response node:

Sink dentine Hop \leftarrow reserve relay node $[u_n] + \text{length}(u_n, v_n)$ packets

Step 6: Relay discovery compute the closest node to non-related path V .

if alt \leftarrow reserve node $[v_n]$:

Access node $[v_n] \leftarrow$ alternate path same $RT \leftarrow$ begins





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Response verify the path at Previous [vn] ← referential path u

If relay node matches the packet length as same acknowledgement access.

Step 7 :If a particular packet itself is destined for the packet header then Check : Receive node Send the following node process data check If yes, check if it has already received.

Else terminate access.

End if, End if

End For

End for

The current node uses the current jam value to determine the next hop of the path. In this way, our packets are routed with less congestion and faster transmission and this will result in fewer packets. Traffic at a particular point in time, since different routes of a single node can be noticed from time to time.

RESULTS AND DISCUSSION

The Reliable fast and ideal traffic aware secure routing protocol based on multi-hop cross site leaping for efficient packet transmission which is referred as (RTASR) The performance of further work on the NS2 simulator network is being evaluated under different simulation conditions. The results of the method were compared with the results of other methods. Functional performance has been measured at other times by a algorithm that is simulated and compared with the results of others. The RTASR method achieves a higher output rate than other methods in each simulation cy. The output performance introduced by the different methods is computed, and the results of Figure 3 comparisons are compiled by the RTASRmethod when the output is significantly higher than that proposed in Figure 2. The packet transfer rate generated by various strategies is measured by the number of packets sent and received. The packet transfer rates generated by them are measured and the results of other methods are compared. The rate of packet change is measured and the comparison is compared. Results in this recipe Table 2 the RTASR method obtains a higher PDR than other methods. PDR performance is measured and the values of other methods are compared. Comparison indicates that the RTASR algorithm achieves higher PDR than previous methods. Delay is a measure of the time at which the packet is sent between any source and destination. Total time is measured based on the number of groups taken and the number of groups taken. Delays generated by various methods are calculated and presented. The algorithm presented in RTASR Table 3 produced shorter delays than other methods. Figure 5 shows the different methods used, and the RTASR algorithm compares the latency delay rate with other methods that combine short-term values.

CONCLUSION

This projected method improves the security as well on fast transition with verifiable relay node to improve the WSN. Which is based on quantum transmission mechanism used to achieve data security in cross layer routing networks. This cross site verification on packet transition verified the node to transfer the data, this used the adaptable quantum frame. Reliable fast and ideal traffic aware secure routing protocol based on multi-hop cross site leaping for efficient packet transmission in WSN can design inspection rules to check the transmission packet to make security n commination. When the status of the verification rule is satisfied, the receiver receives the transmission packet. Otherwise, the receiver will discard the data packet. Based on the above mechanism, data protection can be achieved and attacks carried out can be avoided with produce high performance.



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Table 1. Throughput Comparative Result

Throughput Performance in %				
Time in Sec	FAEM in %	NPBNS in %	NSSR in %	RTASR %
10	13	19	36	38
20	26	34	48	51
30	42	49	67	69
40	68	72	81	82
50	82	91	94	95

Table 2. Performance on accept Delivery Ratio

Packet Delivery ratio in %				
Time in Sec	FAEM in %	NPBNS in %	NSSR in %	RTASR %
10	19	23	34	35
20	36	45	56	57
30	49	61	72	73
40	58	78	86	89
50	73	86	94	95

Table 3. produced shorter delays than other methods

Latency in Seconds				
No. of Packet/sec	FAE Min sec	NPBNS in sec	NSSR in sec.	RTASR in sec
4	4.5	3.4	1.8	1.9
8	6.8	4	2.9	2.3
16	7.2	6.5	4.3	3.6
32	8.9	7.1	5.9	5.1
64	9.4	8.9	6.4	5.4

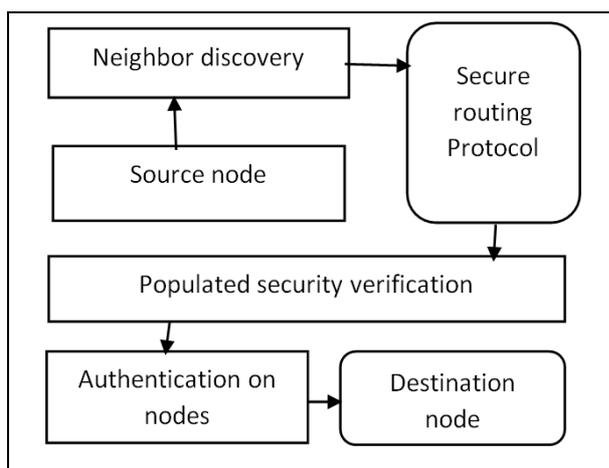


Figure 1 Process of secure data transmission In WSN

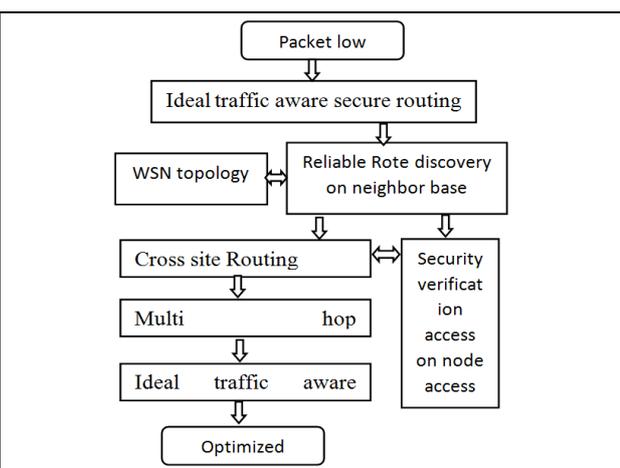


Figure 2: Ideal traffic aware secure routing on multi-hop cross site leaping (ITASR)





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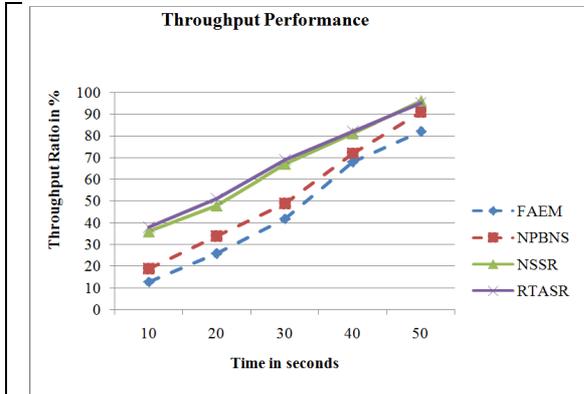


Figure 3. Performances on Throughput



Figure 4. Performance on PDR

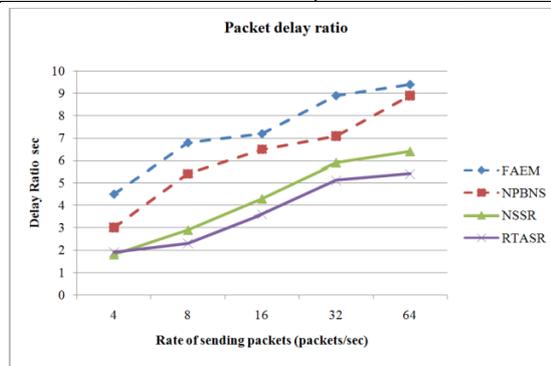


Figure 5. Packet delay Ratio of different methods





An Insight of Colon Targeted Drug Delivery System

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ABSTRACT

The colon is a site where both local and systemic delivery of drugs can take place. Local delivery allows the topical treatment of inflammatory bowel disease. However, treatment can be made active if the drugs can be targeted directly into the colon, thereby reducing the systemic side effects. This review, mainly details about anatomy of colon, challenges and obstacles in targeting to colon, polymers used in targeting to colon, rationality in colon targeting, principles involved in colon targeting, the approaches for CDDS (Colon Specific Drug Delivery) namely prodrugs, pH and time dependent systems, and microbially triggered systems, which achieved limited success and had limitations as compared with newer CDDS namely pressure controlled colonic delivery capsules, CODESTM, and osmotic controlled drug delivery which are unique in terms of achieving in vivo site specificity, and feasibility of manufacturing process.

Keywords: Colon, Polymers, Drug delivery system, controlled release, microflora.

INTRODUCTION

The colon-specific drug delivery system (CDDS) should be capable of protecting the drug en route to the colon, i.e. drug release and absorption should not occur in the stomach as well as the small intestine, and neither the bioactive agent should be degraded in either of the dissolution sites but only released and absorbed once the system reaches the colon. The colon is an ideal site for both systemic and local delivery of drugs. Treatment of significant intestine disorders such as Crohn's disease, irritable bowel syndrome, ulcerative colitis and colon cancer, where a high concentration of the active drug is required, can be improved by colon-targeted drug delivery system. The colon is used for systemic absorption of proteins and peptides also because the proteolytic activity of colon mucosa is much less than that observed in the small intestine. Drug targeting to specific sites of action offers several advantages over non-targeted drugs such as prevention of side effects and reduction of doses. The colon as a site of drug delivery

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offers various therapeutic benefits because of its near-neutral pH and longer transit time. To reach the colon and release the drug, a dosage form must be formulated, taking into account various obstacles introduced by the gastrointestinal tract. Successful delivery of a drug to the colon requires protection of the drug from degradation or release in the stomach and then controlled release of drug in colon. The desired properties of colon targeted drug delivery systems can be achieved by using some polymers either alone or in a combination because it is now recognised that polymers can potentially influence the rate of release and absorption of drugs and play an important role in formulating colon targeted drug delivery systems. Hence an attempt to review starting from anatomy to drug delivery systems in colon targeting has been made here.

Anatomy and Physiology of Colon

The colon is part of the gastro intestinal tract. Its principal function is to absorb water and salt from solid waste before it is excreted from the body in the form of faeces. Besides, the colon contains plenty of bacteria in charge of fermentation of unabsorbed material. The colon does not participate in the absorption of nutrients as it is the case with the small intestine. Still, it is an essential part in terminal processing of faeces and final absorption of water, potassium and some fat-soluble vitamins.

The GIT has been divided into different parts such as abdomen; small intestine and large intestine further the gut that is expanding from ileocecal junction to the anus which is additionally divided into three main parts such as colon, body part and anal canal. The colon is also called the large intestine. The colon is divided into the cecum, ascending colon, transverse colon, rectum and anal canal. Colon has a dilated portion which is blinded interiorly and is continued with the ascending colon dominantly. Ascending colon passes upwards from the cecum to the level of the liver where it bends acutely to the left at the right colic flexure to become transverse colon. The transverse colon, that extends across the abdominal cavity, in front of the duodenum and the stomach to the area of the spleen. The descending colon passes down the left side of the abdominal cavity then bends towards the midline. The pelvic colon looks identical as the S-shaped curve in the pelvic, then continues downwards to become the rectum. The colon consists of a different layer of tissues, i.e., longitudinal muscle fiber, submucous layer, mucus membrane lining. The arterial blood supply in the colon is mainly by superior and inferior mesenteric arteries, and venous drainage is mainly by the superior and mesenteric vein. The colon is 5 feet long (150 cm). The colon performs various functions such as creating a suitable environment for the colonic microorganism and so store faecal materials. The primary function of the colon is the creation of a suitable environment for the growth of colonic microorganisms, storage reservoir of faecal matter, expulsion of the contents of the colon at an appropriate time and absorption of potassium and water from the lumen. The absorptive capacity is very high, each about 2000 ml of fluid enters the colon through the ileocecal valve from which more than 90% of the fluid is absorbed.

Colon transit time of the material

A variety of pharmaceutical dosage forms and bioactive oral in gestion is different than other routes. Colon transit time is a significant factor to be considered in oral ingestion. According to the dosage form, the colonic transit time varies, as shown in Table 1.

Colonic micro flora and their enzymes

Drug release in various parts of GIT depends up on the presence of intestinal enzymes, gut juices and gut microflora. These enzymes are used to degrade coatings/ matrices as well as to break bonds between an inert carrier and an active agent (i.e., the release of a drug from a prodrug) resulting in the drug release from the total formulation. Almost 400 distinct bacterial species have been found, out of which 20% to 30% are of the genus Bacteroides. The upper region of GIT consists of a very little number of bacteria and principally gram-positive facultative bacteria. The concentration of bacteria in the human colon is around 1000 CFU/ml. The essential anaerobic bacteria's are



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Bactericides, *Bifido bacterium*, *Eubacterium*, *Peptococcus*, *Pepto streptococcus*, *Rumino coccus*, *Propioni bacterium*, and *Clostridium*.

Two types of bacterial fermentation occur in the colon; carbohydrate fermentation and protein fermentation. Carbohydrate fermentation occurs in the proximal part of the colon, the metabolic end point of which is the generation of short-chain fatty acids [SCFAs]. Acetate, propionate and butyrate represent the main SCFAs found in faecal samples. Protein fermentation involves the fermentation of dietary peptides as well as mucus and pancreatic enzymes and takes place in the distal colon [26]. This process generates potentially toxic substances.

Colon Ph

The pH is different in the GI tract, starting from the oral cavity to the large intestine. The pH changes are in the small intestine, stomach and large intestine because of several factors such as diet, food intake, intestinal motility and disease status. The differences in the pH in different parts make it very challenging for pharmaceutical scientists to target the drugs in specific colon depending on various factors that would be robust enough to withstand these changes. The pH gradient in GIT ranges from 1.5, pH in small intestine ranges from 6.6 to 7 in the proximal and distal small intestine. The right-left and mid colon have pH values approximately 6.4, 7.0 and 6.6, respectively. The pH of the colon is often lower than the pH of the small intestine, which is as high as 8 or 9.20. There is a fall in pH on the entry into the colon due to the presence of short-chain fatty acids produced by bacterial fermentation of polysaccharides. This fall in pH has to be targeted to deliver the drug to the small intestine by way of pH-sensitive enteric coatings.

Principles and mechanisms involved in colon targeting

A diverse range of mechanisms has developed to achieve colon targeting of drugs. One of the extensively used mechanisms is to coat the formulation using natural (or) synthetic polymers. The greatly used in this colon targeting delivery mechanism is to coat the drug by applying diverse natural or artificial polymers. In this procedure, the drug is present at the core of the medicament having different layers of polymer coatings. It constitutes two types of coating that are first, and outer coating. First coating (next to the core material) is acid-soluble whereas the outer coating is an enteric polymer. The core of the medicament includes the active ingredient and various other excipients. Now, these two first and enteric polymers dissolve at dissimilar pH. The first polymer can dissolve in the stomach when the pH is near 1.3 whereas the secondary dissolves at intestinal pH 7.0. The bacteria that are present in the intestine humiliate the carbohydrates into organic acid and thus leads to the lower pH of the entire system hence leads to the dissolution of the entire coating and the drug release.

Time controlled release system (TCRS)

Time-controlled release system (TCRS) or sustained-release system is a very promising drug release system. Due to the potentially significant variations of gastric emptying time of dosage forms in humans, in these approaches, the colon arrival time of dosage form cannot be accurately predicted, resulting in poor bioavailability. The dosage forms may also be applicable as colon targeting dosage forms by prolonging the lag time of about 5 to 6 h. However, the disadvantages of this system are:

- A) Gastric emptying time varies markedly between subjects or in a manner dependent on type and amount of food intake.
- B) Gastrointestinal movement, especially peristalsis or contraction in the stomach would result in a change in gastrointestinal transit of the drug.
- C) Accelerated transit through different regions of the colon has been experiential in patients with the IBD, the carcinoid syndrome and diarrhoea, and the ulcerative colitis. Therefore, time-dependent systems are not a model to deliver drugs to the colon, specifically for the treatment of colon-related diseases. Appropriate integration of pH-sensitive and time-release functions into a single dosage form may progress the site-specificity of drug delivery to the colon. Since the transit time of dosage forms in the small intestine is fewer variable, i.e. about 3 ± 1 hr. The time-release function (or timer function) should work more competently in the small intestine as compared to the



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stomach. In the small intestine drug carrier will be delivered to the target side, and drug release will be ginatpre arranged time point after gastric emptying. On the other hand, in the stomach, the drug release should be suppressed by a pH sensing function (acid resistance) in the dosage form, which would reduce variation in gastric residence time. Enteric- coated time-released press coated tablets, are composed of three components a drug-containing core tablet (rapid release function), the press coated well able hydrophobic polymer layer (Hydroxy propyl cellulose layer (HPC), time-release function) and an enteric coating layer (acid confrontation function). The tablet does not release the drug in the stomach due to the acid resistance of the outer enteric coating layer. After gastric emptying, the enteric coating layer rapidly dissolves, and the intestinal fluid begins to lei surely wear away the press coated polymer (HPC) layer. When the erosion front reaches the core tablet, rapid drug release occurs since the erosion process takes along time as there is no drugr release period (lagphase) after gastric emptying. The duration of the lag phase is either controlled by weight or composition of polymer layer.

Novel Colon Targeted Delivery System (CODESTM)

CODESTM is a unique CDDS technology that was designed to avoid the inherent problems associated with the PH or time- dependent systems. CODESTM is acombined of PH or micro bialy dependent systems for CDDS. It has been developed by utilizing aunique mechanism involving lactulose, which acts a satriggering site for the colon. The system consists of a conventional tablet core contain lactulose, which is over coated with an acid-soluble material, Eudragit E, and then after wards over coated with an enteric material, Eudragit L. The premise of the technology is that the enteric coatings protect the tablet while it is located in the stomach and then dissolves rapidly following gastric emptying. The acid-soluble material coating then protects the preparation as it passes through the alkaline pH of the small intestine. Once the tablet arrives in the colon, the bacteria enzymatically humiliate the polysaccharide (lactulose) into organic acid. This lowers the pH neighbouring the system adequate to affect the dissolution of the acid-soluble coating and following drug release.

Osmotic Controlled Drug Delivery System(ORDS-CT)

the ORDS-CT (Alza Corporation) can be used to target the drug locally to the colon for the treatment of disease or to achieve systemic absorption that is other wise unattainable. The ORDS-CT is can be a single osmotic unit or may incorporate as many as 5-6 push-pull units, each 4mm diameter, encapsulated with in ahard gelatin capsule. Each bilayer thrust pull unit contains an osmotic push layer and a drug layer, both surrounded by asemi-permeable membrane. An orifice is drilled through the membrane next to the drug layer. Immediately after the OROSCT is swallowed, the gelatin capsule containing the push-pull units dissolves. Because of its drug-impermeable enteric coating, each push-pull unit is prohibited from absorbing water in the acidic aqueous environment of the stomach, and hence no drug is delivered. The unit enters the small intestine the coating dissolves in higher pH of PH>7, water enters the unit, osmotic push compartment to swell, and concomitantly creates a flow able gel in the drug compartment. Swelling of the osmotic push compartment for cesdruggel out of the orifice at a rate specifically controlled by the rate of water transport through the semi permeable membrane. For treating ulcerative colitis, each push-pull unit is designed with a3-4h post gastric delay to prevent drug delivery in the small intestine. Drug release begins when the unit reaches the colon. OROS-CT units can maintain a constan trelease rate for upto 24hours in the colon or can distribute drug over a period as short as four hours. Recently, new phase transited systems have come, which promise to be a good tool for targeting drugs to the colon. Various *in vitro* /*in vivo* assessment techniques have been developed and proposed to test the performance and stability of CDDS.

Polymers used in the Colon Targeting Drug Delivery System

Reach the To colon and release the drug in the colon, the dosage form must be formulated taking into consideration various obstacles introduced by the GI tract. Successful delivery of the drug to the colon requires protection of the drug from degradation or discharge in the stomach and then controlled release of drug in colon. The preferred properties of colon targeted drug delivery systems can be achieved by using some polymers either single-handedly or in a combination because it is now recognized that polymers can potentially influence the rate of release and absorption of drugs and play an important role in formulating colon targeted drug delivery systems. Polysaccharides



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are bacterial enzymes have been greatly used in the targeting of the drugs. These natural polymers demonstrate the potential for drug delivery as they are comprised of polymers with an extensive range of molecular weights resembles in indigestion in the stomach and the small intestine, a large number of derivative groups. Moreover, the polysaccharides are not expensive, naturally occurring, plentifully available and varying chemical compositions. The most favourable property of these materials is their approval as pharmaceutical excipients. Biodegradable Polymers: Natural poly saccharides are extensively used for the development of solid dosage forms for colonic delivery of drugs. Biodegradable polymers are usually hydrophilic in nature and have restricted swelling characteristic in acidic pH. Various bacteria present in the colon secretes many enzymes which can cause hydrolytic cleavage of glycosidic bondse.g. β -D-galactosidase, amylase, pectinase, β -D-glucosidase, dextranase, α -D-xylosidase. These polymers are not expensive and are available in a variety of structures. Linear poly saccharides remain in tact in the stomach, and small intestine but the bacteria of human colon degrades the m and thus make them potentially use fulin colon targeted drug delivery systems.

Poly saccharides involved in the colon-specific drug delivery system

Many natural polysaccharides such as chondroitin sulfate, pectin, dextran, and more particularly guar gum etc. have started with the basis of investigation for their potential in innovating colon-specific drug delivery. These are led to break down by the colonic microflora to simple saccharides. Most of the polysaccharide-based drug delivery systems led to the protection of the bioactive from the hostile conditions of the upper gastro intestinal tract. Hydrolysis of the glycoside linkages led to the arrival in the colon trigger the release proforma of the entrapped bioactive. The main saccharolytic species or we may say particular species which is responsible for this biodegradation are Bacteroides, Bifido bacterium and also *Eubacterium*, *Peptococcus* very specifically *Pepto streptococcus* and most importantly *Ruminococcus*, *Propioni bacterium*, and *Clostridium*.

Natural Polysaccharides

Natural poly saccharides are being used for the development of dosage forms for colon-targeted drug delivery, specifically solid dosage form. Many natural polysaccharides such as chondroitin sulphate, pectin, dextran and more predominantly guar gum, etc. have started with the basis of investigation for their potential in innovating colon-specific drug delivery. These are led to break down by the colonic microflora to simple saccharides. Most of the polysaccharide-based drug delivery systems led to the protection of the bioactive from the antagonistic conditions of the upper gastrointestinal tract. Hydrolysis of the glycosidic linkages led to the arrival in the colon trigger there lease proforma of the entrapped bioactive. These polymers are economical and present in various structures. Bit of polymers is also being used in dosage forms, e.g., amylase, pectin. These natural polysaccharides do grasp advantages over the synthetic polymers, generally, because they are nontoxic, less expensive, and freely available. Chitosan: Chitosan is a high molecular weight, a polycationic polysaccharide derived from naturally occurring chitin by alkaline deacetylation. Chemically, it is a poly (N-glucosamine). Chitosan has favourable biological properties such as non toxicity, biocompatibility and biodegradability. Chitosan, however, is soluble in dilute acid and precipitates at a pH above 7. Because of the solubility of chitosan at low pH ranges, its successful use in colon-specific delivery requires an enteric layer over the chitosan which would protect it against the acidity of the stomach. As the formulation reaches the intestine, the pH increases and the enteric layer dissolves releasing the chitosan-coated core. These cores are acted up on by microflora of the colon, degrading the chitosan and releasing the drug.

Pectin

Pectins are non-starch, linear polysaccharides extracted from the plant cell walls. They are predominantly linear polymers of mainly α (1-4)-linked D-galacturonic acid residues interrupted by 1,2-linked L-rhamnose residues. Pectin has a few hundred to about one thousand building blocks per molecule, corresponding to an average molecular weight of about 50000 to about 180000. These polysaccharides remain in tact in the physiological environment of the stomach and the small intestine but are degraded by the bacterial inhabitants of the human colon. Being soluble in water, pectin is notable to shield its drug load effectively during its passage through the stomach and small intestine. It was found that a coat of a considerable thickness was required to protect the drug



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core is simulated in-vivo conditions. So, the focus shifted to the development of such derivatives of pectin which were less water-soluble but were degradable by the colonic microflora.

Guargum

Guargum derived from the seeds of *Cyamopsis tetragonolobus* is a naturally occurring galacto mannan polysaccharide. It is made up of a linear chain of β -D-mannopyranose joined by β -(1-4) linkage with α -D-galacto pyranosyl units attached by 1, 6-links in the ratio of 1:2. Guargum contains about 80% galactomannan, 12% water, 5% protein, 2% acid in soluble ash, 0.7% ash and 0.7% fat. Guar gum hydrates and swells in cold water forming viscous colloidal dispersions or sols. Guargum is being used to deliver the drug to the colon due to its drug release retarding property and susceptibility to microbial degradation in the large intestine.

Dextran

Dextran is a class of poly saccharides with a linear polymer backbone with mainly 1,6- α -D-glucopyranosidic linkages. They are obtained from bacterial cultures of *Leuconostoc mesenteroides* NRRLB-512. These glycosidic linkages are hydrolysed by moulds, bacteria and also by the mammalian cells. Dextranases are the enzymes which hydrolyse these glycosidic linkages. Dextranase activity of the colon is shown by anaerobic gram-negative intestinal bacteria, especially the *Bacteroides*. Dextran has also been found to be degraded in human faeces due to bacterial action. Various drug-dextran prodrugs in which the drug molecule is linked to the polar end of a macromolecule remain intact and unabsorbed from the stomach and the small intestine but when the prodrug enters into the colonic microflora containing as much as 10¹¹ *Bacteroides* per gram it is acted upon by dextranases which cleave the dextran chain randomly and at the terminal linkages releasing the drug, free in the colon.

Inulin

Inulin is a naturally occurring polysaccharide found in many plants, such as onion, garlic, chicory, artichoke. Chemically, it consists of β -2-linked D-fructose molecules, having a glucosyl unit at the reducing end. Inulin is not hydrolysed by the secretions of the human digestive tract. Bacteria present in the colon, especially bifidobacteria, which constitute up to 25% of the normal gut flora in man are known to ferment inulin.

Chondroitin sulphate

Chondroitin sulphate is a mucopolysaccharide found in animal connective tissues, especially in cartilage. Chemically, it consists of D-glucuronic acid linked to N-acetyl-D-galactosamine. Chondroitin sulphate is degraded by the anaerobic bacteria of the large intestine mainly by *Bacteroides*, *taio* and *B. ovatus*. Such a degradation profile suggests the use of chondroitin sulphate as a drug carrier to deliver drugs, especially to the large intestine where *Bacteroides* are found in abundance. However, the high water solubility of chondroitin sulphate is disadvantageous.

CONCLUSION

The colonic region of the GIT has become an increasingly important site for drug delivery and absorption. CDDS offers considerable therapeutic benefits to patients in terms of both local and systemic treatment. Colon specificity is more likely to be achieved with systems that utilize natural materials that are degraded by colonic bacterial enzymes. This article has described the various types of biodegradable polysaccharides that have already been used in the initial approaches for colon specific drug delivery. Polysaccharides exhibit favorable properties for fabrication of colonic delivery systems. The colon is rich in harboring excellent microflora, which can be used for targeting of drug release to colon.



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Table 1: Transit time of various dosage forms across the segments in GI tract

Dosage form	Stomach	Small intestine	Total
Tablets	2.7+or-1.5	3.1+or-0.4	5.8
Pellets	1.2+or-1.3	3.4+or-1.0	4.6
Capsules	0.8+or-1.2	3.2+or-0.8	4.0
Solution	0.3+or-0.07	4.1+or-0.57	4.4

Table 2: Colonic Microflora with their enzymes and metabolic reaction

Microorganism	Enzyme	Metabolicreaction
<i>E.coli</i> , bacteriods	Nitroreductase	Reduce saromatic & hetero cyclic nitro compounds
<i>Clostridia</i> , <i>Lactobacilli</i>	Hydrodegenase	Reduces carbonyl and aromatic groups
<i>Clostridia</i> , <i>Eubacteria</i>	Glucosidases	Cleavage of b glycosides of alcohol and phenols
<i>Eubacteria</i> , <i>Clostridia</i> , <i>Streptococci</i>	Sulfatase	Cleavage of o sulphates & sulfamates





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Table 3: The average pH in the GIT

Portion of GI tract	pH range
Oral cavity	6.2-7.4
Oesophagus	5.0-6.0
Stomach	Fastedcondition:1.5–2.0
	Fedcondition:3.0-5.0
Small intestine	jejunum:5.0-6.5
	ileum:6.0-7.5
Large intestine	Rightcolon:6.4
	Midcolonandleftcolon:6.0-7.5

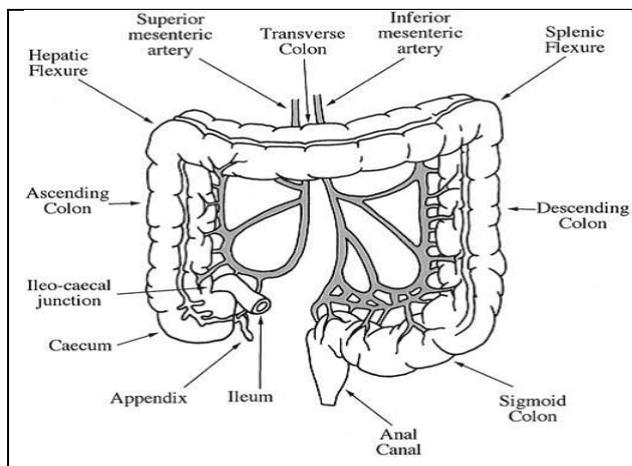


Fig. 1: Anatomy of Colon

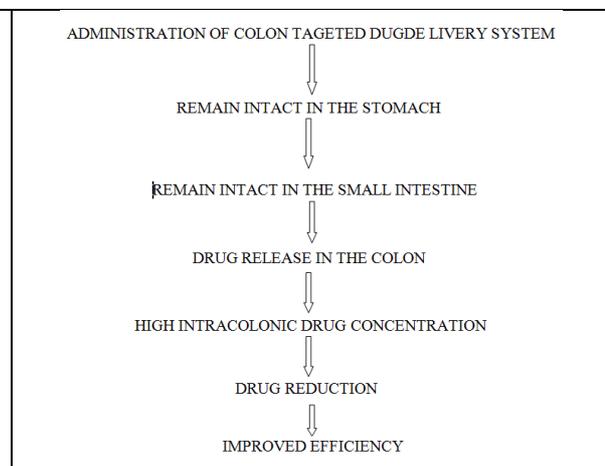


Fig.2: Schematic representation of colon targeted drug delivery approach

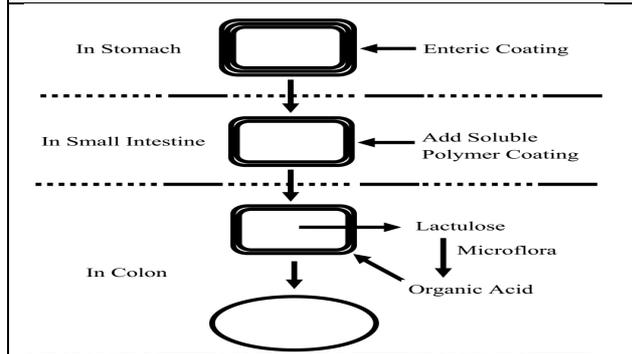


Fig.3: Schematics of the conceptual design of CODESTM

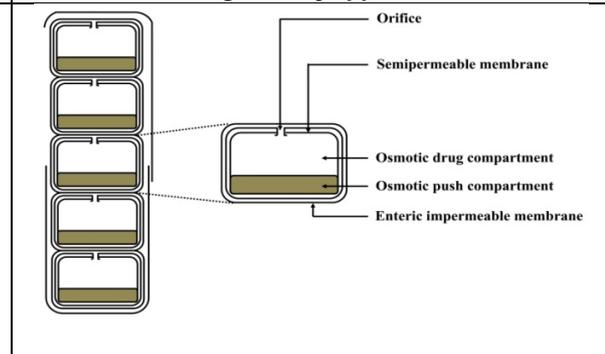


Fig.4: Cross-Section of the ORDS-CT colon targeted drug delivery system

