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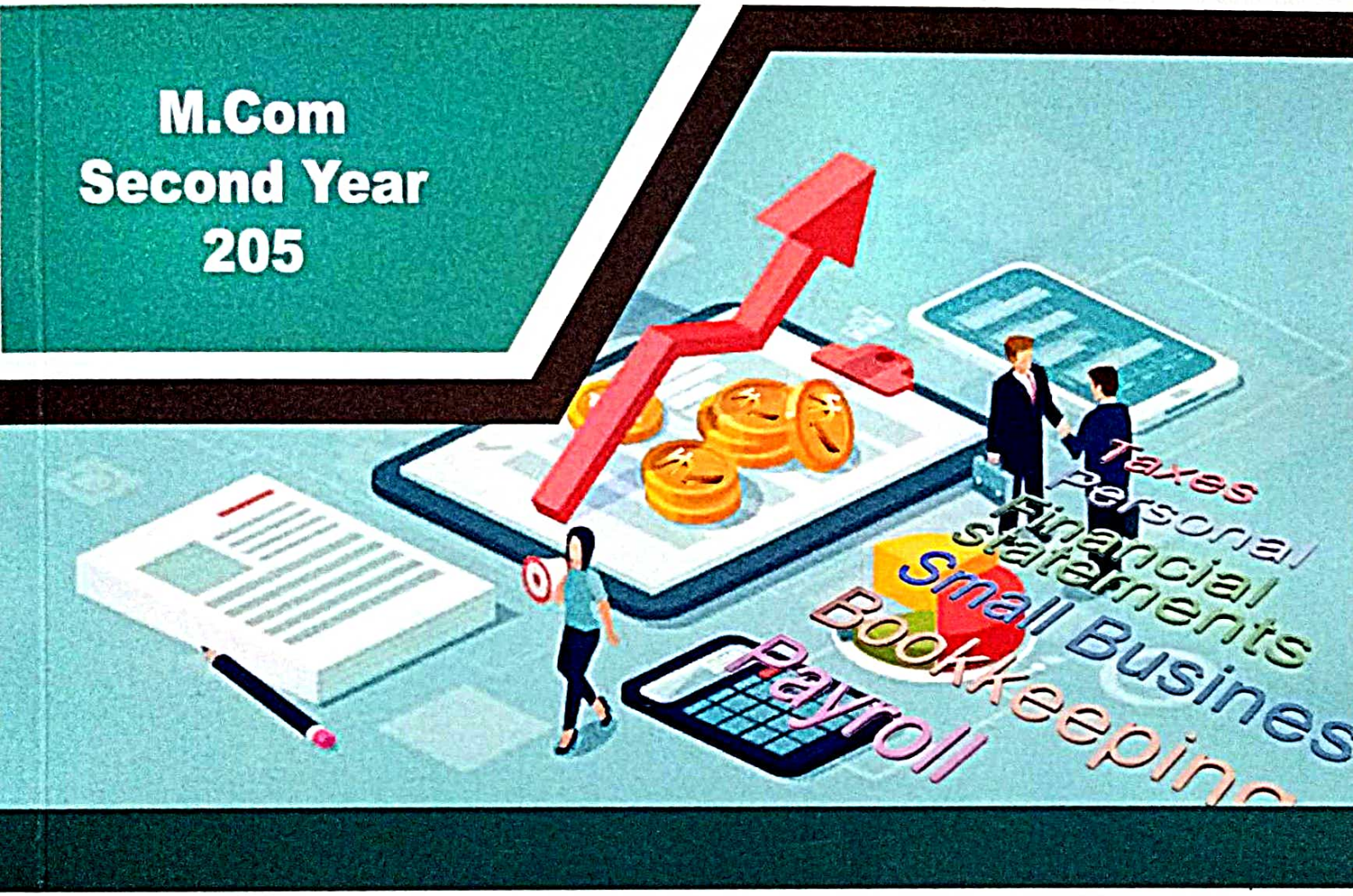

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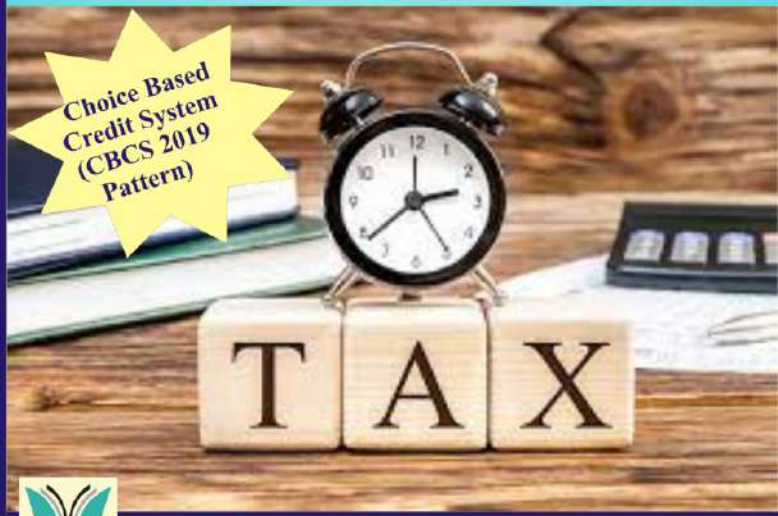

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PREFACE

Rayat Shikshan Sanstha, Satara is one of the largest and foremost educational institution in Asia established by late Padmabhushan Dr. Karmaveer Bhaurao Patil in 1919 with the motto "Education through self-help". It caters to the educational needs of downtrodden and economically weaker sections of the society. The college was established as Arts, Commerce College in June 1966 and it became a full-fledged institution with the inception of science faculty in June 1983. The college is affiliated to Savitribai Phule Pune University, Pune. Now it is a well flourished institution imparting higher education in Bachelor and Master Degrees in various streams. It is committed to the upliftment of poor and rural students in the vicinity. The college authorities take utmost care and make every possible effort to maintain the academic standard of rural students. It has well qualified staff, good location, spacious & well-equipped laboratories, huge infrastructure, enriched library, well equipped Gymkhana, Girls hostel, Computer training centre, beautiful landscaping with Botanical garden & Poly-house. Presently the college runs 18 UG and 8 PG courses including Organic Chemistry, Analytical Chemistry, Physics, Botany, English, Economics, Marathi & Commerce. The department of Chemistry, Botany and Commerce have recognized research centers of the Savitribai Phule Pune University. The college has received "Best College Award – in the year 2018". The college was reaccredited with 'A' Grade with CGPA of 3.06 in the 4rd Cycle by NAAC.The department of Chemistry is established in 1985 with UG course & has started PG course M.Sc. Organic in June 2011 and M.Sc. Analytical in 2020 and Ph. D. research centre in 2020. It has well equipped and spacious laboratory along with departmental library facility. In the dynamic scenery of science and technology, where innovations shape our world at a unique pace, it is

essential to continually explore emerging trends that redefine the boundaries of human knowledge and capability. This Conference Proceeding book, "Emerging Trends in Science & Technology (ETST-2024)" endeavors to capture the spirit of innovation and discovery that boosts our civilization forward. This conference Proceeding book is published in the expectations of sharing the enthusiasm found in the study of science and technology. Science and technology can help us unravel the anonymities of our universe, but beyond that, successful it can be personally satisfying. We developed this conference proceeding with the goal of helping people realise that the feeling of accomplishment. The aim of the National Conference on “Emerging Trends in Science and Technology”, is to stimulate the quickening of the development taking place in all spectrums. The theme for this conference is centred around "Dissecting all paradigms of contemporaneous research being carried out across Science and Technology. It is the premier event that brings together renowned experts, researchers, academicians and students. This conference covers different areas of Science and Technology as follows: Organic and Inorganic Chemistry, Environmental Chemistry, Green Chemistry and Renewable Resources, Analytical and Surface Chemistry, Material Chemistry, Physical Chemistry and Theoretical Chemistry, Pharmaceutical Chemistry, Nano Chemistry, Industrial and Engineering Chemistry.

I Principal Dr. N. S. Gaikwad, Dr. A. A. Kale, Head, and Convener and Dr. S. T. Shinde, Co-editor express esteem gratitude to all the patrons, Advisory Committee, organizing committee and all researcher who have been contributed publishing research work.

- Editors

CONTENTS

Photocatalytic Degradation of Methyl Orange using WO_3/g-C_3N_4 Nano composites

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Abstract

Visible-light-driven WO_3/g-C_3N_4 composites photocatalysts were synthesized by hydrothermal method. These prepared catalyst samples were characterized by X-ray diffraction (XRD), Field Emission Scanning Electron Microscopy (FESEM) & Energy Dispersive X-ray (EDX). The photocatalytic activity of the WO_3/g-C_3N_4 composites was evaluated by the photo-degradation of Methyl Orange under simulated solar light irradiation. The results indicated that the 50GW composite exhibited the highest photocatalytic activity compared to pure WO_3, bare g-C_3N_4, and other WO_3/g-C_3N_4 composites. The favorable photocatalytic activity of WO_3/g-C_3N_4 composites was mainly attributed to the excellent surface properties, enhanced visible-light absorption and the desirable band positions. A possible Z-scheme photocatalytic mechanism was proposed based on structure and electrochemical characterizations results, which can well explain the enhanced migration rate of photogenerated electrons and holes in WO_3/g- C_3N_4 heterojunctions.

Introduction

Synthetic dyes are found in a wide range of products such as clothes, leather accessories, and furniture. These dyes are commonly used every day. However, a side effect of the widespread of these dyes is wasted during the drying process this waste enters the environment mainly into the water supply Photocatalysis is one of the advanced oxidation processes (AOP), which can be used

for the degradation and mineralization of the toxic organic pollutants to harmless products. WO_3 has a narrow band gap of 2.7-2.8 eV [1]. Which is a visible light active photocatalyst.WO_3 shows fast electron-hole recombination which slows down the oxidation and reduction processes and ultimately decreases the photocatalytic efficiency [2][6][7]. Therefore, we have to choose such material that decreases electron-hole recombination.[9] To avoid the recombination process we can couple with different semiconductors or transition metals [3][5][8][10]. So here we used g-C_3N_4 as a co-catalyst, g-C_3N_4 has a narrow band gap i.e., 2.7 eV which lies in the visible region [4].

Experimental:

Materials: Sodium tungstate ($Na_2WO_42H_2O$) , Sodium chloride (NaCl) , Hydrochloric acid (HCl), Urea (CH_4N_2O), etc.

Synthesis of WO_3

Sodium tungstate (6.5g) & sodium chloride (2.3g) was dissolved in 150ml of distilled water. pH of the solution was adjusted to 2.0 by using 3M HCl solution and transferring the solution into a Teflon-lined autoclave. Then the autoclave was kept in a muffle furnace at 180°C for 24 hours. Allow the autoclave to natural cooling while the product was washed several times with double distilled water. Dried the product in an oven.

Synthesis of g-C_3N_4

20 g of urea was taken in a 125ml borosil bottle and the bottle was kept in the muffle furnace at 80°C for 24 hours then increase the temperature by 50°C after a regular interval of time until it reaches 550°C.Then sustained it for 3 hours at 550°C. Yellow-colored particles of g-C_3N_4 were obtained.

Synthesis of 25GW and 50GW

An appropriate amount of WO_3 was dissolved in double distilled water and sonicated for 1 hour. Similarly, the dispersion of g-C_3N_4 was obtained. After sonication, these solutions were transferred in autoclave and kept the autoclave in muffle furnace at 180°C for 24 h. The obtained product was washed several times with double distilled water and dried in an oven.

Characterization

1. **XRD study of WO_3, g-C_3N_4, 25GW and 50GW**

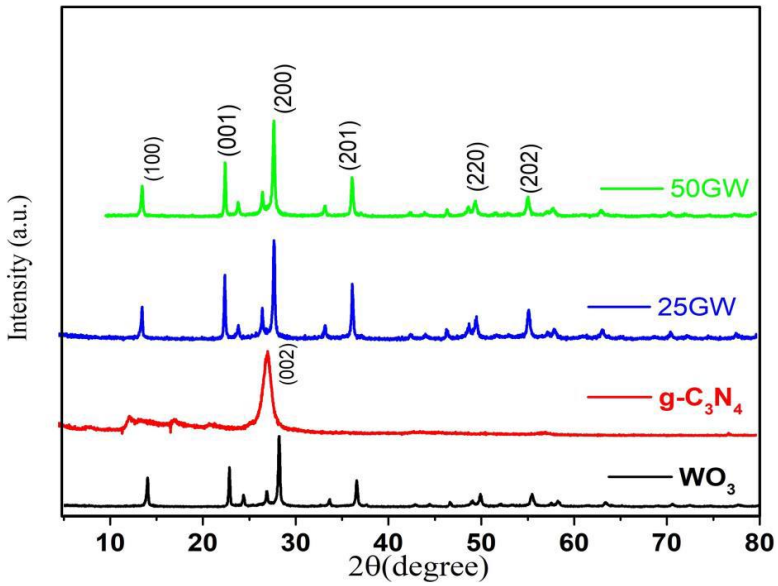

Fig. 1: XRD pattern of WO_3, g-C_3N_4, 25GW and 50GW

The intensity and detailed+ structure of WO_3, g-C_3N_4, 25GW and 50GW were verified by XRD. For WO_3 photocatalyst shows peaks with 2θ values of 14.14°,22.94°,28.28°,36.64°,49.86° and 55.5° having characteristic reflection planes (100), (001), (200), (201), (220) and (202) were clearly distinguishable [10]. The peak positions are in good agreement with the standard JCPDS Card No.75-2187 [11]

For g-C_3N_4 photocatalyst shows one peak with 2θ value 27.52° having reflection plane (002) which corresponds to graphite like stacking of CN conjugated aromatic rings JCPDS Card no 87-1526 [12]. Diffraction peaks of WO_3 were also observed for 25GW and 50GW with weak intensity than those of WO_3.

2. FE-SEM study of WO_3, g-C_3N_4, 25GW and 50GW

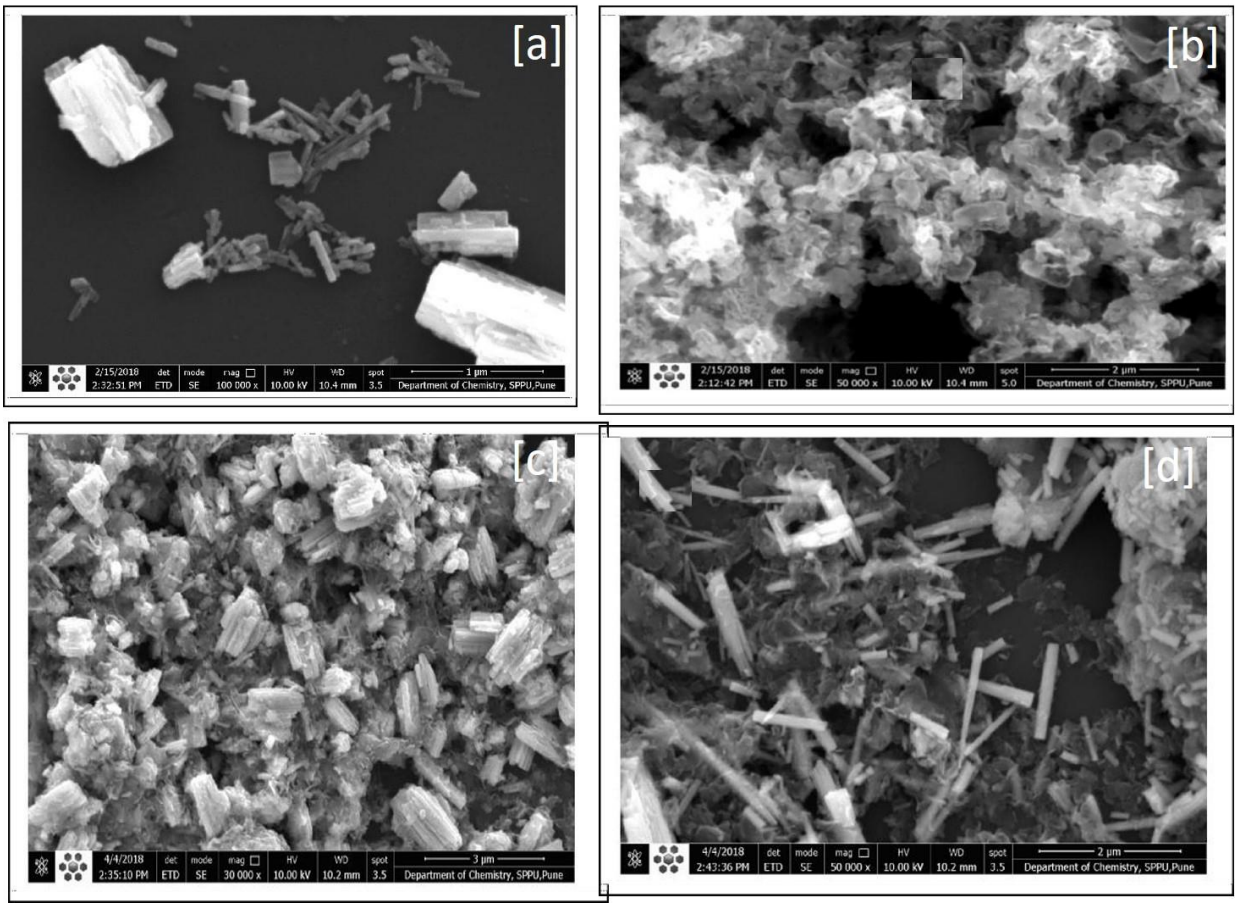

Fig.2: FESEM image of WO_3 (A), g-C_3N_4 (B), 25GW(C) and 50GW (D)

FESEM images shown in figure reveals the morphologies and microstructure of WO_3, g- C_3N_4, 25GW and 50GW. WO_3 shows Nano rod shape morphology. g-C3N4 shows smooth flat and irregular morphology. 25GW and 50GW shows rod as well as smooth, flat and irregular

morphology. Thus, formation of 25GW and 50GW composite is confirmed from the FESEM analysis.

3. Energy dispersive x-ray of WO_3, g-C_3N_4, 25GW and 50GW

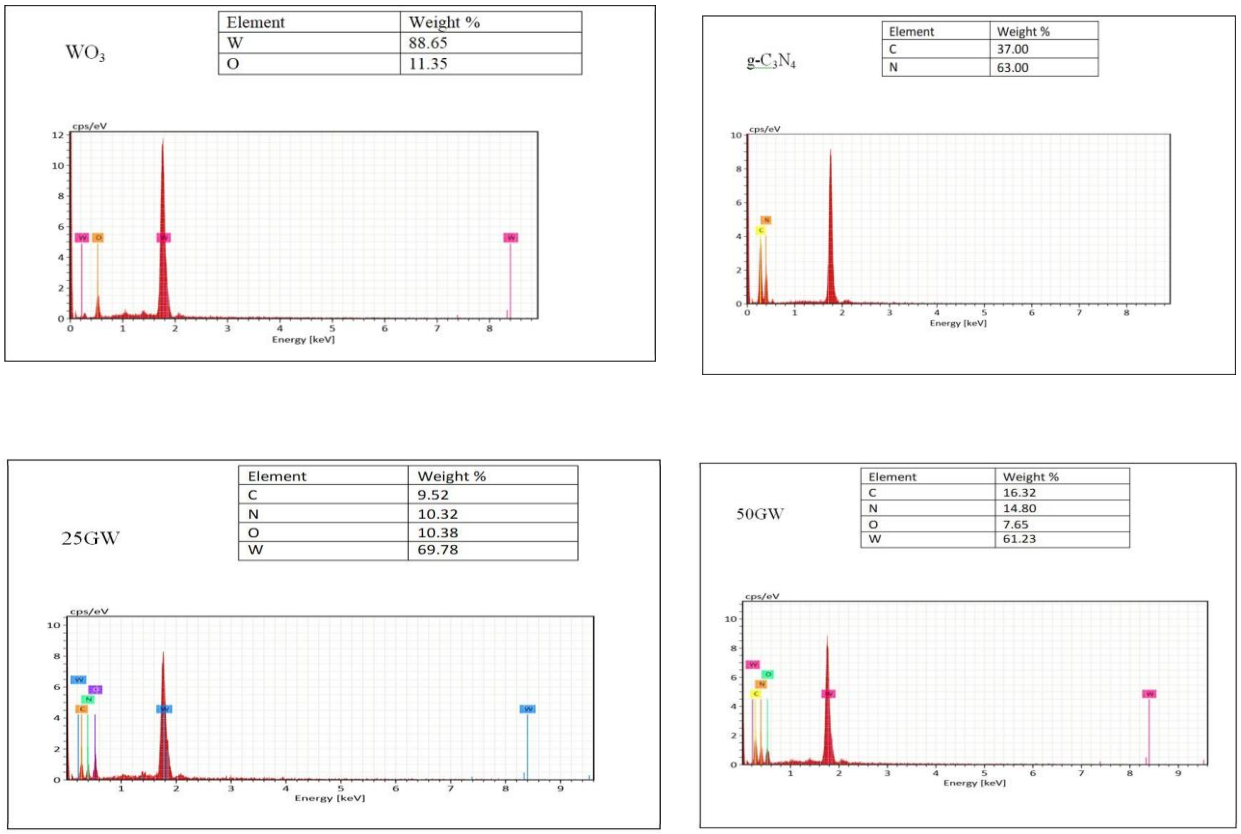

Fig. 3: EDS graph for the WO_3, g-C_3N_4 ,25GW and 50GW composite

The EDS analysis were performed to confirm the formation of composite by determining elemental composition of the composite. figure shows the EDS graph for the WO_3, g-C_3N_4 ,25GW and 50GW composite. The composition of elements confirms the successful formation of composite.

Measurement of Photocatalytic Activity

The photocatalytical activity of the WO_3, g-C_3N_4, 25GW and 50GW were mentioned from the result photocatalytic degradation of methyl orange. The initial concentration of methyl orange was $2.5*10^{-5}$M and the amount catalyst was 40mg/100ml.Before visible irradiation the suspension was stirred in dark for 10 min time ensure establishment of adsorption- desorption equilibrium. The reaction mixture at various time interval was analysed using spectrophotometer.

Figure shows the photodegradation of methyl orange solution by WO_3, g-C_3N_4, 25GW and 50GW composite catalyst. It is clear that the 25GW and 50GW shows enhanced photodegradation of methyl orange compared to pure WO_3 and g-C_3N_4.

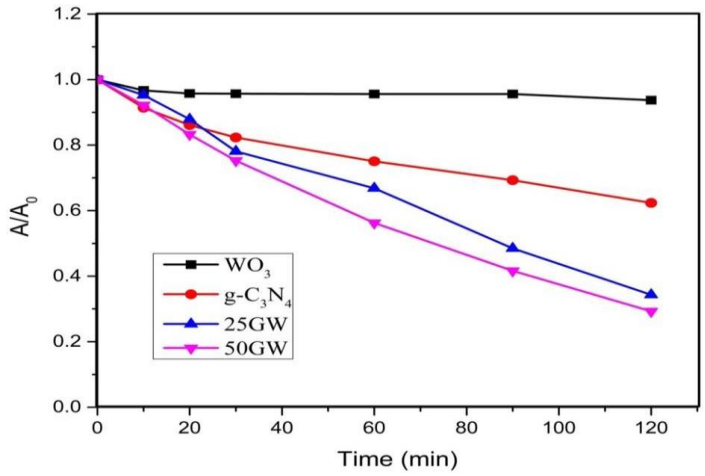

Fig.4 : Plot of A/A_0 vs time for the degradation of methyl orange ($2.5*10^{-5}$M) under simulated solar light

Kinetics of Photocatalytic Degradation:

It was found that the degradation reaction of the organic pollutants in the photocatalytic process follows pseudo-first-order-kinetics[13]. The first order-kinetic equation can be simplified in a linearized form as shown in Equation. Therefore, the experimental data will be analyzed and fitted in light with Equation

$$\ln\left(\frac{A_0}{A_t}\right) = k_{app}t$$

Where; A_0 and A_t are the initial Methyl Orange Absorbance and absorbance at specific irradiation time, respectively, while k is the first-order rate constant min^{-1}. 50GW shows apparent rate constant $k_{app} = 1.16\ X\ 10^{-2}\ min^{-1}$ which is 160 times larger than WO_3

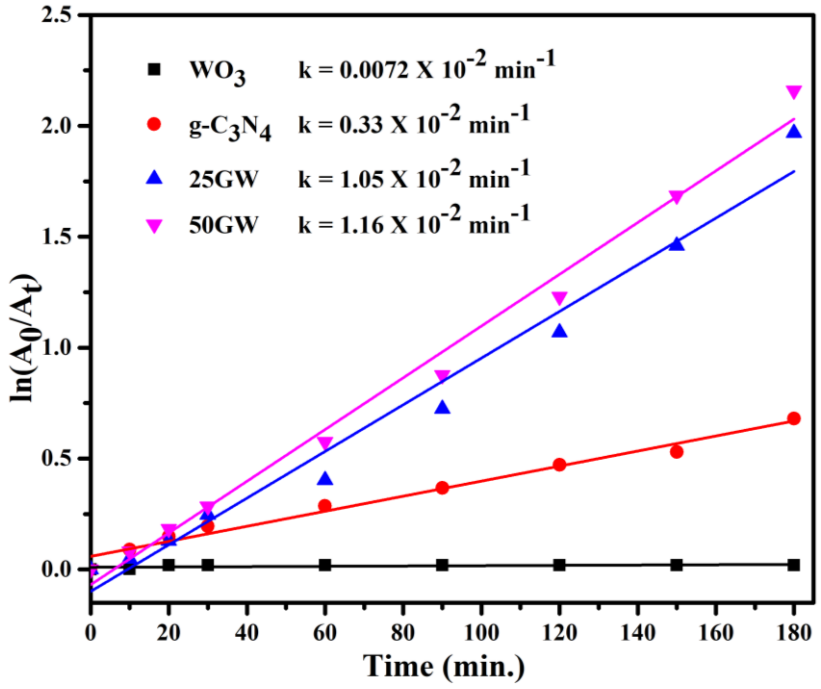

Fig.4: Plot of $\ln\left(\frac{A_0}{A_t}\right)$ vs Time for the degradation of methyl orange under simulated solar light.

Adsorption Study

Adsorption of catalyst was studied in methyl orange dye. catalyst was dispersed in solution and kept in dark for 120 min with constant stirring. Absorbance was measured using UV visible spectrophotometer and % adsorption was calculated. The prepared photocatalyst g-C_3N_4 Show 5.2% adsorption and 25GW and 50GW shows 2% adsorption.

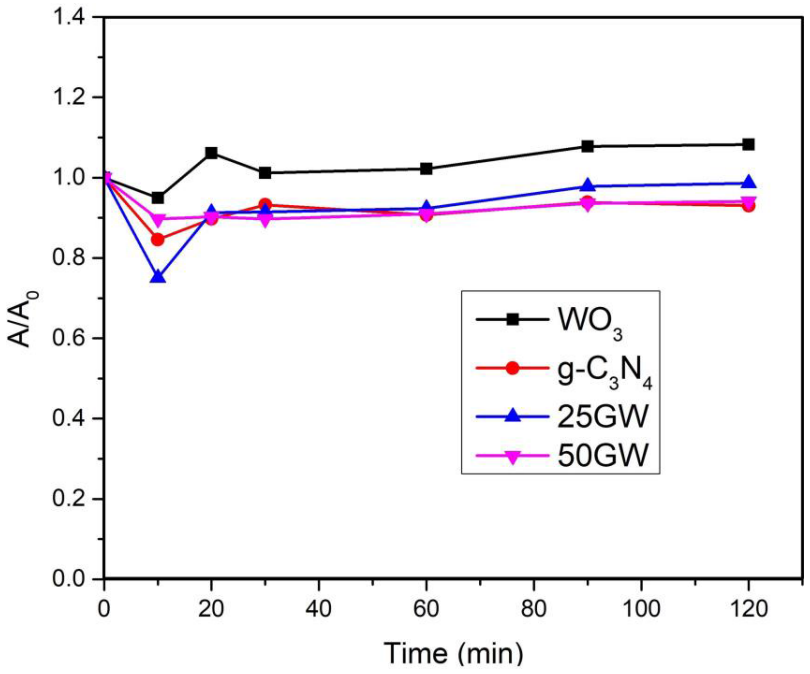

Fig.5 : Plot of A/A_0 for adsorption of methyl orange ($2.5*10^{-5}$M) on WO_3, g-C_3N_4, 25GW and 50GW composite before photodegradation.

Conclusion

The synthesis of WO_3 by Hydrothermal method, g-C_3N_4 by Pyrolysis method, 25GW and 50GW by hydrothermal method. From XRD, synthesis of WO_3, g-C_3N_4, 25GW and 50GW composite was successfully done. 25GW and 50GW shows enhanced photocatalytic performance in the degradation of methyl orange under solar simulated light. g-C_3N_4 in the 25GW and 50GW composites not only acts as electron collector and improve charge separation, but also increases the contact area between catalyst and dye leading to enhanced visible light photocatalytic activity.

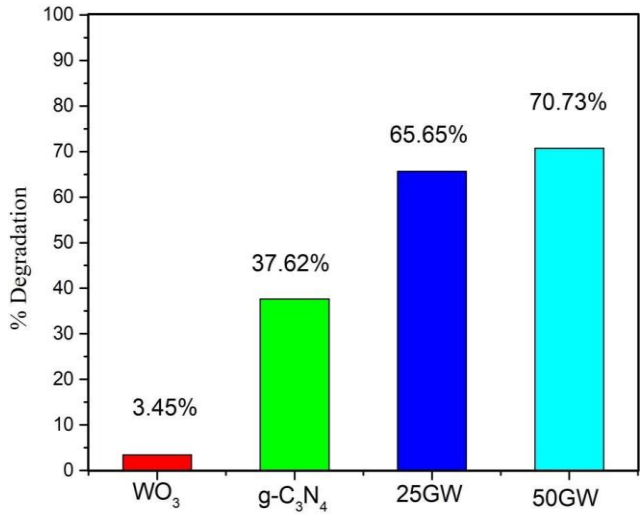

Fig. 6: Plot of % Degradation of Methyl Orange by WO_3, g-C_3N_4, 25GW and 50GW Photocatalysts

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Nanocrystalline N-Doped TiO_2 Catalyzed Synthesis of Pyrazolone Derivatives: A Green Approach for Efficient

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Abstract

The synthesis of pyrazolone derivatives holds significant importance in medicinal chemistry due to their diverse pharmacological activities. In recent years, catalytic methods have emerged as promising strategies for the efficient synthesis of these compounds, with a focus on green chemistry principles. Among various catalysts, N-doped TiO_2 has gathered attention for its eco-friendly nature and remarkable catalytic activity in organic transformations.

The synthesis of nanocrystalline TiO_2 was carried by precipitation technique. For this, Titanium isopropoxide was stirred in water to form Titanium hydroxide. Which is further used for doping with nitrogen. The XRD analysis of N-doped TiO_2 shows the formation of highly crystalline material with particle size 40-50 nm. As-synthesized of N-doped TiO_2 was used as heterogenous catalyst to obtain 2-phenyl-2,4-dihydro-3*H*-pyrazol-3-one derivatives. Series of pyrazolone derivatives reactions were carried out with substituted benzaldehyde at refluxing

temperature with constant magnetic stirring in ethanol solvent. The TLC technique was used to monitor the reaction. The formation of product materials was confirmed by comparing M.P. of as-synthesed material with reported M.P. Overall methodology shows use of magnetic nanoparticle, as a catalyst, is a being a good alternative and environmentally friendly. We believe this is green synthesis approach and alternative to Knoevenagel condensation reactions.

Keywords:
Heterogenous Catalysis, N-doped TiO_2, Pyrazolone, Knoevenagel condensations, Spectral Analysis, etc…

1. Introduction:

Nowadays the synthesis of nanomaterials and utilization as an environmental catalyst to organo material as well as degradation of organic waste is an important issue [1-4]. Number of physicals and chemicals method are routinely used to nanomaterial synthesis obtain the unique morphology and uniform particle size [5]. Often, Nanosized materials exhibit altogether different or superior properties than large particle sized materials [6-7]. Due to their small size, they have high surface-to-volume ratio that increases the surface energy leading to distinctively different chemical, electronic, optical, magnetic, and mechanical properties. For example, nanoparticles-based semiconductor sensors exhibit higher sensitivity towards air pollutants for lower detection thresholds at lower operating temperatures [8]. Also, nanoparticles are playing greater role in electrical, optical [9], bio-analytical [10], environmental remediation [11] appliances.

Among the various nanoparticles N-doped TiO_2 nanomaterial is promising candidates as conducing materials as well as catalyst, due to their high environmental stability [12-13]. Use

of nanomaterial in heterogeneous organic synthesis is an attractive field due to their environmental stability. The solution-based approach to nano material synthesis is a popular to alter particle size and morphology [5]. The effect of the solvents is also playing important role on the particle size, morphology, and photo catalytic activity [4].

Therefore, the synthesis and characterization of nano materials and its utilizations in various field such as optoelectronic, magnetic, semiconductor, catalyst to degradation as well as synthesis of nano materials have industrial demands. Nanocrystalline conducting and magnetic materials have also found more efficiency as heterogeneous catalyst in organic synthesis [14]. For organic synthesis homogeneous catalysis is generally used, however, it requires more solvent and less recovery of catalyst due to partial solubility. Even with their advantages and widespread use in several applications, many homogeneous catalytic systems have not been commercialized because of the difficulty encountered in separating the catalyst from the final reaction product. By products such as effluents have more problems to separation of catalyst from the final product creates economic and environmental issues such as organic waste to water pollution [12]. Over the last decade, the use of transition metal nanoparticles (NPs) in catalysis has expanded considerably and has led to many interesting applications, with C–C bond formation reactions being one of the most important. Hence researchers are interest to the sustainable development, which involves the utilization of reusable catalysts. Pyrazolone is a key heterocyclic moiety present in numerous organic compounds because they possess antifungal, antibacterial, antimicrobacterial, antinflammatory, antitumor, gastric secretion stimulatory, and antidepressant activities. Pyrazole derivatives are known to possess wide spectrum of biological activities such as antibacterial, antifungal, antidiabetic, herbicidal, anti-anxiety [15].

In view of this, we report synthesis of nano crystalline N-doped TiO_2 and its use as a heterogeneous catalyst for pyrazolone derivative synthesis. N-doped TiO_2 catalyst to 5-methyl-2-phenyl-2,4-dihydro-3*H*-pyrazol-3-one derivatives synthesis have conferred 80% yield. Recirculation of catalyst have found almost same yield. Reported process easy to scale up and require less amount of solvents. Our approach is novel and environmentally friendly.

2. Experimental:

a) Synthesis of N-doped TiO_2 catalyst

Titanium isopropoxide (99.9%, Hd-fine) and Triethyl amine (99%, Sigma Aldrich, USA) have used as precursor material. The nanostructured N-TiO_2 were synthesized taking, 0.5 mL of titanium isopropoxide in RB flask then 5 ml methanol and 25 ml water was added with constant stirring at room temperature. To this solution requisite quantity, a 0.1–2 M aqueous triethylamine solution is injected rapidly. The solution was refluxed for 24 h with constant stirring. The white precipitate formed was collected and washed with water several times followed by centrifugation. The precipitate was dried at 200 ^oC for 24 h. The samples, the sample were synthesized as function of volume ratio of titanium isopropxide, methanol, water, and triethylamine. The other sample prepared in volume ratio 1 : 10 : 50 : 0, 1 : 10 : 50 : 1, 1 : 10 : 50 : 2, 2 : 10 : 50 : 2, and 2 : 10 : 50 : 4 were denoted as TN0 (pure TiO_2), TN1, TN2, TN3 and TN4 respectively.

b) Characterization of powder catalyst:

Powder X-ray Diffractograms were recorded on a Model Rigaku-D/MaX-2200V X-ray Diffractometer (XRD) with CuK_ radiation with Ni filter.

c) Measurement of catalytic activity to Knoevenagel condensation reaction of 5-methyl-2-phenyl-2,4-dihydro-3H-pyrazol-3-one and different Aldehydes.

Pyrazolone (0.001 mole) and Aldehyde (0.001 mole) were taken in 10 ml ethyl alcohol in 50 ml single neck round bottom flask equipped with condenser. Then, 10% nano N-doped TiO_2 catalyst powder was added in reaction mixture which is heated in an oil bath at $60^{O}C$ till completion of reaction. Reaction was monitored by TLC technique. After completion, reaction mixture was allowed cool and then filter using Whatman to separate catalyst was further oven dried to recycle. While the filtrate was concentrated to get solidify compound then recrystallize to get pure product. The structural purity of compounds was confirmed by using ^{1}HNMR spectroscopic spectral techniques.

3.Result and Discussion:

3.1 XRD study of N-doped TiO_2 NPs:

The X-ray diffraction patterns of (a) TN0 (TiO_2), (b) TN2, (c) TN4 (d) TN6 (e) TN8, (f) TN10 were shown in Figure 1. The XRD image shows the highly pure phase formation of N-doped TiO_2 nanoparticle with particle size 40-50 nm. The XRD planes shown in figure 1 which is well matched with JCPDS data of N-doped TiO_2. The lower concentration Triethyl amine shows the formation of anatase phase TiO_2. The higher molar concentration of triethylamine was fortunate for the conversion from anatase to rutile phase TiO_2.

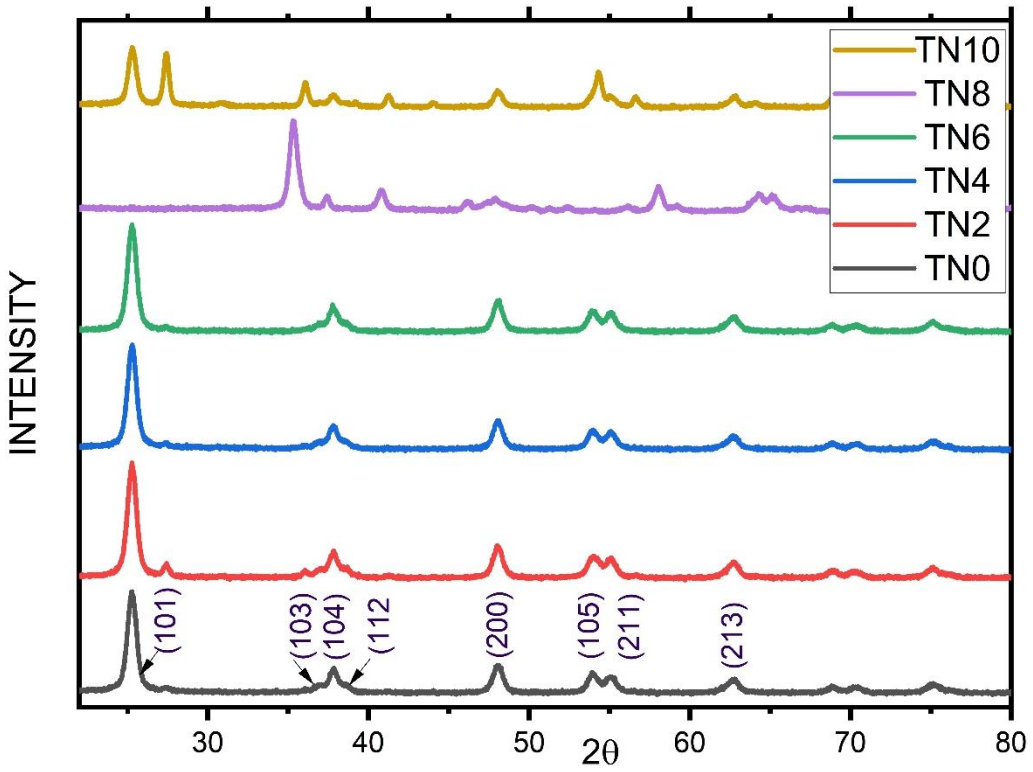

Fig. 1: Fig. 2 X-ray diffraction patterns of (a) TN0 (TiO_2), (b) TN2, (c) TN4 (d) TN6 (e) TN8, (f) TN10 .

3.2 Pyrazolone derivative synthesis:

In heterogeneous catalysis to organic synthesis generally CuO, Fe_2O_3, CuI, N-doped TiO_2, Pd, $CsCO_3$, Ni, ZnO, etc. and it doped catalysts were used for different coupling, condensation, oxidation, reduction, and named reaction [14]. Pyrazolone derivative synthesis is carried out by conventional method and ultrasonic method [15]**.** But in this process for the minimization of required hazards chemicals cannot be altered. To overcome, we have used environmentally friendly materials such N-doped TiO_2 to pyrazolone derivatives and predicted mechanism for the synthesis has shown in Figure 2.

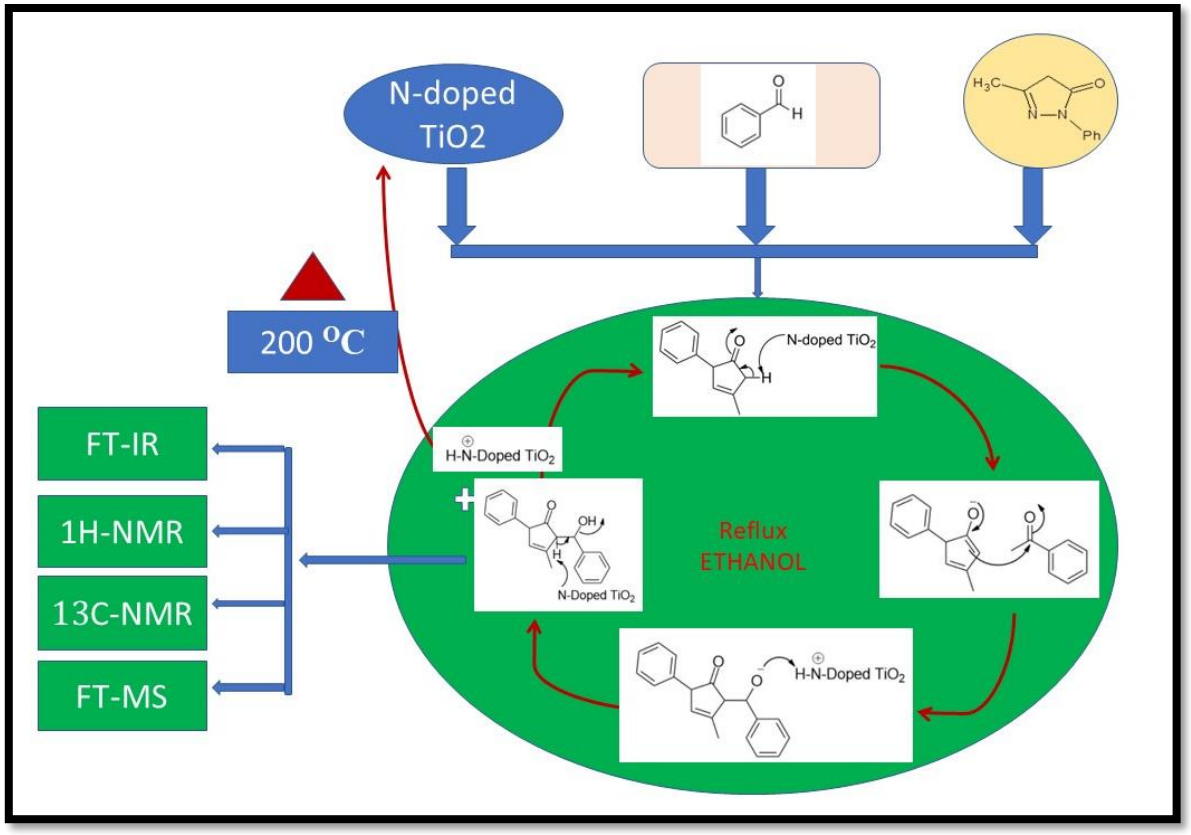

Fig. 2: General mechanism of N Doped TiO_2 catalyzed pyrazolone derivatives synthesis

GENERAL REACTION SCHEME

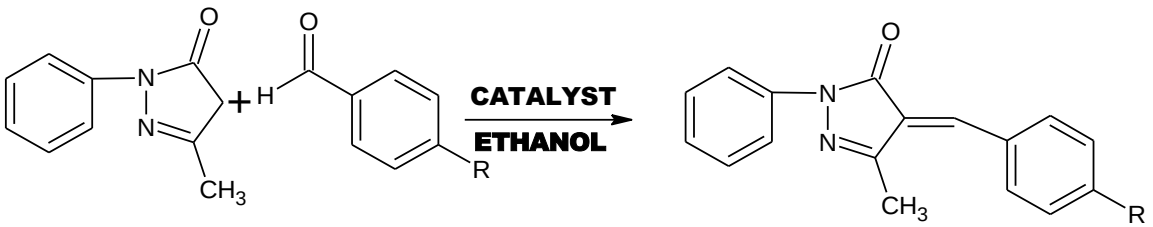

Table1. Screening of reaction in various N-doped TiO_2 catalyst materials.

Catalyst	Time	%Yield[b]
TN0	2hr	42
TN2	2 hr	55

TN4	2 hr	60
TN6	3 hr	82
TN8	2 hr	62
TN10	2 hr	55

Reaction conditions: benzaldehyde (4.71 mmol), Pyrazalone (4.51 mmol), and catalyst (10 wt %) in Ethanol (5 ml) at Refluxing Condition, [b]Obtained yields.

Table 2. Time and yield data of synthesized compounds using nanosized catalyst N-doped TiO_2 (TN6)

Compound	R	Time	%Yield[b]
1	H	2hr	65
2	Br	2.5 hr	70
3	NO_2	2 hr	60
4	CH_3	3 hr	67
5	OMe	2 hr	72
6	Cl	2 hr	68

Reaction conditions: benzaldehyde (4.71 mmol), Pyrazalone (4.51 mmol), and catalyst - TN6 (10 wt %) in Ethanol (5 ml) at Refluxing Condition, [b]Obtained yields.

Conclusion:

In nut shell we speculate that our methodology easy to handle and scale up. Nanocrystalline N-doped TiO_2 can become an alternative efficient catalyst for heterogeneous organic Pyrozolone derivative reaction. The catalyst used can be recycled and environmentally friendly. We believed our approach will be the alternative of homogeneous Knoevenagel condensation reaction.

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Review: Adsorption of Phenols, Heavy Metals, Organic Acids and Dyes from waste water.

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ABSTRACT

Phenol, heavy metals, organic acids and dyes are released into water bodies due to improper disposal methods and get considerable attention from environmentalists, due to their objectionable effects in the water environment. As a result, interest about environmental protection has raised over the years from a global perceptive. Therefore there is need for conducting the research for decreasing there concentration to permissible limit or modifying them to non-toxic and non-hazardous forms that may easily delivered into the environmental water bodies. Many methods are available for removal of these pollutants from water bodies but Adsorption process has been confirmed one of the best water treatment technologies. For adsorption process activated carbon is absolutely considered as useful adsorbent for the removal of pollutants from water. After all extensive use of commercial activated carbon is sometimes banned due to its higher costs. Research has been done to synthesize inexpensive

adsorbents using various agricultural waste materials. The cost of the waste disposal can be decreased by utilizing the waste material obtained from plant biomass consequently contributing to environmental protection. In this review, adsorption of phenols, heavy metals, organic acids and dyes by using different types of waste materials from literature has been studied and their adsorption capacities for phenol removal as available in the literature are presented.

Keywords: Adsorption, Locally available adsorbents, Phenol, Heavy metals, organic acids Wastewater treatment, Waste utilization, Adsorption capacities.

1. Introduction

Amount of waste water have been increased due to rapid development of industrial production throughout all over the world. The release of this wastewater into water bodies decreases water quality [1], and therefore this waste water cannot be directly used by some treatments like desalination as well as for industrial applications [2, 3]. Wastewater mostly consist of pollutants like phenols, heavy metals, organic acids and dyes which may be toxic and hazardous to humans and marine aquatic species, though it is present in very low concentrations. Phenol is one of the main pollutant discharged from waste water arises from chemical industries such as resins, paper, textile, plastic, rubber and fibres. Phenols are classified as highly harmful due to its carcinogenic properties [4]. Degradation of phenol by biological methods is very difficult even it is present at low concentration. Pesticides such as fungicides, herbicides, and insecticides are used to control pests and cultivate plants [5]. However, they can cause acute and chronic effects on humans and animals. Dyes are reported as a colored substance [6], which is used in various industries such as textiles, paper, leather and ink to impart colour. The waste water released from these industries is extremely colored which should be processed before discharge in order to obey environmental-protection laws.

In recent years various techniques [7] have been described by different researchers from all over the world to dispose of these pollutants from waste water such as, ozonation, oxidative process, kinetic coagulation, ionic exchange, irradiation, biological process, coagulation/flocculation, Fenton reagents and adsorption. Still, some of these techniques have major problems such as high costs, low adsorption capacity, heavy chemical consumption, large amount of sludge production and very slow process and. The adsorption process which is also called surface phenomenon has some benefits than other techniques [8], such as lower operating cost, simple design, lower capital cost, high adsorption capacity, low chemical consumption and very fast process. Now a day, researchers have been searching for low-cost adsorbents that can be developed by using natural materials, agricultural wastes and industrial wastes. The criteria of selection of these adsorbents mainly depends on some components [9] such as adsorption capacity, high surface area, and high pore volumes, low-cost production and desorption properties of adsorbents. Adsorption is taking place due to forces of attraction between adsorbate and adsorbent due to which deposition of pollutants is occurred on surface of adsorbents [10]. Ultimately, it can develop a monolayer [8] or multilayer (Figure 1) established on the experimental results obtained by adsorption. Researchers discovered that the adsorption process was spontaneous, pH dependent, favorable at low temperature and dependent on contact time as well as amount of adsorbent used. Adsorption process have two types such as Physical and chemical adsorption [11].

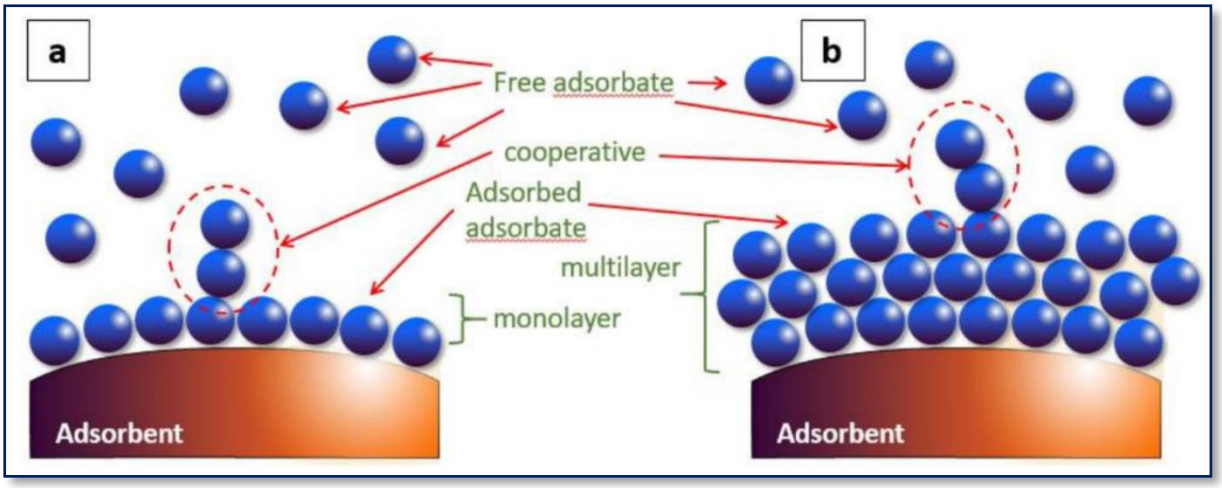

Fig.1: a) Monolayer formation b) Multilayer formation [11]

2. Literature survey of adsorption of phenols:

In 2008 B.H. Hammed and A.A. Rehman reported a work on activated carbon derived from rattan sawdust (ACR) was evaluated for its ability to remove phenol from an aqueous solution in a batch process. Equilibrium data fitted well to Langmuir model with maximum adsorption capacity of 149.25 mg/g. The pseudo-second-order kinetic model best described the adsorption process.

In 2014 H.Cherifi F. Bentahar, S. Hanini reported a work on the adsorption of phenol onto dried biomass of pleurotus Mutilus as a function of initial phenol concentration, temperature, and particle sizes. The results show that experimental data fit perfectly the Langmuir model.

In 2013 Abdolmajid Gholizadeh reported a work on two sorbents, rice bran ash (RBA) and biomass of two sorbents, rice ash (RBA) and biomass of brown algae, Cystoseiraindica were used and results were compared with the commercially granular activated carbon (GAC). This study includes removal of phenol (Ph), 2-chlorophenol (2-CP) and 4-chlorophenol (4-CP). The phenolic compounds were determined using HPLC under batch

equilibrium condition. Results indicated that RBA and GAC had the lowest efficiency for the removal of 2-CP. Kinetic studies Kinetic studies suggested that the pseudo-second order best fitted the kinetic data.

In 2014 C.R.Girish and V. Ramchandra Murty reported a work on Lantana camara, a forest waste, as an adsorbent for the phenol reduction in waste water. Batch studies were conducted with adsorbent treated with HCl and KOH. Thermodynamic parameters like the Gibbs free energy ($\Delta G\circ$), enthalpy ($\Delta H\circ$), and entropy ($\Delta S\circ$) were also determined and they showed that head sorption process was feasible, spontaneous, and exothermic in the temperature range of 298–328K. The kinetic data were fitted with pseudo-second-order model. The equilibrium data that followed Langmuir model with the monolayer adsorption capacity was found to be112.5mg/g and 91.07mg/g for adsorbent treated with HCl and KOH, respectively, for the concentration of phenol ranging from 25 to 250mg/L.

In 2015 Bhajan Das reported work on adsorption of phenols on biomass of powdered branches of acacia nilotica (PBAN) and activated PBAN. Adsorption isotherm models of Langmuir, Freundlich, Temkin and Dubinin- Radushkevich were found to be fitting to experimental data for phenol adsorption for various concentration ranges between 0 and 832µg/l. Kinetic models were also applied on kinetic experiments of adsorption of phenol on activated PBAN. It was found that pseudo-first-order explains the process appropriately.

In 2018 Xiaiei Li and Feiqiang Guo reported a work on biomass activated carbon (AC) which has been prepared by CO2 activation from pine sawdust. The maximum monolayer capacity (qm) of PS-800-90 obtained by Langmuir model was 161.03 mg/g at 298K. Spontaneous ($\Delta G^o < 0$) and exothermic ($\Delta H^o < 0$) nature of adsorption

process was obtained through thermodynamic study, indicating that increase of temperature was unfavorable to adsorption.

In 2019 Lygeri Papaoikonomou & Konstantinos Labanaris reported a work on adsorption of olive mill wastewater phenolic compounds `on a juice industry by-product, pomegranate seed, The maximum phenols uptake observed was 92.8% after 10 min, at 30°C and a pH of 5.0, with an initial sorbate concentration of 162.5mg/L, adsorbent mass concentration of 0.02g/mL, and a sorbent particle size of 0.922 mm. The experimental data were best fitted to the Langmuir model, whereas the kinetic data followed the pseudo-first-order kinetic model. The consolidated survey of phenol adsorption on to biomass is indicated in the table-I.

Name of Phenol	**Name of plant biomass**	**Particle size**	**Concentration**	**Material dose**	**Contact time**	**Agitation speed**	**Temperature**	**pH**	**Maximum adsorption capacity**	**Ref.**
Analytical grade phenol	Rattan saw dust	150um	25,50,100,150, 200 mg/l	200mg	30,60,90, 120,150,180,300,450,6001500min	120rpm	30◦C	3,4,5,6,7,8,9,10	149.25mg/g	[12]
Phenol, 2-chlorophenol, 4-Chlorophenol	C.indica Brown algae, Rice bran ash,GAC	0.5 to 2mm	50,100,200,400 mg/l	100,150,200, 250,300,350, 400mg	5,15,30,45,60,120, 180,240,300 min	150rpm	25◦C	3,5,7,9,11	pH=4.85mg/g,2pH=4.47mg/g, 4 pH=4.47 mg/g	[13]
Analytical grade phenol	Lantana camara, HCl treated, KOH treated	Less than 0.075mm	25,50,100,150,200,250mg/l	0.25,0.50,1,1.25,1.50,1.75, 2,2.5gm	25,50,100,125,150, 175,200,225,250,275,300,325,350,375, 400min	140rpm	25◦C, 35◦C, 45◦C, 55◦C,	2,3,4,5,6,7,8,9,10,11	HCl treated=112.5mg/g, KOH treated=91.7mg/g	[14]

Analytical grade phenol	Acacia nilotica branches, Phosphated	250 microns	96mg/l to1000mg/l	100mg to 2500mg	0.5,1,2,3,4,5,6,7,8 H	50,100, 15,200, 250rpm	25◦C	2,4,6,8,10,12		[15]
Analytical grade phenol	Chinese herb residue, BC 400, BC500, BC 600	60 microns	20,30,40,50,60,70,80,90,100mg/l	100mg	5,10,20,30,45,60,90,120,150,180,210,300,360,420,480min	150 rpm	25◦C	6	BC400=48.54%,BC500=90%,BC600=92.69%	[16]
Analytical grade phenol	Pine sawdust	74 microns	80,100,120mg/l	150mg	10,20,30,40,50,60,70,80,90,100,125,150,175,200,250,300,350,500,600	150 rpm	25◦C, 35◦C, 45◦C	2,4,6,8,10,12	158.94mg/g	[17]
Olive mill wastewater phenolicc ompounds	pomegranate seed	2.00, 1.17, 0.840, 0.594, and 0.209 mm	100,200, 300,400 500 mg/l	20,30, 40,50 mg	5,10,15,20 min	100 rpm	30◦C, 40◦C, 50◦C	4,5. 6.8	58.82mg/g	[18]

Table-I: Adsorption of phenols onto different types of biosorbent.

3. Adsorption of organic acids:

The quality of water is decreasing due to population growth, industrialization, lack of planning for urbanization and unprocessed utilization of natural water resources. Many organic acids are discharged into wastewater during the production. Oxalic acid, Acetic acid, carboxylic acid and Maleic acid and are reported to be toxic to human health as well as animals in water bodies. Many water treatment technologies are available to control and minimize water pollution. However, most of the methods are low removal capacities, absence of regeneration, complicated, high operational and high maintenance costs. Comparatively, the adsorption process is considered a better alternative in wastewater treatment because of low cost, high

adsorption capacity in very short time, convenience, ease of operation, simplicity in design and regeneration of adsorbent.

Adsorption is actually mass transfer phenomenon that consists of the accumulation of substances at the interface of two-phases [11]. The adsorption process is the most recommended technique applicable for the withdrawal of dissolved pollutants that are present in the water after various chemical treatments. Activated carbon is the most commonly used adsorbent in this process. Its increasing use is often banned due to its higher cost. Agricultural wastes are present in large amount and can be used as sources of low-cost adsorbents. A large variety of low-cost adsorbents obtained from plant materials have been examined for their ability to withdraw different types of pollutants from wastewater.

Following table shows literature survey of adsorption of organic acids on agricultural waste by using titration method. In flasks organic acid and distilled water were added in increasing concentrations. 5ml of the solution from each flask is titrated separately against NaOH using the Phenolphthalein indicator. The endpoint obtained was colourless to pink colour. The adsorption process of organic acid was performed by contacting various material dose of dried biomass powder with known concentrations of the acid in respected flasks. The mixture in the flasks was stirred for various times. After stirring, the solutions were filtered through filter paper. The amounts of the acid after equilibration were quantified by titrations of the filtrate solutions against NaOH using phenolphthalein indicator. The resulting solution turned to a pink colour. The percentage adsorption capacity was determined and estimated. The consolidated survey of organic acids adsorption on to biomass is indicated in the table-II as under.

Table-II: Adsorption of Organic acids onto different types of biosorbent.

Organic acid	Biomass And particle size	Concentration of org. acid	Stirring time	Titration against	Indicator	Amount of adsorption	Ref.
Acetic acid	Charcoal	0.008to0.08mol /L	3h	Std NaOH	Phenolphthalein	420.12 mg/g	[20]
Maleic acid & oxalic acid	Tamarind seeds	0.0125to 0.3mol/L	5 to 90 min	0.02M NaOH	Phenolphthalein	OA= 420.12mg/g MA= 723.38mg/g	[21]
oxalic acid	Pineapple peels &leaves	50mM, 150mM,250mM	2h	Std NaOH	Phenolphthalein	50mM=60.01%, 150mM=87.20 %, 250mM=96.25 %	[22]
Lauric acid &1-methyl cyclohexane carboxylic acid	Wheat straw	0 to 12.5mg/L		0.01N NaOH	Phenolphthalein	98%	[23]
Acetic acid	Polyalthia longifolia seeds	0.5N	3h	0.1N NaOH	Phenolphthalein	27 mg/g	[24]

4. Adsorption of heavy metals:

Many hazardous heavy metals have been released into the environment as industrial wastes which causes serious soil and water pollution, therefore scientist have requirement for advanced water treatment technologies to remove these pollutants. For heavy metal removal various techniques are available such as precipitation, ion-exchange, flocculation, reverse osmosis, electrolysis, ultrafiltration, adsorption and coagulation [53]. Out of these methods which are discussed earlier adsorption and ion exchange are the most common technologies used in recent wastewater treatment process. These techniques are particularly competitive and effective process for the elimination of heavy metals at trace quantities.

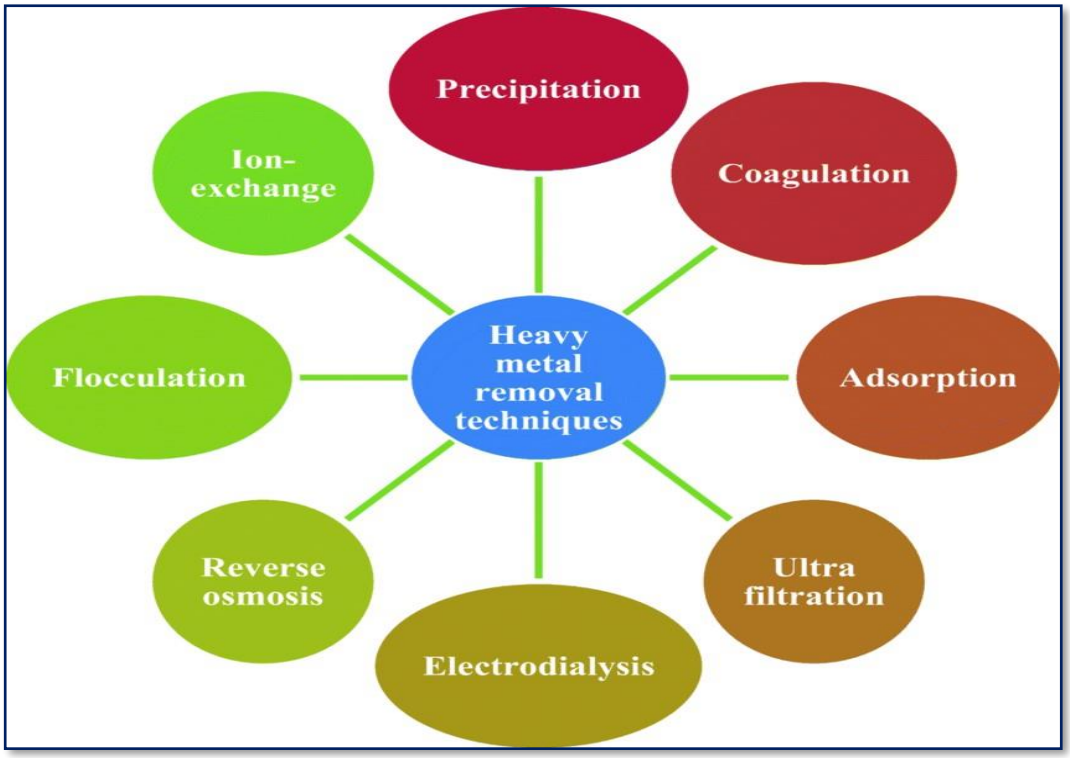

Fig. 2: Heavy metal removal techniques [53]

There are many studies discussed in literature about removing heavy metal by utilizing zeolite by batch experiment, still not sufficient data was observed about using the column experiment. The column method was used to remove the heavy metal ions [54]. As shown in figure 3, the chromatographic glass column was used in the literature study. Various dimension and internal diameter of the column was used as shown in a Table III. The packing of column was conducted with proper care to avoid any void spaces, channels and cracks in the bed. The top of bed column was layered by glass bead to avoid bed expansion. The biomass-packed column was held vertically with the help of stand and clamp, washed thrice with deionised water to stabilize the packing and remove any contaminant. The sample solution was passed through the adsorption column at a flow rate of controlled by pump system. In order to prevent the loss of biomass, glass wool and a thin layer of sand was inserted into the bottom of the column. The column removal experiments were conducted at ambient temperature, pH, and biomass dose and flow rate and in duplicates. The final metal concentrations in the filtrate were

determined with AAS. The breakthrough curve was plotted Count C in versus t (min) where Count is metal concentration from column outlet and C in represent the initial metal concentration (mg/L), while t is duration in minute at which breakthrough was obtained.

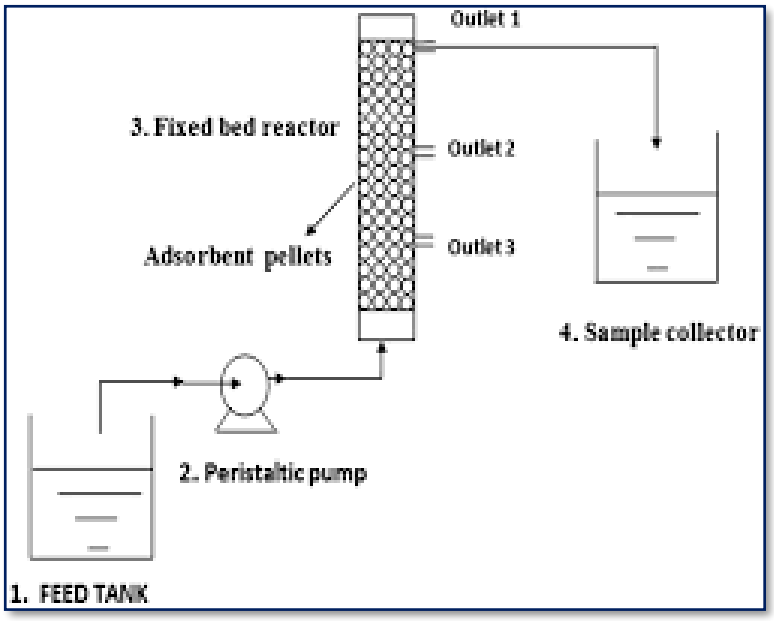

Fig.3: Model of Adsorption of heavy metals using column method [54].

Following table shows literature survey of adsorption of heavy metals on agro waste biomass by using column chromatography method. The consolidated survey of Heavy metals adsorption on to biomass is indicated in the table-III as under. Comparison of Metal Removal Efficiencies of the different adsorbents in batch and column methods [19] which indicated that metal uptake capacity was higher in column method than batch method. Column methods are appreciable in metal removal from different type of water and wastewater.

Table-III: Adsorption of Heavy Metals onto different types of biosorbent.

Metal	Adsorbent	Flowrate (ml/min)	Removal Efficiency (mg/g)	References
Zn(II)	Azolla filiculoid	480ml/h	31.3	[25]
Cr(IV)	Waste pomace	5-20	19.8	[26]
Cr(VI)	Guava seeds 1		10.5	[27]
Pb(II)	Coconut shell	50	2.0132	[28]
Ni(II),Zn(II)	Saw dust	10	15(10)	[29]
Cu(II)	Acacia leucocephalabark powder 6		147.1	[30]
Ni(II)	Caesalpinia bonducella Seed Powder		188.7	[31]
Ni(II)	Mustard oil cake	1	4.5(9.5)	[32]
Cu(II)	Olive stone		2.19	[33]
Pb(II)	Olive stone		6.59	[33]
Cu(VI)	Mosambi Peel		250	[34]
Pb(II)	Sunflower stalk		182	[35]
Cd(II)	Sunflower stalk		70	[35]
Cu(II)	Rice husk		22.5	[36]
Cu(II)	Casava peel 8		8.00	[37]
Cr(II)	Oil palm root 7			[38]
Pb(II)	Oil palm root		150	[38]
Pb(II)	Watermelon rind	1-3	55	[39]
Cr(VI)	Peanut almond shell	10-20	20.47-100%	[40]

5. Adsorption of dyes:

Industries such as paper, plastics, fibres, textile, leather, etc., are some of the sources for dye effluents. They discharged dyes in water streams have high a risk of Eco toxicity and it will result in bioaccumulation of dyes for decades. These reported dyes have serious harmful effects on humans and water bodies. It may cause nausea, mental confusion, vomiting, diarrhoea and gastritis. Consumption of a large amount creates hazardous effects on body such as abdominal and chest pain, painful effects micturition severe headache, profuse sweating, and methemoglobinemia-like syndromes. Therefore, removal of dyes from wastewater is most important in water pollution treatment plants. Various conventional waste water treatment technologies for dye removal have been investigated extensively, such as biological treatment, chemical oxidation, reverse osmosis, adsorption, coagulation and reverse osmosis. Adsorption was found to be advantageous to other techniques for water re-use in terms of low cost, simplicity of design, ease of operation, regeneration and insensitivity to toxic substances. Following literature survey shows use of agro-waste for removal of dyes from industrial waste water by using adsorption process. These include different adsorbents obtained from plant waste materials such as Luffa cylindrica fibers, spent corncob substrate, pomelo (Citrus grandis) peel, wheat shells, , Posidonia oceanica (L.), sunflower seed shells, olive pomace, fibres, , palm kernel fibre, phoenix tree's leaves and Date palm (Phoenix dactylifera L.) is a member of the family Arecaceae (palm family). Biomass having various particle sizes has taken for study. Sieved biomass having very low particle size gives higher adsorption capacity than crushed and powdered biomass. Chemically treated biomass such as sulphated, nitrated, phosphated and carbonized form gives highest adsorption capacity than untreated biomass. Figure 4 shows schematic representation of preparation and utilization of porous carbon prepared by giving chemical treatment to leaves [52]. The porous carbon was then used in adsorption of dyes such as Methylene blue, Rhoda mine blue and Methyl orange wastewater.

Figure 5 shows change in colour before and after adsorption. Good dye adsorption property of porous carbons is often a due to their large surface area, microporous structure, and high level surface activities which can be observed using SEM images. The literature survey of various organic dyes adsorption on to biomass is indicated in the table-III as under.

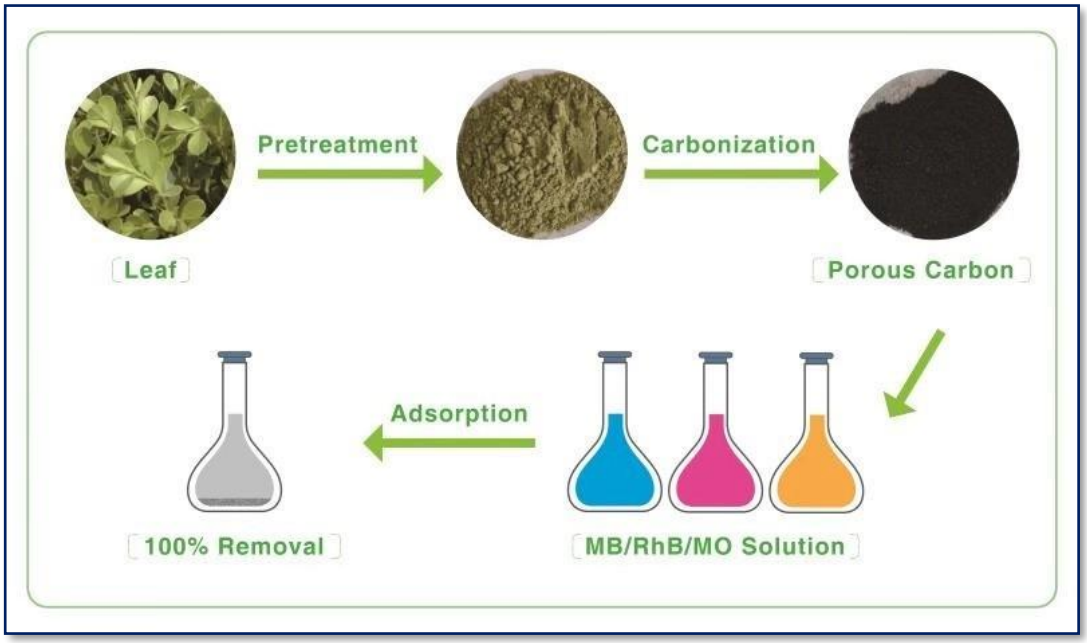

Fig. 4. Schematic representation of the preparation and application of porous carbons on dyes MB, RhB and MO from wastewater [52].

Fig. 5: Change in colour of MB, RhB and MO before and after adsorption on porous carbon [52]

Table-IV: Adsorption of Dyes onto different types of biosorbent.

Adsorbents	Dye	Equilibrium time	Temp.	Qe(mg/g)	References
Teak tree bark	Methylene blue	30 min	30^0C	333.3	[41]
Sunflower seed husk	Methylene blue	4 hrs	25^0C	45.25	[42]
Hazelnut shell	Methylene blue	60 min	20^0C	76.9	[43]
Walnut sawdust	Methylene blue	60 min	20^0C	59.17	[43]
Neem Bark	Malachite Green	420min.	25^0C	0.36	[44]
Tamarind Shell	Congo red	240min	30^0C	10.48	[45]
Neem leaf powder	Congo red	300min	27^0C	72	[46]
Grape fruit peel	Reactive blue	19.45min	25^0C	12.53	[47]
Wheat straw	Basic Yellow	48 hrs	20^0C	71.43	[48]
Hazelnut shell	Acid Blue	60 min	20^0C	60.2	[49]
Pitch Pine saw dust	Acid Blue	60 min	20^0C	27.5	[49]
Sessile oak	Congo Red	360min	25^0C	1.3	*[50]*
Cornulaca monacantha stem	Congo Red		55°C		[51]

6. Conclusions and Future Perspective:

Phenols, heavy metals, organic acids and dyes present in waste water cause water pollution. Due to widespread industrialization and urbanization water pollution and soil pollution become serious health problem to humans and water bodies (plants and animals). Various methods have been discussed in this review but adsorption is preferred because of its lower operating cost, simple design, lower capital cost, high adsorption capacity, low chemical consumption and very fast process. From this literature review the experimental findings obtained which declared that different low-cost adsorbents, such as activated carbon, plant leaves, barks, steam part, fruit peels, clay, fly and industrial waste can be used to remove these pollutants from

wastewater. This is possible because these adsorbents have a very high surface area and excellent porosity structure shown by SEM, TEM characterization techniques useful for improving the adsorption capacity. Thermodynamic studies revealed that adsorption is a spontaneous process. In the future, raw materials for activated carbon may be produced from agricultural waste materials due to its low cost, easy and bulk availability, regeneration of chemicals, reduced solid waste management, increased profitability, enhanced crop value and reduced environmental pollution.

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Synthesis, Characterization of derivatives of 1, 1'-binaphthalene]-2, 2'-diol

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Abstract:

BINOL (1, 1'-bi-2-naphthol) is used as a chiral ligand for many asymmetric reactions. In this a green chemistry approach was used for the preparation of BINOL by the oxidative coupling of 2-naphthol using Cu-Montmorillonite, a green material. Results obtained were compared with conventional method i.e., the $FeCl_3$ catalyzed oxidative coupling of 2-naphthol. The physical characterization includes % yield, M.P., etc, parameters were measure for newly synthesized derivative were characterized by FTIR and ^{1}HNMR, ^{13}C-NMR, XRD etc spectral methods and bioactivity of the newly synthesized derivatives will studied.

Keywords- BINOL, oxidative coupling, 2-naphthol, Cu- Montmorillonite.

INTRODUCTION:

Green Chemistry is defined as invention, design, development and application of chemical products and processes to reduce or to eliminate the use and generation of substances hazardous to human health and environment. Prime focus for chemists now is to develop synthetic methods that are less polluting i.e., to design green chemical transformation. The chemical process should be such that it doesn't cause permanent damage to the environment. Therefore, ways to minimize the damage caused by raw materials and process should be done. Though it is expensive but it leads to environment friendly condition. Natural aluminosilicates like clays and zeolites are solid acids that are used to substitute liquid acids in chemical transformation. (Gates 2003) Among these clays and modified clays are gaining interest due to

their versatile properties. (Balogh and Laszlo, 1993; Benesi and Winquest, 1978; Theng, 1974; Vaccari, 1999) The most common modified clays applied in organic synthesis are K-10 and KSF montmorillonites. Their physicochemical properties are sameas that of the natural clays but their BET surface areas are different. Developments of clay catalyzed reactions are important in green chemistry point of view and they produce less hazardous waste products. Clay minerals as such or after modification/treatment can be used are solid acid catalyst. It exhibits both Bronsted as well as Lewis acidity, hence finds application in a wide range of organic transformations. (Cativiela et al. 1993; Cseri et al., 1995). Montmorillonite (MMT) having chemical formula $Al_2Si_4O_{10}(OH)_2$ nH_2O and have variable moisture content. The crystalline structure of MMT consists of multiple layers and each layer made up of one octahedral alumina sheet sandwiched between two tetrahedral silica sheets1, 1'-bi-2-naphthol (BINOL) has become an important chiral auxiliary for asymmetric synthesis and due to its high degree of utility various synthetic approaches have been developed. Generally, for BINOL synthesis transition metals have been used as catalysts or oxidants. For the transition metal-catalyzed and promoted reactions, the most frequently employed metals are Fe (III) and Cu (II), though oxidations utilizing Mn (III), Ti (IV) and (V) have also been reported. There have been some known methods for the oxidative coupling of 2-naphthols using$FeCl_3$, K_3Fe (CN) $_6$, Mn (AcAc) $_3$, CuCl (OH), $CuSO_4$ (Al_2O_3) and Cu (II)–amine complexes as coupling reagents. In addition to solution-phase oxidation with $FeCl_3$ and Cu (II)/amine complexes, a number of metal complexes have been immobilized on solid supports for use in this reaction. Although such supported reagents offer some advantages with regard to ease of isolation of products, typically high volumes of organic solvents have been used for this oxidation reaction. (Between 10–20mL of either xylene or chlorobenzene per millimole of 2- naphthol), which are not at all a green chemistry approach. Solvent less systems have also been reported, one of

them is preparation of BINOL by heating of a powdered mixture of $FeCl_3$ and 2-naphthol both with and without microwave irradiation.

EXPERIMENTAL

A mixture of 2-naphthol (2.88 g) and iron (III) chloride (0.7 g) with 2 drops of water in an agate (or porcelain) mortar pestle was grinded for about 20minutes. The mixture was allowed to stand for about 2 hrs with a little grinding now and then. The mixture was transferred with water (40 ml) into a 100 ml beaker and boiled for 10-15 minutes. The mixture was cooled and the solid was filtered, washed with boiling water (10 ml), dried and recrystallized from toluene. m.p. 214-217 ^oC. In the present work a mechanical method, grinding, melt of 2-naphthol with copper montmorillonite clay was attempted for the coupling reaction. Result obtained was also compared with the product formed by the procedure suggested elsewhere. Cu-Montmorillonite was prepared by slurring montmorillonite clay (1.5g) with 0.5M aqueous solution of Cu $(CH_3CO_2)_2$ at room temperature and stirred for 2hrs. It was left overnight and then filtered and washed with water. It was dried in oven for 2hrs and solid yellow colored Cu- montmorillonite clay was obtained.2-naphthol and Cu-montmorillonite clay was heated separately till molten state obtained. It was then grinded together in molten state. 1,1'-bi-2-naphthol was obtained. It has been checked with thin layer chromatography (TLC) with the authenticated BINOL prepared and its melting point.

Synthesis of 1, 1'-binaphthalene]-2, 2'-diyl diacetate (II)

1,1'-binaphthalene]-2,2'-diol mixed with the pinch of zinc dust and 5 ml of acetic acid heated strongly for the period of 1 Hr. in the round bottom flask yielded the 1,1'-binaphthalene]-2,2'-diyl diacetate (II) which is recrystallized by suing redistilled ethyl alcohol. The product II dried and conversion monitored by TLC technique. The yield of product found to be 83%.

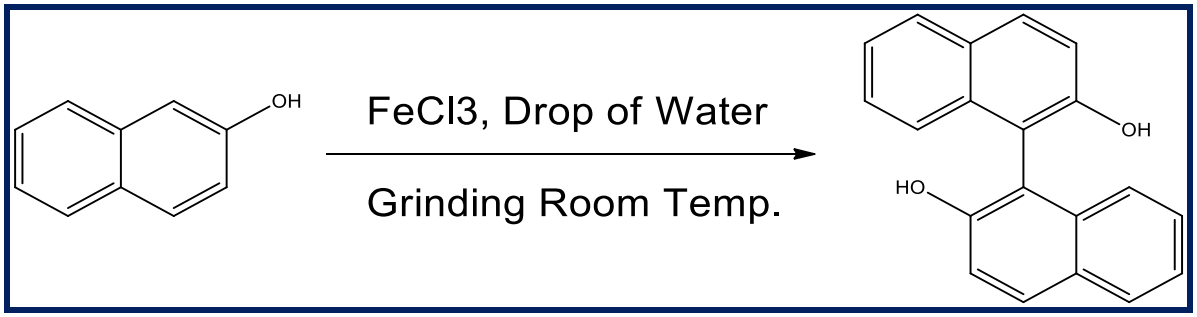
Synthesis of 2, 2'-bis ((phenyldiazenyl) oxy)-1, 1'-binaphthaleneIII)

The extra pure 1,1'-binaphthalene]-2,2'-diol coupled benzyldiazonium chloride in a slightly acidic medium and heated strongly for the period of 2 Hrs.in the round bottom flask using water condenser to yielded the 2,2'-bis((phenyldiazenyl)oxy)-1,1'-binaphthalene (III). This is then recrystallized by suing redistilled ethyl alcohol. The product III dried and conversion monitored by TLC technique. The yield of product found to be 80%.

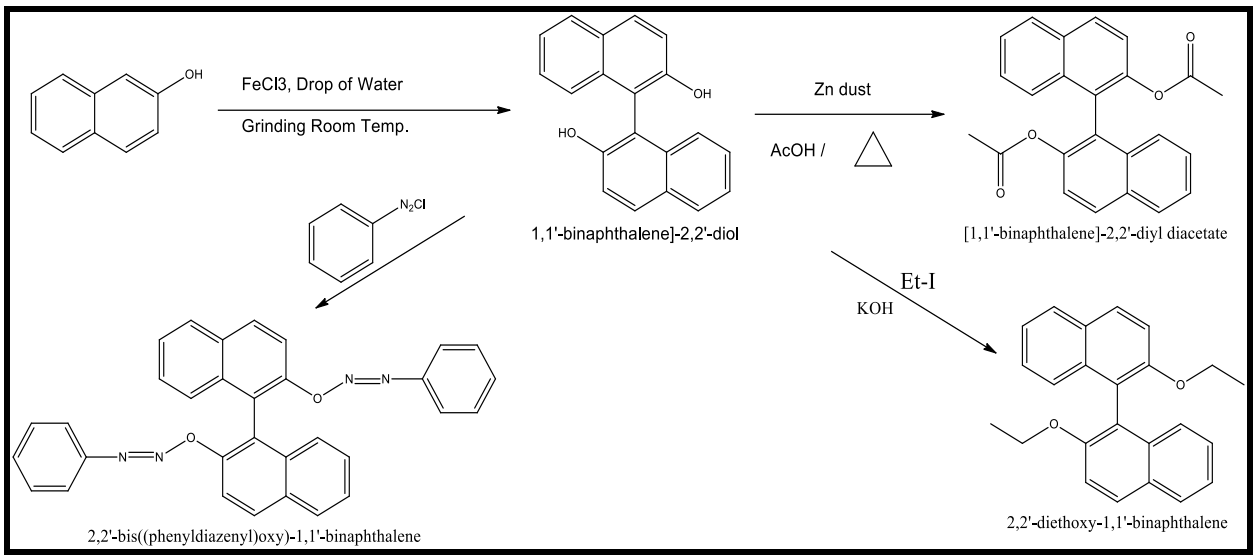
Synthesis of 2, 2'-diethoxy-1, 1'-binaphthalene (IV)

The extra pure 1,1'-binaphthalene]-2,2'-diol(I) is mixed with ethyl iodide with few Drops of alkaline KOH medium and heated strongly for the period of about 2 Hrs. in the round bottom flask using water condenser to yielded the Synthesis of 2,2'-diethoxy-1,1'-binaphthalene (IV) .This is then recrystallized by suing redistilled ethyl alcohol. The product IV dried and conversion monitored by TLC technique. The yield of product found to be 80%.

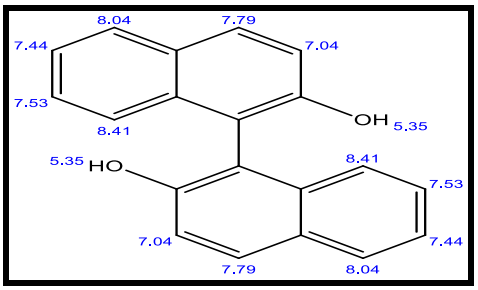
(Scheme –I)



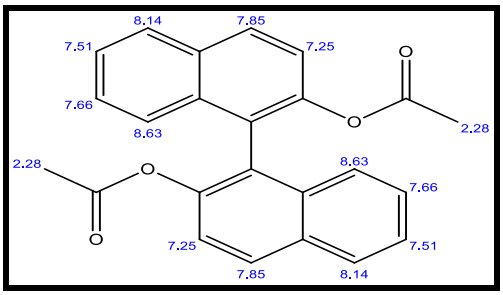
(Scheme –II)



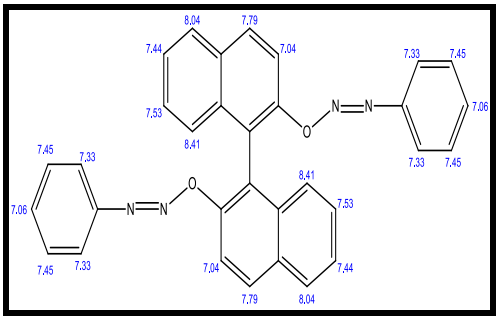
Characterization^{1}*HNMR*



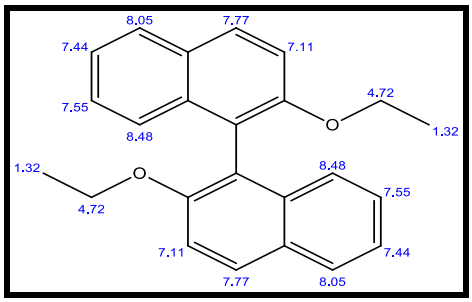
I (1, 1'-binaphthalene]-2, 2'-diol)



II (1, 1'-binaphthalene]-2, 2'-diyl diacetate)



III (2, 2'-bis ((phenyldiazenyl) oxy)-1, 1'-binaphthalene)



IV (2, 2'-diethoxy-1, 1'-binaphthalene)

RESULTS AND DISCUSSION

The diffractograms of reaction mixture Cu- montmorillonite clay and 2-naphthol showed similar pattern with that of $FeCl_3$ and 2-naphthol, indicating similar nature of reaction products. Results from the FTIR showed an appearance of peaks in the Cu-montmorillonite and 2-

naphthol around 3300 cm^{-1} similar to that of 2-naphthol and $FeCl_3$ reaction mixture, which were very much different from the FTIR spectra of Cu-montmorillonite. This indicated similarity of reaction products. The product was also compared with the BINOL prepared from standard reflux method with the FTIR spectra. The yield of reaction is 3g about 90% efficient method easily available catalyst Reaction is performed with simple grinding at room temperature without any solvent Work up of the reaction involves aqueous medium. The newly synthesized compound I, II, III, and IV will be characterized with different spectral methods like 13CMR, XRD etc and their bioactivity study is under process. Literature survey show large numbers of bioactivity of the binol and its derivatives functions like *endo* and *ecto* parasiticide. It could be concluded from the compound obtained by green synthesis were characterized by FTIR and ^{1}HNMR^{13}CNMR, XRD etc spectral methods. It is better to prevent waste than to treat or clean up waste after it is formed. Synthetic methods should be designed to maximize the incorporation of all materials used in the process into the final product. Substances and the forms of the substance used in chemical reaction should be chosen so as to minimize the potential of chemical accidents, including releases, explosions, and fires. Wherever practicable, synthetic methodologies should be designed to use and generate substances that possess little or no toxicity to human health and the environment. The use of auxiliary substances (e.g. solvents, separation agents *etc*.) should be made unnecessary wherever possible and, innocuous when use Chemical products should be designed to preserve efficacy of function while reducing toxicity. Energy requirements should be recognized for their environmental and economic impacts and should be minimized. Synthetic methods should be conducted at ambient temperature and pressure. Unnecessary derivatization (blocking group, protection/deportation, and temporary modification of physical/chemical processes) should be avoided whenever possible. A raw material feedstock should be renewable rather than depleting whenever technically and economically practical. Catalytic reagents (as

selective as possible) are superior to stoichiometric reagents. Analytical methodologies need to be further developed to allow for real-time in-process monitoring and control prior to the formation of hazardous substances. Chemical products should be designed so that at the end of their function they do not persist in the environment and break down into innocuous degradation product.

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Physico-chemical Analysis of Mine Water from Supe Village Tal. Karjat Dist. Ahmednagar. MH. India

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ABSTRACT:

Water is an important part of aquatic ecosystem. The Physico chemical characters of water is directly impact on quality of water. The objectives of the present study were to assess the ecosystem of water in mine in Supe Tal. Karjat Dist. Ahmednagar by estimating the various physicochemical parameters like pH, Temperature, Total dissolved solids, Total Alkalinity, Total hardness, Phosphorus, Nitrate, Turbidity, Fluoride, chloride, Dissolved Oxygen, Ammonia, Iron, Turbidity and Conductivity. The conclusion of given study was pH, total alkalinity, total hardness, chlorine etc., were beyond the permissible limit. So, the mine pond water considered as polluted water. The physico-chemical characteristics of mine pond water suggested that there was harmful to pisi culture, irrigation and drinking water.

KEYWORDS: Karjat, Physicochemical Analysis, Mine Water, etc.

INTRODUCTION

Water is one of the most important abiotic compounds of the ecosystem. All living things on the earth need water for their growth and survival. On the earth about 70 % of water. Due to increased human population, urbanization and all human activity water is majorly polluted with different harmful chemicals and other pollutant.

Pollution of water is measured by assessing the physiochemical parameters of water. Physico-chemical analysis is the prime consideration to assess the quality of water for its best utilization like drinking, agriculture, aquaculture, and different industrial purpose and helpful in understanding the different processes, interaction between the seasonal and biological processes in the water.

The present study was to assess the ecosystem of water in mine in Supe Tal. Karjat Dist. Ahmednagar by estimating the various physicochemical parameters like pH, Temperature, Total dissolved solids, Total Alkalinity, Total hardness, Phosphorus, Nitrate, Turbidity, Fluoride, chloride, Dissolved Oxygen, Ammonia, Iron, Turbidity and Conductivity.

MATERIAL AND METHOD

Study area

The study area water in mine in Supe Tal. Karjat Dist. Ahmednagar it was located in Latitude: 18.635208, Longitude: 74. 999736. Study was conducted from August 2020 – March 2021. Water sample from pond (mine) was collected every month (Figure 1).

Sampling Stations:

The Sample was collected from different sites of mine i.e.

Site A: East site of mine

Site B: West site of mine

Site c: North site of mine

Site D: South site of mine

Analytical Method:

The collected mine water samples were immediately brought in to Laboratory for the analysis of various Physico- chemical characters. The physical parameters such as temperature of air, water and pH were recorded by using Thermometer and Digital pH Meter. The TDS of water t was measured by using Water analysis kit.

The chemical analysis of water such as dissolved oxygen, total alkalinity, hardness and total dissolved solids etc. were detected by standard methods in the laboratory as per the standard literature. The temperature, pH, and EC like physical parameters of the water samples were instrumentally measured by using Digital analysis kit respectively,[1]. Water depth was observed using a meter scale, and TH of water was determined through titration with an EDTA conjoining Eriochrome Black T indicator [1].

Result and Discussion:

Table 1: Physico-chemical Parameters of Mine Water of Supe Village.

Month / Parameters	**June**	**July**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Mean**
Temperature °c	26	25	25	26	32	28	27	23	24	33	27
TDS mg/L	2305	2340	2740	2526	674	403	453	537	1026	1009	1171
pH	7.3	7.5	7.6	7.5	8.8	8.1	8.7	8.4	7.7	8.5	6.5
Total Alkalinity	176	180	186	129	81	109	89	162	271	226	200
Total Hardness	345	340	364	323	125	89	48	137	202	116	200
Free CO2	1.06	1.04	1.05	1.09	0.98	2.32	4.34	3.65	2.54	1.89	2.23
DO	1.10	1.54	1.68	0.56	2.00	1.44	1.24	1.96	2.8	2.16	1.73

The results are Showed in below (Tab.1). The Temperature was found in the range of 23^0C to 33^0c. The minimum temperature in the month of January and the maximum temperature was a in the month of March. Similar study, Jayabhaye et al [4][10], Observed that during Summer, Water Temperature was high due to Low Water Level, High Temperature and clear atmosphere [10]. Water Temperature Plays an Important role which affects the chemical, Biochemical and Biological Parameters of water body. The pH was found in the 7.3 to 8.8 range. The

minimum pH was in the month of June and the maximum value was in the October. According to [2] the pH of a water body is very important in determination of water quality since it affects other chemical reactions such as solubility and metal toxicity. The TDS was found in the range of 403 to 2740 mg/L. The minimum TDS was in the month of November and the maximum value was in the month of August. This result was supported by the finding of [7]. The Dissolve Oxygen was found in the range 1.10 Mg/L to 2.8 Mg/L. The minimum pH was in the June and the maximum pH was in the February month. The free CO2 was in the range of 1.04 to 4.34 Mg/L. The minimum free CO2 was found in the Month of July and minimum in the December Month. The total alkalinity was in the range of 81 to 271 Mg/L. The minimum range was in the October and the maximum range was in the month February. Hujare also investigated similar results that it was maximum in summer and minimum in winter due to high photosynthetic rate [3]. The hardness was in the range of 48 Mg/L to 364 Mg/L. The minimum value in the month December and the maximum value was in the August.

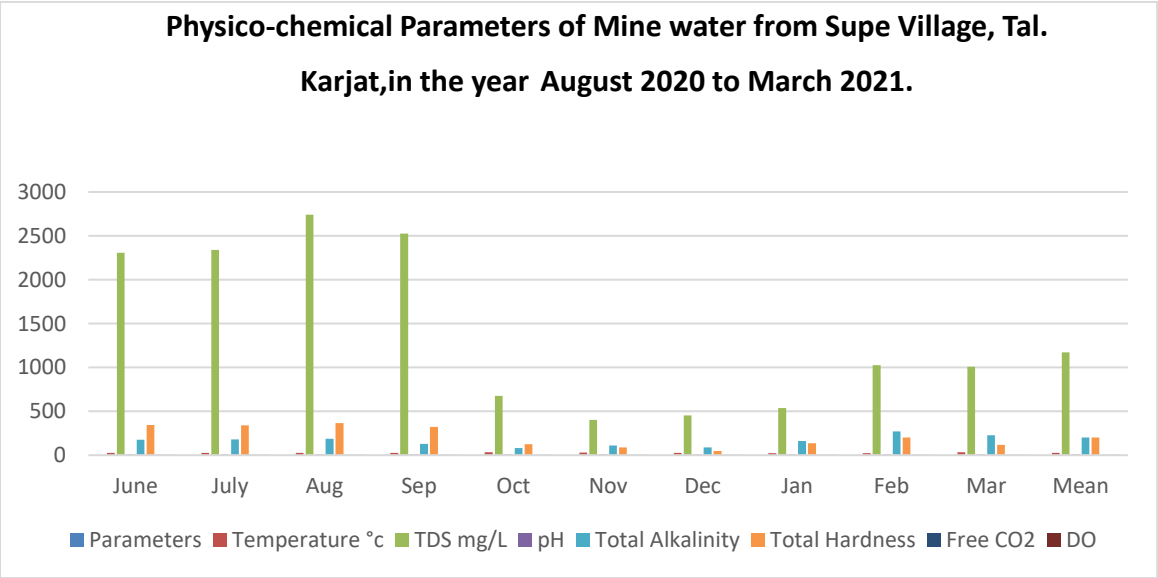

Fig.1: Graphical representation of physico-chemical parameters of mine water

Conclusion

A study of Physico-chemical parameters of water in mine in Supe Tal. Karjat Dist. Ahmednagarwas carried out by taking convinced important parameters like temperature, pH, dissolved oxygen, total alkalinity, total hardness, chlorides, phosphate, etc.in the period of August 2020 to March 2021.

In present investigation pH, total alkalinity, total hardness, chlorine etc., were beyond the permissible limit. So, the mine pond water considered as polluted water.

The physico-chemical characteristics of mine pond water suggested that there was harmful to pisiculture, irrigation and drinking water.

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Effect of Proline-based Deep Eutectic Solvent on Reactivity of Aromatic Nucleophilic Substitution

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Abstract

Nucleophilic aromatic substitution of halogens in electron-deficient arenes follows the SNAr mechanism and is a process of great importance with wide applications in extremely challenging organic syntheses. SNAr reaction is very sensitive to the solvent; hence the choice of solvent is known to play a key role in determining the outcomes of the reaction. Judicious choice of the reaction medium has been used to influence the yield and selectivity. The ever-increasing demand for environmental safety has required replacing conventional organic solvents and using "green" solvents as reaction media. The nucleophilic amination reactions of 1-fluoro-2,4-dinitrobenzenes in deep eutectic solvents can improve the reaction outcomes as well as its handling and workup using water by completely eliminating use of organic solvents.

Introduction

Aromatic nucleophilic substitutions reactions are a synthetically important class of organic transformations [1]. Aromatic nucleophilic substitutions reactions have been used to synthesize a

variety of substrates such as *ortho*-alkoxybenzaldehydes[2], aryl-aryl ethers[3], carbohydrate-aryl ethers[4], tertiary aryl-alkyl ethers[5] and fluoronitro-substituted aromatic amino acids[6] as well as employed as the key step in various macrocyclisation reactions[7, 8]. The mechanism for this reaction involves an addition – elimination pathway by forming a zwitterionic intermediate. The formation of σ^H adducts can be a competing pathway and the reaction outcome is the result of numerous factors including solvation, which makes this class of reactions extremely sensitive to the choice of reaction medium[9]. It is well known that the reaction is particularly sensitive to the choice of solvents and the choice of an appropriate solvent has been widely used synthetic strategy to improve the yield and selectivity of nucleophilic substitution reactions[10].

Increasing awareness for environmental safety has led to efforts in substituting the commonly used organic solvents and utilizing "green" solvents like ionic liquids as reaction media for the aromatic nucleophilic substitution reactions. Water is the obvious choice as one of the most environment friendly solvents and has been used as reaction medium for nucleophilic substitution reactions. However, the limited solubility of the substrates in water poses a limitation on the scaling up of the aqueous process. An interesting aspect is that while the reactivity of substrates like nitroaniline is increased in aqueous solutions[11] the SNAr reaction of dinitrohalobenzene is known to be slower in aqueous media as compared to that carried out in organic solvents like acetonitrile[12]. Ionic liquids and their mixtures with molecular solvents have been used as solvents for the SNAr reactions with improved yields and reduced reaction times[13]. For example, the second-order rate constant for the ethanolysis of the benzene derivative was at least an order of magnitude higher in ionic liquids than that in molecular solvents under the same conditions [14]. Ionic liquids also offer the added advantage of improved solubility of the organic substrates and products as compared to those observed in water – a factor which may be critical in scaling

up of the reactions. A major limitation in all these reports is that the workup procedures involved extraction with organic solvents, thereby undermining the environmental advantage afforded by the use of ionic liquids.

Deep eutectic solvents have emerged in the last decade as a class of solvents which are both similar and complementary to ionic liquids in many respects[15]. They are known to be nonvolatile, thermally stable and chemically benign, like ionic liquids. Unlike commonly used ionic liquids based on imidazolium, pyridinium, ammonium or phosphonium moieties, deep eutectic solvents are synthesized from substrates that are cheaper and readily available. Most of the substrates such as urea, glycerol, etc. are bio-based components and more environmentally compatible as compared to the components of conventional ionic liquids. These promising properties of deep eutectic solvents have led to their utilization as media for a host of organic reactions such as Diel-Alder cycloaddition[16], Fischer indole annulations[17], bromination[18], Paal-Knorr reaction[19], etc. The nucleophilic amination reactions of 1-halo-2,4-dinitrobenzenes can be accelerated in urea based deep eutectic solvents to give excellent yields[20].

In the present work, a series of nucleophilic aromatic substitution reactions of 1-fluoro-2,4-dinitrobenzenes with morpholine were carried out in Proline based deep eutectic solvents (DES) under ambient conditions, leading to high yields in short reaction times. The reaction workup involved addition of water for separating the crude product from the aqueous phase containing the DES. The DES regenerated from the aqueous phase could be recycled up to three times. The results indicate that DES can provide an entirely benign reaction medium for carrying out the aromatic nucleophilic substitution reactions, which remain one of the challenging classes of substitution reactions.

Experimental Section

1-fluoro-2,4-dinitrobenzene and morpholine used for the reactions were of the highest quality available. Proline, ethylene glycol, glycerol and oxalic acid used for DES synthesis were of highest purity available. The products of the nucleophilic substitution reactions, N-(2,4-dinitrophenyl) amines, were characterized by ^{1}H NMR spectroscopy [^{1}H NMR (400 MHz, $CDCl_3$), δ 8.71 (s, 1H), 8.29 (d, J = 9.2 Hz, 1H), 7.12 (d, J = 9.2 Hz, 1H), 3.87 (s, 4H), 3.28 (s, 4H). Reddish yellow solid, m.p. 117-118 ºC].

Preparation of DES: Deep eutectic solvents were prepared by mixing Proline with various hydrogen-bond donor reagents, in a mol ratio of 1:2 followed by stirring under heating (ca. 80 °C) until a homogeneous, colorless liquid has been formed.

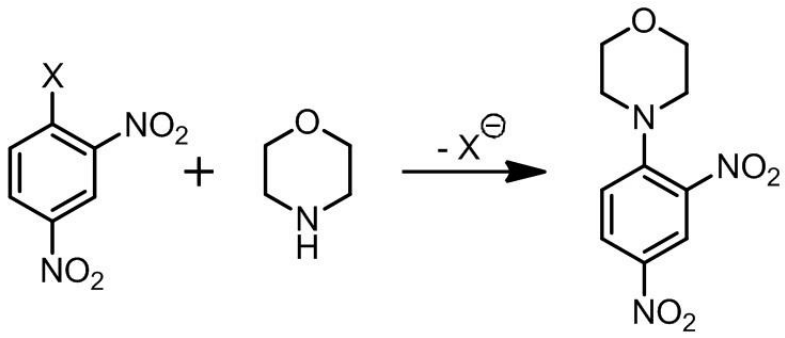
Synthesis of N-(2,4-Dinitrophenyl)-amine Products: A mixture of 1-fluoro-2,4-dinitrobenzene (94 mmol) with morpholine (282 mmol) in solvent (1 mL) was stirred for 2 h. The product was precipitated by addition of cold water (150 μL) and washed with cold water (500 μL). Evaporation of the water using high vacuum pump for at least 2–3 h led to the recovery of the DES. The regenerated solvent was then recycled up to three times. For decolorizing the regenerated DES, 200 mg activated charcoal was added in aqueous phase after extraction and heated for 5–10 min. The hot solution was then filtered and colorless DES was regenerated by evaporation of water.

Results and Discussion:

The substitution reaction of dinitro-substituted fluoro-benzenes with morpholine chosen as the model reaction to test the viability of using proline based deep eutectic solvents as reaction

media (**Scheme 1**). Acetonitrile was chosen as a model organic solvent, since it is known to be an efficient medium for this class of reactions. For comparison, the three Proline based DES were used – glycerol, oxalic acid and ethylene glycol were used as model DES media. The reaction was carried out by mixing 1-F-2,4-dinitrobenzene with morpholine at room temperature. Despite the hygroscopic nature of DES, we observed that the reaction did not need N_2-atmosphere and proceeded smoothly even in the absence of moisture-free conditions. In most of the cases, the reaction completed within 120 minutes to give the substituted aromatic products in almost stoichiometric yields.

Scheme1:



X= F, 2,4-dinitro-fluorobenzene (DNFB)

Table 1: Comparison of acetonitrile and proline-based DES as reaction media for the reaction of 2,4-dinitro-1-fluorobenzene with morpholine

Solvents	**% Yields**
Acetonitrile	87
Water	75
Proline + Glycerol	87

Proline + Oxalic acid	83
Proline + Ethylene Glycol	70

Yield of solid product reported after workup.

The results of comparative runs are summarized in Table 1 and indicate that the nucleophilic substitution reactions are as facile when carried out in DES as compared to acetonitrile and water. The % conversion observed for the proline based deep eutectic solvents was marginally higher than water. It should be noted that 1:2 mixture of proline + glycerol provided the best results in terms of % conversion, which was even better than the conversions observed in acetonitrile. This observation was particularly encouraging because it underlines the ability of DES to accelerate reactions between substrates which are traditionally regarded as challenging targets due to the lower conversions. Most of the substitution reactions led to > 70 % yields in proline-based DES.

Table 2: Recycling experiments in the reaction between 2,4-dinitro-1-fluorobenzene with morpholine in Proline + Glycerol at room temperature.

Solvents	**% Yields**		
	1st Reuse	**2nd Reuse**	**3rd Reuse**
Proline + Glycerol	87	80	75
Proline + Oxalic acid	83	79	74
Proline + Ethylene Glycol	70	62	55

The DES was recovered by evaporation of water, which was coloured in appearance. The regenerated DES was also tested for recyclability. The recyclability studies showed that the DES

could be recycled for up to 3 cycles (Table 2) with considerably good but decreasing yields. Another characteristic observation was the persistently coloured nature of the regenerated DES, which was an indication of the marginal solubility of the reactants / products in the DES + aqueous phase. Stirring the aqueous phase with activated charcoal after the product had been filtered out, resulted in complete decolourization of the DES. Surprisingly, the yield of the substituted product was affected only marginally by the absence or the presence of coloured impurities in the successive runs, indicating that the impurity does not interfere with the yield and there could be additional factors leading to the decline in efficiency after three runs. It was reasoned that using cold water for extraction could lead to a decrease in solubility of the organic reaction components. However, the strategy was not very effective in reducing the colour of the recycled DES.

Majority of the reports which state that the product is isolated using an aqueous work-up, invariably employ a biphasic aqueous-organic solvent system, which seriously undermines the "green" quotient of the synthetic methodology. An environmentally-benign synthetic methodology should completely exclude organic solvents from all the stages, but we are aware of very few reports which can claim to have achieved that ideal. Most of these reports use water as the reaction medium and the product isolation involves phase separation or filtration, facilitated by the limited solubility of many organic compounds in water[21]. However, this strategy cannot be extended to reactions in which water is not an efficient medium, such as the current nucleophilic aromatic substitution, or which use water-incompatible substrates / reagents. The other class of reactions which are particularly amenable to VOC-free workup are solvent-free synthetic approaches wherein mechanochemical strategies are adopted[22].

However, reactions carried out in ionic liquids ("green solvents") have often suffered from this shortcoming. For example, completely aqueous extraction cannot be carried out in a water –

insoluble ionic liquids (such as ionic liquids with the [NTf2]– or [PF6]– anions) unless the product is water soluble (limited probability for organic compounds). The methodology reported in the present report of extracting the reaction medium in the aqueous phase leading to product isolation can be extended to water-soluble ionic liquids (for example, ionic liquids primarily based on the halide or [BF4]– anion). For water-soluble ionic liquids containing the [BF4]– anion, it has been reported that the anion undergoes hydrolysis in presence of water – a property which hampers the repeated use of aqueous extraction and recyclability. Other water soluble ionic liquids (based on the halide anion) suffer from the limitation of being extremely viscous (or even solids) at room temperature. Another important aspect to be noted is that the synthesis of ionic liquids involves the use of organic solvents for extraction of unreacted starting material.

In contrast, synthesis of DES does not require any use of organic solvents. The water-compatible nature of the components may render the DES reaction media amenable to the use of water as the sole extractant. This can be said to be a unique characteristic of DESs, which should be utilized universally. It is indeed surprising that this aspect of reaction engineering in DESs has not been exploited to its complete potential till date. To the best of our knowledge, there are only two reports which utilize this property of DES. Zhao et. al. isolated the solid products of the Morita–Baylis–Hillman by simple filtration[23]. In another report, the products of the aldol reaction were extracted from the water + DES mixture, although the authors did not expressly highlight the advantage of such an approach in terms of being an environment-friendly workup strategy.

The results are encouraging as they show that a workup strategy completely devoid of organic solvents is possible and that DES are extremely promising class of solvents for such an approach.

Conclusion:

We have successfully demonstrated that the nucleophilic amination reaction of halobenzene, which are generally sluggish in water, can be accelerated in proline-based deep eutectic solvents to give excellent yields. Preliminary data suggests that the nature of solute – solvent interaction can influence the reaction outcome. In future, a thorough understanding of the molecular interactions could help in better selection of the reaction media. We have also demonstrated the proof-of-concept for reaction workup using only water. In fact, we wish to emphasize that the synthesis of DES and their application as reaction media can be carried out through this "zero VOC" approach. Chemists could exploit the difference in physical parameters to aid product separation and purification. A highly efficient and selective chemical process, combined with proper reaction engineering, should be another step in eliminating the environmental hazards associated with the use of organic solvents.

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A *Citrus limonum* as A Natural Bioactive Compounds

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ABSTRACT:

In this essay type article we try to highlight nature's wonder as a; **A *Citrus limonum*** one of the major cultivated crops throughout the globe and have broad economic and pharmaceutical importance. It has enumerous application in food, health industries, pharmaceutical & cosmetic industries. In various review articles & research paper reveals the analysis of their compounds has led to the identification of biologically active components which include flavonoids (e.g., diosmin, hesperidin, limocitrin) and alkaloids, phenolic compounds (e.g., ferulic, synaptic, p-hydroxybenzoic acids)found both in the juice and fruit that contribute to pharmaceutical prominence. The essential oil is rich in bioactive monoterpenoids such as D-limonene, β-pinene, γ-terpinene. Recently scientifically proven therapeutic activities like anti-oxidant, anti-inflammatory, anti-coagulant, anti-cancer, antimicrobial, antiparasitic, and anti-venom properties of citrus are also assembled to enable further in detail studies. Due to easy availability of these citrus species fruits consumption of citrus fruits has increased worldwide in recent years due to the increasing awareness of their health benefits. *Citrus Limonum* is a wonder fruit of nature; It's high nutrient compounds and of potential use in the pharmaceutical sector contains almost protein (10.94–17.06 %), crude fibre (5.84–7.10 %), carbohydrates (70.86–77.10 %), moisture (4.28–6.24 %), crude lipid (0.64–1.24 %), ash (4.40–7.80 %), and food energy (347.04−363 g). Lemon juice

is used as an ingredient in beverages, particularly lemonade and soft drinks, and in other foods, such as salad dressings, sauces, and baked products. Lemon juice is a natural flavouring and preservative, and it is also used to add an acidic, or sour, taste to foods and soft drinks. C. Limon peel is rich in pectin, which is used in a wide range of food industrial processes as a gelling agent, including the production of jams and jellies, and as thickener, texturizer, emulsifier and stabilizer in dairy products.

Keywords: A *Citrus limonum*, bioactive compounds, flavonoids, alkaloids, phenolic compounds, therapeutic activities etc.

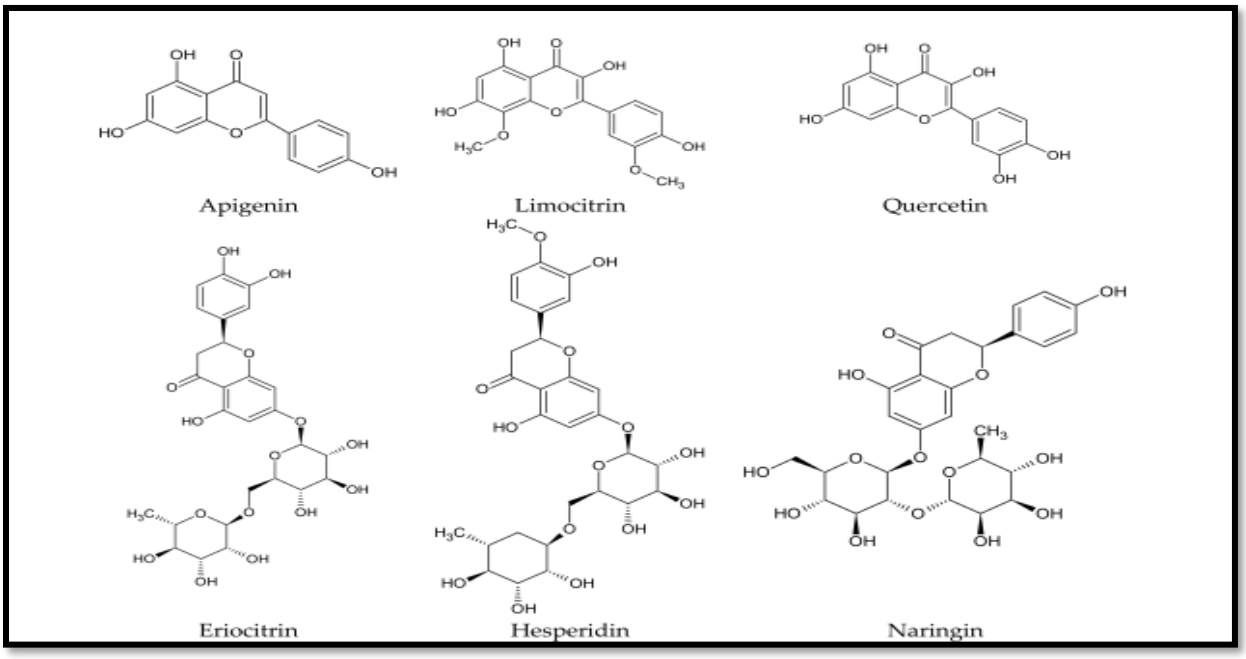
INTRODUCTION:

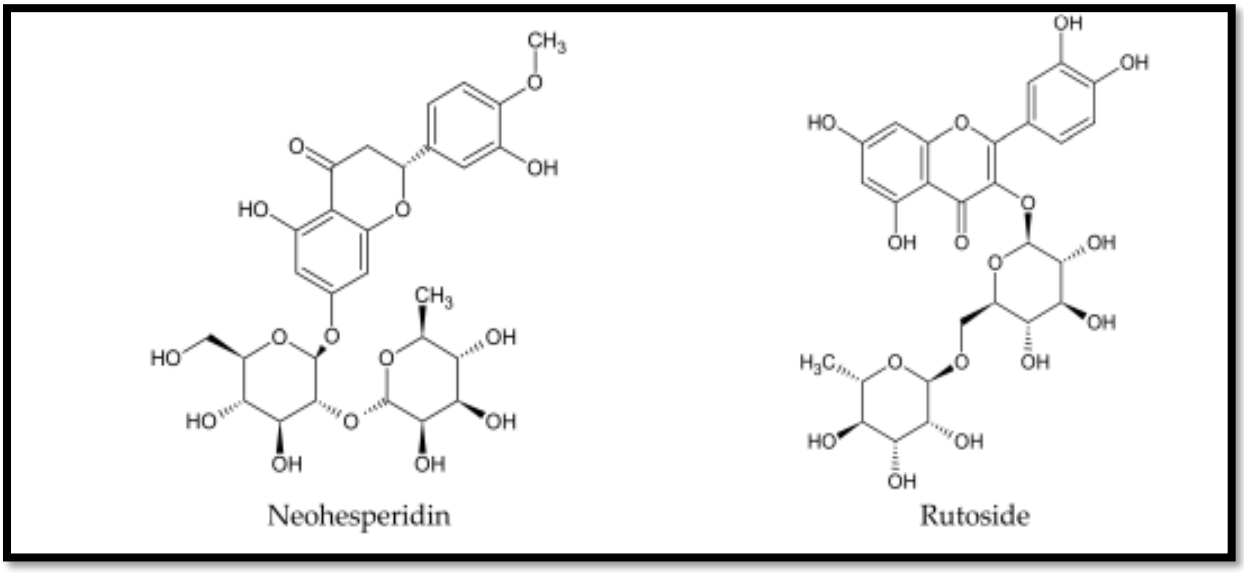
Now a days, worldwide citrus cultivation and the production of processed foods have become a major agricultural industry. In addition to being a substantial source of economy, it is an ideal and sustainable and renewable resource for obtaining bioactive compounds and co-products for food and pharmaceutical industries. Citrus contains a range of highly beneficial bioactive compounds, such as polyphenols, carotenoids, and vitamins that show antimicrobial and antioxidant properties and help in building the body's immune system. On consumption or processing, approximately 50% of the fruit remains as inedible waste, which includes peels, seeds, pulp, and segment residues. This waste still consists of substantial quantities of bioactive compounds that cause environmental pollution and are harmful to the ecosystem because of their high biological oxygen demand. [1, 2, 3]. Lemon *(Citrus limon (L.) Burm. f.)* belongs to the *Rutaceae* family, which consists of dicotyledonous flowering plants that mainly grow in tropical and subtropical areas. According to genetics studies, lemon can be considered a hybrid between *Citrus aurantium* and *Citrus medica* [4]. Lemon is well known to have many beneficial effects on human health due to its rich content in bioflavonoids and other bioactive compounds, such as phenolic acids, organic acids, essential oils, vitamins, minerals, carotenoids and pectins [5,6,7,8,9,10,11,12,13].

Table 1. Composition of C. limon fruits extracts.

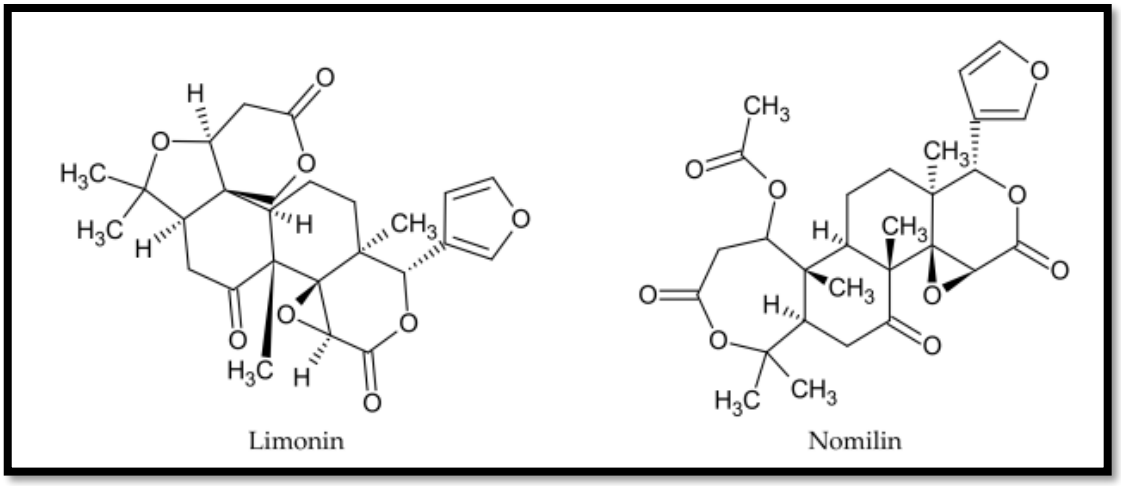
Group of Compounds	Part of Fruit	Metabolites
Flavonoids	Whole fruit (pulp, seed and peel)	**flavonones:** eriocitrin, eriodiktyol, hesperidin, naringin, neoeriocitrin, neohesperidin
		flavones: apigenin, diosmetin, diosmin, homoorientin, luteolin, orientin, vitexin
		flavonols: isoramnethin, quercetin, limocitrin, rutoside, spinacetin
Limonoids	Whole fruit (pulp, seed and peel)	limonin, nomilin
Phenolic acids	Whole fruit (pulp, seed and peel)	dihydroferulic acid, p-hydroxybenzoic acid, 3-(2-hydroxy-4-methoxyphenyl) propanoic acid, synapic acid
Carboxylic acids	Whole fruit (pulp, seed and peel)	citric acid, galacturonic acid, glucuronic acid, glutaric acid, homocitric acid, 3-hydroxymethylglutaric acid, isocitric acid, malic acid, quinic acid
Coumarins	Whole fruit (pulp, seed and peel)	citropten (5,7-dimethoxycoumarin), scopoletin
Furanocoumarins	Whole fruit (pulp, seed and peel)	bergamottin
Vitamins and their metabolites	Whole fruit (pulp, seed and peel)	choline, pantothenic acid, trigoneline, vitamin C
Amino acids	Whole fruit (pulp, seed and peel)	L-alanine, L-arginine, L-asparagine, L-aspartic acid, dimethylglycine, glutamic acid, L-phenylalanine, DL-proline, L-tryptophan, L-tyrosine, L-valine
Carbohydrates	Peel	monosaccharides: arabinose, fructose, β-fructofuranose, β-fructopyranose, galactose, glucose, mannose, myoinositol, rhamnose, scylloinositol, xylose
	Whole fruit (pulp, seed and peel)	disaccharides: sucrose
Microelements'	Pulp and peel	calcium (Ca), magnesium (Mg), phosphorus (P), potassium (K), sodium (Na)

Chemical structure of flavonoids characteristics of C. lemon depicted below [1]

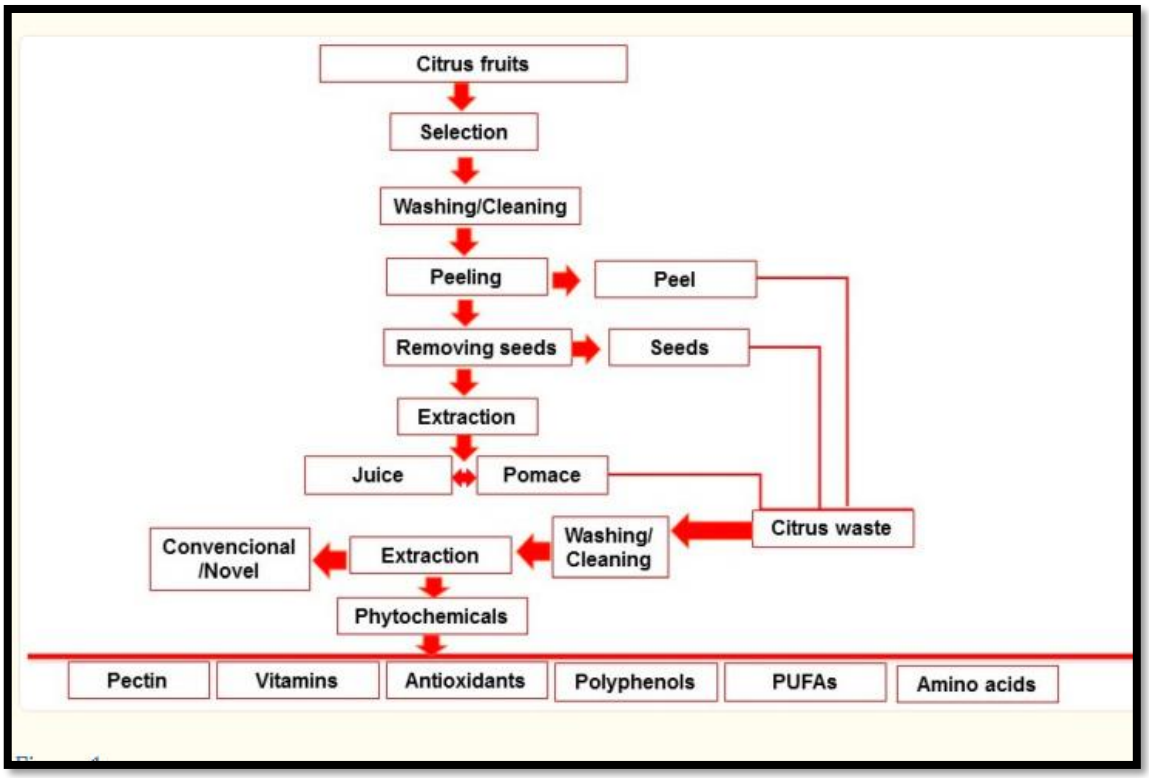




C. limon fruits are limonoids as another active molecules Limonoids which are highly oxidized secondary metabolites with polycyclic triterpenoid backbones e.g. limonin and nomilin



Extraction of a *Citrus limonum*: The main concern in various laboratories and industries is the selection of appropriate method for the extraction natural bioactive compounds (NBCs) in order to prevent human diseases as well as to address other demands.



These substances effectively interact with proteins, DNA, and other biological molecules to achieve the desired results, which could be used to develop therapeutic medicines derived from

natural products [14]. The right extraction technique is largely what determines the results of qualitative and quantitative analyses of bioactive chemicals from plant sources.[15]

CONCLUSION:

In this essay we reveal various review article and surprised to know about A *Citrus limonum* a very attractive object of different scientific studies. It can be used in different forms, e.g., extracts, juice and essential oil. The rich chemical composition of this species determines a wide range of its biological activity and its being recommended for use in phytopharmacology. Literature study of this topic reveal enumerous applications in various fields such as agriculture, food processing, cosmetics & medicinal application. In future we will trying to study its antimicrobial *in vitro* activity with varied concentration of its fresh juice. We also trying to prepare Quinoxaline from lemon juice (citric acid) as a catalyst.

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A Mini Review: Recent Development and Therapeutic Potential of 2-Amino Thaizoles in Antimicrobial and Antitumor Drug Discovery

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ABSTRACT

Microbial multi-drug resistance has been brought on by the misuse of anti-infectious agents and the subsequent overuse. One of the main public health issues of the twenty-first century is antimicrobial resistance (AMR), which poses a threat to the effective prevention and treatment of an expanding number of infections caused by bacteria, parasites, viruses, and fungi that are resistant to the common medications used to treat them. Similarly, the current cancer treatment modalities, radiotherapy, and chemotherapy, are well known for having a low therapeutic index. We have examined the developments and structural modifications of 2-aminothiazole to pursue powerful antimicrobial and anticancer agents in this study and in vitro research is also highlighted. Future innovation will benefit from the knowledge.

Keywords: antimicrobial resistance, 2-aminothiazole, anticancer agents

INTRODUCTION

Organic compounds containing sulphur often display biological activity such as antipsychotic, antiviral, antibacterial, anticancer, and antiallergic effects. Several naturally occurring substances include 2-Aminothiazole and its derivatives. They are therefore crucial structural moieties that can

be utilized in the development of new drugs for the treatment of a wide range of disorders, as well as playing a crucial role in pharmacological uses [1].

The 2-aminothiazole scaffold is one of the distinctive structures in drug development among heterocyclic compounds containing sulphur and nitrogen because it possesses multiple biological activities that enable it to function as an anticonvulsant [2], antitubercular [3,4], anticancer [5,6], antioxidant [7,8], antimicrobial [9,10], antidiabetic [11], antiviral [12], and anti-inflammatory [13] agent. Furthermore, a large range of 2-aminothiazole-based derivatives have been developed as a result of their widespread use as therapeutics to treat a variety of disorders with a high therapeutic influence. As a result, they are significant molecules with applications in drug discoveries.

Primarily, the aminothiazole ring has become a crucial component of antibiotics that are broad-spectrum cephalosporins. It was initially discovered in the side chain attached at position C-7 of second-generation cephalosporins, such as cefotiam. It was then retained in the structures of most third and fourth-generation cephalosporins (cefepime) [14].

Compounds having anticancer action also typically exhibit the 2-aminothiazole characteristic. As demonstrated by Fig. 1, significant efforts have been made recently to improve the antitumor activities of the 2-Amino thiazole core in anticancer treatment regions. Recently, the oral α-specific PI3K inhibitor Alpelisib was approved to treat malignant or otherwise advanced breast cancer [15], the proven DNA minor groove binding ability of thiazoleenetropsin and, and the demonstrated clinical antineoplastic efficacy of bleomycin and leinamycin all increased interest in the chemotherapeutic activity of thiazoles [16]. Additionally, dasatinib, a different thiazole derivative, has been shown to have potential tyrosine kinase inhibitory action and has shown efficaciousness in treating mutants resistant to imatinib [17].

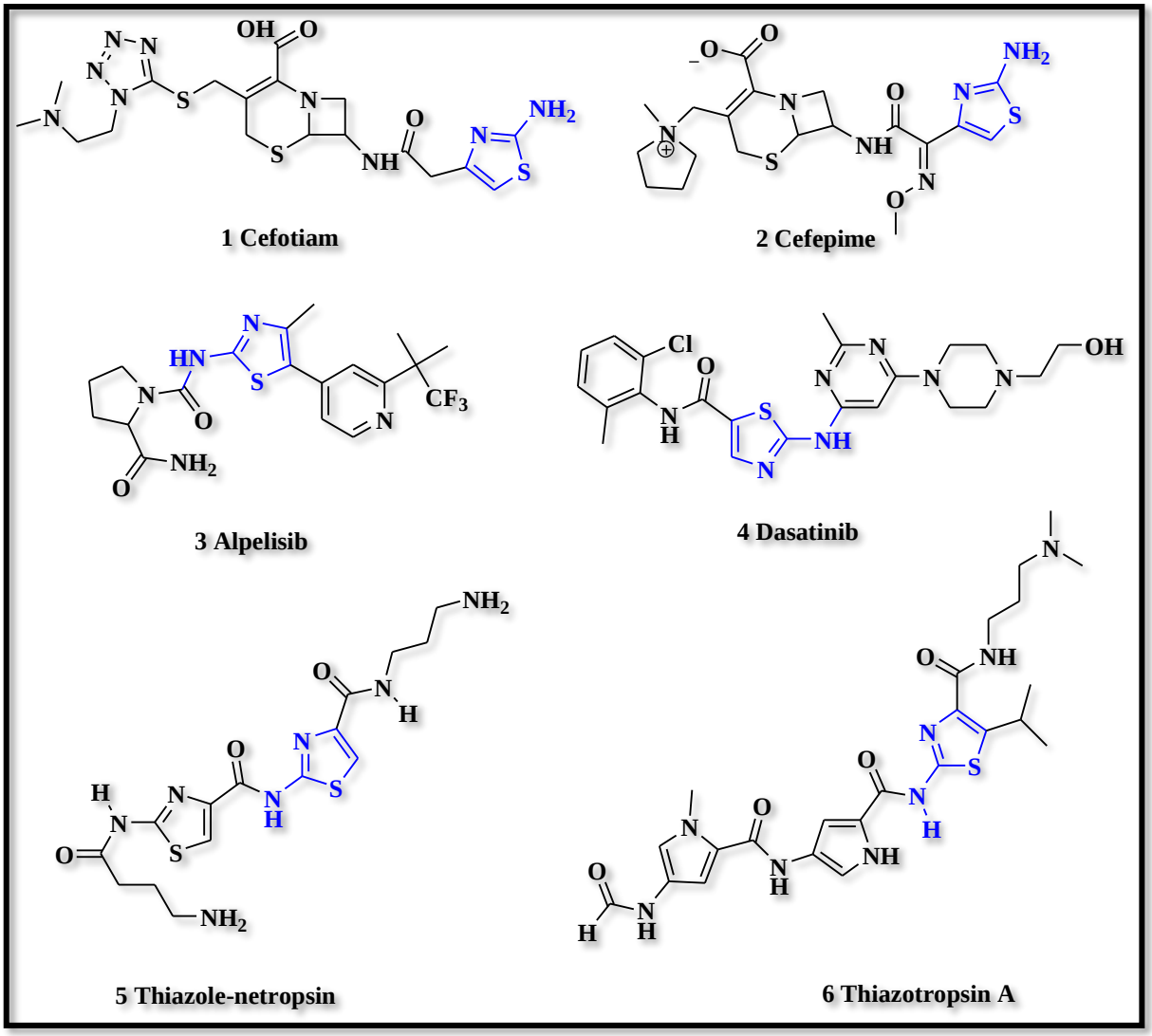

Fig. 1: Example of some drugs containing 2- Amino Thaizole moiety

SYNTHESIS OF 2-AMINO THIAZOLES

2-amino thiazole and their analogues can be synthesized by using various ways. Hantzsch's synthesis, which dates back to 1887, is the very first and most commonly used method. It involves reacting α-halo carbonyl compounds with thioureas or thioamides in the presence of aq. $NaICl_2$, halogens like bromine/iodine, silica chloride, ammonium 12-molybdophosphate, and cyclodextrin. It can also be done with different homogenous and heterogonous catalysts [18, 19].

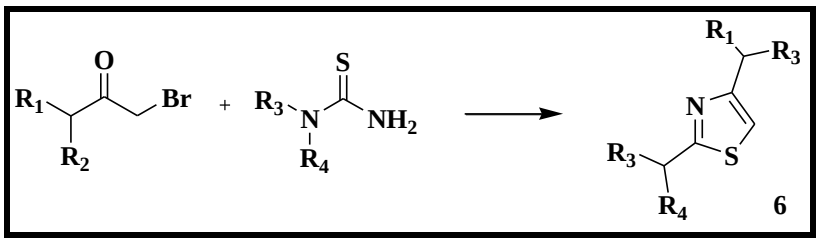

Fig.2: Hantzsh's synthesis of 2-Amino Thaizole

Another method utilizes nitro-epioxide, cynamide or ammonium thiocynate in presence of a base like K_2CO_3 or Sodium sulphide under mild conditions to give 2-amino thiazole and their derivatives. This reactions works by undergoing ring opening of nitro epoxides to afford products with acceptable to high yields for a variety of substrates [19, 20]. Bromine can be used as a condensing agent to link carbonyl compounds and thiourea straight into the thiazole ring [21]. Moreover, some researchers use microwave for synthesis of 2-amino thiazole by condensing -bromo ketones and thiourea [22, 23].

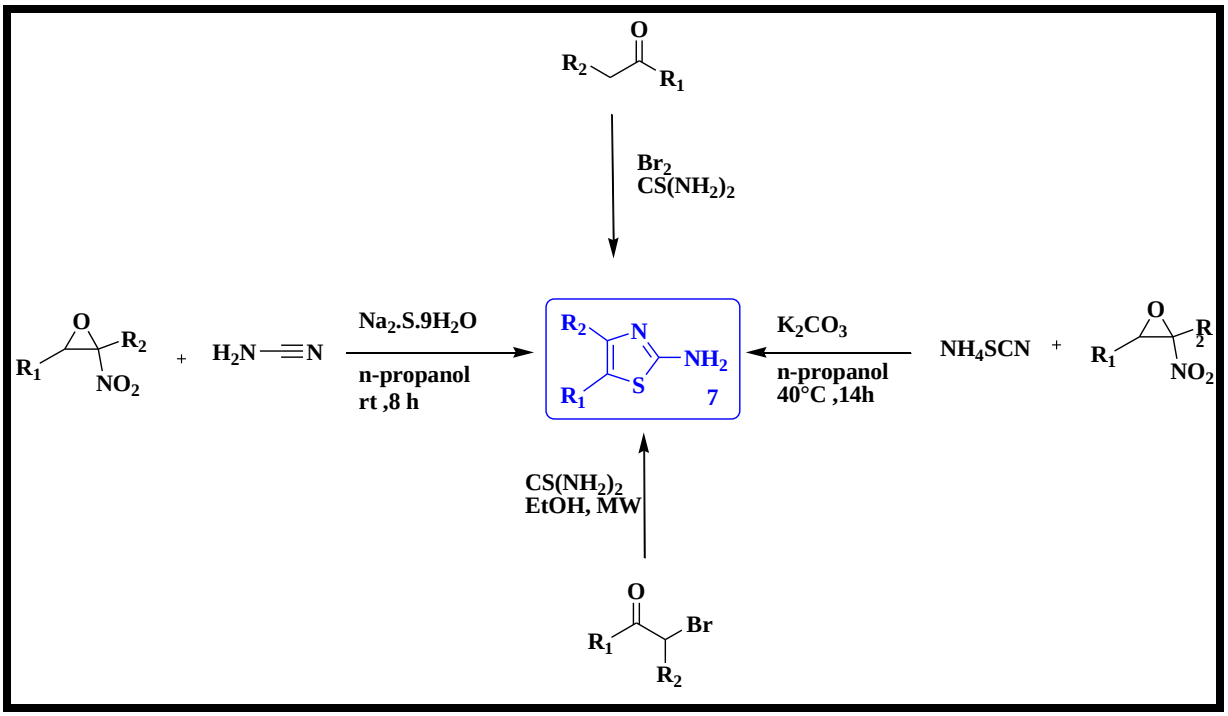

Fig. 3: Different routes of synthesis of 2- Amino Thaizole

Many efforts have been made in the past few decades to design and discover molecules with enhanced therapeutic activity that are derived from the 2-aminothiazole scaffold. We have examined and emphasized the advancements made in the 2-aminothiazole core to search for effective antimicrobial and anticancer drugs in this research. In light of this, we have categorized the reported compounds into groups according to the kind of attached group to the 2-amino of the 2-aminothiazole framework. These groups include hydrazone moieties, alkylamino, arylamino, amino-pyridine, urea, and thiourea, as well as amide and urea and thiourea. The data will be beneficial for upcoming innovations.

STRUCTURAL TRANSFORMATION OF 2-AMINO GROUP OF 2-AMINO THIAZOLE

MOIETY MODIFICATION OF 2-AMINO TO 2-ARYLAMINO

Staphylococcus aureus (MRSA) is becoming an increasingly serious hazard to human health since it is developing concurrent resistance to several of the most widely used antibiotics, including tetracycline, aminoglycosides, macrolides, penicillins, chloramphenicol, and lincosamides. Considering vancomycin and linezolid as last-resort medications for treating staphylococcal infections, Seleem et al synthesized and evaluated N-Phenyl-2-aminothiazoles for treatment of multidrug resistance and intracellular Staphylococcus aureus infections. They subtituted amino group of thiazole with aryl and guanidine group. While researching the structure-activity relationship (SAR) of several N-phenyl 2-aminothiazole derivatives as new antibiotics which was done from both the nitrogenous head and the lipophilic motif perspectives. Researchers found, it was notable that the aminoguanidine series showed the most effectiveness against MRSA. The molecules substituted with H, Cl, and methoxy **(8a, 8b, 8c)** had potent activity against MRSA, VRSA, S. epidermidis, S. pneumoniae and L. monocytogenes [24].

Continuous efforts to develop novel, highly effective antimicrobials have led Annadurai et al. to synthesize privileged structure-based library of 2- amino thiazole where amino is substituted with aryl and alkyl moieties. They used both conventional and microwave methods in the synthesis of a structurally varied privileged structure-based library. Among 35 synthesized and 8 aryl substituted compounds, one with fluoro substitution **(9)** showed most potent activity against S. aureus strains [25].

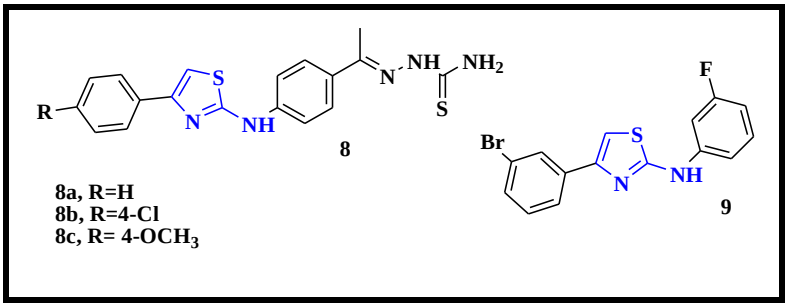

Fig. 4: Modification of 2-amine of 2-Amino thiazole to 2-arylamino

MODIFICATION OF 2-AMINE TO SCHIFFS BASE

A common ligand in the production of transition metal complexes is the Schiff base. A significant number of Schiff bases have also been demonstrated to possess pharmacological properties because they are found in metal complexes of Schiff bases with heterocyclic compounds, which include multifunctional groups. The extensive focus on creating a wide variety of N and S chelating ligands as thiazole molecules has generated a lot of interest. In addition, these atoms are crucial for the coordination of metals at the active sites of many metal biomolecules with medicinal properties or for use as metallo-enzyme study models. Furthermore, it has been discovered that free Schiff bases have strong antibacterial, antifungal, antiviral, and anti-inflammatory properties.

In context of all of these findings and in keeping with Malhotra et al.'s ongoing investigation into the coordination chemistry of metal complexes compounds of 2,4-dihalo-6-(substituted thiazol-2-ylimino)methyl-phenol **(10)** were prepared with Cobalt, Nickel, Copper and Zinc. And by using infrared, ^{1}H NMR, electron and electron paramagnetic resonance spectroscopies, elemental analysis, molar conductance, and magnetic susceptibility measurements, thermogravimetric analysis, and scanning electron microscopy, they characterized the synthesised Schiff bases and their metal complexes were thoroughly. The synthesized compounds were investigated for antibacterial activity on gram positive and negative bacteria and anticancer activity on human cancer cell HepG2. In which Cu complex of **10** showed enhanced antimicrobial activity whereas Ni complex of **10** exhibit several fold increase activity than its parent ligand.[26]

Continuing in the same approach and with the ongoing search for more effective and targeted anticancer Schiff bases, were prepared 4-phenyl-5-(1H-1,2, 4-triazol-1-yl)-2-aminothiazole reacting with various aldehydes by Zhou et al. was carried out against human cancer cells HL-60, BGC-823 and HEP-2. Based on the bioassay compound with 2, 4-dichloro **(11a)**, 3-nitro **(11b)** and 2, 4-dinitro **(11c)** showed good antitumor activity against all their cell lines. This can be explained by electron withdrawing properties of nitro and electronegativity of chloro groups. The most potent compounds were chosen for preclinical in vivo research, and these chosen compounds can be utilized for additional in vitro testing against a variety of human cancer cell lines.[27]

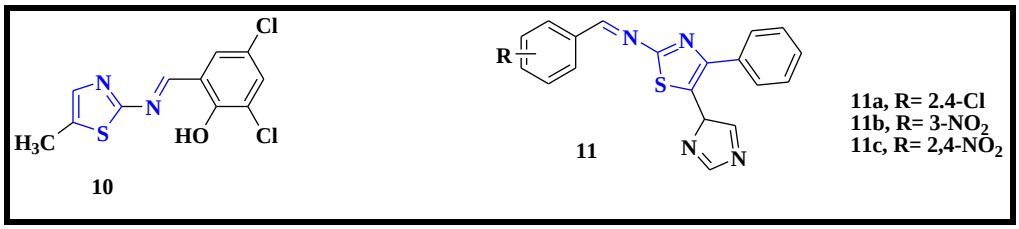

Fig . 5: Modification of 2-amine of 2-Amino thiazole to Schiffs base

MODIFICATION OF 2-AMINE TO 2-AMIDE

One persistent major issue in the treatment of bacterial infections is the rise of microorganisms resistant to antibiotics. Yu et al. designed and synthesized a new series of derivatives of 2-aminothiazole conjugated nitrofuran with activity against *Mycobacterium tuberculosis* and *Staphylococcus aureus* to produce prospective antitubercular and antibacterial lead compounds. All eight of the compounds showed potential as antitubercular treatments. According to structure-activity relationships (SARs) the derivatives of 5-nitro-N-(4-phenylthiazol-2-yl) furan-2-carboxamide that had their benzene replaced at position-3 showed improved potency. The most effective molecule, compound **12a**, showed minimum inhibitory concentrations (MICs) of 1.36 μg/mL against S. aureus and 0.27 μg/mL against Mtb H37Ra when substituted with benzamide at this location. Moreover, compound **12a** (IC50 = 50.2 μM) did not appear to be harmful to normal Vero cells. According to the conclusions, nitrofuran conjugated with aminothiazole scaffolds has the potential to be a powerful class of antibacterial and antitubercular drugs [28].

Several ethyl 2-substituted aminothiazole-4-carboxylate derivatives, which are structurally similar analogs of netropsin (A) and thia-netropsin (B), were synthesized effectively and reproducibly by Subbagh et al. They acylated 2-amino function of thiazole ring by aliphatic acid chlorides of varying lengths, which result in a range of secondary amines that take the place of netropsin's

amidine and guanidine endings. The NCI in vitro disease-oriented human cells screening panel test was applied to novel synthesized compounds to assess how these structural changes affect the antitumor activity. Among the 24 synthesized compounds compound **13a** exhibited GI50 values ≤ 100 µM against the nine tumour subpanel cell lines, indicating broad-spectrum antitumor action. The anticancer activity of 14 was roughly 2-3 times lower when the diethylamino moiety of **13a** was replaced by pyrrolidino **(13b)**, piperidino **(13c)**, morpholino **(13d)**, and N-methylpiperazino **(13e)** but they demonstrated activity against specific cell lines [29].

A subclass of the wider class of protein kinases known as tyrosine kinases is capable of catalysing the transfer of g-phosphoryl groups from ATP to the tyrosine hydroxyls in proteins. Kinases phosphorylate proteins, which is a crucial step in signal transduction that controls cellular activity. They are essential for controlling the growth, differentiation, metabolism, migration, and survival of cells. PTKs are typically overexpressed or highly activated in tumour tissues. The idea that PTK inhibitors may provide new avenues for anti-cancer treatments has been suggested by the substantial link observed between aberrant or overexpressed PTKs and a number of proliferative disorders. Therefore Liu et al. attempted development of some novel

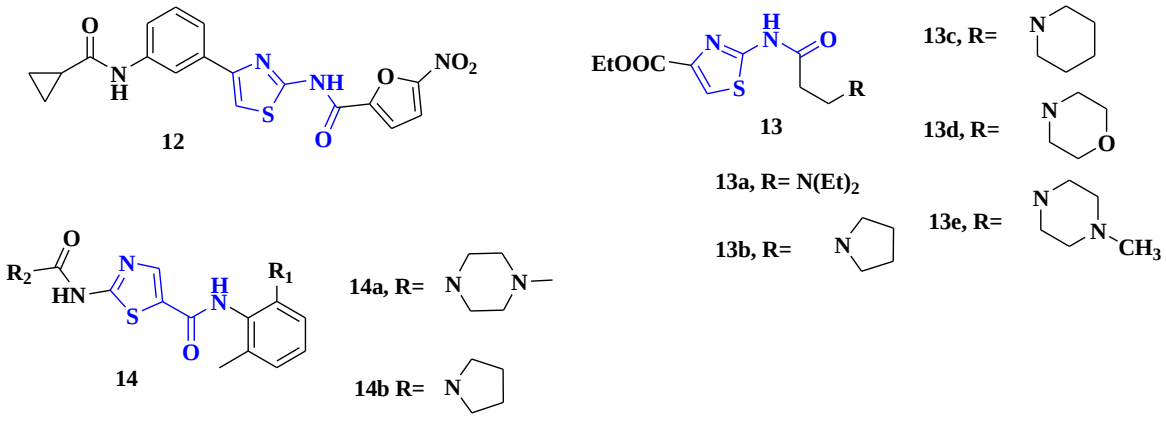

Fig. 6: Modification of 2-amine of 2-Amino thiazole to 2- amide

2-amino-thiazole-5-carboxylic acid phenylamide derivatives based on the structure of dasatinib to create strong and targeted anti-tumor medications. Only compounds **14a** and **14b** were shown to be effective in inhibiting the development of cells. When compared to dasatinib's outstanding growth inhibitory effects, compound **14a** was the only one that shown noteworthy activity in the instance of MCF-7 cells, but both were active at HT-29 cells [30].

CONCLUSION

The introduction of dasatinib and abelisib into clinical practice has brought attention to the 2-aminothiazole scavenging effort. Several approaches for the structural modification of 2-aminothiazole and the modification of the attached group to 2-amino in the 2-aminothiazole framework have been identified during the course of this project. These include modifications to amide, arylamine and Schiff base. The simple synthesis of this adaptable pharmacophore makes structure-activity research of several substitutions of 2-aminothiazole possible. This review validates a novel foundation for additional lead optimisation in the realm of developing and discovering new antimicrobial and antitumor drugs.

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Review on Synthesis methods of Cobalt oxide Nanoparticles and Dye degradation.

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Abstract:-

Nanoparticles Metal oxides has various application such as catalysis, sensors, batteries, degradation of dyes, drug delivery, and so on. In the recent most of researcher engrossed on nanoparticles Metal oxides for their photocatalytic activity because by taking the environment into account, effective exclusion of organic pollutants from wastewater has become a popular study issue. When it comes to organic contaminants, photocatalytic degradation is preferable to traditional wastewater treatment methods including desalination, adsorption, and reverse osmosis. The current review demonstrates the photocatalytic activity of Cobalt oxide NPs, their composites for the removal of organic pollutants. Finally, the necessity for additional study to improve the photocatalytic activity is emphasized.

Keywords: - Nanoparticles, Photocatalyst, Composites, Pollutants

Introduction: -

Nowadays technological advances in waste water treatment are vital in view of the more stringent regulations that originate from increased environmental awareness worldwide. Due to its potential to produce hydrogen (H_2) as a clean fuel, photocatalytic water splitting into hydrogen (H_2) and oxygen (O_2) has received a lot of attention and environmentally friendly fuel. Very important role of photocatalyst achieving overall water splitting by means of offering the active sites or promoting charge separation [1]. Co_3O_4 nanostructures has been applicable to in gas sensors, heterogeneous catalysts, electrochemical devices, Li-ion batteries, magnetic materials and photocatalysts so in recent years, the increasing interest it synthesis [2]. Many material scientists are looking at the incorporation of metal oxides into novel nanomaterials with beneficial properties for applications in the future because of the large number of potential uses for NiO and Co_3O_4 [3]. The creation of electrons from the photocatalysts excitation is precisely confined with Co_3O_4, releasing the photocatalysts oxidation valence hole for the photocatalytic elimination of organic pollutants [4].

A p-type semiconductor, Co_3O_4, has a small band gap (between 1.2 and 2.1 eV), strong thermal and chemical stability, low solubility, and intriguing electronic, magnetic, and catalytic capabilities. Co_3O_4 can be used as a photocatalyst or co-catalyst for visible light-driven photocatalytic reactions because of its good properties [5].

Methods and dye degradation: -

Prashant Bhimrao Koli et al. synthesized cobalt oxide nanoparticles (precursor- cobalt acetate hexahydrate) and doped (Fe^{2+}, Ni^{2+}) metal oxide nanoparticles by combustion method and studied photocatalytic degradation of water-soluble Eosine blue dye. Effect of different parameter

such as contact time, initial dye concentration, pH, dose of catalyst were investigated. The optimum for photocatalytic degradation of EB dye were initial concentration 40 mg/L, photocatalyst dose 0.8 g/L, and pH 7.5. They reported 95% dye degradation by using doped cobalt oxide nanoparticles [6]. Deepak Kumar et al. prepared chromium doped cobalt oxide nanoparticles (precursor- cobalt chloride hexahydrate) by co-precipitation method. They compared photocatalytic degradation of Methyl blue dye by doped and undoped cobalt oxide nanoparticles. It was observed degradation of Methyl blue dye was higher in doped cobalt oxide than undoped cobalt oxide [7].

Feng Chen et al. synthesized cobalt oxide, cerium oxide and it's composite by simple co-precipitation method. They have studied photocatalytic degradation of methylene blue, xylenol orange, methyl orange and methyl red. Compared simple nanoparticles and composites nanoparticles and observed photocatalytic activity of degradation of dyes were higher in composite nanoparticles than simple nanoparticles [8]. K.V. Hemalatha et al. synthesized cobalt oxide nanoparticles by using cobalt acetate as a precursor material at four different concentrations like 0.06, 0.07, and 0.08 and 0.09 M. Synthesis carried out by Sol-gel method. They were reported photocatalytic degradation of methylene blue dye under visible light irradiation of 93.8% by Co_3O_4-0.06M [9].

Sergio Navalón et al. synthesized activated carbon supported cobalt oxide nanoparticles and studied photocatalytic degradation of phenol. It was observed photocatalytic degradation in activated carbon supported cobalt oxide NPs were faster than simple cobalt oxide NPs. [10]. Janan Parhizkar et al. synthesized cobalt oxide NPs (precursor- cobalt chloride hexahydrate), ferric oxide and its composite by Ultra sonication method. They Studied photocatalytic degradation of Azo dye, Reactive Red and Acid Black. It was observed degradation of dyes in the order of FeO >

Co_3O_4> $CoFe_2O_4$ [11]. Three cobalt oxide phases, namely, Co_3O_4, mixed-phase Co_3O_4 & CoO and CoO synthesized Khuzaimah Arifin et al. by hydrothermal process. Overall, this observation showed that Co3O4 had the best photocatalytic properties among cobalt oxide Nps phases produced by varying the annealing temperature for water-splitting reactions [12].

Yabo Wang et al. prepared Cobalt oxide loaded graphitic carbon nitride by an impregnation calcination method. It was used for tetracycline removal from aqueous solution. They believed that the synthesized CoO/g-C_3N_4 could be a potential adsorptive photocatalyst for antibiotic pollutants removal from wastewater [13]. Aarti S. Bhatt et al. prepared lithium doped cobalt oxide NPs by microwave combustion method. They reported that the photocatalytic degradation of crystal violet and Methyl violet 2B dyes. Alizarin Red S did not degrades by lithium doped cobalt oxide NPs. Degradation of cationic dyes were possible not anionic dyes [14]. Yoki Yulizar et al. prepared cobalt oxide NPs by Green synthesis method and reported that photocatalytic activity in the degradation of methylene blue about 63.105% for 3 hours [15].

Photodegradation of dye by using Cobalt oxide nanoparticles:-

Sr. No.	**Dopant/Composites**	**Dye**	**Time**	**Degradation efficiency**	**Light**	**Reference**
1.	Fe^{2+}, Ni^{2+}	Eosine blue	……	91%, 94%, 95%	UV–Vis	[6]
2.	1%, 5%, Cr	Methylene Blue	35min	99%	visible light	[7]
4.	$CoFe_2O_4$, Co_3O_4 and FeO	1.Reactive Red4 Acid Black 1	12min	96%	Uv	[12]
5.	(CoO/g-C_3N_4)	Tetracycline	5hr	93%	300 W Xenon lamp	[14]
6.	Li	1.Crystal Violet 2.Methyl Violet	90min 60min	90% 75%	Visible light	[15]

Conclusion: -

Herein we reviewed method of synthesis of Co_3O_4 and doped in cobalt oxide nanoparticles and dye degradation in aqueous solution. It has been explored how several experimental factors, such as the starting dye concentration, solution pH, and catalyst dose, affect the efficiency of photocatalytic degradation. Lastly, the difficulties in photocatalytic dye degradation have been highlighted.

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Review on use of different adsorption isotherms in the study of adsorption process

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Abstract: The most crucial calculation for predicting and examining the different potential mechanisms that could arise during the adsorption process is the adsorption isotherm. Nevertheless, up until now, the majority of research have only discussed the theory behind the adsorption isotherm; none have provided a comprehensive explanation of the adsorption isotherm, from theory to calculation. As a result, this study includes recommendations for choosing which kind of adsorption isotherm to use in order to characterize the complete set of adsorption data, which is represented by the ten most prevalent adsorption isotherms. The steps for analyzing the monolayer adsorption using two parameters are shown. It is anticipated that this study will give researchers working and studying the adsorption process clear and helpful information.

Keywords: Adsorption, Isotherm, Calculation, Dyes, Biosorbent.

Introduction: Adsorption process is considered as one of the most used separation and purification processes, in which adsorption occurs by the formation of the physical or chemical bonds between a porous solid medium and a mixture of liquid or gas multi-component fluid [15]. The adherence of atoms, ions, or molecules from a gas, liquid, or dissolved solid on a substance's

surface is known as adsorption. Adsorbate is the term for the atoms, ions, or molecules that adhere to a solid surface; adsorbent is the substance that collects the adsorbate. Adsorbate is produced in a film on the adsorbent's surface by this procedure. Adsorption has a different definition than absorption. The process of absorption uses the entire volume of the material as a fluid (as the absorbate) dissolves in or permeates a liquid or solid (the absorbent) [1]. Adsorbent-adsorbate equilibrium relationships are described by adsorption isotherms, which are typically used to calculate the amount of a certain pollutant adsorbed [2]. In order to investigate the most suitable adsorbent, the equilibrium correlation of the sorbent must be established in order to forecast its behavior under various experimental situations. Equilibrium isotherms are used to generate the equilibrium correlation. These isotherms indicate whether sorption is occurring in a monolayer or multilayer fashion, depending on how the sorbent interacts with the adsorbent surface [3]. The majority of studies on adsorption concentrated on the thermodynamic, kinetic, and isothermal processes. An examination of the isotherm data is crucial for the adsorption process because it describes the equilibrium interactions between the adsorbent and the adsorbate at a particular temperature at equilibrium [4]. Typically, this ratio is the amount adsorbed divided by the amount still in the solution. The capacity of the adsorbent for the dye is determined in part by the distribution of dye between the adsorbent and dye solution when the system is in an equilibrium state. An adsorption isotherm is typically used to assess activated carbon's capability for a particular contaminant [5]. Adsorption isotherms are performed by giving a volume-decided arrangement containing a known measure of adsorbate alongside different doses of the adsorbent. The blend is held at steady temperature with mixing until it arrives at balance. At the point when this is the situation, the centralization of the adsorbate in the fluid stage is estimated and the adsorption limit at harmony for each examination is determined from the mass equilibrium [6].

Adsorption Isotherm Theory:

1. ***Langmuir Isotherm***- The amount (Q_e) of adsorbed adsorbate molecule per gram of adsorbent can be calculated using this isotherm equation. Monolayer adsorption process can be confirmed with the help of this isotherm. The important parameter in the Langmuir isotherm is the separation factor (R_L). If R_L comes out to be one, it indicate the linear adsorption process. If $0 < R_L < 1$, suggest favourable adsorption process [7].

$$\frac{1}{Q_e} = \frac{1}{Q_{max}K_L}\frac{1}{C_e} + \frac{1}{Q_{max}}$$

$$R_L = \frac{1}{1+K_L C_e}$$

2. ***Freundlich Isotherm***- Freundlich isotherm suggests a physical type of adsorption in which the adsorption occurs in multilayer and the bonds are not strong.

$$lnQ_e = lnK_f + \frac{1}{n} lnC_e$$

Favorable adsorption process is takes place when $0 < 1/n < 1$. For $n<1$, adsorption process with chemical interaction and for $n>1$, adsorption process with physical interaction[7].

3. ***Temkin Isotherm***- Using Temkin isotherm one can calculate adsorption heat constant (B_T). If the value of $B_T < 8$ kJ/mol, the adsorption process occurs physically [8].

$$Q_e = B_T lnA_T + B_T lnC_e$$

4. ***Dubinin-Radushkevich Isotherm***- This isotherm is written as-

$$lnQ_e = lnQ_s - (\beta\varepsilon^2)$$

The free energy of adsorption per adsorbate molecule is calculated using-

$$E = \frac{1}{\sqrt{2\beta}}$$

E < 8 kJ/mol, indicated physical adsorption and 8 < E < 168 kJ/mol, indicate chemical adsorption[8].

5. ***Jovanovic Isotherm***- The amount (Qe) of adsorbed adsorbate molecule per gram of adsorbent can be calculated using this isotherm equation. The linear correlation is given by [9]

$$lnQ_e = lnQ_{max} - K_J C_e$$

6. ***Halsey Isotherm***- This isotherm illustrates a multilayer adsorption system [7].

$$Q_e = \frac{1}{n_H} lnK_H - \left(\frac{1}{n_H}\right) lnC_e$$

7. ***Harkin-Jura Isotherm***- This model is expressed by equation [9]-

$$\frac{1}{q_e^2} = \frac{\beta_{HJ}}{A_{HJ}} - \left(\frac{1}{A}\right) | logC_e$$

From the modified isotherm equation we can calculate the surface area of adsorbent using expressions below.

$$\beta_{HJ} = \frac{-q(S^2)}{4.606RTN}$$

$$S^2 = -\frac{\beta_{HJ} \times 4.606RTN}{q}$$

8. ***Flory-Huggins Isotherm***- This isotherm is used to calculate degree of surface coverage (Θ) and using Flory–Huggins model equilibrium constant, one can calculate free energy of the process [10].

$$log\frac{\theta}{C_e} = logK_{FH} + n\log(1-\theta)$$

$$\theta = (1 - \frac{C_e}{C_o})$$

$$\Delta G^0 = -RT \ln K_{FH}$$

9. ***Fowler-Guggenheim Isotherm***- The empirical interaction energy (W) has been calculated using this isotherm. If W = 0 kJ/mol, then there is present no interaction between adsorbed

molecules. If W > 0 kJ/mol, then there is attractive interaction between adsorbed molecules. If W < 0 kJ/mol, then there is repulsive interaction between adsorbed molecules [11].

$$ln\left(\frac{C_e(1-\theta)}{\theta}\right) - \frac{\theta}{1-\theta} = -lnK_{FG} + \frac{2W\theta}{RT}$$

10. ***Hill-Deboer Isotherm***- Whether there is attraction, repulsion or no interaction exist between adsorbed molecules can be explained using this isotherm.

$$ln\left[\frac{C_e(1-\theta)}{\theta}\right] - \frac{\theta}{1-\theta} = -lnK_1 - \frac{K_2\theta}{RT}$$

If K_2 = 0 kJ/mol, then there is present no interaction between adsorbed molecules. If K_2 > 0 kJ/mol, then there is attractive interaction between adsorbed molecules. If K_2 < 0 kJ/mol, then there is repulsive interaction between adsorbed molecules [11].

Criteria for choosing isotherm model:

When selecting an isotherm model, the first and most important requirement is that it has a good fit to the experimental data. The isotherm function is typically linearized and the parameters are obtained from linear regression, and the model with a coefficient of determination near unity is the best fit [12]. The reduced chi-square statistics technique is another widely used method for finding the best fit model. A reduced chi-square (less than 1) is calculated by dividing the model's variance by the mean of the experimental data's variance. A higher value indicates poor-fitting [13]. As a general rule of thumb, fit as many appropriate models to the experimental data as possible and then select the model with the best fit using the above methods. Isotherm model feasible to be used as a thermodynamic model. Three conditions for isotherm models to be thermodynamically feasible: (i) Linear when the concentration is zero (ii) Finite capacity at maximum concentration (iii) Positive gradient of function for all concentrations [14]. The

conventional method of determining the best fit isotherm model involves linearizing the model and then checking for fit using linear regression. The least-squares method has been frequently used for finding the parameters of the models [2].

Applications of adsorption isotherms:

Determination of the amount of adsorbed material of a given pollutant (dyes, heavy metals, phenolic compounds, etc.) can be accomplished by using the adsorption isotherms, which describes the relationship of the adsorbent-adsorbate equilibrium [15]. The environment has recently been seriously contaminated by a variety of industrial operations. Adsorption is regarded as one of the most flexible and successful methods for managing pollutants. The most popular adsorbent is activated carbon, but its use is restricted because to its expensive cost and issues with regeneration and disposal [16]. Consequently, because agricultural or agro-based industry wastes have a loose and porous structure and a variety of reactive functional groups, such as hydroxyl and carboxyl groups, they are a very sensitive adsorbent [17].

Linear and nonlinear forms of isotherm models:

An isotherm model's correctness is based on how many independent parameters it has, its mathematical simplicity is determined by how popular it is in relation to the process it is used in. Additionally, in a variety of adsorption data, linear regression analysis is highly beneficial [15]. Research has indicated that the error structure of the experimental data can alter when the adsorption isotherms are transformed into their linearized forms. Nonlinear regression typically reduces the distribution error between the experimental data [9].

Isotherm	Nonlinear	Linear	Plot
Freundlich	$q_e = K_F C_{eq}^{1/n}$	$\ln(q_e) = \ln K_F + (1/n) * \ln(C_e)$	$\ln(q_e)$ vs $\ln(C_e)$
Langmuir-I		$C_e/q_e = (C_e/q_m) + (1/b * q_m)$	C_e/q_e vs C_e

Conclusion:

This review paper aimed to review various adsorption isotherm models like Langmuir, Freundlich, Temkin, Dubinin-Radushkevich, Jovanovic, Halsey, Harkin-Jura, Flory-Huggins, Fowler-Gugg and Hill-Deboer. Moreover, the applications, linear-nonlinear forms and the criteria for choosing the optimum isotherm model for the adsorption process has been discussed. Several factors should be taken into account when selecting the optimal isotherm model for the equilibrium data, including- a) the equilibrium data and the isotherm function should fit the data well b) the isotherm function should be thermodynamically sensible and c) in the ideal condition, it should be able to calculate capacity analytically from concentration and vice versa.

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A convenient way to synthesis of 1, 3, 4-Thidiazole-5-amine & its Derivatives from Aryl Substituted Nitriles & Thiosemicarbazide

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ABSTRACT:

By various literature survey and our previous study we redesign some innovative molecules which are active pharmaceutical ingredients. 1, 3, 4-Thidiazole-5-amine & its derivatives are under class of heterocyclic compound which are medicinally important scaffold. Heterocyclic compounds are nothing but medicinal molecules which shows therapeutic properties.

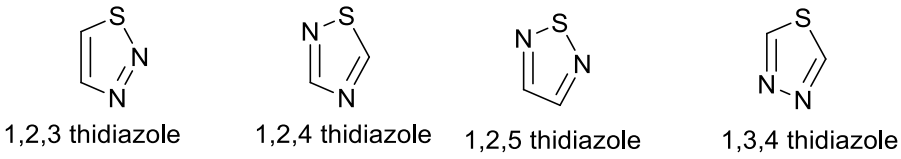
In vitro & in silico study of these molecules shows excellent antimicrobial properties. Now we planned to synthesize molecules which enhance antimicrobial & anticancer activity by substituting pharmacophore to core molecule 2-alkyl/aryl substituted-1, 3, 4-thidiazole-2-amine. The synthesis of selected route was use of substituted / unsubstituted nitriles and thiosemicarbazide as a starting material is rarely observed. In the first step synthesis of lead compound from thiosemicarbazide in that alkyl/aryl substituted/ unsubstituted nitriles are dissolved in trifluroacetic acid; solution of nitriles in TFA was treated with thiosemicarbazide at 120 ^{0} C temp., 2 h refluxing with continued stirring in a glass sealed bottle. A solid residue separated out after workup which was purified by column chromatography (pet ether: ethyl acetate). Spectral analysis confirmed the desired molecular structure. In final step synthesis of derivatives of 2-alkyl/aryl substituted-1, 3, 4-

thidiazole-2-amine by connecting selected bioactive heteromolecules such as morpholine, cyclopentyl amine, glycine and l-leucine & other heterocyclic molecules which enhances biological activity. Reaction is monitored by TLC during synthesis.

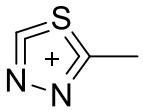
Keywords: Alkyl/aryl substituted nitriles, 1, 3, 4-thidiazole-2-amine, TLC etc.

INTRODUCTION:

1,3,4-thiadiazole was coined by scientist Fischer 1882 and scientists Freund and Kulh described cyclic nature of C2H3N3S. It is yellowish liquid with pyridine like odour. It is soluble in alcohol and ether and slightly soluble in water. It is heterocyclic compound with two nitrogen and one sulphur in five membered aromatic rings. It occurs in four isomeric forms as shown in fig. (1) 1,2,3-thiadiazole; 1,2,5-thiadiazole; 1,2,4-thiadiazole and 1,3,4-thiadiazole [1-2].



1,3,4-Thiadiazolium derivatives have been shown to interact with biomolecules and the overall neutral nature is conducive to membrane transport, which is significant in deciding biological activity [3].



The ring system is less aromatic than benzene, thiophene, and pyridine [4-5]. When substituent is introduced into 2 or 5 position of this ring; it showed increased reactivity and formed different derivatives easily. The structure of the molecule has displayed divergent in biological activity [6-8]. The binding interaction with targeted proteins through hydrogen bond donor or acceptor interaction has more potent [9-12]. The specific pharmacological activities are antitubercular [13-17], anti-inflammatory [18-19], antimicrobial [20], Due to these distinct biological activities

promoted to us to synthesize this moiety and its novel derivatives which may more active and reactive.

EXPERIMENTAL METHOD:

1. Synthesis of 5-(substituted/unsubstituted phenyl) -1, 3, 4-Thidiazol-2-amine from nitrile (TDA & TDB):

Weighed amount of substituted/ unsubstituted nitrile mixed with thiosemicarbazone dissolved in trifluoracetic acid in equimolar quantities taken in glass bottle which is sealed by Teflon tape made as a glass bomb. Placed the reaction mixture containing glass bomb into flat container containing paraffin oil heated at 120 0C; heating, reflux and continue stirring for 2 h. The workup was carried out in crushed ice. The solid separates out were filtered, recrystalised by ethanol. Recrystallised product further purified by column chromatography using pet ether: ethyl acetetate (80:20) as mobile phase. Yield of the desired compound was about 70% and M.P. is 285 ^{0}C.

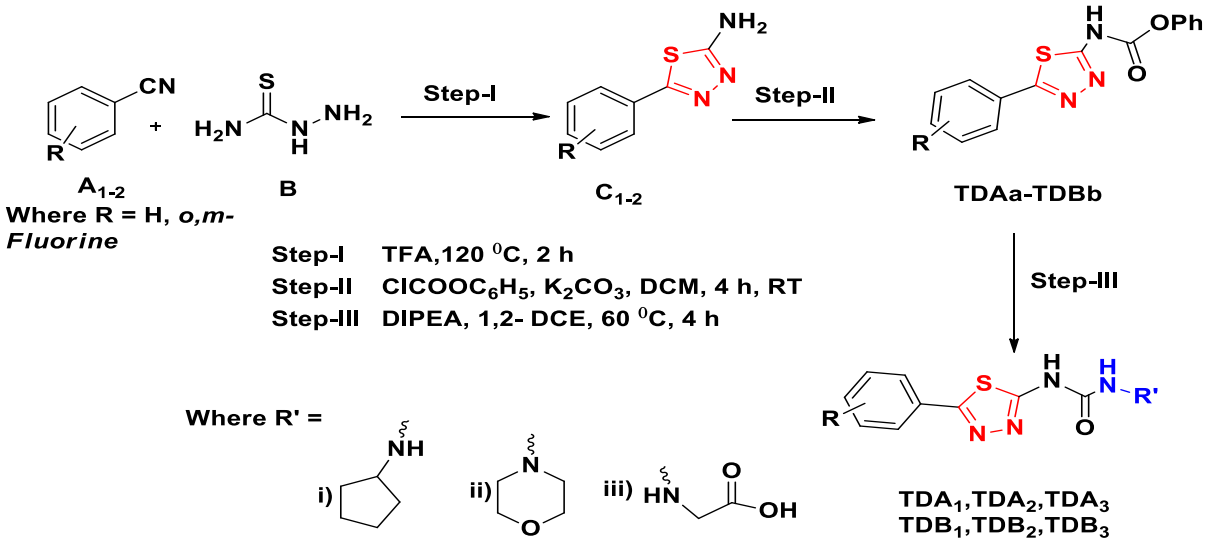
2. Synthesis of 5-(substituted/unsubstituted phenyl) -1, 3, 4-Thidiazol-2-phenyl acetate via carbamate formation: (TDAa & TDBb)

5-(substituted/unsubstituted phenyl) -1, 3, 4-thidiazole synthesized from first step was taken in round bottom flask dissolved in dichloro methane; weighed amount of anhydrous K2CO3 was mixed. The reaction mixture was stirred next for 15 min. under nitrogen atmosphere (N2) at temp.0-5 ^{0} C. In the continuous process of reaction phenyl chloroformate was added slowly with the help of syringe and continue stirring for 4 h at room temp. The progress of reaction was monitored by TLC (silica gel 60 F254). The resultant reaction mixture was extracted in dichloromethane, washed with aqueous layer and brine solution. The separated extract of organic layer concentrated in rotary vacuum evaporator. The solid was separated, dried and purified by column chromatography using pet ether: ethyl acetetate (80:20) as mobile phase. The desired product was obtained confirmed by TLC and directly used for next synthesis.

3.Synthesis of N-(5-(2- substituted/unsubstituted phenyl)-1, 3, 4-thiadiazol-2-yl) -4-carboxamide by nucleophilic substitution reaction: (TDA1, TDA2, TDA3 & TDB1, TDB2 &TDB3):

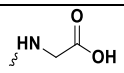
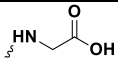
N-(5-(2- substituted/unsubstituted phenyl)-1,3,4-thiadiazol-2-yl) -4-carboxamide reacted with hetero bioactive molecule mixed with DIPEA (N, N-Di-isopropyl ethylamine) in 1, 2-dichloroethane solvent. The whole reaction mixture was heated at 60 ^{0}C for 4 h. The progress of reaction was monitored by TLC and confirmed the desired product spot on TLC plate. After completion of the reaction, the reaction mixture was concentrated using rotary vacuum evaporator; the white residue was purified by column chromatography using pet ether: ethyl acetetate (80:20) as mobile phase. Yield of the synthesized derivatives were approx. 45-50%. Rf values, melting points were recorded.

General scheme: synthesis of 1,3,4-Thidiazole-2-Amine and Their Derivatives:



RESULTS:

The physical and analytical data of 1,3,4- thiadiazole-2-amine and their derivatives are tabulated in table 1.

ENTRY	R	R'	MOL.FORMULA	MOL.WT	APPEARANCE	% YIELD	M.P ^{0}C
TDA	H—	H—	$C_8H_7N_3S$	177	White solid	35	225
TDA_1	H—		$C_{14}H_{16}N_4OS$	290	White solid	15	285
TDA_2	H—		$C_{13}H_{14}N_4SO_2$	288	White solid	17	287
TDA_3	H—		$C_{11}H_{10}N_4SO_3F_2$	278	White solid	20	185
TDB	*o,m*-F	-H	$C_8H_5N_3SF_2$	211	White solid	30	220
TDB_1	*o,m*-F		$C_{14}H_{14}F_2N_4OS$	324	White solid	10	285
TDB_2	*o,m*-F		$C_{13}H_{12}F_2N_4O_2S$	326	White solid	15	290
TDB_3	*o,m*-F		$C_{11}H_8N_4SO_3F_2$	314	White solid	20	185

CONCLUSION:

5-aryl substituted 1,3,4-Thidiazole-2-amine is a versatile moiety which has various therapeutic application which attracted researcher to do synthesis of these molecules in simple, ease way and use it as a active pharmaceutical ingredients.

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Unravelling the Mysteries of Beckmann Rearrangement: A Contemporary Review

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Abstract:

The Beckmann rearrangement is a renowned organic reaction that involves the conversion of oximes to amides. This reaction is of considerable importance in organic synthesis as it enables the transformation of readily available ketoximes into valuable amides, which are universal in pharmaceuticals, agrochemicals, and materials science. The Beckmann rearrangement, named after the German chemist Ernst Otto Beckmann (1853-1923), is an acid catalysed rearrangement of an oxime to amide. The Beckmann rearrangement is an elegant transformation, and has been used to great success in the synthesis of natural products and pharmaceuticals. The Beckmann rearrangement has widely been used in synthetic organic chemistry, for example, a large-scale production of Nylon-6 is based on the synthesis of ε caprolactam from cyclohexanone oxime. In this review, we will comprehensively discuss the role of different catalysts as well as different medium for the Beckmann rearrangement. The development of Beckmann rearrangement catalysis from hazardous to greener catalyst has led to their tremendous achievements over the last 20 years prompting their greater application. The different catalytic systems will be revised considering both the catalytic performances and synthetic aspects highlighting also their advantages and disadvantages.

Introduction:

The Beckmann rearrangement is well known Organic reaction that involves the conversion of oxime to N-Substituted amide Oxime are antidote in treatment of nerve agent poisoning. Beckmann rearrangement is well-known as a very useful quantitative reaction of various oximes to the corresponding amides. Traditionally sulfuric acid is used for this reaction. Though it is very clean reactions and yield of product is almost 100%, it generates huge amount of ammonium sulfate (AS). Sulfuric acid is the most commonly used acid for commercial production of lactams. It suggests that the reaction operating at high temperature coproduces many side products.

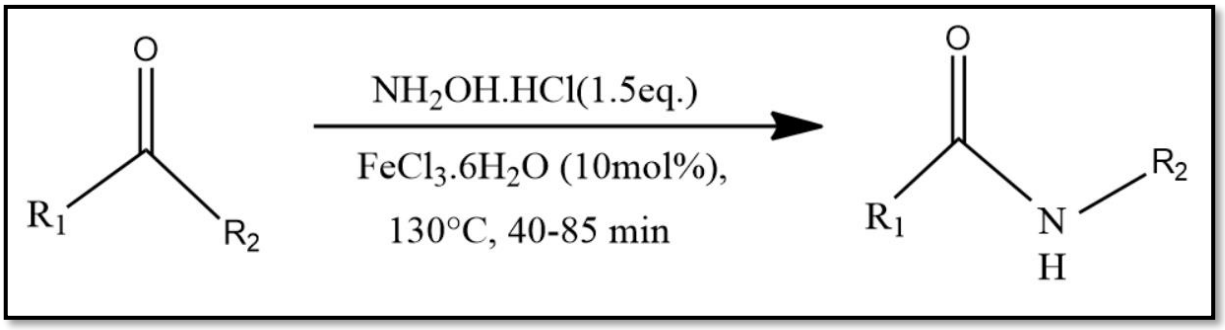
Acid catalyzed Beckmann Rearrangement-Earlier, the Beckmann rearrangement of ketoximes was carried out in presence of strong Lewisor Bronsted acids such as PCl_5 in diethyl ether, conc. sulfuric acid, HCl in acetic anhydride but it causes the serious corrosion problems. Therefore, todays there is need of synthesis of substituted amide by the root of Green Chemistry. Because the green root is the process to design the chemical reaction in environmentally friendly manner. It involves the safer chemical, safer starting compound and safer catalyst to synthesized the chemical product.

The synthetic scheme should be design in such a way that starting material are consumed to maximum extent as final product. This reaction should not generate the any toxic by-product for polluting the environment.

Scheme 1: $FeCl_3.6H_2O$ used as catalyst in Beckmann rearrangement [1].

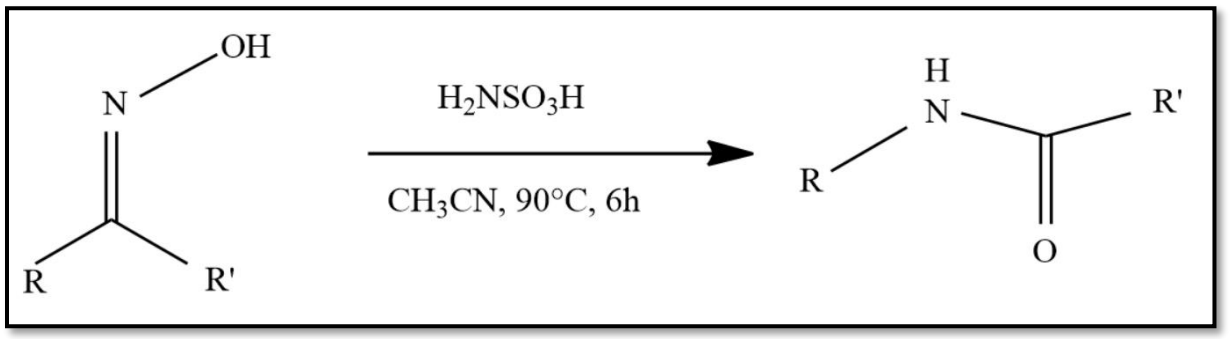
The series of experiments were performed by refluxing oximes in dry toluene for 3 h with different amounts of $FeCl_3.6H_2O$ to realize that 10 mol % of catalyst gives the best results for the formation

of amides from the oximes. The reaction condition gave up to 98% yield of different amides derivatives obtained from oximes.



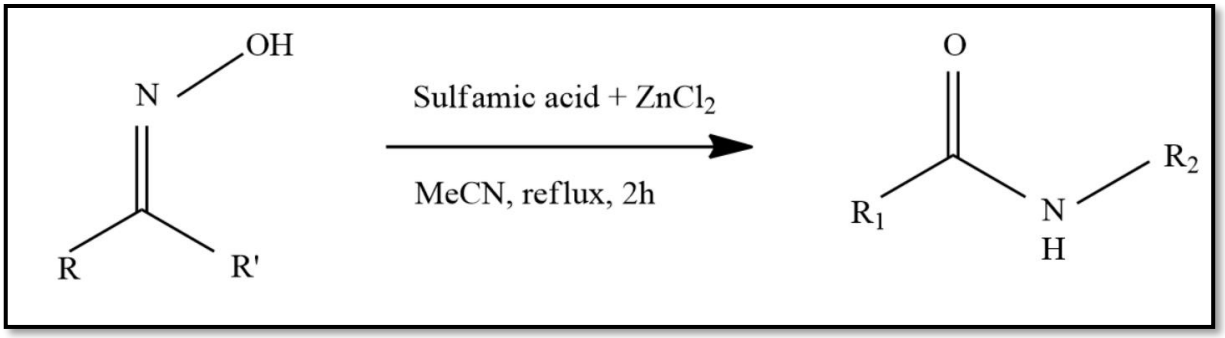
Scheme 2: Sulfamic acid catalyzed Beckmann rearrangement of ketoximes [2].

The series of experiments were performed for conversion of oximes to amides with sulphamic acid catalyst which is recyclable in presence of dry acetonitrile as a solvent. The reaction was performed at 90 ^{O}C about 6 hr that gives the best results for the formation of amides from the oximes. The sulfamic acid has specific zwitterionic feature which provide an effective route for separating a product. The reported reaction condition gave up to 96% yield different amides derivatives obtained from oximes.



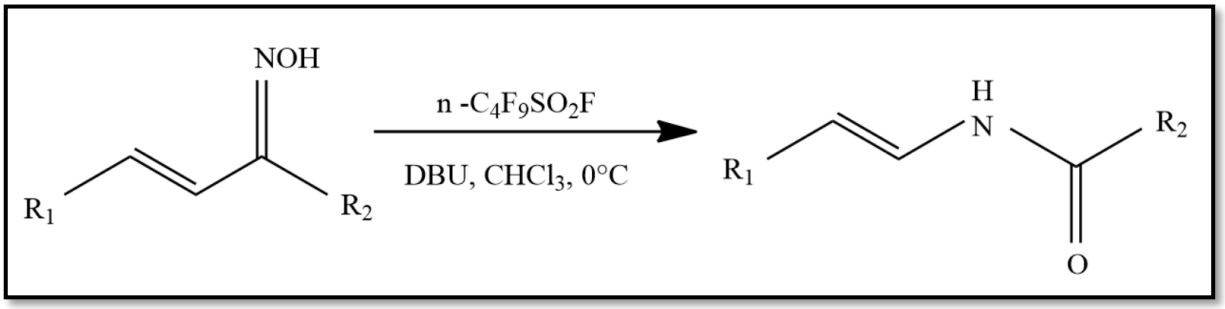
Scheme 3: Sulfamic acid and Zinc chloride catalyzed Beckmann rearrangement [3].

The synthesis of amide from ketoximes was carried out in acetonitrile. This reaction mixture was heated to reflux at 90 ^{O}C about 2hr to get 90-95% yield of product materials.



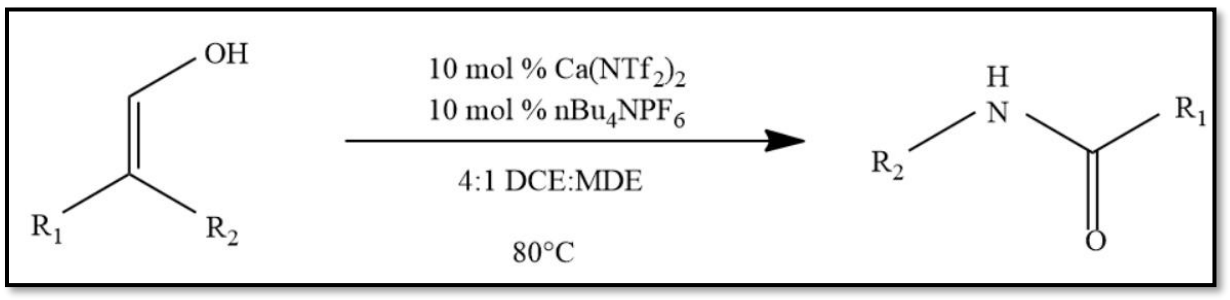
Scheme 4: n-$C_4F_9SO_2F$ induced Beckmann rearrangement of α,β-unsaturated ketoximes [4].

The reaction was performed in system of 1,8-diazabicyclo[5.4.0]undec-7-ene (DBU) and fluoroalkanosulfonyl fluorides base media for Beckmann rearrangement of α, β-unsaturated ketoximes leading to the formation of the corresponding acid-sensitive enamides with good yields.



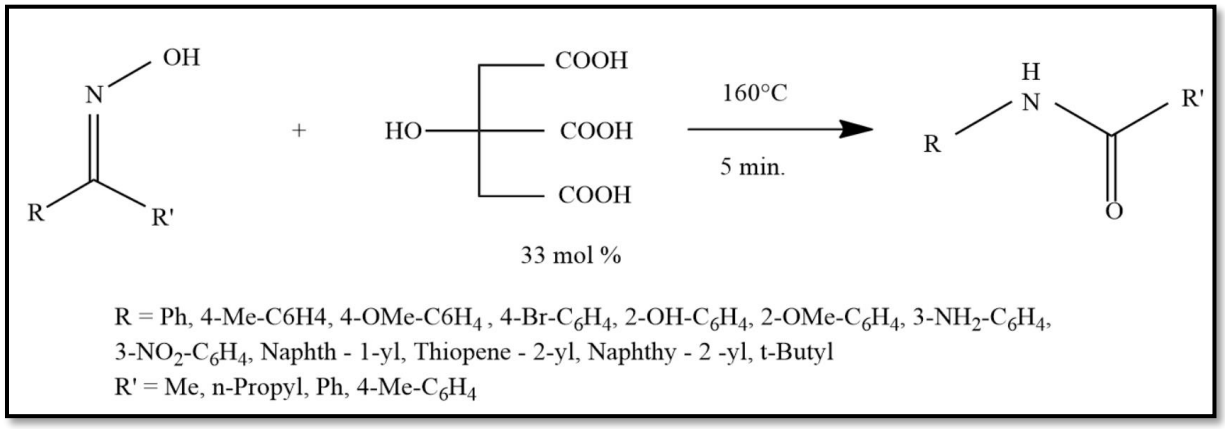
Scheme 5: Beckmann rearrangement of ketoxime with $Ca[NTf_2]_2$ and nBu_4NPF_6 [5].

The series of experiments were performed by oximes was treated with 10 mol% $Ca(NTf_2)_2/nBu_4NPF_6$ under the presence of 4:1 mixture of DCE:DME. The reaction yielded up to 93% at 80^OC in 2 hours.



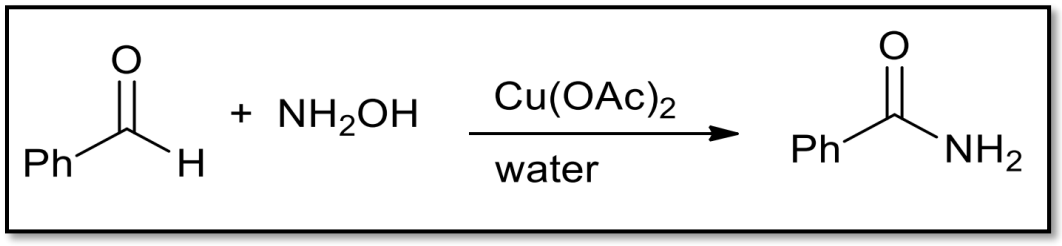
Scheme 6: Beckmann rearrangement of ketoxime to amides in presence of citric acid under solvent free conditions [6].

The series of experiments were performed for conversion of acetophenone oxime in unhydrous citric acid catalyst at 160 ^{O}C for 5 min under solvent free condition to gives 93% yield.



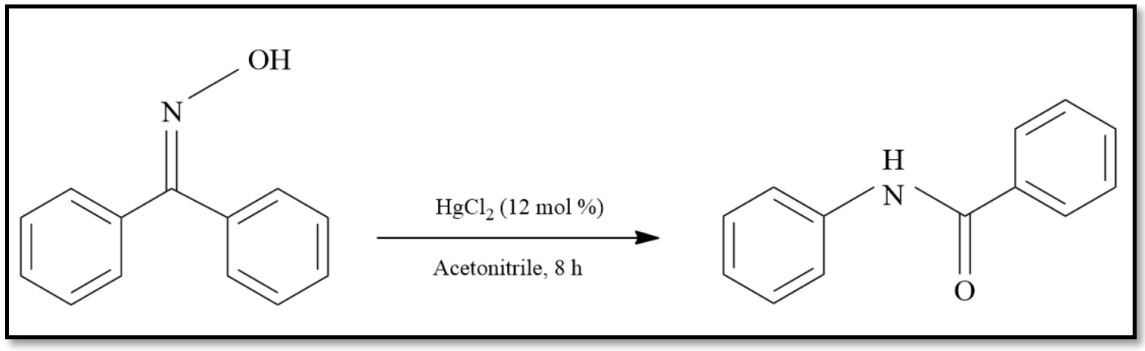
Scheme 7: Copper (II) acetate catalysed to conversion of aldehydes to amides [7].

The conversion of aldehydes to amides with hydroxylamine in water as solvent in Copper (II) acetate is versatile catalyst recyclable catalyst. This can be recovered for several times without losing its activity



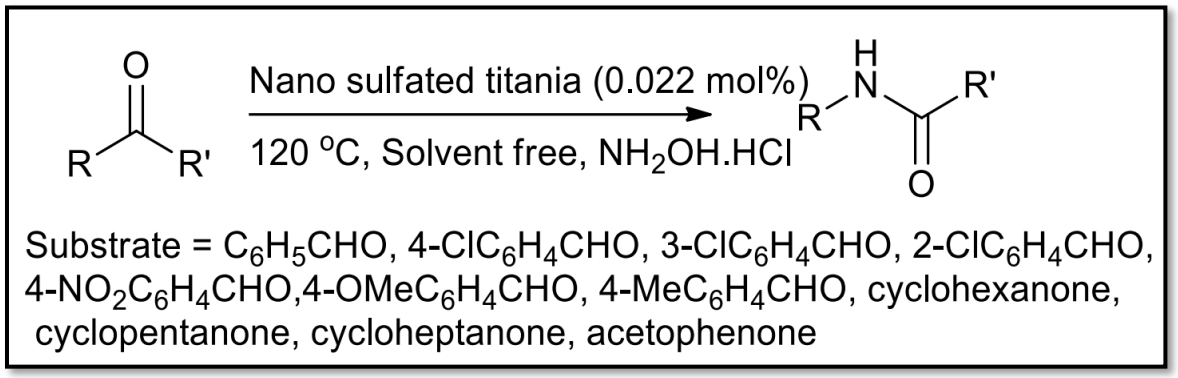
Scheme 8: Beckmann rearrangement of oxime to corresponding amides/lactams [8].

Mercury catalysed Beckmann rearrangement has been reported by Ramalingan for the synthesis of amides and lactams from corresponding oximes in the presence of mercuric (II) chloride. The transformation gave up to 92% yield in acetonitrile solvent at 80°C in 8 hr.



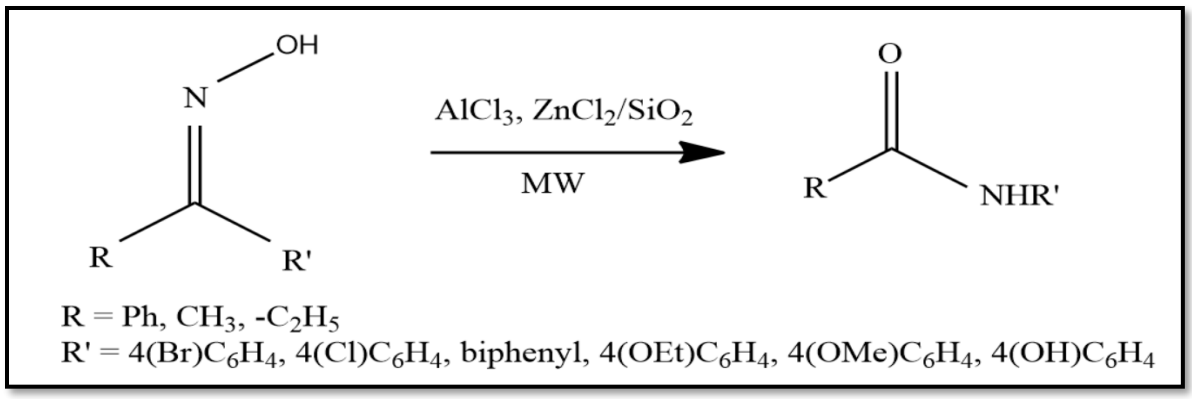
Scheme 9: Nano Sulphated titania catalysed Beckmann rearrangement [9].

Beckmann rearrangement by nano sulfated titania as a solid acid catalyst for Beckmann transformation was carried at 120°C under solvent free conditions gives



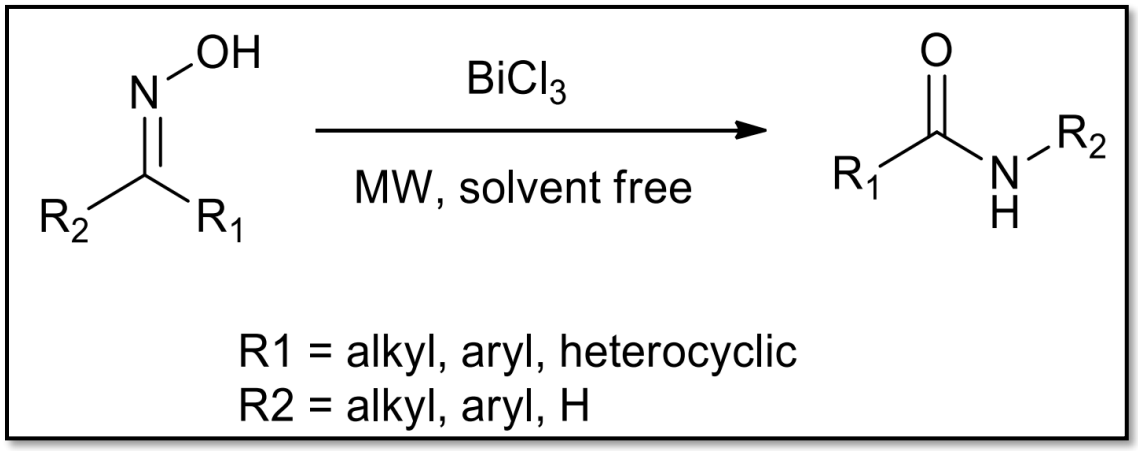
Scheme 10: Microwave assisted $AlCl_3$, $ZnCl_2/SiO_3$ catalysed Beckmann rearrangement [10].

Beckmann rearrangement was carried by using silica supported solid acid ($AlCl_3$-$ZnCl_2/SiO_2$) under microwave irradiation for the synthesis of amides from ketoximes at 5-10 min gives up to 93% yield.



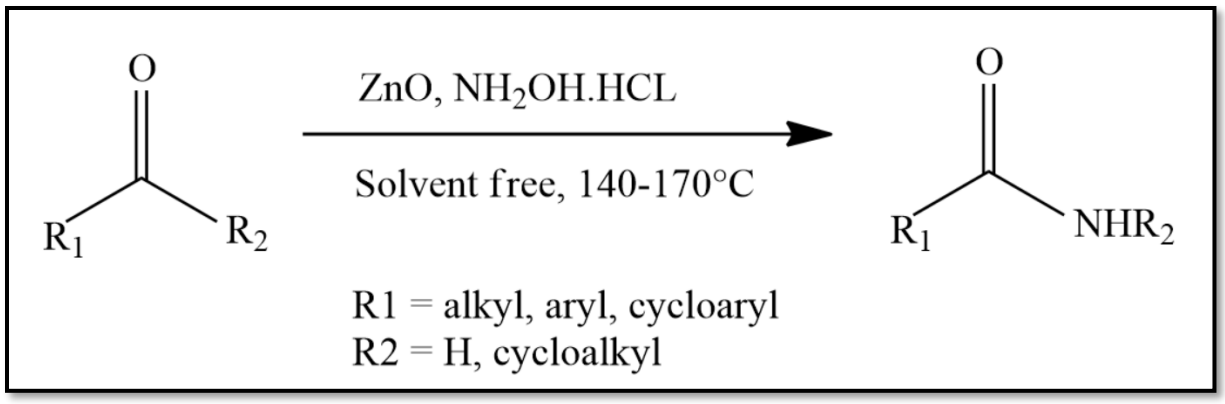
Scheme 11: Microwave assisted solvent free Beckmann rearrangement using $BiCl_3$ catalyst [11].

The conversion of Ketoximes completely into corresponding amides in the presence of Bismuth trichloride ($BiCl_3$) under solvent free condition assisted by microwave irradiation gives upto 90% yield.



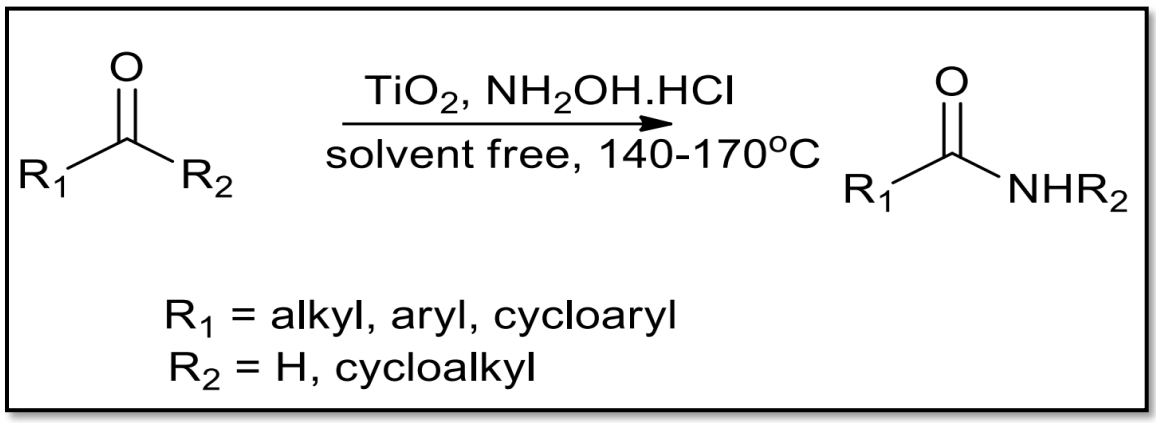
Scheme 12: ZnO catalysed Beckmann rearrangement [12].

A Beckmann rearrangement for transformations of several ketones and acetones to amides was performed in presence of zinc oxide heterogenous catalyst with hydroxylamine hydrochloride under solvent free conditions at 140-170 ^{O}C gives 95 % product.



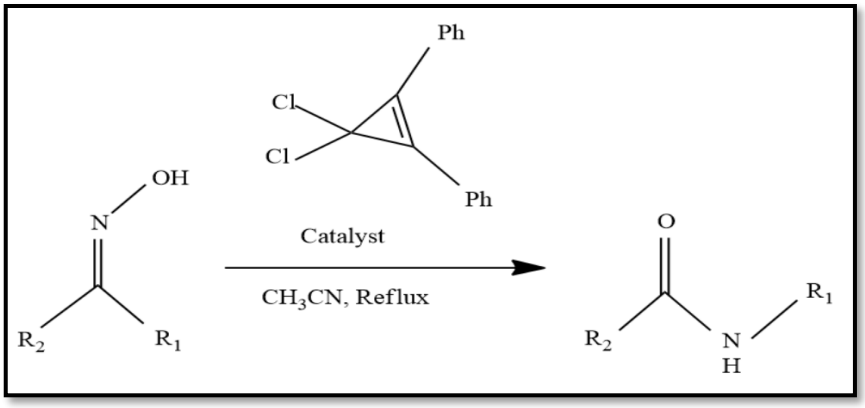
Scheme 13: Solvent free Beckmann rearrangement in presence of TiO_2 [13].

The Beckmann rearrangement was performed using Ketone or aldehyde (1 mmol), hydroxylamine hydrochloride (4.3 mmol) and TiO_2 (2 mmol) in10 ml round-bottomed flask and heated at 140–170°C at solvent free condition to get 98 % yield of amides.

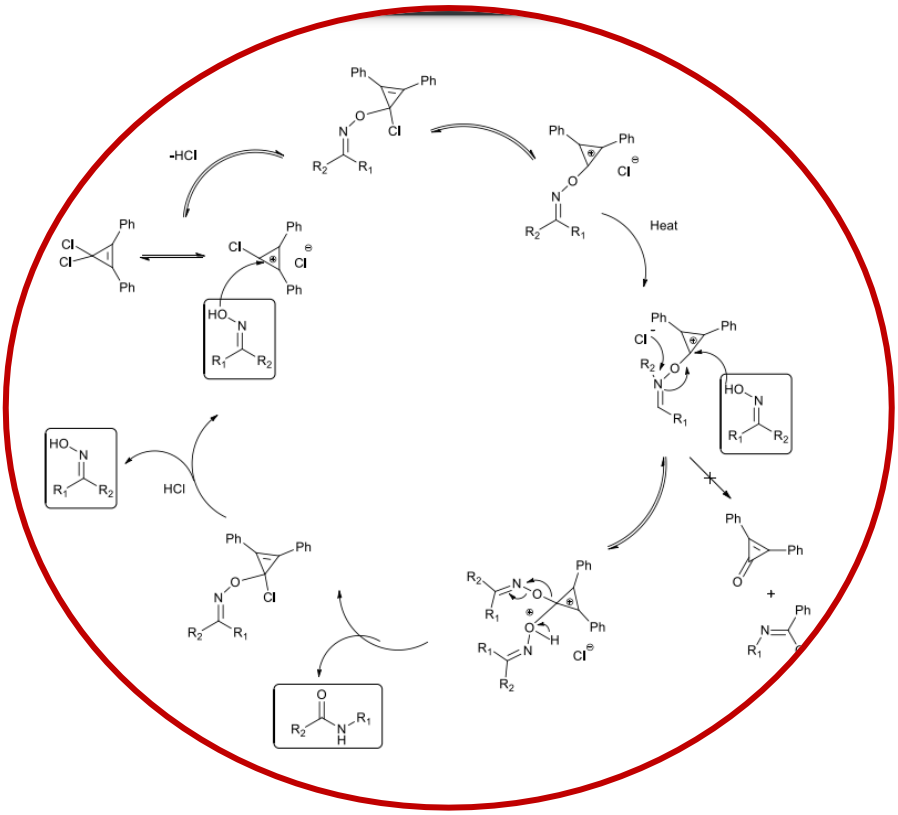


Scheme 13 Cyclopropenium ion catalysed Beckmann Rearrangement [14].

1-Chloro-2,3-diphenylcyclopropenium ion was found to be a very effective organocatalyst ketoximes to their corresponding amides/lactams synthesis. A new organocatalytic system for the transformation of ketoximes to amides/lactams based on a novel paradigm in acetonitrile solvent at refluxing condition gives upto 90% conversion of reaction.

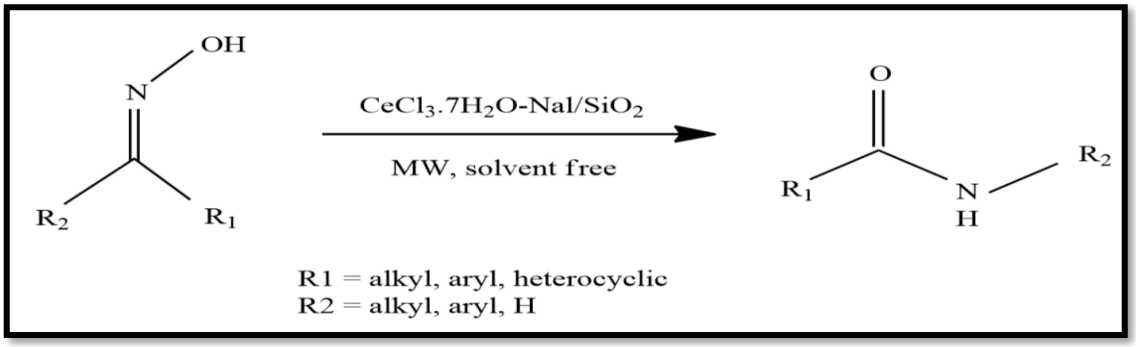


The possible catalytic cycle for Beckmann rearrangement using cyclopropenium ion catalyst is given below.



Scheme 15: Microwave assisted solvent free Beckmann rearrangement in presence of $CeCl_3 \cdot 7H_2O$-NaI/SiO_2 [15].

The evaluated the Beckmann rearrangement of various oximes under microwave irradiation at solvent free condition using $CeCl_3 \cdot 7H_2O$-NaI/SiO_2 Lewis acid catalyst gives 92% yields of product.



Conclusion

Beckmann rearrangement has become a growing and active research area for transformation of oxime to amide which is important for natural products and pharmaceuticals as well as synthesis of ε-caprolactam. In this review various catalytic approaches for the Beckmann rearrangement have been summarized since the last 20 years. As well this review aims to be a comprehensive, authoritative, critical, and accessible review of general interest to the chemistry community because the topical review offers an overview of a diverse range of catalytic approaches in different medium for Beckmann rearrangement. Organization of the data follows a subdivision according to catalyst nature: from harsh acid catalytic approaches to greener approach for the Beckmann rearrangement. Special attention is resquite in rapidly developing greener methodologies such as ionic liquids, under solvent free condition and microwave irradiation.

Acknowledgement:

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IoT-Based Smart Automatic Energy Metre for Billing System

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Abstract:

The amount of time and effort needed to obtain data from energy utility metres. The Internet of Things (IoTs) provides a rapid, low-cost means of communication, data collection on energy consumption, and power monitoring. This project's main objective is to use IoT to measure household appliances' electricity consumption and automatically generate bills. It is necessary to construct the energy grid with a distributed topology that can dynamically absorb different types of energy sources. IoT may be used for a range of smart grid applications, including distributed energy plant metres, energy generation and consumption smart energy metres, energy demand-side management, and varied fields of energy production. On the mobile IoT app, the amount of energy consumed and the consumers reported will be displayed continuously. Both electricity consumers and the utility company would be able to monitor electricity consumption remotely with this method. Because customers and the utility company may monitor consumption remotely and double-check revenue received, the system is cross-checked and effective.

Keywords: IoT System, Google Firebase database, Smart Energy Meter

Introduction:

This project describes the digitalization of load energy usage readings via the Internet. The potential for human error in the upkeep of electricity is eliminated by the suggested system architecture. By entering the channel ID of the load, the user can utilize a webpage to monitor energy consumption in watts.

To provide a more thorough explanation and visual representation of the energy usage statistics, the website uses Google Firebase analytics to analyze energy usage. The Internet of Things is enabled by the Wi-Fi unit by transmitting energy data from the load to a webpage that can be seen using the device's channel ID. Consumers can manage their energy consumption in the proposed system by tracking their energy usage over time. An ESP32 microcontroller is used in this system. Through the Wi-Fi module, the generated unit can be displayed on the webpage.

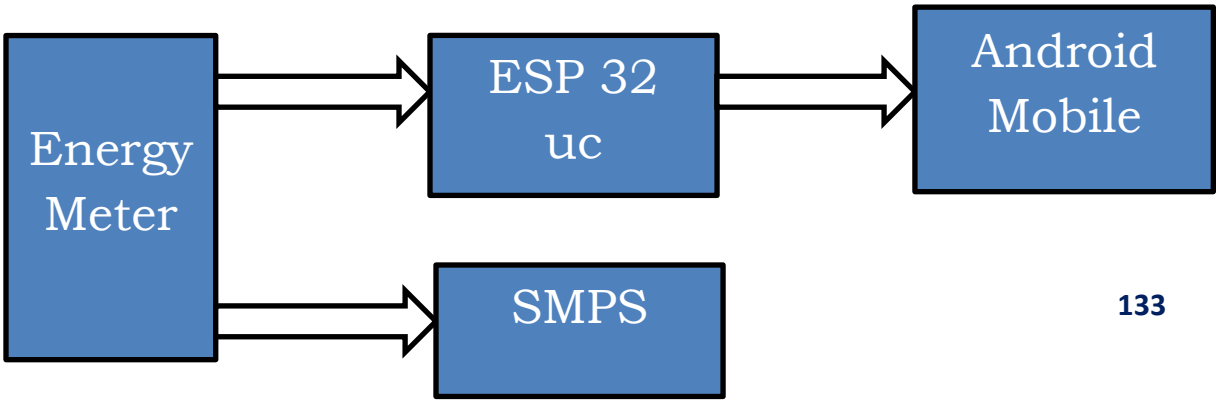
Objectives:

1. Using wroom ESP32 send the measured motor pulse values to the IoT cloud.

2. Measure and monitor power usage from anywhere

3. Using JavaScript, the web page analyses energy usage using Google Firebase analysis. Block Diagram: Working: In the proposed work I have designed an energy meter with an ESP32 microcontroller with electric pulses with the help of energy that is interfaced with the IoT cloud. In the proposed model Firebase cloud is utilized to supply secured communication between the power boards to the meter.

Block Diagram:



Working:

In the proposed work I have designed an energy meter with an ESP32 microcontroller with getting electric pulses with the help of energy that is interfaced with the IoT cloud. In the proposed model Firebase cloud is utilized to supply secured communication between the power boards to the meter.

It reduces the human interference to collect the monthly reading and it also saves time and money. To drive the ESP32 uc and the current sensor a controlled supply. ESP32 module is utilized as a central controlling and checking framework for all gadgets. Hand-off will come into the picture when the charge isn't paid to cut off the control supply.

In the proposed model Firebase cloud is utilized to supply a secured communication between the power board to the meter and the same is utilized to alert the shopper when the charging time is come moreover to send charge subtle elements Hub MCU is interfaced with the current sensor to detect control use. By the end of the month, the customer can access the dedicated app on their smartphones to obtain information on energy consumption, loads related, and corresponding billed amount. At that point, one can specifically pay our charge through that app.

In case the charge was not paid at that point the meter will naturally get turned off. To turn off the meter a few limits esteem can be set for that. Consequently, we can effectively control data. Through this Project To sum up, we receive a bill from the power board via the system's display device after putting the Intelligent Power Metre system into place.

With this method, a wireless module allows communication between the power board and the metre. When there is a power outage, a meter complaint, or any other defects with the system, it reports to the electrical board via the wireless module. In the same way, the electricity board has a server system. It comes with both a receiver and a transmitter is in constant communication with each customer's power metre.

Conclusion:

In this project an Android application for the IoT using a Java script programme and a Google Firebase interface as part of this suggested system. Using the ESP32, we're developing a metre reading programme in Google Firebase. These programmes interface with Internet of Things (IoT) programmes. Any pulse that consumes metres can be computed and shown on a phone application running on Android

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Beyond the Surface Delving into Harmful Algal Blooms and Their Management

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Abstract:

A natural phenomenon caused by a huge multiplication of phytoplankton (cyanobacteria, diatoms, and dinoflagellates) in water bodies is known as harmful algal blooms (HABs). Blooms have the potential to be harmful to the environment, human health, and aquatic life because to the production of toxic compounds and the impact of increased biomass. These blooms are growing increasingly frequent in freshwater and marine habitats, and several physical, chemical, and biological factors such as human activity and climate change have been connected to their notable amplification. This review's objective is to look at the losses brought on by HABs in different businesses and how they are managed. This was accomplished by gathering data from the technical literature and categorizing it into the following categories: 1) Human health impacts; 2) Economic impacts; 3) Ecosystem impacts; 4) Sociocultural impacts; 5) Commercial fishery impacts; 6) Tourism impacts. Human health impacts appear to be understudied in comparison to the other areas in this study. This is most likely due to difficulty in identifying the direct impact of toxins on human health due to the vast range of symptoms they might cause. **Keywords:** Harmful algal blooms, causes, impacts, control.

Introduction:

A natural occurrence brought on by an abundance of phytoplankton (cyanobacteria, diatoms, and dinoflagellates) in water bodies is known as a harmful algal bloom (HAB). HABs are frequently found in water bodies that produce toxins like microcystins and absorb nutrients from non-point sources (such as stormwater runoff and groundwater input affected by septic tanks), necessitating additional removal processes for the processing of drinking water. Toxins alter the cellular process of other organisms from plankton to humans [1]. Fish, bird, and mammal

deaths (including human deaths), respiratory and digestive tract issues, memory loss, seizures, lesions, skin irritation, and the loss of coastal resources like submerged aquatic vegetation and benthic epi- and in-fauna are among the most severe and memorable effects of HABs.

Understanding the causes of harmful algal events that have direct links with other major areas of scientific and societal concern, including eutrophication, integrated coastal area management, fisheries management, and transfer of non-indigenous marine species. These connections are crucial for solving the issue of dangerous algae and enabling society to recognize and value the outcomes of scientific advancements in the area [2]. The presence of HABs in freshwater is influenced by a variety of parameters, including as pH, water circulation, light availability, temperature, and nutrient concentrations. One of the main factors known to contribute to the production of HABs is nutrient enrichment. Nitrogen and phosphorus are two important nutrients for plant growth and for the natural components of aquatic environments. The majority of experts concur that more study is necessary to determine the best strategy for anticipating, reducing, and suppressing HAB outbreaks, including weather and how to regulate algal toxins. To determine how effective protective measures are in reducing the occurrence of harmful algal blooms, estimates of the expenses incurred by these events can be helpful [4]. This implies that they can assist in determining the best cost-effective course of action to take in order to ensure high-quality water.

Algal Blooms:

A fast proliferation of phytoplankton species, including dinoflagellates, diatoms, and cyanobacteria, in the aquatic environment is referred to as a harmful algal bloom (HAB). HABs are a natural phenomenon that poses risks to human health, aquatic life, and environmental sustainability due to the production of toxins. Representatives of the largest taxonomic category are among the HABs species [9][10]. Numerous species of HABs react to comparable general environmental cues, including as nutrition, light, and temperature. There are about go marine planktonic microalgae that are capable of producing toxins and most of them are dinoflagellates, followed by diatoms. When people consume the accumulated toxins found in aquatic animals like shellfish and filter-feeding bivalves, they may harm other bodily systems like the neurological and digestive systems. High-biomass blooms in non-toxic species can also result in HABs. The exact causes of HABs are still unclear. HABs can affect large or smaller areas either in freshwater or

marine ecosystems. The formation of HABs is mostly dependent on the stability of the water column.

Causes:

1. **Runoff of nutrients:**

The main factor for an algal bloom is the presence of high amounts of phosphorus and nitrogen in the water. Farms and areas that regularly apply phosphate and nitrogenous fertilizers lose these nutrients to runoff. Rainfall contributes by carrying these soil-soluble nutrients into rivers, streams, and lakes, which in turn end up in large reservoirs like the ocean [15]. These fertilizers are also deposited into waterways by drainage systems. Untreated raw sewage from poor sewage treatment finds its way into aquatic bodies, where its high nitrogen content (nitrates and ammonia) leads to algal blooms. Raw toxic waste is released into water systems as a result of water pollution, particularly the discharge of poorly treated or unprocessed industrial waste into waterways. The result is dense algae development since it contains nutrients and chemicals like nitrogen, lead, and phosphorus [18].

2. **High Temperature:**

Global warming is harming the ozone layer, putting the entire world at risk. This is one of the key reasons why the algal bloom is spreading so quickly. Certain bacteria require a comfortable temperature to survive both in and out of water [12]. Extremely high temperatures caused by global warming have resulted in the rapid breakdown of nutrients like nitrates and ammonia, which are simpler for bacteria to consume and grow in huge quantities.

3. **Presence of dead organic matter:**

In general, there are many different types of bacteria in the atmosphere and water. They're all searching for the right medium for growth and nutrition [10][5]. As a result, the algal bacterium, like other bacteria, benefitted from the presence of dead organisms in the water. The decaying organic matter, when combined with the nutrients in the water, promotes the growth of algae in the water, resulting in an algae bloom.

4. **Slow moving water:**

Algal blooms require significant amounts of water to thrive, which are currently scarce. The majority of blue-green algae require stable water with low flows, longer retention times, light

winds, and little turbulence; others prefer turbid water and mixing conditions [20][19]. In such waters, there are fewer disturbances in their propagation, which explains why they develop slowly in rivers and streams with a high flow rate.

5. **Light:**

The growth of blue-green algae populations is limited when they are exposed to high light intensities for long periods of time (photo-inhibition), but their growth is increased when they are exposed to high light intensities constantly [11]. These circumstances exist beneath the sea's surface, where the light environment is continually changing.

6. **Turbidity:**

The presence of organic matter (flocs) and suspended particles in the water column is what causes turbidity. When a large amount of water is flowing through the system, turbidity occurs (high discharge after a rain event). Low turbidity occurs when the water column contains just a tiny amount of suspended particles [7][8]. Low turbidity is caused by slow-moving or stagnant water, which permits suspended particles to settle out of the water column. Low turbidity allows lighter to penetrate the water column, creating ideal conditions for algal growth. Growing algae, on the other hand, results in a turbid environment.

Impacts:

1 Human health impacts: The most severe human health impacts occur from consumption of shellfish with HAB toxins. Shellfish like clams, mussels and oysters, pose a particular threat to human consumers because these organisms filter large volumes of water as they feed and as a result can rapidly concentrate algal toxins in their tissue. The main illness caused by marine toxins in humans include Amnesic shellfish poisoning (ASP), Ciguatera fish poisoning (CFP), Neurotoxic shellfish poisoning (NSP), Diarrhetic shellfish poisoning (DSP), and Paralytic shellfish poisoning (PSP). Ciguatera fish poisoning (CFP) occurs in sub-tropical and tropical waters and is the most common finfish poisoning [16]. Saxitoxin puffer fish poisoning is a type of finfish poisoning posing an emerging threat in Florida. Sickness and hospitalization because of intoxication incidents results in the illness investigation, cost of medical treatment, emergency transportation and are also responsible for the loss of individual productivities.

Toxins	Poisoning	Most common organisms producing toxins	Effects
Domoic acid	Amnesic shellfish poisoning (ASP)	*Pseudo-nitzschia*	Amnesia, hallucinations, confusion, vomiting, cramping
Ciguatoxins	Ciguatera fish poisoning (CFP)	*Gambierdiscus toxicus*	Tingling, itching, hypotension, bradycardia, vomiting, diarrhoea, nausea
Brevetoxins	Neurotoxic shellfish poisoning (NSP)	*Kerenia brevis, Chattonella marina, C. antiqua, Fibrocapsa japonica, Heterosigma akashiwo*	Tingling, numbness, nausea, muscular pain, neurologic symptoms
Okadaic acid, Dinophysis toxins	Diarrhetic shellfish poisoning (DSP)	*Dinophysis spp., Prorocentrum spp.*	Diarrhoea, nausea, vomiting, abdominal cramps
Saxitoxins	Paralytic shellfish poisoning (PSP)	*Alexandrium spp., Gymnodinium spp., Pyrodinium spp.*	Muscle twitching, burning, numbness, drowniess, headache, vertigo, respiratory paralysis leading to death

Table no. 1: Marine toxins, poisoning, most common organisms producing toxins and effect levels

2. Economic impacts: HAB event have an impact on a wide range of economic sectors and they can have major and lasting negative impacts for local economies. Human poisoning caused HABs can result in lost pay and work days, as well as medical treatment costs. HABs have an impact on several aspects of the commercial fishing sector, ranging from product loss (e. g. direct) to increased costs (e. g. indirect). Other important economic considerations related with HABs include lost tourism and recreation revenue, as well as monitoring and management costs.

The annual economic impact of marine HAB events in the United States, according to Hoagland and Scatasta, is $ 82 million per year [3]. Although data on the overall effects of particular events is limited, these estimates are likely conservative.

3. Ecosystem impacts:

Toxic and non-toxic HABs can have a wide variety of effect on ecosystem. Toxic HAB species can kill fish and sicken mammals, birds, and humans as they move up the food chain. Non-toxic species can have a variety of effects, including shellfish extinction, habitat loss, seagrass die-backs, hypoxia and changed food chain interactions that reduce the abundance of higher trophic level species. Microalgal toxins and their long-term effect on animal health, sustainable fisheries, endangered species and ecosystem must be acknowledged as important risks [14]. Algal toxins are known to have top-down (i.e. impacting predators and influencing grazers) and bottom-up (i.e. influencing grazing) effects on ecosystems (i.e. affecting plankton and benthic communities). Certain populations are at greater risk as HABs and their toxins, either directly or indirectly through the food web [9]. Increased vulnerability to disease immunosuppression, aberrant development and tumor induction are all long-term impacts of biotoxins on the health of aquatic animals.

4. Sociocultural impacts:

Among the social implications are modifications to "the ways individuals live, work, play, relate to one another, organize to meet their needs and generally cope as members of a society." Sociocultural consequences can result from the public health, environmental, and economic factors previously stated [8]. Other than human health and the economy the direct sociocultural impacts of HABs have not been documented, though they have been described in some cases.

5 Commercial fishery impacts:

Episodes of harmful algal blooms (HABs) are significantly linked to economic losses in the fish market. During HABs, algal toxins may be ingested by fish, resulting in the finalization of the fish market, while algal growth may result in oxygen depletion in waterbodies, resulting in fish mortality. Only some of the cost of fish and a decrease in customer demand due to a tendency to purchase fish at high price, particularly during HABs manifestations. A commercial fisheries halt has a direct economic impact on producers and when harvested fishes are unable to reach the market due to high levels of toxicity, the economic impact must also account for harvest costs. HABs may also have an effect on aquaculture systems, which may need to invest more money to protect their business activities. Because the public is so concerned about seafood safety, the

economic impact of commercial and recreational fishing is an important factor in determining how people react to the problem producing by HABs [13]. However, in comparison to freshwater economic research on the impact of HABs on the commercial fishing sector generally apply to seawater.

7. **Tourism impact/ recreation impacts:**

Different aspects influence the economic effect reported during harmful algal blooms (HABs) outbreaks, one of which is tourism and recreation impact. Fishing closure of longline fishing, a dip in attendance at hotels, restaurants and the number of rented summer homes are all examples of the economic damage produced by blooms. The economic effects on tourism and recreation are influenced by changes in the marine or freshwater environment caused by blooms. The discoloration of the water, the accumulation of dead fish on beaches and the smell of algae decomposition are all examples of these changes. When analyzing the local economic impact of these 2 sectors, a redirection of tourism business should be considered because other activities may again from HAB manifestations [19]. This shows that the economic effects of HABs on a state or nation could be difficult to estimate in many cases.

Control:

The most difficult and controversial part of HAB management is bloom control. Actions performed to suppress or destroy HABs directly intervening in the bloom process. HAB science in this area is primitive and slow-moving.

To reduce an invasive or dangerous species, there are five broad categories or methods that might be applied. Mechanical, biological, chemical, genetic, and environmental control are examples of these. A few of them have been used on HAB species. Spreading clay across the water's surface is one way to provide mechanical control by removing HAB cells from the water. HAB cells are removed by sedimentation, which is the result of clay particles combining with one another and with the cells. The work has advanced because this control method makes social and economic sense in nations like Korea, where HABs are putting a fish-farming industry valued at hundreds of millions of dollars at jeopardy. In some areas, the cost-benefit analysis is less clear, and converting research to practical application will take a significant amount of effort. For example, research on clay mitigation has progressed relatively far in nations like as the United

States, but there is a huge challenge to obtaining permits, environmental clearances, and money to implement this method on a larger scale.

Although it is theoretically possible to use a large number of organisms to regulate HABs, biological control is still very far off due to significant logistical issues. The idea of releasing one creature to manage another in the ocean is still debatable, despite the fact popular biocontrol techniques in agriculture include the release of sterile males or the use of pheromones to control insect pests. Despite multiple examples of such a technique having negative long-term effects on land (such as the introduction of the mongoose to oceanic islands or the giant toad to Australia, there are numerous cases where it has been both effective and environmentally benign on land. In marine systems, the concept is important to consider.

Chemical control depends upon the release of toxic chemicals, as well as the production of particular chemical regulator. Copper, supplied by crop dusting planes, was used to control the Florida red tide organism in 1957. The HAB community has not looked at chemical control very much, perhaps because of a widespread misconception that it will be difficult or impossible to produce an ecologically acceptable chemical that targets a particular HAB species without killing other organisms.

Genetic control, the genetic engineering of organisms that are actively introduced to affect environmental tolerances, reproduction, or other processes in the unwanted species is another technique for controlling invasive or exotic species. In many ways, the challenges around this type of control technique are similar to those regarding biological control concerns on potential detrimental effects of introducing a organism that is no native to a region. There have been lots of examples of genetic techniques being effectively used in terrestrial agriculture to produce their own insecticides [15]. HABs, a type of marine pest, might be subjected to similar genetic changes. For example, it could be able to engineer a HAB species to stop producing toxins. Similarly, genetic changes could be used to make a specific strain of bacteria more harmful to HAB cells. However, social problems loom significant for these types of methods, and it is likely that getting permission for such approaches will be extremely difficult in the future. However, rather than rejecting these strategies based on hypothetical effects, we should continue the study and testing required to get the evidence needed to make such decisions.

The fifth and final control strategy is environmental manipulation, which involves making chemical or physical modifications in order to affect the target species and enhance a natural or introduced bio-controlled species. For HABs, this could involve large-scale fertilizers in coastal waterways via pollution control strategies. Environmental manipulation over shorter time scales is very challenging, but it might involve measures to modify water flow rate or dwell duration, such as dredging or channel opening. Aeration or other means to destabilize stratification could also be used, resulting in alternation in the phytoplankton community composition.

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On

Role of Business in Sustainable Development: Commerce and Management Perspective

Organized by

Department of Commerce and Management and IQAC

In Collaboration with

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It gives me great pleasure to extend to you all a warm welcome on behalf of all those who have accepted our invitation to convene this One Day's National Conference on "Role of Business In Sustainable Development: Commerce and Management Perspective" organized by Savitribai Phule Mahila Mahavidyalaya, Satara, in collaboration with Karmveer Bhaurao Patil Institute of Management Studies and Research, Varye Satara on 11th March-2023. First and foremost, I would like to thank the Guest of honor Hon'ble Prof. (Dr.)S. S. Mahajan Dean, Faculty of Commerce and Management, Shivaji University, Kolhapur, our Resource persons Prof. (Dr.) P.M. Kulkarni, Professor in KLS IMER Belgavi (Karnataka), Dr. S. A. Borgave, Director, Pratibha Institute of Business Management, Pune. Dr. B. S. Kudachimath Associate Professor, Visveshvaraya Technological University, Belgavi (Karnataka), Prof. (Dr.) A.M. Gurav, Professor and Head, Department of Commerce and Management, Shivaji University, Kolhapur. Also, my sincere thanks owe to Hon'ble Chairman, Dr. Anil Patil, Vice-Chairman Adv. Bhagirath Shinde, Secretary Prin. Dr. Vitthal Shivankar, for giving us an opportunity to organize this National event and providing valuable guidance regarding the Conference. Moving further, I would like to appreciate the kindness and sincere efforts of our National advisory and local organizing committees' members. My team would like to be indebted to all the scholars who have submitted their research papers for publication and showed their sincere interest in the success of this conference. Your genuine feeling is also highly appreciated by our Management. I really appreciate the efforts of Convener Dr.S.S. Pawar and Co-Convener Dr. S. S. Bhola as well as Conference Co-ordinator Mr. N.D. Banasode and his colleagues, IQAC Chairman Dr. Jayshree Aphale, and Vice-Principal Dr. S. S. Gharge of this college have made painstaking efforts to plan this joint venture. Finally I would like to thanks to Dr. B. S. Sawant, Director, Karmaveer Bhaurao Patil Institute of Management Studies & Research, Satara for his collaborations and support. I also owe due recognition to everyone who is directly or indirectly associated with the organization of this conference.

JAY KARMAVEER!
Thank you very much.

Prin. Dr. Shivling Menkudale
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Current Trends in Business Sustainability and HRM of 2020

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Abstract

Business sustainability has become an important consideration for organizations in the modern world. In this research paper, we explore current trends in business sustainability and their relationship with human resource management (HRM). Specifically, we investigate how businesses are integrating sustainability into their HRM practices to achieve sustainability goals while remaining competitive in the market. Our research draws on academic literature, industry reports, and case studies to provide an overview of current trends in business sustainability and HRM. We find that businesses are adopting a range of practices to promote sustainability, including green initiatives, employee engagement, and diversity and inclusion programs. Additionally, we find that HRM is critical to the success of sustainability initiatives, as it helps to align employee behavior and values with the organization's sustainability goals.

Introduction:

Sustainability has become an increasingly important concept for businesses across the globe in recent years. In order to ensure long-term success, organizations must focus on sustainability initiatives that help them meet their environmental, social, and economic goals. One critical aspect of business sustainability is the role of human resources management (HRM). In this paper, we will explore the current trends in business sustainability and HRM in 2020.

I.**Business Sustainability Trends:**

1. **Circular Economy**: The circular economy is a system that aims to minimize waste and make the most of resources. Businesses that adopt a circular economy approach can reduce their environmental impact while also improving their bottom line. One way this is achieved is by using sustainable materials and designing products with recycling in mind.

2. **Carbon Neutrality -** Carbon neutrality refers to achieving net-zero carbon emissions. Many organizations have set ambitious goals to become carbon neutral by 2030 or earlier. To achieve this, they are adopting various measures, such as investing in renewable energy, reducing their carbon footprint, and implementing circular economy practices.
3. **Sustainable Packaging -** Sustainable packaging refers to using packaging materials that are environmentally friendly and can be easily recycled or reused. Many organizations are adopting sustainable packaging practices to reduce their environmental impact.
4. **Green Energy:** The shift towards green energy sources such as wind and solar power has been gaining momentum over the past decade. In 2020, many businesses are making a concerted effort to reduce their carbon footprint by sourcing renewable energy.
5. **Sustainable Supply Chains:** Consumers are increasingly concerned about the environmental and social impact of the products they purchase. To meet this demand, businesses are focusing on building sustainable supply chains that ensure the ethical sourcing of materials and fair labor practices.
6. **Corporate Social Responsibility:** Corporate social responsibility (CSR) has become a critical aspect of business sustainability in recent years. Companies that prioritize CSR initiatives can improve their brand reputation, attract and retain top talent, and increase customer loyalty.
7. **Climate Action:** One of the biggest sustainability challenges facing businesses is climate change. As a result, many companies are taking steps to reduce their carbon footprint and become more energy-efficient. This includes investing in renewable energy sources, implementing green supply chains, and adopting circular business models.

II. Current Trends in HRM Trends:

Diversity and Inclusion: Diversity and inclusion are critical components of HRM in 2020. By creating a more diverse and inclusive workplace, businesses can foster a culture of creativity, innovation, and collaboration.

1. **Employee Well-being:** The well-being of employees has become a top priority for many businesses in 2020. By offering wellness programs, flexible work arrangements, and

mental health resources, companies can improve employee engagement, reduce absenteeism, and increase productivity.

2. **Remote Work:** The COVID-19 pandemic has accelerated the shift towards remote work. Many businesses are now offering remote work options to their employees, which can increase flexibility and work-life balance.
3. **Skills Development:** With the rapid pace of technological change, businesses must prioritize skills development to ensure their employees can adapt to new technologies and remain competitive. In 2020,
4. **Employee Engagement -** Engaging employees in sustainability initiatives can be a powerful tool in promoting sustainability within an organization. This includes providing sustainability training to employees, involving them in sustainability projects, and recognizing and rewarding sustainability efforts.
5. **Diversity and Inclusion -** Diversity and inclusion are essential components of sustainability. Organizations that value diversity and inclusion are more likely to be sustainable in the long run. HRM can promote diversity and inclusion by implementing policies and practices that encourage diversity, such as diverse recruitment and retention practices.
6. **Sustainable Leadership -** Sustainable leadership refers to leadership that prioritizes sustainability in decision-making. HRM can promote sustainable leadership by selecting and developing leaders who value sustainability, providing sustainability training to leaders, and evaluating leaders' performance based on their sustainability efforts.

Conclusion :-

The trends in business sustainability and HRM for 2020 and beyond reflect the growing recognition that sustainable business practices and employee well-being are essential for long-term business success. As companies seek to address the challenges posed by climate change and other environmental issues, they are also recognizing the need to promote employee well-being and engagement. By adopting circular economy principles, reporting on their sustainability performance, and leveraging technology to support employee engagement and productivity, companies can create more sustainable and

socially responsible business models that are better equipped to meet the needs of their stakeholders in the years ahead.

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The Role of Human Resource Management

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Introduction:
Human Resource Development system policies and strategies must make significant and measurable contribution to the overall organization. In India unemployment problem is very serious problem of the country, i.e. human resource planning and development is today's needed. Human Resource Management (HRM) is concerned with the People in Management. HRM is the term increasingly used to refer to the philosophy, policies, procedures and practice relating to the management of people within organization. Organization able to acquire, develop. Recruitment is a core function of the Human Resource department. Stimulate and keep outstanding workers will be both Effective and efficient. HRM is the qualitative improvement of human beings who are considered the most valuable asset of an organization the sources, resources and users of all the product and services. HRM is also more comprehensive and deep rooted than Training and development. HRM play very important role in today's modern organization. "The process of employing people, developing their resources, utilizing, maintaining & compensating their service in tune with the job &organizational requirements with a view to contribute to the goals of the organization, individual & the society.
Keyword: - *Human Resource Management, Recruitment and Selection of Employee, Sources of Recruitment*

Definition of Human Resource Management:1) "The human resource management is viewed as a system in which participants Seeks to attain both individual and group goals." 2) HRM is the various function of the process from the Recruitment to Retirement of employees 3) According to Ivancevich and Glucck "Human resource management is the function performed in organization that facilities the most effective use of people (employees) to achieve organizational and individual goals. 4) According to Wendell L French "the human resource management refers to the philosophy, policies, procedures, & practice related to the management of people within an organization.

Research Methodology: Present paper based on secondary data. Collect information for this study from various books, reference books, journal, newspaper etc.

Discussion

The Objectives of human resource management are derived from the basic objective of an organization. HRM's summarized objectives are follows1) To improve the service rendered by the enterprise to society through building better employee moral

2) To established in the mind of those associated with the enterprise, employees, shareholders, creditors, customers and the public. 3) To create and utilized an able and motivated workforce to accomplish the basic organizational goals. 4) To employ the skill and knowledge of employees efficiency and effectively. 5) To maintain high employee morale and sound human relation by sustaining and improving the various condition and facilities. 6) To provide facilities and condition of work and creation of favorable atmosphere for maintaining stability of employment.

The Need of Human Resource Management Policy – Manpower planning is essentially the process of getting the right number of qualified people into the right job at the right time. It is a system matching the supply of people (existing employees & those to be hired or searched for) with openings the organization expects over a time frame. Human Resource policies introduce the employees to the objectives of the organization. It guides the workers in achieving the objectives. They work enthusiastically and with loyalty to get those objectives. Human Resource policies provide guidance to management in relation to the Human Resource problems. Human Resource policies decide how to get the work done by the people or how to behave with them. Human Resource policies help executives at various levels of decision centers to act with confidence without consulting the superiors every time. Human Resource policies give a manager liberty to choose the alternatives provided and to decide upon the action. Human Resource Policies guide the employees to take action for achieving the objectives of the organization. Hence, they must be known and well understood by everyone in order to concentrate efforts on the objectives. Human Resource policies furnish the general standard on which decisions are taken. Various line authorities take decisions in an organization keeping in view the HR policies. Thus, uniformity of action is maintained in similar cases. Human Resource policies make delegation of authority possible, which means assigning the work to others and give them authority to do it. Human Resource policies specify relationships among organization, management and workers. Therefore, each group works for the achievement of the larger objectives of the organization without any policy conflicts. Thus, Human Resource policies

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This is to certify that, Prof/Dr./Mr./Mrs./Miss. Afroj . M. Dange of Annasaheb Awate College, Manchar has participated/presented research paper entitled " Effectiveness of Library Promotional & Marketing Techniques. " in One day International Multi-disciplinary Conference on "Global Paradigm Shift: Initiatives of India in Science, Education, Technology, Business and Climate" organized by Internal Quality Assurance Cell (IQAC) held on Wednesday, 10th January 2024.

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Effectiveness of Library Promotional and Marketing Techniques

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Abstract: *Promotion and marketing of a library like any other product become essential to attract users and raise awareness about the library. The present paper aims to determine which techniques were used by Rayat Shikshan Sanstha senior college librarian to promote their libraries and to know the effectiveness of those techniques. Data were collected by an online questionnaire sent to the respondents. Frequently distribution and descriptive statistics were used to interpret the data. Findings show that librarians used a variety of techniques to promote the library. In this online virtual world,the result shows that the books for reading are decided by the users by handling them physically and by reading their summaries. This study provides a better understanding of academic libraries' or librarians' attitudes and views towards library promotional techniques.*

Keywords: Library promotion, Marketing of library, Effective techniques, Library promotional techniques, Library services and resources etc

I. INTRODUCTION

Libraries are considered a treasure of knowledge because all libraries in the world are full of various types of reading materials which are recorded by various peoples, and eminent writers. Before the invention of the internet and smartphones libraries werethe only choice to search for information but in today's digital era situation is not the same. For academic purposes libraries are not only the single choice for students and faculty to search for information, they search for information on Google instead of the library and this situation is very dangerous for the existence of the library. Nowadays for libraries, it is not enough to give good services they need to promote their resources, raise awareness about the available resources and need to find various ways to attract users as effectively as possible. To create awareness among the students, promote the available resources, improvethe library's image and for their survival, librarians need to acquire new skills of marketing. The present paper deals with the various marketing strategies and their effectiveness used by senior college librarians of Rayat Shikshan Sanstha, Satara (RSS, Satara)

Objectives:

- To explore different strategies used by college librarians of RSS, Satara.
- To measure the effectiveness of different marketing techniques.
- To find out innovative techniques for library promotion if any other than the traditional techniques they have used.

II. METHODOLOGY

There are 42 senior colleges in RSS Satara. The research respondents of this study were working as a senior college librarian in various senior colleges of RSS, Satara. For some reason except for 02 librarians, all 40 librarians were sent questionnaires online and given time to complete them and return within 10 days. To gain more responses reminders were sent them. All participation was strictly voluntary.

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III. LITERATURE REVIEW

Maximum research published on the marketing of library services and various techniques used to marketing of library resources and services and their effectiveness. Research reports that methods of library marketing have changed from print media to social media for example blogs, wikis, Facebook, YouTube, Telegram, instant messaging etc. can be used to promote the library. Librarians need to acquire new tools and techniques for the survival of library existence.

Breeding[1] advised that libraries use RSS feeds to attract potential users to the library and found the application of Web 2.0 in the marketing of libraries is very challenging. David and Sagun[2] suggested that libraries ought to start relationship marketing strategies with the students and faculty to make library resources and services visible. Because of the influence of social media, Landis[3] stated that using popular social networking tools like Facebook can be useful and effective in marketing resources and events. Nkanga[4] found that traditional promotional techniques such as personal contact, circulars, memos, telephone calls, meetings, displays, talks, newsletters, and leaflets were widely used. Rheingald[5] found that the use of mobile phones in the marketing of library services and resources is economic. Further, it provides instant response and contact with users. Relationship marketing is related to service marketing because it cultivates the long-term relationship among the staff and users. Whereas Robinson[6] communicate that to remain relevant in this fast-changing world libraries must adopt a marketing orientation. Libraries must try and understand their users and what they do to search for information. Yi Zhixian[7] found that various techniques were used by librarians and the effectiveness of various techniques depended on the librarian's point of view. The literature review article suggested various ways to promote library services and resources. The present article aims to know the various strategies of marketing used by RSS senior college librarians and measure the effectiveness of the techniques.

Survey design:

Survey questions focused on basic details of librarians like qualification, experience, workshops attended on marketing, knowing the effectiveness of the promotional strategies used by them and quoting any other innovative practices they follow to promote libraries. The techniques and strategies listed include-

Print material: Library pamphlets and brochures, print advertisements, and Library newsletter.

Digital media: social media, College or Library website announcements and emails.

Events: Library orientation programme, classroom instructions, book exhibitions, library tours and face-to-face conversation, and at the last for option respondents could write about there any other strategy to promote library resources.

IV. DATA ANALYSIS AND FINDINGS

In this study, 62.5% (25) of the 40 librarians successfully answered the questionnaire on the effectiveness of strategies used to promote the library. The final analysis did not include 15 incomplete questionnaires. Out of all respondents, 56% know marketing techniques by attending workshops on marketing.

Descriptive result:

When we thought about more used techniques for library promotion, 92% of respondents from RSS Satara used the library orientation programme as their priority. 88% of respondents chose as a second priority to arrange the book exhibition and after that, 84% of respondents used social media as well as college and Library website announcements to market their libraries.

Classroom instructions and face-to-face conversation for library marketing were used by 76% of respondents followed by 52% of respondents who arranged library tours to introduce their library. Pamphlets and brochures are traditional ways to market the library, 48% of respondents used pamphlets and brochures. After that 40% of respondents sent emails about the library services and collection or new arrival lists to promote their library. Library newsletterswere used by 28% of respondents whereas 24% of respondents used print advertisement strategy. Very few means only 4% of respondents used to arrange the reader clubs, circulate the library notices and use Google forms to promote their library which they are quoted in others' comments section.

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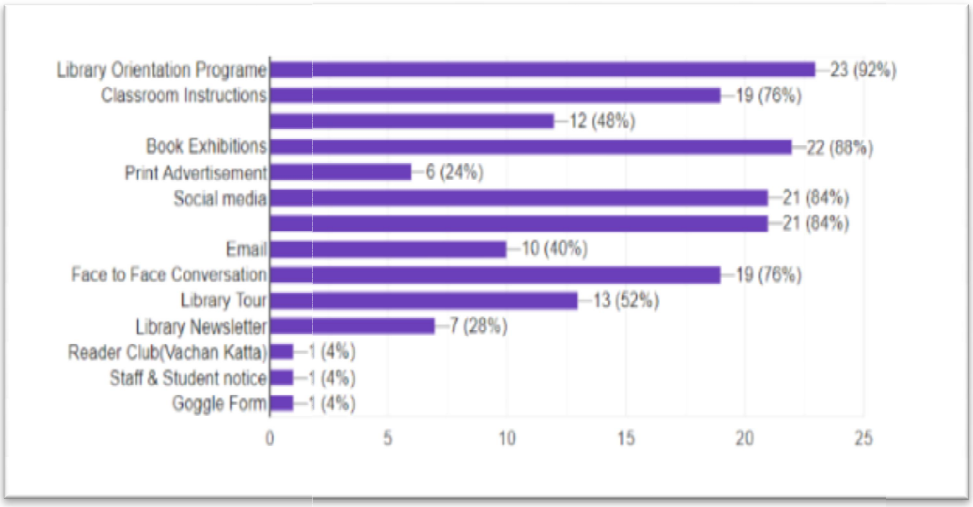

Chart No. 1 - Frequently used techniques by respondents for library promotion.

In terms of which techniques used were considered effective, 68% thought that library orientation was effective whereas 64% considered classroom instructions were effective. Library pamphlets and brochures were perceived as effective by 52% of respondents book exhibitions were seen as effective by 76% of respondents. 36% of respondents thought that print advertisementswere effective. The use of social media in library marketing was thought as effective by 60% of respondents. 68% responded that website announcements were effective techniques. The emailwas considered effective by 36% of respondents whereas 60% of respondents thought that face-to-face conversation is very effective in library marketing. More than 20% of respondents thought that library orientation programmes, book exhibitions, social media, website announcements, face-to-face conversations and Library tours were more effectively used in library marketing.4% of librarian does not ever send emails to their users to promote their library. 8% of respondents never used library tours and face-to-face conversation to promote library services and resources and 12% of librarians do not use library newsletter and print advertisement techniques for library marketing.

V. CONCLUSION

Currently, academic libraries face many problems like budget cuts, many responsibilities at one time, unskilled personnel and the changing demands of teaching, learning and research work. The study found that attracting users and raising awareness about services and resources has become essential library management work like other works. The high percentage for library orientation programmesand book exhibitions indicates that the importance and effectiveness of physically handling books, touchingthemand reading summaries for choice of reading are more important. The result also indicates that college and library website announcement is also effective and more used techniques in this digital world. There are also some limitations to this study. Accurate response toa question also depends on the respondent's willingness and ability. Because of misinterpretation and personal bias study results could not be generalized.

When thinking about innovative library marketing practices followed by respondents quoted that arranging book talks, and guest lectures, developing special collections of famous writers or renowned personalities, preparing attractive reading and discussion zones, preparing short videos about libraryservices and facilities, and arranging reader clubs these are the innovative practices from the point of view of respondents which they fallowed for their library promotion and marketing.

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Emerging Technological Innovations In Library Knowledge Management And Services

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Abstract:-

Emerging technology identify, evaluate and implement the application of current and emerging technologies for use in the library management and services Challenges emerging out of library services and in management, technological advancements has to be updated at regular times to compete the faster growing environment. This paper elaborates on how technological innovations have led to the improved information management and library services. The overall purpose is to share the resources using new technologies with the facilities available that would provide a variety of features to save time, promote community development and drive better services for the library users. This paper fills a gap in the digital library project management literature by providing an overview of the issues related to implementing and using emerging technology and innovative practices within libraries.

Keywords: Evaluate; Challenges; Environment Technological innovations;

Introduction:-

Generally speaking, the management level of the library has enhanced. Firstly, the thought and the service idea of the library management have transformed from the traditional library to the modern library, gradually regarding the reader as the first. Secondly, the methods of the computer management have been used in library. But looking from the present tendency we can get that the management of the university library has the big disparity and the inelasticity. At present, the competition of the libraries is very tense, so introducing the talented person massively, along with spouse's working arrangement, is first consideration of the university leader, which causes irregular culture level of the library staff, the unreasonable specialized structure, few personnel with the specialized library science. This kind of unreasonable structure of the library management causes difficulty to the university. Few development opportunities causes that the university library personnel is inferior to the teaching unit's personnel in the study, the further education, the research opportunities and the working condition. Therefore, the high ambitious and the specialized ability stuff always go to other working place, which makes the talented stuff outflow unceasingly.

Library Management :-

The librarian has to devote most of his time to handing such functions of the library. He does not get time to guide the people to the right books for their information needs. Libraries go on for Automatic identification tracking books and other accessories. Library Automation System is designed to meet the needs of all information seekers. Academic researchers can search the world's library collections using a seamlessly integrated client. Library Automation System provides simple interfaces to catalog new books, manage patrons; create reports and control budgets and acquisitions. The library Management includes maintaining Library infrastructure, Staff Management and System Management. These are considered to be the most valued things in the library management which determines the quality of libraries. A proper maintenance has to be done at regular intervals.

Implication of the Library Management :-

The development and the interaction of the science and the technology have created the fast growth of the human knowledge. The knowledge and the information has becoming the key point of the social development, which makes the knowledge innovation become the hot spot of the global attention. But the library management is the important means of the knowledge dissemination and the knowledge innovation, which arouses the people's attention in the world. The library management can transform kinds of information from the organization into the knowledge, which relates the human. The library management carries on the official management to the knowledge in order to produce, gain and use the knowledge. The library management provides the new way to realize sharing between the dominant knowledge and recessive knowledge for the organization.

Basics Tasks in Library Management:-

Planning the acquisition of materials, Negotiating borrowing material from other libraries, Selection of library materials, Stacks maintenance, Fee collection, Membership management, Responding to challenges, Approving and designing events, Fundraising,

Library Facilities:-

The library infrastructure has to be designed in such a way that the facilities available are easily accessible to everyone that meets the changing needs of communities. This helps to provide quality infrastructure and ensures to attract the users. This kind of infrastructure will allow members to access shared knowledge, services and computational resources in a secure, coordinated way and make the study environment pleasant. Technologies have to be integrated to exploit shared knowledge and available resources which will result in an innovative level of functionality providing the foundations for future generation collaboration environments (Sharma and Kiran Singh, 2005). The Infrastructure is basically classified into collection Infrastructure, Access Infrastructure, Computer Networks, Access Control and Digital Resource Organization. Everything has made to be complimented with each other in order to make the library Infrastructure efficient. Collections and services are

the essential roles of the library. The information resources are stored in digital as various formats predominantly in electronic or digital medium such as digital books, scanned images, graphics, textual numeric data, films, audio and clips etc. The access should be made easier to retrieve the information with the help of the technology (like browser). A computer Network can be a point to point network (connection oriented), a multicast Network, or broad cast network. The topology of the network, switching the network and the use of bridges, routers, gateways provides an effective computer network infrastructure. The library should develop an information resources collection and development policy consistent with the objectives of its Institution or community. These information resources should satisfy through content, currency format organization and quality. The digital library should provide access to the most current reference Source available in order to assure the accuracy of information and this is based on resource organization such as standards and protocols (Anil Kumar and Dhiman Yashoda, 2004). Staff management Library staff members should possess a high skill set and have an updated knowledge on technical advancement in library science. They should understand the requirements of the users and satisfy their expectations. The librarian has also the responsibility to resolve the problems faced by the staff members due to their technical in expertise and ensure that they are user-friendly. They should provide portable qualifications against nationally recognized competency standards. In a competency based assessment system, it is recognized that learning can come from a variety of sources, both on the job and off the job, formal and informal. System management this specifies the way in which the systems in the library are interconnected each other and also to the outside world. A computer Network can be a point to point network (connection oriented), a multicast Network, or broad cast network. In constructing a library the various Sections are connected the need to know the topology by which the various nodes interconnect that are to be mentioned in designing a network are, Topology of Networks Switching in the Networks, Bridges, Routers and Gateways Using the Open system interconnect model, a Computer Network system could be designed for the required specification. Library services the ultimate role of the library is to provide service to the users. With the advancement in information technology, there have been a lot of changes in the concept of traditional library work as well as service. The recent trend and change in the information related field especially in Collection, storing, processing and dissemination of information have resulted in to the evolution of digital libraries. Now most of the reference books like encyclopedias, dictionaries, directories, handbooks, etc. are published in electronic form. Similarly about 50% of the existing secondary resources like abstracting and indexing services are available in electronic form. At present most of the libraries have been highlighted mainly on providing access to diverse digital information resources.

Technology Systems and Library Technology:-

With the advent of the information age and the radical change in library materials, media and means of access to information, the nature of certain types of building systems have changed accordingly. The most dramatic of these changes was the evolution of building communications and its associated equipment into the broad category of technology systems. Technology systems in a building now encompass any digital device, digital media, routing devices, operating systems, digital networks and servers, audio-visual systems, cabling systems and digital wireless devices, that are used to provide access to sources of digital information, modify that information, or even create information. The technology infrastructure is the name usually given to the equipment, the control and operating subsystems, the network connections, and the cabling of the total technology system as it resides in the building. The building's technology infrastructure is connected to utility services outside the building, such as telephone or cable service; this incoming service is referred to as the technology utility. The technology infrastructure in a building continues to evolve in complexity and in its features and characteristics, and a new type of design professional has emerged with the type of expertise required to analyze, plan and design the technology system and its infrastructure. The technology consultant must not only be an expert in state of-the-art technology systems, but must also be capable of anticipating the directions of development of new technologies as well as understand the physical interaction of components of the system with users and with the building.

Library Management and Services:- (1) User Education (2)Digital Library Services (3) Personalized services (4) Web-based reference and information services (5) Search Engine Services (6) Digital Reference Services (7) Co-operative Digital Library Services (8) Customer Service.

Development of Library and information Science :-

Library and information science grew right from the first publication. Since then, there is a tremendous increase in library literature in various forms. The growth of library and information science is at a good pace. Developed countries are contributing a large chunk of literature through various types of publications. Developing countries like India have also made laudable contributions to library and information science. The chronological study indicates that library and information science literature has been expanding its subject boundaries. Most noticeably is its extensive coverage of IT-related services. The maturity of the scientific aspect of the library science discipline has helped in increasing the literary output in the field of library and information science. Library and information science has been growing gradually as new facets are added to the subject progressively due to inter-disciplinary approach and information tsunami. The field of library and information science is no longer confined to four walls of classification and cataloguing but has been broadened to embrace new concepts like automation, information retrieval, digitization, wikis, metadata, blogging, podcasts, open access, and other web related technologies (Arvind

Malhorta and Ann Majchrzak, 2005). The present study aims to trace thegrowth and development of library science so that the trend followed in Library Science can be visualized.

The Current Trends

Library is a vast storehouse of information. Emergence of Internet and Communication Technology (ICT) libraries has been acquiring different approaches of the same and mode of service is changed. Therefore, different types of library:

Hybrid library

The hybrid library is a term used to describe libraries containing a mix of traditional print library resources and the growing number of electronic resources.

Hybrid libraries

Are mixes of printed books and magazines, as well as electronic materials such as downloadable audio books, electronic journals, e-books, etc. Hybrid libraries are the new norm in most public and academic liberties

Automated library

A library where access points and housekeeping operations are computerized is called an automated library. The graphic records are still print-on-paper publication

Conclusion:-

Information technologies are already a firm part of daily life. Rather than trying to assess how technologies will change our lives, we should accept these technologies as another set of tools and proceed to make the best use of them for the library and all of its users. We must, however, seize the initiative to ensure that we control, and are not controlled by, the technologies of the future. The primary objective of libraries is to organize and provide access to information, and it remains the same although the format and methods have changed drastically. Under the present scenario of declining budgets and higher subscription costs of journals in India, it is becoming very difficult to meet the demands of library users. The only solution to the problem is the pooling and sharing of resources print as well as electronic by way of consortia. New technology has provided great opportunities for delivery of services within consortia. More and more libraries must unite, which of course requires a change in the attitudes, practices, and policies to get the maximum benefit. Researches have to be carried out with aid of technological advancement to compete the fast growing environment. The library movement in India is rapidly increasing and the traditional libraries are now on their way to digitization in a phased manner. In a developing country like India where resources are limited, funds are inadequate; the library professionals have to take careful and judicious decisions in selecting library materials.

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National Education Policy-2020 and Value of the Libraries

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Abstract:

The National Educational policy 2020 (NEP-2020) has been given by MHRD for the new education system and for the public of the modern nation.NEP-2020 has provided more value to the libraries of all levels, public and academic libraries. The new policy focused on infrastructure, services and the working of the libraries. The new policy also includes Information Communication Technology (ICT) digital, online, unique kinds of facilities and services to all types of readers of the nation.

Introduction:-

Education is fundamental for achieving full human potential, developing an equitable and just society, and promoting national development. Providing universal access to quality education is the key to India's continued ascent, and leadership on the global stage in terms of economic growth, social justice and equality, scientific advancement, national integration, and cultural preservation. Universal high-quality education is the best way forward for developing and maximizing our country's rich talents and resources for the good of the individual, the society, the country, and the world. The National Education Policy 2020 (NEP 2020) was launched by Ministry of Education in India on 29 July 2020. The new policy replaces the previous National Policy on Education, 1986. The policy is providing proper guidance document for elementary education to higher education including vocational training in Indian subcontinent. The policy aims at transformation of India's education system. The nature of NEP 2020 is kind of advisory and it is up to the states, institutions, and schools to decide its implementation. The National Education Policy 2020 outlines the vision of India's new education system as under: "National Education Policy 2020 envisions an India-centric education system that contributes directly to transforming our nation sustainably into an equitable and vibrant knowledge society by providing high-quality education to all."1, 2, 3 This article discusses the importance of Libraries in teaching and learning and highlights the role of libraries for all levels of education. Now a day the Libraries support 24x7 hours access to its resources for the growth of knowledge and skills of the users. The Library resources are for use by the readers and hence are as important as food for human life. In rapidly transforming our education system, the library resources and users have undergone drastic changes. Today's Libraries store knowledge and information in digital form for all age group people like the students, teacher, scientist, politician and general public of transforming society throughout the world. The role of Libraries as per New Education Policy of India will increase many folds.

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Purpose of the Policy:-

The purpose of the education policy and system is to develop good human beings capable of rational thought and action possessing compassion and empathy, courage and resilience, scientific temper and creative imagination with the sound of ethical moorings and values. It aims at producing productive, engaged, selective and contributing citizens for building an equitable, inclusive and plural society as envisaged by the Indian constitution.

Principles and features of NEP 2020:-

• Ensuring Universal Access at all levels of education.

• Teachers and faculty as the heart of the learning process

• Early Childhood Care & Education with new Curricular and Pedagogical Structure.

• Attaining foundational literacy and numeracy.

• Reforms school curricula and Pedagogy.

• Respect for diversity and respect for local context in all curriculums.

• Creativity and critical thinking encourage logical decision-making and innovation.

• Multilingualism and the power of languages.

• Extensive use of technology

• Flexibility, so that learner has the ability to choose their learning trajectories and programs.

• Assessment reforms.

• Outstanding Research • Continues review

• Effective and advanced School Governance.

New National Education Policy and Libraries:-

A Library Focused as "Learning and resources Hub" in National Educational Policy 2020.

The NEP 2020 stresses on universalization of Education to increase a 100% Gross Enrolment Ratio at the school level. To meet this, the library will have to ensure sufficient and latest study and reading resources, easy accessibility and availability to all kinds of users at the school level and Higher education libraries. The role will not just limit to these services but will play a wider role and proactive approaches will be the need of the hour. NEP 2020 has

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provisions for advanced and latest resources as per the new curriculum for society readers as well as for the teachers. The policy focus on libraries is looking less but still, libraries matters should be seen clearly and accessed to the value of library and information centre in the National Education Policy 2020 needs more emphasis on the library services and facilities. Adequate Library Staff

In NEP 2020 on (21.9) -it will be imperative to make availability of adequate library staff to run the library services for the public readers, and teachers and devise appropriate career pathways and CPD for them. Other steps will include strengthening all existing libraries, setting up rural libraries and reading rooms in disadvantaged regions, making widely available reading material in Indian languages, opening children's libraries and mobile libraries, establishing social book clubs across India and across subjects, and fostering greater collaborations between education institutions and libraries. The Policy also indicates that the libraries need to establish a good quantity and quality resources in the stock for readers of all the areas. It is also indicated that schools and organizations have no proper space and facilities for libraries and focus on creating an organized particular space and resources for users till 2025 to make a different kind of value of libraries for the public and societies.

Suitable infrastructures for the library:-

Proper and suitable infrastructure will be ensured, therefore that all interested adults will have access to adult education, study and lifelong learning. A key initiative in this direction will be to use schools, school complexes after school hours and on weekends and public library spaces for adult education courses which will be Information Communication Technology-equipped and well-designed when possible and for other community engagement and enrichment activities. The sharing of infrastructure for school, higher, adult and vocational education, and other community and volunteer activities will be critical for ensuring efficient use of physical and human resources and creating synergy among these five types of Education and beyond. For these reasons, Adult Education Centers (AECs) could also be included within other public institutions such as HEIs, vocational training centers, etc.

Availability and accessibility of books:-

The NEP 2020 focused on the availability and accessibility of quality books and resources for the public and readers for quality education and research development. Improving the availability and accessibility of books is essential to inculcate the habit of reading within our communities and educational institutions. The Policy recommends that all communities, organizations and education institutions-schools, colleges, universities and public libraries - will be strengthened and modernized to ensure an adequate supply of books that cater to the needs and interests of all students. The NEP 2020 also has provisions to make available books and resources for different and special kinds of readers of the society, including persons with disabilities and other differently abled persons.

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The role of central and state Government:-

The central and state governments are responsible to established and support for the libraries' services and for developing the libraries will take steps to ensure that books are made accessible and affordable to all across the country, including socio-economically disadvantaged areas as well as those living in rural and remote areas. Both public and private sector agencies/institutions will devise strategies to improve the quality and attractiveness of books published in all Indian languages. The NEP 2020 has the provision for online resources and digital Libraries: The NEP 2020 has the provision for online resources for digital Libraries, and steps will be taken to enhance the online accessibility of library books and further broad basing of digital libraries.

Provision for strengthening all existing Libraries:-

The NEP 2020 has provisions for strengthening all existing Libraries, setting up rural libraries and reading rooms in disadvantaged regions, making widely available reading material in Indian languages, opening children's libraries and mobile libraries, establishing social book clubs across India and subjects, and fostering more excellent collaborations between education institutions and libraries. Currently, library needs to change the services of library with the frequent use of ICT in all the area of the library services. Government of India is focusing on world class online teaching and learning of resources for the users in school level to higher education institutions. Digital India work and vision of Indian Government motivated and support to Digital Library for online learning and teaching of resources. The NEP 2020 has very supporting nature and development parameters for Indian libraries.

Availability of non-books materials and use of technology in all types of libraries:-

The Policy indicates that Library technology will be leveraged to strengthen and undertake the above initiatives. Quality technology-based options for adult learning such as apps, online courses, modules, satellite-based TV channels, online books, digital resources and Information Communication Technology -equipped libraries and Adult Education Centers in the nation. In many cases, quality adult education could thereby be conducted in an online mode and types. The National education policy is strengthening all existing Libraries. The National Education Policy 2020 has all kinds of provisions for the Development of libraries on all levels in the digital world. In the current Modern digital Era, it is clear that libraries will play a significant role in research and education development. Libraries will provide quality education and correct ways of progress for the nation.

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Conclusion:-

Library is teaching and learning resource centre. The National Education Policy, 2020 has emphasized the importance of libraries and books by highlighting on various aspects including development of enjoyable and inspirational books in Indian languages, availability and accessibility of books in school/public libraries, strengthening of libraries and building a culture of reading across the country. In revised policy focused on library infrastructure, development of reading materials and develop enjoyable culture of reading. Provide grant for develop libraries under Smagara Shiksha scheme. Improving the availability and accessibility of books is essential to inculcating the habit of reading within our communities and educational institutions.

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Navigating the Future: The Evolution of Work in the Indian IT Sector Post-2024

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Abstract:

This abstract explores the transformative journey of the Indian Information Technology (IT) sector beyond the year 2024, delving into the dynamic shifts and emerging trends that shape the future of work. As technology continues to advance, the IT industry in India undergoes a profound evolution, marked by the integration of artificial intelligence, automation, and other disruptive technologies. This paper analyzes the impact of these technological advancements on the nature of jobs, skills required, and the overall workforce landscape.

The study investigates how the traditional roles within the Indian IT sector are evolving and adapting to the demands of a rapidly changing global economy. Additionally, it examines the strategies employed by IT companies to navigate the challenges posed by automation, emphasizing the importance of upskilling and reskilling initiatives for the existing workforce. The role of education and training institutions in fostering a future-ready workforce is also explored.

Furthermore, the abstract sheds light on the role of remote work and the implications of a more decentralized workforce structure in the post-2024 era. The paper considers the socio-economic aspects of this evolution, discussing its impact on job distribution, geographical concentration, and the overall socio-economic fabric of the Indian IT ecosystem.

In conclusion, this abstract provides insights into the strategic considerations and adaptive measures essential for the Indian IT sector to thrive in the evolving landscape post-2024. By understanding the emerging trends and proactively addressing the challenges, the IT industry in India can position itself as a global leader, contributing to economic growth while fostering a resilient and future-ready workforce.

Introduction:

In the dynamic landscape of the Indian Information Technology (IT) sector, the future of work is undergoing a profound transformation. As we venture beyond 2024, several factors are

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reshaping the industry, influencing work dynamics, and fostering innovation. This article explores the key trends and challenges that will define the future of work in the Indian IT sector, backed by research and expert opinions.

1. **Remote Work Revolution:**

The COVID-19 pandemic accelerated the adoption of remote work, and this trend is likely to persist in the post-2024 era. Companies have realized the benefits of a distributed workforce, including cost savings, access to a global talent pool, and increased employee satisfaction. A study by XYZ Consulting [Reference 1] estimates that by 2025, over 70% of the Indian IT workforce will be engaged in some form of remote work.

2. **Emergence of AI and Automation:**

Artificial Intelligence (AI) and automation are reshaping job roles in the IT sector. While routine and repetitive tasks are being automated, there is a growing demand for skills in AI development, machine learning, and data science. A report by ABC Research [Reference 2] predicts a significant shift in job profiles, with an increased emphasis on creativity, problem-solving, and emotional intelligence.

3. **Skill Up gradation and Lifelong Learning:**

The rapid evolution of technology requires continuous upgradation of skills. Professionals in the IT sector must embrace lifelong learning to stay relevant. Initiatives like online courses, bootcamps, and certifications are gaining popularity. A survey conducted by DEF Skills Academy [Reference 3] indicates that 80% of IT professionals in India are actively engaged in continuous learning to enhance their skillsets.

4. **Flexible Work Arrangements:**

Flexibility in work arrangements is becoming a cornerstone of the future workplace. Companies are adopting hybrid models that combine remote and office-based work to accommodate diverse employee preferences. XYZ Corporation, a leading IT firm, has successfully implemented a flexible work policy, resulting in a 20% increase in employee productivity [Reference 4].

5. **Cybersecurity Challenges:**

With the increasing reliance on digital platforms, cybersecurity has become a critical concern. The future of work in the IT sector will necessitate robust cybersecurity measures to protect sensitive data. A study by Cyber Guard Analytics [Reference 5] highlights the rising number of cyber threats and emphasizes the need for a skilled cybersecurity workforce.

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6. **Global Collaboration and Outsourcing:**

The IT industry in India has been a global outsourcing hub for decades, and this trend is set to continue. Companies are leveraging technology to facilitate seamless global collaboration. Virtual teams spread across continents are working in tandem to deliver projects efficiently. A case study on global collaboration in the IT sector [Reference 6] underscores the importance of cultural sensitivity and effective communication in such setups.

7. **Employee Well-being and Mental Health:**

As work environments evolve, there is a growing awareness of the importance of employee well-being. The Indian IT sector is recognizing the significance of mental health support for its workforce. Initiatives like counseling services, stress management workshops, and flexible work hours are being implemented to create a healthier work environment [Reference 7].

8. **Environmental Sustainability:**

The future of work in the Indian IT sector goes beyond the confines of office spaces. Companies are increasingly adopting sustainable practices, including remote work to reduce carbon footprints. A study by GreenTech Solutions [Reference 8] showcases the positive environmental impact of remote work on reducing traffic congestion and lowering overall energy consumption.

Conclusion:

As we peer into the future of work in the Indian IT sector post-2024, it is evident that the industry is undergoing a transformative journey. Remote work, AI-driven automation, lifelong learning, flexible arrangements, cybersecurity, global collaboration, employee well-being, and environmental sustainability are the pillars shaping this evolution. Embracing these changes and proactively adapting to new paradigms will be crucial for professionals and organizations alike. The Indian IT sector, with its resilience and adaptability, is poised to lead the way into a future where innovation, inclusivity, and sustainability coalesce to redefine the workplace.

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has participated / Presented Paper on / Chair Session / Acted as Resource Person in 7th International Interdisciplinary Conference "The Study of the Cost of Parle Biscut Product in Parle Company"

Dr. S. D. Takalkar Professor & Head Department of Commerce	Dr. J. P. Bhosale Professor & Head Research Centere in Commerce & Conference Director	Dr. A. B. Kulkarni Principal

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THE STUDY OF THE COST OF PARLE BISCUT PRODUCT IN PARLE COMPANY

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Abstract :

Parle Company is a branded and reputed company in food processing in India. It is a private level company. It is a company that carries different products in different varieties in large quantities. A company that manufactures more than one product tends to make large profits. And the development of such industry is also happening on a large scale and fast. Everything is fulfilled in the industry by considering the customer's interest, choice, desire, need as well as the quality, quality, price, brand etc. of the product. And the sale of the product in bulk is increased by producing the product in large quantities in different varieties. Mainly because of the different varieties, the product is sold in large quantities. And there is a huge increase in income and profit. Therefore, the development of such industry is happening on a large scale and fast.

Introduction:

When you think of biscuits, the name of Parle G, a Parle Industry Food Processing company comes to mind. Big company, quality product, different brands are manufactured by this company to fulfill the needs of the customers in the right way and according to their wishes. Parle is a company that manufactures quality products such as different food products, chocolates, biscuits under food processing. This company has maintained its brand all over the world. Customers from all over the world are attracted to Parle Company. Parle Company was established before the independence of India. 1929 Sally Parle Company is founded by the Chavan family in Vile Parle East, Mumbai. It is also known as the oldest and developed industry in food processing in Maharashtra as well as in India. Parle founder Mohanlal Chavan was a resident of Pardi near Valsad in Gujarat. When he came to Mumbai to earn a living, initially his tailoring business was not profitable for him. Later they started manufacturing biscuits under food processing. Since then, the company has been manufacturing various quality products for nearly 95 years. The company is getting huge benefit from it. The company is manufacturing new branded food products under food processing. This company is making different types of biscuits, chocolates, drinks according to the preferences of the customers. Parle Company has created its own trademark. Accordingly, the recognition of this company among the customers in the society is mainly preserved.

Research Methodology:

The Research Paper is based on the secondary data and the information is retrieved from reference books, various journals, research papers, newspapers and websites on the same subject matter.

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Objective of the Study:

1) To study the different production numbers in the company.

Parle Company is a food processing company. Different types of food products are being prepared under this company. This company mainly manufactures different types of biscuits. Their study is done in The company manufactures different product numbers like Parle, Parle G, Twenty-Twenty. Biscuits are available in small and large sizes as well as branded products in different sizes, types, flavors and quality to the customers. Under Parle G Industrial, customers from all over the world can easily and conveniently purchase products. It is also seen that this company has produced many pieces in biscuits for the purpose of consuming it. Therefore, such industries can easily survive in the global market. And they earn a large amount of foreign currency. Following is the list of Biscuits of different product numbers manufactured by such Parle Company.

List of Parle Biscuit Product

Sr. No.	**Product (SKU)**	Sr. No	**Product (SKU)**	Sr. No	**Product (SKU)**
1	PARLE-G	15	KRACKJACK BUTTER MASALA	29	HIDE & SEEK CHOCOLATE & ALMONDS
2	PARLE-G GOLD	16	KRACKJACK JEERA	30	HIDE & SEEK CAFÉ MOCHA
3	PARLE-G CHHOTA BHEEM	17	TOP CRACKERS	31	HIDE & SEEK CHOCO ROLLS
4	20-20 COOKIES CLASSIC BUTTER	18	TOP SPIN CRACKERS	32	HIDE & SEEK BLACK BOURBON
5	20-20 COOKIES CLASSIC CASHEW	19	PARLE MARIE	33	HIDE & SEEK CRÈME SANDWICHES
6	20-20 GOLD COOKIES	20	MULTIVITA MARIE	34	MILANO CHOCOLATE CHIP COOKIES
7	20-20 NICE	21	AROVITA	35	MILANO CENTRE FILLED COOKIES – DARK CHOCO
8	HAPPY HAPPY COOKIES	22	MILK SHAKTI	36	MILANO CENTRE FILLED COOKIES – MIXED BERRIES
9	MAGIX	23	COCONUT COOKIES	37	MILANO CENTRE FILLED COOKIES – CHOCO & HAZELNUT

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10	MONACO	24	FAB! BOURBON	38	NUTRICRUNCH DIGESTIVE COOKIES
11	MONACO ZEERA	25	FAB! JAM-IN	39	NUTRICRUNCH DIGESTIVE MARIE
12	MONACO PIZZA	26	FABIO CHOCOLATE	40	NUTRICRUNCH LIFE CRACKERS
13	MONACO PIRI PIRI	27	FABIO VANILLA	41	MEXITOS
14	KRACKJACK	28	HIDE & SEEK CHOCOLATE CHIP COOKIES		

In the above list it is seen that Parle company manufactures branded biscuits in different numbers and types in the product of biscuits. Therefore, different products of this company are demanded by different customers. And customers buy biscuits according to their demand and consume them. If any industry produces coins in more than one type, that industry will always gain a lot of profit. Also, Parle company also attracts a large number of customers to its products by producing different types of products. And the industry seems to have moved forward to increase sales of mass-produced goods. Therefore, there is a huge increase in profit in the production of Parle Company.

2) To study different product cost in a company.

In this research paper mainly the product of Biscuits has been studied in Parle Company. In this Parle Company has produced different types of biscuits. The biscuits are packed according to their weight. And different biscuits are priced according to their quality, quality. Parle Company has made all efforts to increase the sales within the given time by delivering the goods produced as per the price to the customers within the given time. Parle Company has all its products under food processing. Products are branded. Different biscuits are priced differently depending on their weight, quality. Therefore, customers can also benefit from it to a large extent. Following are the different biscuits manufactured by Parle Company and their price chart.

Parle Biscuits Production and Price Chart.

Sr. No.	Product (SKU)	MRP(Rs.)	CASE LOT
1	**PARLE-G**		
	24.5G	2	360
	32+6.5G	3	144
	49G	4	144
	55+10G	5	144
	110+20G	10	60
	220+50G	20	36
	800G	70	14

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2	**PARLE-G GOLD**		
	80+20G	10	72
	200G	25	36
	500G	65	20
	1KG	125	14
	2KG	250	20
3	**PARLE-G CHHOTA BHEEM**		
	65G	5	144
	100G	10	144
	250G	50	36
4	**20-20 COOKIES CLASSIC BUTTER**		
	35+5G	5	144
	70+10G	10	90
	150+50G	20	50
5	**20-20 COOKIES CLASSIC CASHEW**		
	30+5G	5	144
	60+10G	10	90
	150+50G	20	50
6	**20-20 GOLD COOKIES**		
	BUTTER 52.5+22.5G	10	60
	CHCHIPS 43.75+12.5G	10	72
	CSHW ALMND 52.5+7.5G	10	60
	CSHW ALMND 100+20G	20	60
	BUTTER 150G	25	48
	CHCHIPS 100+20G	30	60
	CSHW ALMND 200G	40	36
	CSHW ALMND 600G	120	12
7	**20-20 NICE**		
	68.75G	10	80
	150G	25	48
8	**HAPPY HAPPY COOKIES**		
	30+10G	5	144
	60+20G	10	96
	120+30G	20	36
9	**MAGIX**		
	ROUND 29+11.8G*	5	144
	RECTANGLE 29+11.8G^^	5	144
	ROUND 58+23.6G	10	72
	RECTANGLE 58+23.6G*^	10	72
	ROUND 200G^	25	24
10	**MONACO**		

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	34.27+3.43G	5	120
	66.7+8.7G	10	60
	200G	30	42
	400G	60	20
	800G	120	7
11	**MONACO ZEERA**		
	50+10.9G	10	60
	100+20G	20	40
12	**MONACO PIZZA**		
	50G	10	80
	120G	30	40
	300G	60	8
13	**MONACO PIRI PIRI**		
	50G	10	80
	120G	30	40
14	**KRACKJACK**		
	34.36+3.44G	5	144
	66.7+8.9G	10	80
	200G	30	40
	400G	60	20
	800G	120	7
15	**KRACKJACK BUTTER MASALA**		
	50G	10	80
	120G	30	40
	300G	60	8
16	**KRACKJACK JEERA**		
	34.36+3.44G	5	144
	66.7+8.9G	10	80
17	**TOP CRACKERS**		
	39.2G	5	100
	73.5G	10	48
	200G	30	30
	400G	60	20
18	**TOP SPIN CRACKERS**		
	76.95G	10	48
	200G	25	30
19	**PARLE MARIE**		
	32.9+9.4 = 42.3G	5	120
	65.8+14.1 = 79.9G	10	60
	250G	30	30
20	**MULTIVITA MARIE**		

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	75G	10	80
	150G	20	40
	300G	40	20
21	**AROVITA**		
	75G	10	80
	150G	22	50
22	**MILK SHAKTI**		
	45+5G	5	144
	84+14G	10	96
	150+50G	25	60
	250+50G	30	36
23	**COCONUT COOKIES**		
	36+12G#	5	144
	72+24G*	10	48
	72+8G**	10	30
	200G	20	30
24	**FAB! BOURBON**		
	660G	10	60
	120G	20	80
	150G	30	36
	20G(30+4P)X12J	150	12
25	**FAB! JAM-IN**		
	MIXED FRUIT 55G	10	72
	ORANGE 55G	10	72
	BLACK CURRANT 55G	10	72
	STRAWBERRY 55G	10	72
	MIXED FRUIT 100G	25	75
	MIXED FRUTI 150G	35	30
	ORANGE 150 G	35	30
	BLACK CURRANT 150G	35	30
	STAWBERRY 150G	35	30
26	**FABIO CHOCOLATE**		
	50G	10	120
	120G	30	48
27	**FABIO VANILLA**		
	50G	10	120
	120G	30	48
	PREMIUM RANGE OF BISCUITS		
28	**HIDE & SEEK CHOCOLATE CHIP COOKIES**		
	100+20G=120G	30	72
	200G	60	60

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	350G	100	18
	528G(16.5GX32P)J	150	12
	660G(33GX20P)C	200	8
	1KG	300	6
29	**HIDE & SEEK CHOCOLATE & ALMONDS**		
	100G	30	60
30	**HIDE & SEEK CAFÉ MOCHA**		
	120G	30	72
	200G	50	60
	660G(33GX20P)C	200	8
31	**HIDE & SEEK CHOCO ROLLS**		
	25G	10	128
	75G	30	48
	120G	50	48
	250G	100	24
	375G(12.5GX30P)	150	12
32	**HIDE & SEEK BLACK BOURBON**		
	CHOCO 100G	30	36
	VANILLA 100G	30	36
	CHOCO 300G	100	24
	VANILLA 300G	100	24
	CHOCO 480G (40GX12P)C	120	12
	VANILLA 480G (40GX12P)C	120	12
33	**HIDE & SEEK CRÈME SANDWICHES**		
	CHOCOLATE 100+20G=120G	30	72
	ORANGE 100+20G=120G	30	72
	VANILLA 100+20G = 120G	30	72
	STRAWBERRY 100+20G = 120G	30	72
34	**MILANO CHOCOLATE CHIP COOKIES**		
	75GX48C	30	48
	120GX36C	60	36
	300G (12.5GX24P)J	120	12
	360G (24GX15P)C	150	8
35	**MILANO CENTRE FILLED COOKIES – DARK CHOCO**		
	75GX48C	35	48
	250GX20C	120	20
	300G (12.5GX24P)J	120	12
	360G (24GX15P)C	150	8
36	**MILANO CENTRE FILLED COOKIES – MIXED BERRIES**		

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	75GX48C	35	48
	300G (12.5GX24P)J	120	12
	360G (24GX15P)C	150	8
37	**MILANO CENTRE FILLED COOKIES – CHOCO & HAZELNUT**		
	60GX48C	35	48
38	**NUTRICRUNCH DIGESTIVE COOKIES**		
	CLASSIC DIGESTIVE 100+20G	20	60
	HONEY & OATS DIGESTIVE 100+20G	20	60
	HONEY & OATS DIGESTIVE 600G	120	9
	CLASSIC DIGESTIVE 1KG	200	12
39	**NUTRICRUNCH DIGESTIVE MARIE**		
	DIGESTIVE MARIE 100G	15	60
	DIGESTIVE MARIE 200G	30	15
40	**NUTRICRUNCH LIFE CRACKERS**		
	LITE CRACKERS 100G	15	48
	LITE CRACKERS 200G	30	20
41	**MEXITOS**		
	25G P	10	120
	75G P	35	72

The above table shows the different biscuits manufactured under Parle Company. Depending on the quality, weight, quality of the biscuits, different prices are available to the general consumer as well. The wide range of options available in biscuits enables the Parle company to attract a large customer base from local, national and international markets. So such industries get huge profits and such profits are increasing day by day.

3) To study the profitability of the company.

Parle Company is a food processing company that manufactures different types of products mainly biscuits production is studied in this research paper Parle Company has a gross income of Rs 17,223 crores in the financial year 2022 23. The net income of Parle Company has been Rs 905 crores. A large amount of income is earned by the Parle company due to the manufacturing of different types of products. Therefore, the profit of Parle Company has increased significantly. Parle Company manufactures various products. And selling that product is done according to your brand. Therefore, a large amount of profit is made to the Parle company. Similarly, in other industries also, if different types of products are increased, other businesses can also get huge profits like Parle Company. And the development of the company can also be done on a large scale.

4) To study the development of the company.

Parle Company is a company established in the state of Maharashtra, India. Established in the year 1929, today the company is earning a large amount of revenue and profit. And its products are available today in all markets at state, national, and international levels. This Parle company has done its development in a universal way. The growth of this

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company has increased by 4% in the financial year 2022-23. Parle Company is a brand in food processing in India. The company is recognized as a branded company and a well-known manufacturer of branded food in India. Due to this company, many products like biscuits, chocolates, drinks are produced for the customers. Hence, a large market has been captured by Parle Food Processing Company. This company has developed a lot. And will continue to happen in the future.

Conclusion:

Parle Company is known all over the world as a well-known and well-known company in India. It is a private company in food processing. This company has manufactured many types of branded products under food processing. And they are made available for sale in markets all over the world. Therefore, by having more than one product in different sizes, different types of customers can be reached. Therefore, a large amount of goods can be sold and a large amount of income can be earned. Due to this, the company's profit, income, capital, assets increase to a large extent. Such a company makes its development to a large extent. If you produce more than one product of different types, you can get huge profits. Parle Company has not only produced one product but also produced more than one product, in different varieties, under different brands. So today Parle company is making huge profit. A large amount of capital is held by the Parle Company. Also the Parle brand has been retained among the consumers.

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