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Effects of Chrysoidine Y on Structural, Functional and Optical properties of Potassium Dihydrogen Orthophosphate single crystals

Gabriya L R[1*], A. Darlin Mary[2], J.Johnson[2]

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Abstract

Doping different organic and inorganic substances in KDP single crystals have been carried out for a long period of time to analyse the influence of impurities on the crystal structure, rate of growth and optoelectronic properties of the KDP crystals. Organic impurities are of particular interest considering they can enhance the characteristics of the KDP single crystals. Doping of organic dyes created a vast change in the non-linear optical properties of the KDP crystals. Single crystals of pure and Chrysoidine Y doped Potassium dihydrogen orthophosphate (KDP) are grown using the slow evaporation method at room temperature. The grown crystals are harvested after the time period of 25 to 30 days. The grown crystals are characterized using powder XRD, FTIR and UV- Visible analysis. The studies on the grown crystals clearly indicate the effects of dopant on KDP single crystals. The XRD peaks of pure and chrysoidine Y doped KDP single crystals are identical but only vary on their intensities and there are no changes in the crystal structure. The absorbance and transmittance spectra for the grown crystals are plotted using UV-visible spectrum analysis and their optical band gap energy is calculated. The vibrational assignments of the grown crystal are analyzed using the FTIR spectrum. Elastic stiffness constant for the grown crystal is also calculated. Doping of dye in KDP leads to the development of new photonic materials by coupling the optical properties of both KDP and dye.

Key words: KDP, Chrysoidine Y, XRD, UV-visible, FTIR, crystal growth, single crystal

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Abstract

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Key words: KDP, Chrysoidine Y, XRD, UV-visible, FTIR, crystal growth, single crystal

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Effect of Crystal Violet and Malachite Green on L-Lysine Potassium Dihydrogen Orthophosphate (LLKDP) single crystals

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[2]Assistant Professor, AnnaiVelankanni College, Tholayavattam, Tamilnadu, India, 629157

Abstract: Potassium dihydrogen orthophosphate single crystal exhibits excellent electro-optical and nonlinear optical properties. When amino acids are used as the dopant these properties are enhanced, with organic dyes they are enhanced further and has a wide range of applications. In the present study two different organic dyes (Crystal Violet and Malachite Green) are doped in L-Lysine Potassium Dihydrogen Orthophosphate single crystals. Optically good quality single crystals of crystal violet and malachite green doped L-Lysine Potassium dihydrogen orthophosphate were grown by slow solvent evaporation method. Crystal structure is determined by using powder XRD analysis. The optical energy band gap of the crystal is determined by using UV-visible spectrum. The vibrational assignments of the crystals were analyzed and reported using FTIR spectrum. The mechanical behaviour of the crystal is analyzed using Vickers microhardness studies.

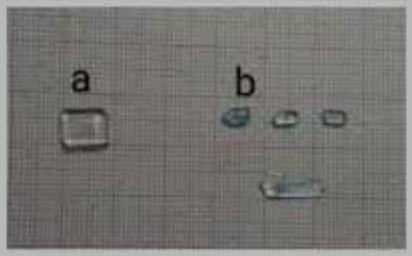

Fig.1. Image of the grown crystal (a- crystal violet doped LLKDP, b- malachite green doped LLKDP)

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Antibacterial activities of Zinc Doped Magnesium Ferrite Nanoparticles with Combustion method

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Abstract : In this paper, Magnesium Zinc Ferrite ($Mg_{0.8-x}Zn_xFe_2O_4$, where x = 0.2 ,0.4 and 0.6) nanoparticles were successfully fabricated by combusion method. The prepared samples were characterized by XRD, FTIR, UV, SEM, EDAX and TEM. The antibacterial properties of the nanoparticles were studied in detail and the results are discussed. From the XRD spectrum it is confirmed that the prepared samples have cubic spinel structure with crystallite size in the range of 13-15 nm. IR absorbtion bands confirm the formation of spinel structure. Surface morphology of the samples have been investigated using SEM and confirmed the spherical shape of prepared samples in agglomeration. From the UV spectrum, the optical band gap was calculated which ranges from 5.2 – 4.6 eV. TEM micrographs confirm the nano crystalline nature of combustion derived ferrite nanoparticles with average particle diameter of 7-28 nm. The antibacterial studies confirm that the prepared nanoparticles are more toxic to pseudomonas aeruginose having a maximum zone of inhibition of 25 mm.

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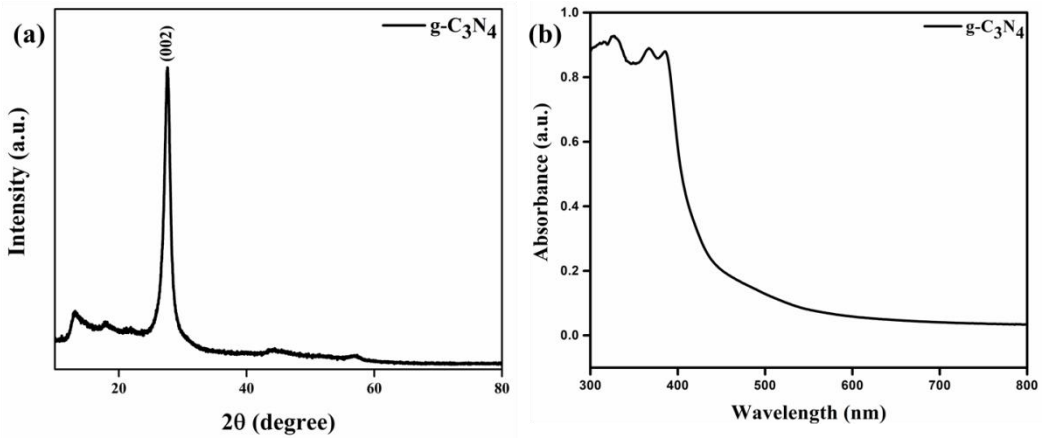

Figure. 1(a) shows the as prepared XRD pattern for g-C_3N_4, (b) absorption spectra of g-C_3N_4

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Characterization of Potassium nitrate doped Nickel Thiourea Sulphate Single crystals

R.Kalaivani, A.Darlin Mary, J.Johnson, S.Minisha

Department of Physics and Research Centre,AnnaiVelankanni College,

Tholayavattam-629157, Tamilnadu, INDIA.

Abstract: Research on Semiorganic nonlinear optical materials grow in recent years. Organic materials have low mechanical strength and poor physico-chemical stability.As a result,nowadays research is focused on semiorganic NLO materials to obtain superior NLO crystals by combining the advantages of organic and inorganic materials. The thiourea molecule is an interesting matrix modifier due to its large dipole moment and ability to form extensive network of hydrogen bonds. Semiorganic crystal has high-optical nonlinearity of a purely organic ion combined with favourable mechanical and thermal properties of an inorganic counter ion. In the present work, Nickel thiourea sulphate doped with potassium nitrate is explained. The crystal structure, spectroscopic and mechanical properties are discussed. The doped crystal belongs to the orthorhombic crystal system. The functional groups associated with the doped crystals are found by FTIR spectral studies. The mechanical properties of the doped crystals is found by Vicker's microhardness studies. Due to the doping of inorganic material, the mechanical properties of crystals can be improved compared to the pure crystals. Crystals with improved mechanical properties are used in commercial purposes.

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Separation Axioms on $\hat{g}^{**}$s-Closed Sets

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[1]Associate Proffessor *and* [2] Ph.D Scholar (Reg.No:19213012092006)
[1,2]P.G and Research Department of Mathematics, Annai Vellankanni College, Tholayavattam - 629187, Kanyakumari District,Tamil Nadu S.India

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Abstract

Topology is the branch of Mathematics which was introduced by Johann Benedict Listing in 19^{th} century and its purpose is t investigate the ideas of continuity, within the frame work of Mathematics. The authors introduce a new class of sets namely, $\hat{g}^{**}$s-close sets. We define $\hat{g}^{**}$s-closed sets by "A subset of a topological space (X, τ) is called a $\hat{g}^{**}$s-closed sets if $scl(A) \subseteq U$, whenever $A \subseteq l$ and U is $\hat{g}^{**}$- open". In this paper we introduce the concept of separation axioms using $\hat{g}^{**}$s-closed sets namely $\hat{g}^{**}s - T_0, \hat{g}^{**}s - T_1$ an $\hat{g}^{**}s - T_2$ spaces and also, we discuss various properties of these spaces.

Keywords: $\hat{g}^{**}$s-closed set; $\hat{g}^{**}s - T_0, \hat{g}^{**}s - T_1; \hat{g}^{**}s - T_2$ spaces.

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Fibonacci Heat Equation Generated by Two and Three Dimensional Difference Equation

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Abstract

In this paper we define three of solutions is heat equation generated by two and three dimensional difference equation we need to hav applied q-difference operator called generalized three dimensional difference operator for a real valued function. Also we derive som theorems Fibonacci Sequence, Numerical solution and examples.

Keywords:
Generalized partial difference equation; Numerical solution; Partial difference operator; Two and Three dimensional heat equation an Fibonacci Sequence.

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Discrete Laplace Transform of Trigonometric,Exponential and Hyperbolic Functions

Shiny N.S [1,*], Dominic Babu G [2]

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Abstract

Generalized Laplace Transform (GLT) is applicable in the field of Digital Signal Processing which has revolutionized many areas i science and engineering such as space, medical, commercial, military, industrial and communication. In this paper, we defined a GL obtained by an Inverse Difference Operator and we derived Laplace Transform of Exponential, Trigonometric and Hyperbolic Functions.

Key words: Inverse Difference Operator; Generalized Laplace Transform; Exponential; Trigonomertic and Hyperbolic Functions.

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Extorial Function and its properties in Difference Operator

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Abstract

In this paper developing certain properties of the newly defined extorial function,we derive the value for difference operator using th extorial function and also find higher difference operator value using extorial function and the negative index extorial function.Suitabl examples are inserted to illustrate the main results.

Key words: Difference operator,Extorial function,Difference equation.

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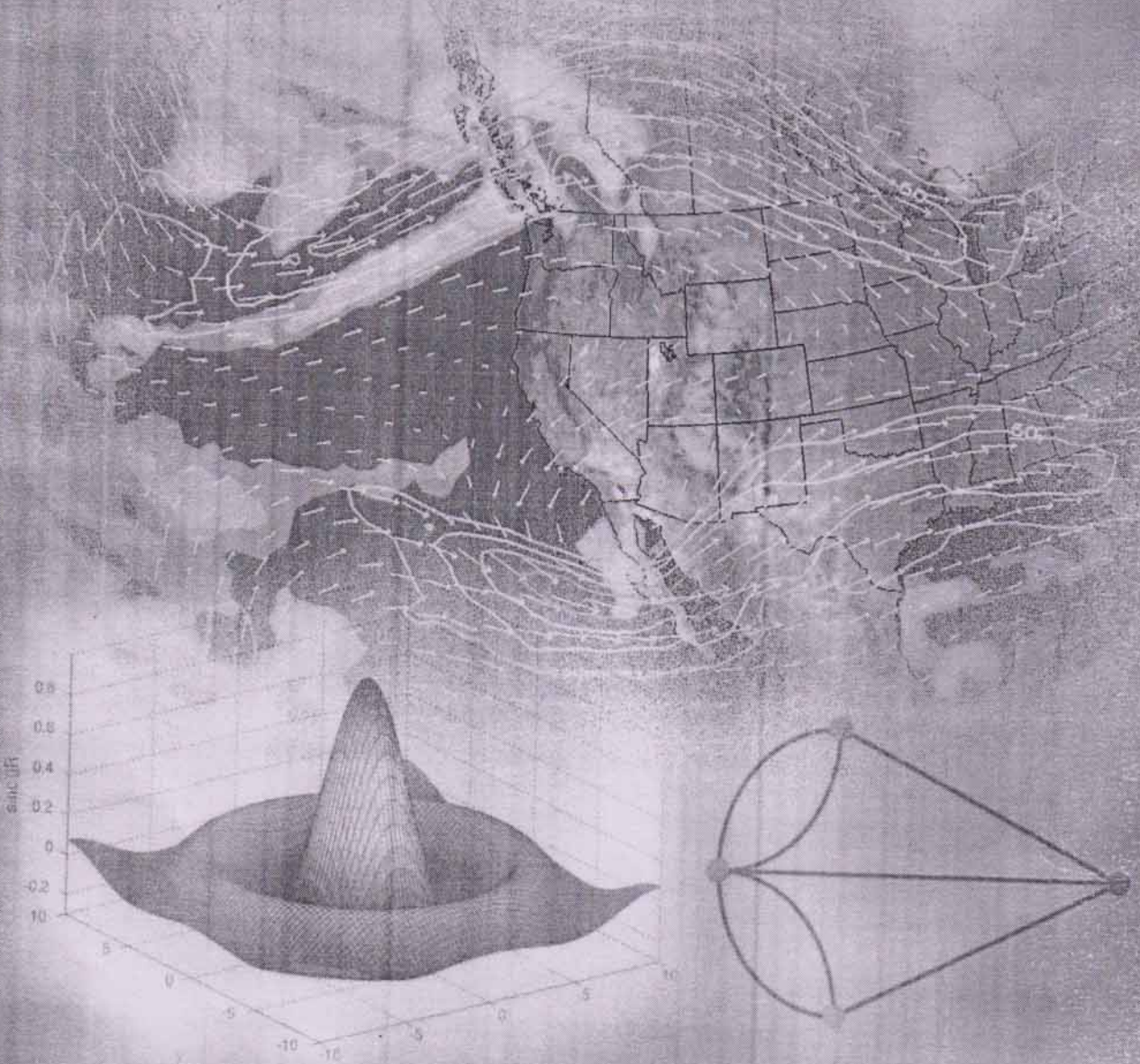

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Keywords - Neutrosophic gsα* - closed set, Neutrosophic gsα* - open set, Contra Neutrosophic gsα* - continuous function, Almost Contra Neutrosophic gsα* - continuous function.

Paper ID: RTMM005

Perfect Mean Cordial Labeling of Subdivision of Graphs

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Abstract: A vertex labeling $h : V(G) \rightarrow \{0,1,2,3\}$ is said to be a perfect mean cordial labeling of a graph G if it induces an edge labeling h^* defined as follows:

$$h^*(uv) = \begin{cases} 1 & if\ 2|(h(u)+h(v)) \\ 0 & otherwise \end{cases} \quad for\ all\ uv \in E(G)$$

with the condition that $|e_h(0) - e_h(1)| \leq 1$ and $|v_h(\alpha) - v_h(\beta)| \leq 1$ for all $\alpha, \beta \in \{0,1,2,3\}$, where $e_h(\delta)$ is number of edges label with δ ($\delta = 0, 1$) and $v_h(\lambda)$ denote the number of vertices labeled with ($\lambda = 0, 1, 2, 3$). A graph G is said to be perfect mean cordial graph if it admits a perfect mean cordial labeling. In this paper, we prove perfect mean cordial labeling of subdivision of graphs.

Keywords: perfect mean cordial graph, perfect mean cordial labeling.

AMS Subject Classification: 05C78

Paper ID: RTMM006

Convergence Results for Generalized (α, β)-nonexpansive Mappings

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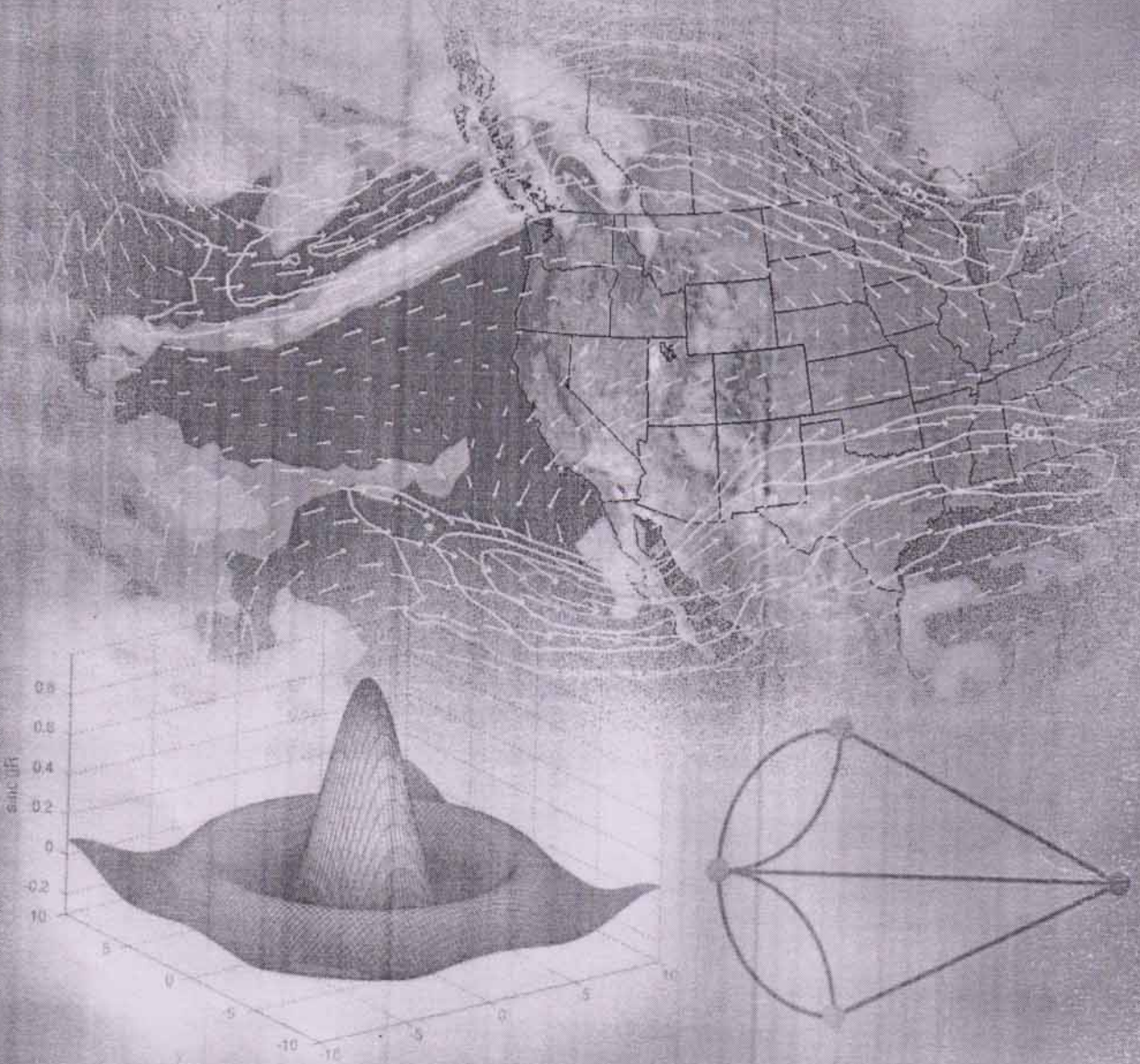

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Some Applications of Discrete Laplace Transforms on Exponential, Trigonometric and Hyperbolic Functions Using Nabla Operator

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Abstract: In this paper, we define the inverse difference operator providing some results

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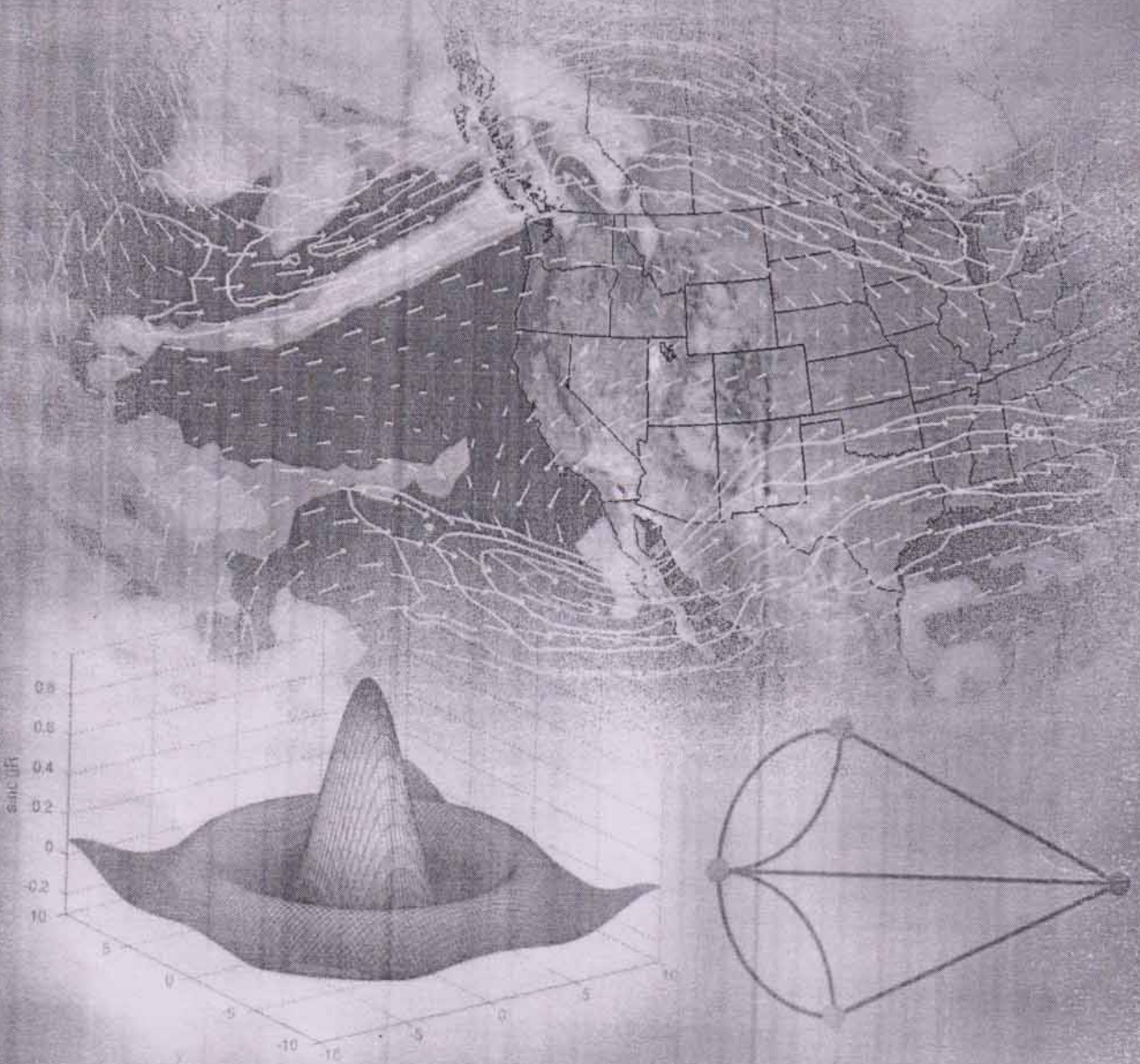

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Beta Difference Equation of Positive Variable (k>0) With Finite Series

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Abstract: In this paper, we define the multi series of Generalized Beta difference equation. Also we find the closed form solution which is coinciding with the finite the summation form solution of the higher order generalized β difference equation with suitable example.

Keywords: Difference equation, Difference operator, closed form solution, higher order generalized, finite summation.

Paper ID: RTMM092

On Continuity And *i*-Continuity In *i*-Topological Spaces

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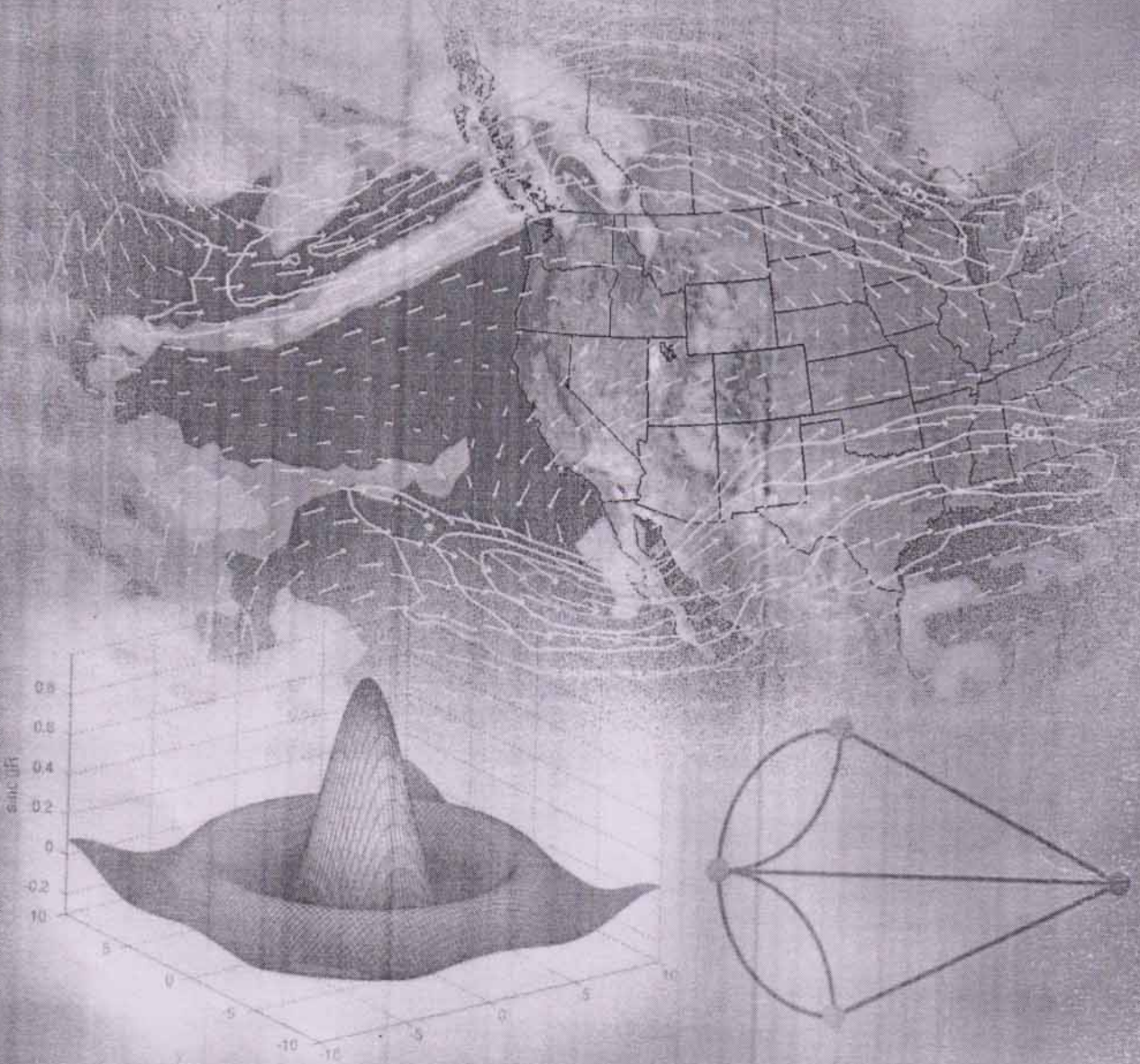

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Paper ID: RTMM089

A Case Study Of Stochastic Process Using Queuing Model

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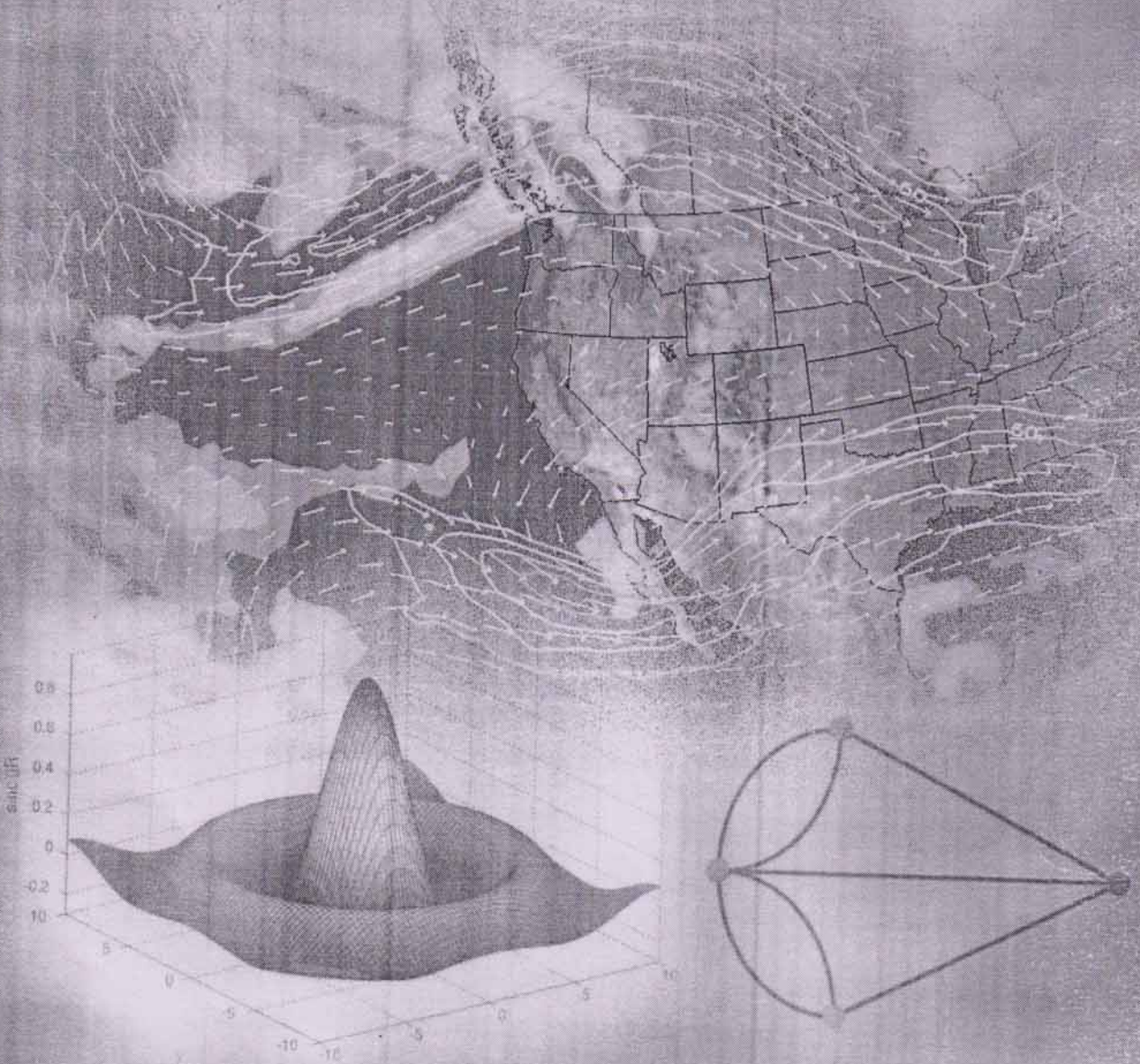

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A Study On $\hat{g}^{**}s$ – Connected Spaces

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Abstract: Topology is the branch of Mathematics. It is introduced by Johann Benedict Listing in 19th century and the main purpose of it is to investigate the ideas of continuity, within the frame work of Mathematics. The connectedness is the fundamental notions of general topology. Basic properties of connectedness have been investigated by many researchers. Generalisation of closed sets lead to attempts by Mathematicians to generalise the notions of connectedness. In the course of these attempts many stronger and weaker forms of connectedness has been introduced. The authors introduce a new class of sets namely, $\hat{g}^{**}s$-closed sets and define it by "A subset of a topological space (X, τ) is called a $\hat{g}^{**}s$-closed set if $scl(A) \subseteq U$, whenever $A \subseteq U$ and U is $\hat{g}^{*}$-open". In this paper we try to generalise connectedness using $\hat{g}^{**}s$ -closed sets a weaker form of connectedness and investigate the basic properties.

Keywords: $\hat{g}^{**}s$-closed set, Connected space, $\hat{g}^{**}s$-connected spaces.

Paper ID: RTMM114

Topological Cordial Labeling of Some Special Graphs

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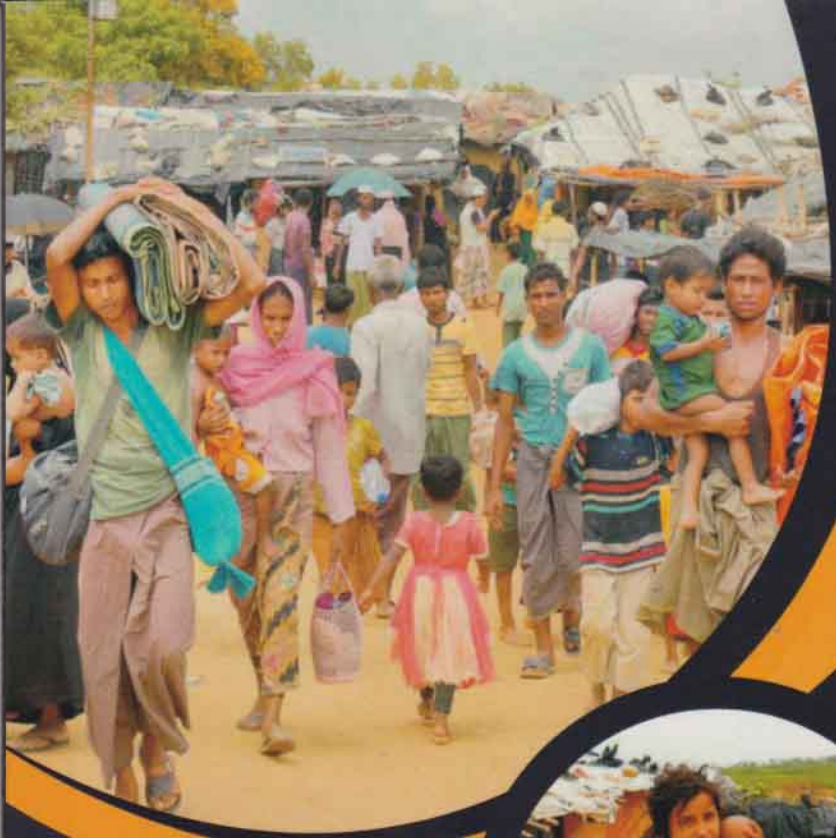

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Dr. R. Sukithar

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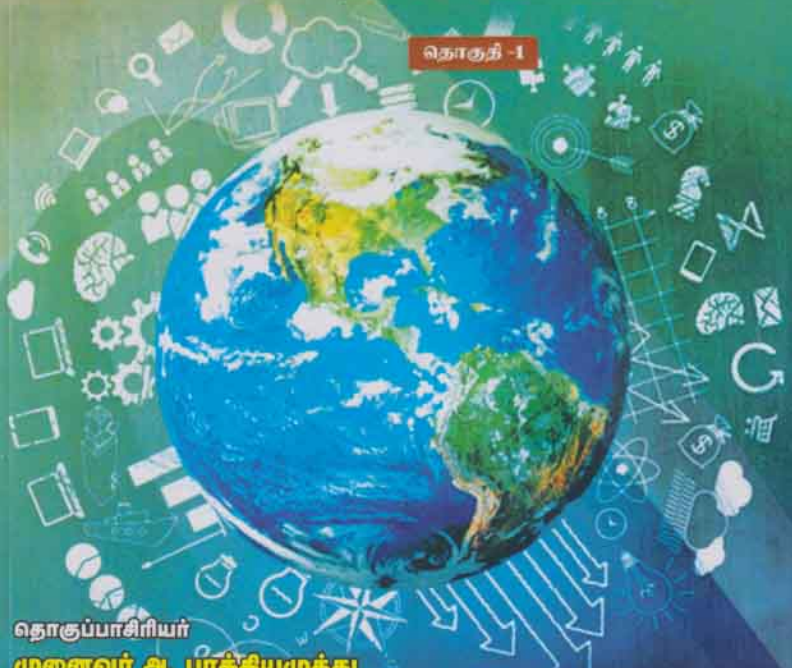

தொகுப்பாசிரியர்

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துணைத் தொகுப்பாசிரியர்கள்

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பொருளடக்கம்

பழமொழிகளில் பெண்கள்

ஜெ.ஜெபா,
முனைவர் பட்ட ஆய்வாளர், தமிழ்த்துறை,
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தொலையாவட்டம்

ஆய்வுச் சுருக்கம்

நாட்டுப்புற இலக்கிய வடிவங்களில் குறிப்பிடத்தக்க தனிப்பெரும் சிறப்பினை உடையவை பழமொழிகள். அன்றாட வாழ்வியல் சூழலில் நாட்டுப்புற மக்கள் தங்கள் வாழ்வு நிலைகளுக்கு ஏற்ப பழமொழிகளைப் பயன்படுத்துவதுண்டு. இப்பழமொழிகள் பெரும்பாலும் ஒழுக்க நெறிகளைக் கூறுவனவாகவும் ஆழமான பொருட்செறிவு உடையனவாகவும் அமைவதுண்டு. பழமொழிகள் பல்வேறு கருப்பொருட்களை மையமாகக் கொண்டு அமைகின்றன. இவற்றில் பெண்கள் குறித்த பழமொழிகளும் பெருமளவில் காணப்படுகின்றன. இப்பழமொழிகள் பெண்களின் வாழ்வியலையும், மன உணர்வுகளையும், சமுதாயத்தில் பெண்கள் பெறும் முக்கியத்துவத்தையும் விளக்குவனவாக உள்ளன.

முன்னுரை

பழமொழிகளைச் சமுகத்தைப் பிரதிபலித்துக்காட்டும் கண்ணாடி எனலாம். ஏனென்றால் பழமொழிகளைக் கொண்டே மக்களின் எண்ணங்கள் மற்றும் அவர்கள் செய்யும் தொழில் இவைகளைக் குறித்துத் தெளிவாக அறிந்து கொள்ள முடியும். பெண்களின் வளர்ச்சிநிலை, பண்பாடு, பழக்கவழக்கங்கள் மற்றும் அவர்களின் பொருளாதாரநிலை இவைகளைப்

பழமொழிகள் காட்டுகின்றன. பெண்களின் சமுதாய நோக்கு, அவர்களின் சமுகச் சூழ்நிலைகள் இவைகளை பழமொழிகள் முலம் ஆராய்வதே இக்கட்டுரையின் நோக்கம் ஆகும்.

பழமொழிகள்

பழமொழிகள் உலகின் தொன்மையான பழங்குடி மக்களிடையே தோற்றம் பெற்று இன்று உலகளவில் விரிவடைந்த ஓர் நாட்டார் இலக்கிய வடிவமாகக் காணப்படுகிறது. பழமொழிகள் குறித்து, "பழமொழிகள் அந்தந்த காலங்களில் பயிலப்பட்ட பகுதிகளின் கலை, கலாச்சாரம், பண்பாடு, வாழ்க்கை முறை இவற்றின் வர்ணனையாக -வெளிப்பாடாகவே இருந்திருக்கின்றன" என்று மாணிக்கவாசகர் சுட்டுகிறார்.

மேலும் "பழமொழிகள் எம்மொழியிலும் அனுபவங்களின் சாரமாகப் போற்றப்படுகின்றன், பயிலப்படுகின்றன, பின்பற்றப்படுகின்றன"[2] என்று பழமொழி நானூறு குறிப்பிடுகின்றது.

பெண்கள் தொடர்பான பழமொழிகள்

பெண்களைப் பற்றிய பல விதமான கதைகளைப் புராணங்களிலும், இதிகாசங்களிலும் காணமுடிகிறது. ஒரு சில கதைகள் உண்மைச் சம்பவங்களாகவும் இருக்கும். இதன் அடிப்படையில் பெண்கள் குறித்து வரும் பழமொழிகளும் உள்ளன. 'பழமொழிகள் என்றாலே பழமையான மொழி' என்றுதான் பொருள். இதன் அடிப்படையில் இப்பழமொழிகளும் முன்னோர்களின் அடிப்படையில் தோன்றியவைகளே.

பெண்குழந்தைகளைப் பற்றிய பழமொழிகள் மாடுகளுக்கு ஒப்பாக விளக்கப்பட்டுள்ளன.

"வைக்கப் படப்புக்கு ரெண்டு மொட்ட எருமையும்
வாழுற வீட்டுக்கு ரெண்டு பொட்டப் புள்ளையும்"

வைக்கோல் குவிக்கப்பட்டிருக்கும் இடத்தில் இரண்டு எருமை மாடுகளைக் கட்டி வைத்திருந்தால் அது அத்தனை வைக்கோலையும் தின்று அழித்துவிடும். அதுபோல, வீட்டில் இரண்டு பெண் பிள்ளைகள் இருந்தால் அவர்களின் திருமணத்தின் போது சீர்வரிசைகள் கொடுத்து புகுந்த வீட்டிற்கு அனுப்புகையில் வீட்டில் இருக்கும் அனைத்து செல்வங்களும் கரைந்துவிடும் என்ற அடிப்படையில் இப்பழமொழியினைக் கூறுவர்.

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A study on $\hat{g}^{**}s$-continuous and $\hat{g}^{**}s$-irresolute functions in topological spaces

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ABSTRACT

In this paper we introduce the concept of $\hat{g}^{**}s$-continuous functions. We study the relationship of these functions with other generalized continuous functions. Also, we study the composition of $\hat{g}^{**}s$-continuous functions and $\hat{g}^{**}s$-irresolute function.

Keywords:closed set, $\hat{g}^{**}s$*-continuous function,* $\hat{g}^{**}s$*-irresolute function, composite function.*

I. INTRODUCTION

Levine introduced the class of semi open sets in 1963 **[11]** and g-closed sets **[12]** in 1970. M.K.R.S. Veera Kumar defined $\hat{g}$-closed sets **[7]** in 2001 and $\hat{g}^{*}$-closed sets **[9]** in 1996. In 1991, K. Balachandran,H. Maki and P.Sundaramdefined a new class of mappings called generalised continuous mappings which contains the class of continuous mappings.In the same way, we introduced, $\hat{g}^{**}s$-continuous mappings. The authors introduce a new class of sets called $\hat{g}^{**}s$-closed sets, which properly placed in between the class of $g^{*}s$-closed sets**[4]** and the class of gs-closed sets**[13]**.

II.PRELIMINARIES

Throughout this paper (X, τ) represent the non-empty topological spaces on which no separation axioms are assumed unless otherwise mentioned. For a subset A of a space (X, τ), $cl(A)$ *and* $int(A)$ denote the closure and interior of A respectively.

Definition: 2.1: Let (X, τ)be a topological space. A subset A of X is called

1) A function $f: (X, \tau) \to (Y, \sigma)$ is said to be a continuous function**[6]**if $f^{-1}(V)$ is a closed set in (X, τ) for every closed set V in (Y, σ).

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BETA DIFFERENCE OPERATOR OF POSITIVE VARIABLE (K > 0) WITH INFINITE SERIES

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Abstract: In this paper, we discuss about Multi series of Generalized Beta difference equation. Also we find the closed form solution which is coinciding with the infinite summation form solution of the higher order generalized β_i–difference equation.

Key Words: Higher order generalized difference equation, Summation form solution, Infinite summation, Difference operator.

1. INTRODUCTION

In 1984 Jerzy Popenda introduced a particular type of difference operator Δ_β defined on $u(k)$ as $\Delta_\beta u(k) = u(k+1) - u(k)$. In 1989 miller and Rose introduced the discrete analogue of the fractional derivative and proved some properties of the fractional difference operator. The general fractional difference Riemann Liouville operator and its inverse operator on polynomial fractional$v(k) = \Delta^{-1}_{\beta(-l)} u(k)$.

In 2011 M.Maria Susai Manual, et.al has extended the definition of Δ_β to $\Delta_{\beta(-l)}$ wgich defined as $\Delta_{\beta(-l)} u(k) = u(k-1) - \beta u(k)$ for the real valued function$u(k) l(0,\infty)$. In [6] the authors have used the generalized difference equation. $u(k-l) - \beta u(k) = u(k), k[0,\infty], l(0,\infty)$ And obtained a summation solution and the higher order generalized difference equation are defined as.

$$\Delta_{\beta_1(-l_1)}\left(\Delta_{\beta_2(-l_1)} \dots \Delta_{\beta_n(-l_n)}(v(k))\right) = u(k), k[0,\infty], -l_{i>0}$$

There are two types of solutions for the equation. One is summation form and another one is called form. Hence in this paper, we obtain higher order multi Beta series to $u(k)$ with respect to by equating summation and closed form solution.

Definition: 1.1

The higher order generalized β_i difference equation is defined as is defined as.

$$\Delta_{\beta_1(-l_1)}\left(\Delta_{\beta_2(-l_2)} \dots\right) = u(k), k \in [0,\infty] l_{i>0} \qquad (1)$$

2. INFINITE α–SUMMATION

Lemma: 2.1

(Infinite $k, l > 0, \beta$ Summation formula), For $\beta > 0$ If $\Delta^{-1}_{\beta(-l)} \underset{r \to \infty}{Lt} \beta^{\left[\frac{k}{l}\right]} u\left(k + \left[\frac{k}{l}\right] l\right) = 0$. Then β- difference equation.

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Higher Order in n^{th} order Extorial Function

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Abstract:

In this paper, using the n^{th} order positive and negative extorial function, we derive higher order difference operator values of n^{th} order positive and negative extorial function. Suitable examples are inserted to illustrate the main results.

1. Introduction

The basic theory of difference equations is based on the difference operator Δ defined as, $\Delta u(k) = u(k+1) - u(k)$ where $\{u(k)\}$ sequence of numbers. The factorial polynomial is $k_l^{(n)} = \prod_{r=o}^{n-1}(k - rl)$. This factorial polynomial is used to define a new extorial function. This extorial function satisfies the higher order difference equation $\Delta_l^m u(k) = v(k)$.

Definition: 1.1

Let $l \neq 0$ be any real and $u(k)$ be any real valued function. Then the generalized difference operator on $u(k)$ defined as,

$$\Delta_l u(k) = u(k+l) - u(k)$$

For example, if $u(k) = e^k$

$$\Delta_l u(k) = \Delta_l(e^k)$$

$$= e^{k+l} - e^k$$

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Some Applications of Generalized Laplace Transform in Cosine Series

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Abstract

In this paper, we consider an application of generalized Laplace transform in cosine series and define the inverse difference operator, providing some results and we derived Laplace transform of cosine series. .

Keywords: Cosine Series, Exponential Function, Generalized Laplace Transform, Inverse Difference Operator and Nabla Operator

1. Introduction

The Laplace Transform has many applications in science and engineering because it is the tool for solving differential equations. The cosine function, along with sine and tangent is one of the three most common trigonometric functions. The theory of difference equation is developed with the definition of the difference operator $\nabla_\ell u(k) = u(k) - u(k-\ell)$, $k \epsilon N$, where N is the set of natural numbers. The Laplace Transform of f(t) is defined by $L(f(t)) = \int_0^\infty e^{-st} f(t)dt$ provided the integral exists, s is a parameter which may be a real or complex number.

தொல்காப்பியத்தில் வாழ்வியல் விழுமியங்கள்

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முனைவர். எஸ். அலக்ஸ் ஜேக்கப்

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பதிப்பாசிரியர் உரை

தமிழ்மொழி மிக நீண்ட இலக்கியப் பாரம்பரியத்தினை உடையது. தொல் பழங்காலந்தொட்டு சீரிய இலக்கிய, இலக்கணச் செந்நெறிகளைக் கொண்டு வளரும் மொழி தமிழ். இதன் சீர் இளமை குன்றாமல் காக்கப்படுவதில் பெரும் பங்கு இம்மொழியின் காலத்தால் அழியாத இலக்கண நூலாகிய தொல்காப்பியத்திற்கு உண்டு. இந்நூலின் ஆசிரியரான தொல்காப்பியர் மூத்த மொழி நூலறிஞர். இன்றைய மொழியியலார் கண்டுரைக்கும் உண்மைகளை அன்றே கண்டுணர்ந்த பேரறிஞர். தொல்காப்பியர் திட்டமிட்டு நூல்செய்வதில் வல்லவர் என்பது நூலின் கட்டமைப்பு மூலம் தெரிகிறது.

தொல்காப்பியம் இலக்கணக் கருவூலம் மட்டுமின்றி தமிழரின் வாழ்வு நலக் களஞ்சியமாகவும் திகழ்கிறது. பின்தோன்றும் புதுமைகளுக்கெல்லாம் களம் அமைத்து வழிவகை செய்த மொழியியல் பெருமைகளுடையது. எழுத்து, சொல், பொருள், யாப்பு, அணி, என்னும் ஐந்தனுக்கும் விரிவாக இலக்கணம் வகுத்துள்ளது. குறிப்பாக தொல்காப்பியப் பொருளதிகாரத்தில் பல்வேறு வாழ்வியல் நெறிமுறைகள் பதிவு செய்யப்பட்டுள்ளன. இவற்றை அறிந்து கொள்வது இன்றைய காலக்கட்டத்திற்குத் தேவையானதாகும். ஆகவே தொல்காப்பியர் குறிப்பிட்டுள்ள வாழ்வியல் விழுமியங்களை எடுத்துரைக்கும் நோக்கிலும் இன்றைய இலக்கண ஆய்வில் ஈடுபடுவோருக்குப் புதிய களம் அமைக்கும் விதத்திலும் இந்நூலைப் பதிப்பித்து வெளியிடுவதில் பெரும்மகிழ்ச்சி அடைகிறேன்.

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பதிப்பாசிரியர்

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தொல்காப்பியத்தில் பிரிவு

முனைவர் செ.அஜிதா,
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தொலையாவட்டம், கன்னியாகுமரிமாவட்டம்

முன்னுரை

பண்டைத்தமிழர்கள் எத்தகைய பண்பட்ட வாழ்க்கை வாழ்ந்தனர் என்பதனை மக்களின் அகம் சார்ந்த வாழ்க்கையையும் புறம் சார்ந்த வாழ்க்கையையும் பண்டைத்தமிழ் இலக்கியங்கள் நமக்கு வெளிச்சமிட்டு காட்டுகின்றன. அகவாழ்வில் காதல் கற்பனை விரவியும்;புறவாழ்வில் வீரமும் கொடையும் உள்ளது கூறும் முகமாகவும் படைக்கப்பட்டுள்ளன. காதல் வாழ்வில் தலைவன் தலைவியின் உள்ளம் இணைப்பும் பிரிவும் என்பதில் மக்கள் வாழ்வியல் நிலைகள் மொத்தமாக அடங்கிவிடுகின்றன. இதற்கு இலக்கியங்கள் சான்றாக அமைகின்றன. அதற்கு இலக்கணம் வரையறை கூறும் முகமாக அமைகின்றது. தமிழ் கூறும் நல்லுலகிற்குக் கிடைக்கப்பெற்ற மிகப்பழமையான முதல் இலக்கண நூலான தொல்காப்பியத்தில் அகவாழ்விற்கான வரையறை கூறப்பட்டுள்ளன. அதன்கண் அமைந்துள்ள பிரிவு பற்றி இங்கு காண்போம்.

காதல் வாழ்வு

பண்டைத்தமிழ் நிலங்கள் ஐ வகையாகப் பகுக்கப்பட்டு அந்தந்த நிலங்களின் தொழிலியலை அடிப்படையாகக் கொண்டு மக்கள் காதல் வாழ்வு வாழ்ந்து வந்தனர். இதனை முதல், கரு, உரிப்பொருட்களாக தொல்காப்பியம் சுட்டுகிறது. இந்த அடிப்படையில் நோக்கும் போது பிரிவு என்பது பாலை நிலத்திற்குரியது. இந்த பாலை நிலம் உருவானப் பாங்கை,

"முல்லையும் குறிஞ்சியு முறைமையிற் றிரிந்து
நல்லியல் பிழந்து நடுங்குதுய ருறுத்துப்
பாலை யென்பதோர் படிவங் கொள்ளும்"

(சிலம்பு. காடு. 64 – 66)

என்று குறிப்பிடப்பட்டுள்ளது.

தொல்காப்பியத்தில் களவு வாழ்க்கை

முனைவர். சா.லிட்டில் பிளவர்,
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முன்னுரை

பண்டைத் தமிழ் மக்கள் தம் வாழ்வியலை அகம், புறம் என இரு பிரிவுகளாகப் பிரித்து சிறப்புற வாழ்ந்தனர்.. 'அகம்' என்பது தலைவன் தலைவியின் அக வாழ்வையும் புறம் என்பது சமூகம் சார்ந்த வாழ்வியலையும் சிறப்பாக போர்க் கடமைகளையும் குறித்தது. அக வாழ்வில் களவு, கற்பு என இரு பிரிவுகள் காணப்படுகின்றன. இதில் 'களவு' என்பது தலைவன் தலைவியின் திருமணத்திற்கு முந்தைய காதல் வாழ்வையும் 'கற்பு' என்பது தலைவன் தலைவியின் திருமணத்திற்குப் பிந்தைய இல்லற வாழ்வையும் குறித்தது. தொல்காப்பியர் களவு, கற்பு வாழ்வுகளைக் குறித்து மிக அழுத்தமாகப் தொல்காப்பியத்தில் பதிவு செய்துள்ளார். இவற்றில் 'களவு' வாழ்க்கைக் குறித்து இங்கு ஆராயப் பட்டுள்ளது.

களவு

உலகத் தொடக்கம் முதல் இன்றுவரை காதல் என்னும் உணர்வு மனித உயிர்களிடையே இருந்து வருகிறது. இவ்வுணர்வுக்கு மாடி வீடு கூட கோபுரத்தில் வாழும் வலியவனாக இருந்தாலும் சரி குடிசை வீடு குப்பை மேட்டில் வாழும் எளியவனாக இருந்தாலும் சரி உயர்ந்தவன் தாழ்ந்தவன் என்ற எவ்வித வேறுபாடும் இல்லாமல் எல்லா தரப்பு மனிதர்களிடத்தும் வருவது தான் காதல். இக்காதலையே 'களவு' என்று பண்டை இலக்கியங்கள் சுட்டுகின்றன. ஏனெனில் தலைவனும் தலைவியும் பிறர் அறியாவண்ணம் சந்தித்துத் தங்கள் காதல் உறவை வளர்த்துக் கொள்வதால் இ.ட்து களவு எனப் பட்டது.

'களவு' என்பதற்குத் **"திருட்டு, திருடிய பொருள், கள்ளம், பிறர் பொருளை மறைவாகக் கவருதல் என்றும் களவுப் புணர்ச்சி என்பதற்குத் தலைவனும் தலைவியும்**

தொல்காப்பியத்தில் கற்பு வாழ்க்கை

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அன்னை வேளாங்கண்ணி கல்லூரி, தொலையாவட்டம்

முன்னுரை

தமிழ் மொழியில் கிடைத்துள்ள மிகப் பழமையான நூல் தொல்காப்பியம். எழுத்து, சொல், பொருள் என்னும் மூன்று அதிகாரங்களைக் கொண்டுள்ள இந்நூல் அனைத்து இலக்கண நூல்களுக்கும் முன்னோடியாகத் திகழ்கின்றது. பொருளதிகாரத்தில் மக்களின் அகவாழ்வு, புறவாழ்வு குறித்தச் செய்திகளும் எடுத்துரைக்கப்பட்டுள்ளன. கற்பியல் என்னும் இயலின் வழியாக தலைவன் தலைவியின் இல்லற வாழ்வு, பரத்தமை ஒழுக்கம், ஊடல், பிரிவு போன்ற வாழ்வியல் பதிவுகள் வெளிக்கொணரப்பட்டுள்ளன. தொல்காப்பியர் கற்பு குறித்தும் கற்பு காலத்தில் நிகழும் பல்வேறு நிகழ்வுகள் குறித்தும் விரிவாகப் பதிவு செய்துள்ளார். அவை குறித்து இங்கு ஆராயப்படுகிறது.

கற்பு

தலைவனும் தலைவியும் திருமணத்திற்கு பின் இல்லற வாழ்வில் நிலைத்து உறவு பூண்டு வாழ்வது கற்பு ஒழுக்கம் எனப்படுகிறது. கற்பு பெண்ணுக்கு மட்டுமல்லாமல் ஆணுக்கும் முக்கியமானப் பண்பாகும்.

பெண்ணின் பெருந்தக்க யாவுள கற்பென்னும்
திண்மை உண்டாகப் பெறின். (குறள்:54)

என்னும் குறளில் பெண்ணிற்கு கற்பினைக் காட்டிலும் பெருமையுடைய செயல் ஒன்றுமில்லை என வள்ளுவர் சுட்டி காட்டி உள்ளார். கற்புடையப் பெண் மழையைப் பெய் என்றுச் சொன்னால் பெய்யும் என்று வள்ளுவர் கற்புடைய பெண்ணிற்கு முக்கியத்தும் கொடுக்கிறார்.

அருந்ததி அணைய கற்பின்
(ஐங் :442)
நாணொடு மிடைத்த கற்பின் வாணுதல்
(அகம் 33:2)
ஆறிய கற்பின் தேறிய நல்லிசை
(பதிற் 90:49)

என்னும் பாடலடிகள் கற்பின் சிறப்பினை எடுத்துரைக்கின்றன.

'நீதில்லா வடமீனின் திறம் இவள் திறம்' என்று சிலப்பதிகாரத்தில் இளங்கோவடிகள் கண்ணகியின் கற்பினை அருந்ததி என்னும் நட்சத்திரத்திற்கு இணையாகப் பாடுகின்றார். கண்ணகி தன்னுடைய கற்பின் திறத்தால பத்தினி தெய்வமாக உயர்கின்றாள். கற்பு என்பது குறித்து தொல்காப்பியம் பின்வருமாறு கூறுகின்றது

கற்பெனப் படுவது கரணமொடு புணரக்
கொளற்குரி மரபின் கிழவன் கிழத்தியை
கொடைக்குரி மரபினோர் கொடுப்பக்கொள் வதுவே
(தொல்:கற்:140)

என்னும் நூற்பாவில், கற்பென்று சொல்லப்படுவது கரணத்தொடு பொருந்தி கொள்ளுதற்குரிய மரபிளையுடைய தலைவன் தலைவியைக் கொடுத்தற்கரிய மரபினையுடையோர் கொடுப்பக் கொள்வதாகும். அதைத் தவிர தலைவன் தலைவி உடன்போக்கு நிகழும் காலத்தில் கொடுப்போர் இன்றியும் மணம் நிகழ்வது உண்டு. இதை,

கொடுப்போர் இன்றியும் கரணம் உண்டே
புணர்ந்துடன் போகிய காலை யான (தொல்:கற்: 141)

என்ற நூற்பாவில் தொல்காப்பியர் விளக்குகிறார்.

தலைவன் வினை செய்து பொருள் ஈட்டுபவனாகவும் தலைவி வீட்டில் இருந்து கற்பு நெறி தவறாமல் இல்லறக் கடமை ஆற்றுபவளாகவும் சங்க இலக்கியங்கள் கூட்டுகின்றன. இன்றைய காலங்களில் ஆண் பெண் இருவரும் வேலைக்குச் சென்று சம்பாதிப்பவர்களாகவும் தங்கள் குடும்ப பொருளாதாரத்தை நிறைவு செய்பவர்களாகவும் உள்ளனர். கால மாற்றத்திற்கேற்ப மனிதனின் வாழ்வும் மாறிக்கொண்டு வருகிறது. இதனால் தனிமனித கற்பு என்பது பேசும் பொருளாக மாறி வருகின்றது.

தலைவியின் மாண்புகள்

'பெண்கள் நாட்டின் கண்கள்' என்பது பழமொழி. இல்லத்திற்கு அழகு சேர்ப்பவளும் இல்லத்தை நன்முறையில் கட்டிக் காப்பவளும் பெண் ஆவாள்.

தொல்காப்பியத்தில் மெய்ப்பாடுகள்

முனைவர். அ. கிறிஸ்டல் ஷீபா,
உதவிப் பேராசிரியர், தமிழ்த்துறை,
அன்னை வேளாங்கண்ணி கல்லூரி, தொலையாவட்டம்

முன்னுரை:

பேச்சுமொழி தோன்றுவதற்கு முன்பே மனிதன் தன் உள்ளத்து உணர்ச்சிகளை உடலசைவுகளால் வெளிப்படுத்தினான். உள்ளத்து உணர்ச்சிகளின் வெளிப்பாடாக தோன்றும் புறக்குறிகள் மெய்ப்பாடுகள் எனப்படும். தொல்காப்பிய பொருளதிகாரத்தில் உள்ள ஒன்பது இயல்களில் ஒன்று மெய்ப்பாட்டியல். தொல்காப்பியர் காட்டும் மெய்ப்பாடுகள் எட்டு வகைப்படும். இவற்றை ஆராய்வதாக இக்கட்டுரை அமைகிறது.

மெய்பாடுகள்

மெய்யில் படுவது மெய்ப்பாடு அதாவது உள்ளத்து உணர்ச்சிகள் உடலில் தென்படுவது மெய்பாடு. இம்மெய்பாட்டினை உடல் மொழி எனவும் குறிப்பிடலாம். தொல்காப்பியர் எண்வகை மெய்ப்பாடுகளாக நகை, அழுகை, இளிவரல், மருட்கை, அச்சம், பெருமை, உவகை, வியப்பு ஆகியவற்றை குறிப்பிட்டுள்ளார். இம்மெய்ப்பாடுகள் தோன்றும் இடங்களை நான்கு வகைகளாக பகுத்து கூறுகிறார். எண்வகை மெய்ப்பாடுகளை,

நகையே அழுகை இளிவரல் மருட்கை
அச்சம் பெருமிதம் வெகுளி உவகை என்று
அப்பால் எட்டாம் மெய்பா டென்ப

(தொல். மெய் : 1)

என்ற தொல்காப்பிய நூற்பா வாயிலாக அறியமுடிகிறது.

தொல்காப்பியர் எண்வகை மெய்ப்பாடுகளைக் கூறுமிடத்து இன்பம் வரும் நகையை முதற்கண் வைத்தார். அதற்கு முரணாக விளங்கும் அழுகையை ஒருவகையில் இளிவரலோடு தொடர்புடையது. எனவே அழுகைக்குப் பின் இளிவரலைக் குறிப்பிடுகிறார். இளிவரலுக்குப்பின் தம்மினும் உயர்ந்தாரை எண்ணி அச்சத்தை முன் வைக்கிறார். அச்சத்திற்கு நேரிடையான எதிர்ச்சொல் வீரம். எனவே

வீரத்தை அதற்கு அடுத்தாகக் குறிப்பிடுகின்றார். வீரத்தின் வெளிப்பாடு வெகுளி காரணமாகப் பிறத்தலின் வெகுளியை அடுத்ததாக கூறுகிறார். இறுதியில் பெறப்படும் இன்பத்தை உவகை என்ற வகையில் குறிப்பிடுகிறார்.

நகை

நகை என்பது சிரிப்பு. சிரிப்பு என்பது மனிதரோடு மனிதரை ஒன்றி இணைக்கும் ஓர் ஆற்றல் சக்தி ஆகும். வள்ளுவர் இந்நகையினை **"இடுக்கண் வருங்கால நகுக."** என்கிறார். மனிதர்கள் பொன்நகையினாலும், அழகு பொருட்களினாலும் தங்கள் முகங்களை அலங்கரிப்பதை விட புன்னகையினால் அலங்கரிப்பது சிறந்தது. வாய்விட்டு சிரித்தால் நோய் விட்டுப் போகும் என்பது பழமொழி. பரபரப்பும் விறுவிறுப்பும் இன்றைய வாழ்க்கைச் சூழலில் மனிதர்களுக்கு எல்லாவற்றிற்கும் நேரம் ஒதுக்கிறது. ஆனால் சிரிப்பதற்கு மட்டும் நேரம் இல்லை. அதன் விளைவாக பலவகை நோய்களுக்கு உட்பட்டு அல்லல் பட்டு தங்கள் வாழ்க்கையை இழக்கும் சூழல் காணப்படுகிறது.

தொல்காப்பியர் சிரிப்பின் முக்கியத்துவத்தை பல நூற்றாண்டுகளுக்கு முன்பே உணர்ந்து நகை என்றொரு மெய்ப்பாட்டினை முன்வைத்தார். எள்ளல், இளமை, பேதைமை, மடமை இவற்றின் வாயிலாக நகை பிறக்கும். என்கிறார் தொல்காப்பியர். இதனை

"எள்ளல் இளமை பேதமை மடனென்று
உள்ளப்பட்ட நகைதான் கென்ப"

(தொல். பொருள் : 248)

என்னும் நூற்பா வழி அறியமுடிகிறது.

அழுகை

அழுகை என்பது கண்ணளிலிருந்து நீரைச் சிந்தும் உணர்ச்சிவசப்பட்ட ஓர் நிலை அழுகை என்னும் மெய்ப்பாடு தன்னிமித்தமும் பிறர் நிமித்தமும் பிறக்கும். அழுகை என்பது இழிவு, இழவு அசைவு, வறுமை ஆகிய நான்கு காரணங்களால் பிறக்கும் என்பதை

இளிவரல் இகழ்வே அசைவே வறுமை என
விளிவில் கொள்கை அழுகை நான்கே

(தொல். பொருள் : 249)

என்னும் நூற்பாவின் வழி அறிய முடிகிறது.

இளிவரல்

பிறரால் இகழப்படுவது இளிவரல் ஆகும். பண்டைய நிலமை கெட்டு தாழ்நிலையை அடைவது இளிவரல் ஆகும். இது இழிபு எனவும் பொருள்படும். இது

தொல்காப்பியத்தில் கூற்றுகள்

முனைவர். த.மேபல் ராணி,
உதவிப் பேராசிரியர், தமிழ்த்துறை,
அன்னை வேளாங்கண்ணி கல்லூரி, தொலையாவட்டம்.

தொல்காப்பியம் மிகவும் பழமையான இலக்கண நூலாகும். மிகவும் தொன்மையான காப்பியம் என்பதால் இது தொல்காப்பியம் என்று அழைக்கப்படுகின்றது. இது இலக்கிய வடிவிலிருக்கும் இலக்கண நூல் ஆகும். இலக்கியங்களின் அமைப்பையும் பாடுபொருளையும் பயனையும் விளக்கும் இலக்கண நூலாகத் தொல்காப்பியம் திகழ்கிறது. இந்நூலின் ஆசிரியர் தொல்காப்பியர் ஆவர். தொல்காப்பியம் 1602 நூற்பாக்களால் ஆனது. இது எழுத்ததிகாரம், சொல்லதிகாரம், பொருளதிகாரம் என மூன்று அதிகாரங்களாகப் பிரிக்கப்பட்டுள்ளது. பல்வேறு வாழ்வியல் விழுமியங்களை உள்ளடக்கிய இந்நூலில் கூற்றுகள் குறித்தும் விளக்கப்பட்டுள்ளன. தொல்காப்பியர் குறிப்பிடும் கூற்றுகளை விளக்குவதாக இக்கட்டுரை அமைந்துள்ளது.

கூற்று

அகப்பாடல்களில் பேசுவோர் யார் என்பதை உணர்த்தும் பகுதி கூற்று எனப்படும். அகத்துறை இலக்கியங்களில் வரும் தலைவன், தலைவி, தோழி, பாங்கன், நற்றாய், செவிலித்தாய் ஆகியோர் நிகழ்த்தும் கூற்றுகளைத் தொல்காப்பியர் அகத்திணையியல், களவியல், கற்பியல் ஆகிய இயல்களில் கூறியுள்ளார். உடன்போக்கில் நிகழும் கூற்றுக்களை அகத்திணையியலிலும், களவொழுக்கத்தின்கண் நிகழும் கூற்றுகளைக் களவியலிலும், கற்பொழுக்கத்தின் கண் நிகழும் கூற்றுகளைக் கற்பியலிலும் கூறியுள்ளார்.

கூற்று நிகழ்த்துதற்குரியோர்

தொல்காப்பியம் பொருளதிகாரத்திலுள்ள அகத்திணையியல், களவியல், கற்பியல் ஆகிய இயல்களில் கூற்றுகள் இடம் பெறுகின்றன. இம்மூன்றிலுமே தலைவன், தோழி, செவிலி ஆகியோரின் கூற்றுகள் இடம்பெற்றுள்ளன. தலைவி கூற்று களவியல், கற்பியலில் மட்டும் இடம் பெற்றுள்ளது. காமக்கிழத்தி, கூத்தர்,

தொல்காப்பியத்தில் திருமணம்

முனைவர். க. அஜி,
உதவிப் பேராசிரியர், தமிழ்த்துறை,
அன்னை வேளாங்கண்ணி கல்லூரி, தொலையாவட்டம்

மணம் என்ற சொல்லுக்கு கூடுதல் என்பது பொருள். ஓர் ஆணும் பெண்ணும் இணைந்து இல்லறம் மேற்கொள்ள நடத்தப்பெறும் ஒரு வாழ்க்கை ஒப்பந்தமே திருமணம். இத்திருமணத்தைப் பெரிய மங்கல நிகழ்வாகவும், சமூக வளர்ச்சியின் அடிப்படை காரணியாகவும் கருதுகின்றனர். காலந்தோறும் ஏற்படும் மாற்றங்கள் திருமணத்திலும் பிரதிபலிப்புகளை ஏற்படுத்துகின்றன. பழந்தமிழ் சமூகத்தில் திருமணத்திற்கான பல வரைமுறைகள் இருந்தன என்பதை ஆய்வதே இக்கட்டுரையின் நோக்கமாக அமைகிறது.

திருமண முறைகள்

இன்றைய சமுதாயத்தில் ஆணும் பெண்ணும் ஒருவரை ஒருவர் சந்தித்து காதல் வயப்பட்டு களவுப்புணர்ச்சி வெளிப்பட்ட பின் திருமணம் செய்தலும் களவுப்புணர்ச்சி வெளிப்படுவதற்கு முன் திருமணம் செய்வது நடைமுறையில் உள்ளது. தொல்காப்பியர் காலத்திலும் இத்தகைய முறையிலேயே திருமணம் நடைபெற்றது. இத்திருமணத்தை களவுமணம், கற்புமணம் எனப் பாகுப்படுத்தியுள்ளார்.

"வெளிப்பட வரைதல் வரைதல் என்று
ஆயிரன்டென்ப வரைதல் ஆறே"

(தொல். நூ:1086)

என்ற வரிகள் நமக்குக் காட்டுகின்றன.

கற்புமணம்

கற்பு மணம் என்பது இருவீட்டுப் பெற்றோரின் விருப்பின் காரணமாக பல்வேறு சடங்குகளைச் செய்து திருமணம் செய்வது. இக்கூற்றைத் தொல்காப்பியரும் வதுகைச் சடங்குடன் திருமணம் செய்யத் தகுதியுடைய தலைவன், தகுதியுடைய தலைவியைத் திருமணம் செய்தல் என்கிறார். இதனை,

"கற்பு எனப்படுவது கரணமொடு புணரக்
கொளற்குரி மரபின் கிழவன் கிழத்தியைக்
கொடைக்குரிய மரபினோர் கொடுப்பக் கொள்வதுவே"

(தொல். நூ. 1088)

என்ற நூற்பா மூலம் அறியலாம். கற்பினைத் திருவள்ளுவர்,

"பெண்ணின் பெருந்தக்க யாவுள கற்பென்னும்
திண்மையுண் டாகப் பெறின்"

(குறள்:பா.54)

என்று குறிப்பிட்டுள்ளார்.

களவு மணம்

இன்றைய சமுதாயத்தில் ஆணும், பெண்ணும் காதல் வயப்பட்டு பெற்றோரின் விருப்பமின்ற அவர்களாகவே திருமணம் செய்கின்றனர். இத்திருமணம் தொல்காப்பியர் காலம் முதலே இருந்ததுள்ளது. இதனைக் களவு மணம் என்று வரையறுத்துக் கூறியுள்ளார்.

"கொடுப்போர் இன்றியும் காணம் உண்டே
புணர்ந்து உடன்போகிய காலையான"

(தொல்.நூ.1089)

களவொழுக்கத்தில் இணைந்து உடன்போகிய காலத்தில் இத்தகைய திருமணம் நிகழந்துள்ளது என்பதை மேற்காண் வரிகள் தெளிவுறுத்துகின்றன.

திருமணம் தோன்றக் காரணம்

பெற்றோர்கள், பெரியோர்கள் துணையின்றி உடன்போக்கில் திருமணம் செய்யும் போது தலைவியையும், தலைவனையும் பற்றிய முழுமையான உண்மைகள் தெரிய முடியாது. நீங்காத புணர்ச்சியின் காரணமாக அவர்கள் திருமணம் செய்துக் கொள்வார்கள். காதலித்து தாமே திருமணம் செய்த தம்பதிகளிடையே, பொய்கள், தவறுகள் ஏற்பட்ட பிறகுதான் தலைவர்கள் கற்பு மனத்திலும் சடங்கு முறைகளை ஏற்படுத்தினரென்பதை,

"பொய்யும் வழுவும் தோன்றிய பின்னர்
ஐயர் யாத்தனர் கரணம் என்ப"

(தொல்.நூ.1091)

என்ற நூற்பா நமக்கு காட்டுகிறது.

தொல்காப்பியத்தில் உயிரினங்கள்

முனைவர். ச.தோமை பிரின்சியா,
உதவிப் பேராசிரியர், தமிழ்த் துறை,
அன்னை வேளாங்கண்ணி கல்லூரி, தொலையாவட்டம்

தமிழ் நாகரீகத்தின் ஒப்புயர்வற்ற ஒளி விளக்காகத் திகழ்வது தொல்காப்பியம் என்னும் பெருநூல் ஆகும். காலத்தால் முற்பட்ட தொல்காப்பியம் இடைச்சங்கத்தார்க்கும், கடைச்சங்கத்தார்க்கும் இலக்கண நூலாக திகழ்ந்தது. ஈடு இணையற்ற இலக்கண நூலான தொல்காப்பியம் இலக்கண நூலாக மட்டுமின்றி வாழ்விற்கு வழிகாட்டும் வழிகாட்டியாகவும் திகழ்கிறது. மனிதர்களின் வாழ்கை முறைக்கு முக்கியத்துவம் கொடுப்பது போல் பிற உயிர்களின் தன்மையை விளக்கும் விதத்திலும் சிறப்பாகச் செயல்படுகிறது. இந்நூல் உயிரினங்களை இளமைப் பெயர்கள், ஓரறி முதல் ஆறறிவு வரை உள்ள உயிரினங்கள், ஆண்பால் பெயர்கள், பெண்பால் பெயர்கள் என்று பல வகையாக பிரித்து கூறுகிறது. முதல் நூலான தொல்காப்பியம் பிரித்து சொன்ன முறைகள் இன்றளவும் ஏற்றுக்கொள்ளக் கூடியதாகவே உள்ளது. அதிக அளவிலான சொற்கள் பயன்பாட்டிலும் உள்ளன. இதிலிருந்து தொல்காப்பியத்தின் சிறப்பை அறிந்து கொள்ளலாம்.

இளமைப் பெயர்கள்

தொல்காப்பியம் இளமைப் பெயர்களை குறிப்பிடும் போது ஏறு, ஏற்றை, ஒருத்தல், களிறு, சே, சேவல், இரலை, கலை, மோத்தை, தகர், உதள், அப்பர், போத்து, கண்டி, கடுவன் என்னும் பதினைந்து ஆண்பால் இளமைப் பெயர்களையும், பேடை, பெடை, பெண், மூடு, நாகு, கடமை, அளகு, மந்தி, பாட்டி, பிணை, பிணவு, பிடி என்னும் பதின்மூன்று பெண்பாற் இளமைப் பெயர்களையும் எடுத்து சொல்கிறது.

பார்பு, பிள்ளை என்பவை பறவையின் இளமைப் பெயர்களாகும். இவை ஊர்வனவற்றிற்கும் பொருந்தும். மேலும் குட்டி என்பது மூங்கா, வெருகு, எலி, அணில் இவற்றின் இளமைப் பெயர்களாகும். குரங்கிற்கும் இது பொருந்தும். மேற்குறிப்பிட்ட நான்கும் பறழ் என்றும் சொல்லப்படும் அப்படி சொல்வதால் தவறு ஒன்றும் இல்லை.

தொல்காப்பியத்தில் பரத்தமை

முனைவர். ஹா.சுபி
தமிழ்த்துறை உதவிப்பேராசிரியர்,
அன்னை வேளாங்கண்ணி கல்லூரி,தொலையாவட்டம்

முன்னுரை

ஆடலும் பாடலும் வல்லவராகி அழகும் இளமையும் காட்டி இன்பமும் பொருளும் விரும்பி ஒருவரை மட்டும் தக்க வைக்காமல் பல பேருக்கும் உரியவர்களாய் வாழுபவர்கள் பரத்தையர் எனப்படுவார்கள். இப்பரத்தையர்களை சேரிப்பரத்தையர், குலப்பரத்தையர் என்றெல்லாம் பிரித்து பேசுவார்கள். பரத்தையரும் காமக்கிளத்திகளும் ஒன்று அல்ல. பரத்தையருக்கும் காமக்கிளத்திகளுக்கும் வேறுபாடு உண்டு. காமக்கிளத்திகள் ஒருவருக்கு மட்டுமே காமம் காரணமாக தலைவனால் வரையப்பட்டவர்கள் எனலாம். பரத்தையர்கள் குறித்து தொல்காப்பியர் கூறும் செய்திகளை காண்போம்.

மணத்தினுள் அடங்கிய பரத்தமை:

தொல்காப்பியர் எண் வகை மணத்தைப்பற்றி கூறுகிறார். அவை பிரம்மம், பிராசபத்தியம், ஆரிடம், தெய்வம், காந்தருவம், அசுரம், இராக்கதம், பைசாசம் என்பவை ஆகும். இதில் கூறப்பட்ட **"பைசாசம்"** என்பது பரத்தமை நிலையை உணர்த்துகின்றது. பைசாசம் என்பது கள்ளுண்டு களித்தார் மாட்டும் துயின்றார் மாட்டும் சென்று கூடுதல் . இவ்வாறும் திருமணம் தீர்மானிக்கப்படுகிறது என்கிறார்.

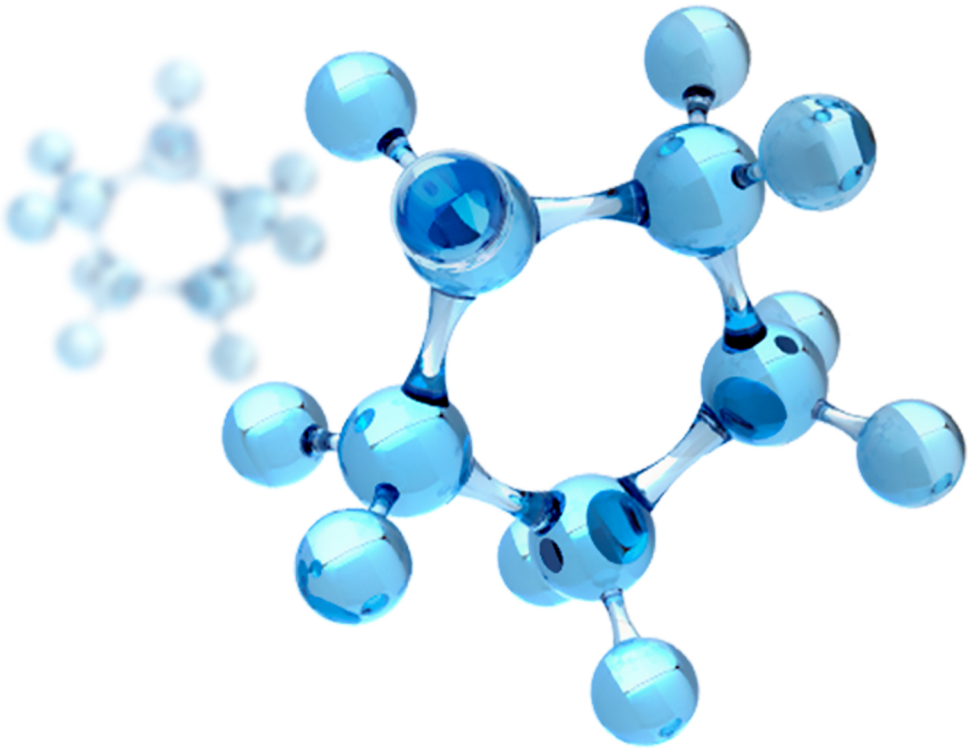
பெண்கள் தானே சென்று தூங்கி துயில் கொள்பவர்களிடமும் கள்ளுண்டு களிப்பவர்களிடமும் கூடும் கூட்டத்தை கூறுகிறது. அக்காலத்திலேயே இவ்வாறான பெண்கள் இருந்திருக்கின்றனர் என்பது குறிப்பிடத்தக்கது.

இன்றைய காலகட்டத்தில் மண முறையில் இப்படிப்பட்ட ஒரு கூடுகையை சேர்த்துக் கொள்வதில்லை. தற்போது இப்படி சென்று கூடுகிறவர்களைப் பரத்தை

EMERGING TRENDS IN MULTIDISCIPLINARY RESEARCH

ETMR - 2021

PROCEEDINGS



Organized by

DEPARTMENT OF CHEMISTRY & RESEARCH

Annai Velankanni College,

(Accredited by NAAC with B++ grade)

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Tholayavattam - 629157

Kanyakumari District, Tamilnadu, India.

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EMERGING TRENDS IN MULTIDISCIPLINARY RESEARCH

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Former Senior Scientist,
ISRO, Trivandrum.

MESSAGE

It gives me an immense pleasure to know that the Chemistry Department of Annai Velankanni College organized a National Conference on, "*Emerging Trends in Multidisciplinary Research*" on 8th October 2021.

The development of Science & Technology are playing a vital role in the growth of the modern society. Many scientific problems are solved through different type of research for the betterment of the humanity all over the world.

The improvement of scientific temper in the present Globe is a catalyst for building science in multidisciplinary fields based on innovative ideas subject to the availability and affordability.

It is heartening to know that eminent personalities from different part of our Nation participated in the Conference, which provided a platform for research workers to have scientific ideas and solutions through a detailed delibrations and discussions.

I am confident that this conference draw the attention of many researchers to think over the formidable power of science for the solutions of the existing problems in the present multidisciplinary subjects.

M. Xavier James Raj

Dr. M. Xavier James Raj

Rev. Fr. Dr. E. John Kulandai
Correspondent,
Annai Velankanni College, Tholayavattam.
Kanyakumari District.

MESSAGE

I am extremely pleased to address the staff and students of our department of Chemistry and all readers!

The Department of Chemistry in Annai Velankanni College has high a reputation among all colleges of Manonmaniam Sundaranar University for the high level of admissions, the quality of academic performance, the rate of passing and acquainting of ranks/awards from the University.

But the department has now and an uphill task because of the pandemic COVID-19 situation. Besides motivating the School and College students it is necessary to spread the message on the beauty and necessity of subject of Chemistry to the general public!

Will the members of the faculty do something effective along these lines!

This my wish and appeal to all in the department of Chemistry.

Fr. John Kulandai

Rev. Dr. E. John Kulandai

Dr. GLADYS LILY, I.R.S.
Treasurer
Annai Velankanni College
Tholayavattam

MESSAGE

I am extremely happy that the Chemistry Department of Annai Velankanni College, Tholayavattam is organizing ***"National Conferenceon Emerging Trends in Multidisciplinary Research"*** on the 8th October 2021.

Multidisciplinary Research is an important factor in all the fields. It has lot of importance to study all the aspects of a problem and it minimizes the partial or one sided result of the issue. Life is influenced by various factors, therefore studying any aspect in isolation in the absence of other discipline wouldnot give the clear picture. Therefore study of any issue necessarily demands recourse of the other discipline and there is no doubt that it enhances the vision of the researchers.

I am sure that this conference will inspire the researchers and I believe that this conference will be useful for the researchers to share their experience.

I extend a warm welcome to the delegates Dr. G. Glan Devadhas and Dr. F. Andrea Mary.

I congratulate the organizers Dr. S. Mary Helen, HOD of Chemistry Department, the Professors of the Chemistry Department, Dr. M. Jayarajan, organizing Secretary and scholars of Chemistry. I wish this conference to be a great successful one.

Dr. GLADYS LILY, I.R.S.

Treasurer

Dr. JOHNSON J, *M.Sc., M.Phil., Ph.D.*
Principal
Annai Velankanni College, Tholayavattam.
Kanyakumari District.

MESSAGE

I am happy to know that the Research Department of Chemistry is organizing ***"National Conference on Emerging Trends in Multidisciplinary Research"*** on 8th October 2021.

I am sure that this Conference will provide a unique platform for research scholars, delegates and students to share their experiences and knowledge in emerging field of Chemistry. I hope that this conference will challenge and inspire the researchers and helps to improve their research work by getting feedback from the experts in the field and also it will give an opportunity to sharpen your saw by learning new skills in a varied materials science environment. I earnestly trust this conference will provide an effective platform for the researchers to share their experience and to discuss the issues and challenges concerning with their field of research.

For a proceeding carries the contributions reflecting the ethos and aspirations of the students, faculty and other team members of an institution.

I congratulate the Department of Chemistry for organizing this conference and I wish them to be a great successful.

Dr. J. Johnson

Dr. S.R. BRINTHA, *M.Sc., M.Phil., Ph.D.*
Vice Principal
Annai Velankanni College, Tholayavattam.
Kanyakumari District.

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MESSAGE

I am extremely happy to know that the Department of Chemistry is organizing a National Conference on "Emerging Trends in Multidisciplinary Research" on 8th October 2021. It gives me great pleasure to send you a very sincere message of support and good wishes

New knowledge and findings cannot be generated without any research and development activities. The goal of a conference is to bring together, a multi-disciplinary group of scientists from all over the world to present and exchange break-through ideas relating to the thrust areas. It promotes top level research and to globalize the quality research in general, thus making discussions, presentations more internationally competitive and focusing attention on the recent outstanding achievements in the field of Chemistry, and future trends and needs.

I hope that this conference shares an insight into the recent research and cutting edge technologies, which gains immense interest with the colossal and exuberant presence of adepts, young and brilliant researchers and talented student communities.

I whole heartedly congratulate the convenor and head of the Department of Chemistry, Dr. S. Mary Helen , the organizing secretary Dr. M. Jaya Rajan, organizing members and the participants. Wishing you all a very fruitful and rewarding conference."

S.R. Brin

Dr. S.R. Brintha

Dr. M. ANTO, *M.Sc., M.Phil., Ph.D.*
Co-ordinator, IQAC,
Annai Velankanni College, Tholayavattam.
Kanyakumari District.

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MESSAGE

I'm happy to learn that the Chemistry Department of Annai Velankanni College, befitting its reputation as a Research Centre as well as the FIRST Post Graduate Department of the College, is bringing out a Conference Proceedings, in connection with the conduct of the National Conference entitled *Emerging Trends in Multi-disciplinary Research* held on 08.10.2021. I sincerely believe that the venture would promote Research and inculcate Research Culture at the Department Level and would act as a tool to share knowledge with our peers and the community.

Dr. M. Anto.

Dr. S. MARY HELEN, *M.Sc., M.Phil., Ph.D.*
Associate Professor cum HOD
Department of Chemistry
Annai Velankanni College, Tholayavattam,
Kanyakumari District.

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MESSAGE

As the head of the department of Chemistry, I am extremely happy for the National Level conference ETMR-2021 organized by the Department of Chemistry of Annai Velankanni College, Tholayavattam.

Conferences and Seminars are capable of keeping the students updated with the technologies and provide latest information about the things which are happening in science and technology. ETMR 2021 offers a existing platform for the students to interact with the eminent personalities.

I thank the experts who have reviewed these papers and the team of organizing committee for their dedicated work to bring about this proceeding.

Dr. S. Mary Helen

Dr. M. JAYA RAJAN, *M.Sc., M.Sc(PSy.)., M.Phil., Ph.D.*
Associate Professor
Research Department of Chemistry
Annai Velankanni College, Tholayavattam.
Kanyakumari District.

PREFACE

It is a pleasure to present the proceedings of a National Conference on "Emerging Trends in Multidisciplinary Research" (ETMR-2021). It is an initiative to bring about challenging leads, enhancing research skills and edifying insights in the field of Multidisciplinary research in chemistry. The ETMR-2021 provides an opportunity to the actively working researchers to improve the current state of Multidisciplinary research in Chemistry which would help in the betterment of mankind. I hope that this conference would certainly induce innovative ideas among the participants paving way for new inventions and new technologies in Chemical Research.

This proceeding consists of 45 research papers from Academics, Research Scholars and Post Graduate students. I wish to record my gratitude to the Management of our Institution, Principal and Vice-Principal, HODs and the valuable contribution of the staff, research scholars and students of the Department of Chemistry for the success of this conference.

Dr. M. Jaya Rajan,
Organizing Secretary (ETMR-2021)

NATIONAL CONFERENCE

ON

"EMERGING TRENDS IN MULTIDISCIPLINARY RESEARCH"

"ETMR- 2021"

Programme Schedule (08- 10-2021)

Inaugural Function

Welcome Address	:	**Dr. S.Mary Helen**, Head, Department of Chemistry, AVC, Tholayavattam.
Inaugural Address	:	**Rev. Dr. E. John Kulandai,** Correspondent, AVC, Tholayavattam.
Presidential Address	:	**Dr. M. Xavier James Raj,** Rtd. Scientist ISRO, President, AVC, Tholayavattam.
Felicitation	:	**Dr.Gladys Lily , I.R.S** Treasurer, AVC, Tholayavattam.
Felicitation	:	**Dr. J. Johnson,** Principal, AVC, Tholayavattam.
Felicitation	:	**Dr. S. R. Brintha,** Vice Principal, AVC, Tholayavattam.
Vote of Thanks	:	**Mrs. V. Usha,** Assistant Professor, Department of Chemistry, AVC, Tholayavattam.

Technical Session-I

10.30 A.M. -11.30 A.M.

Introduction of Resource Person	:	**Dr. M. Jaya Rajan,** Associate professor, Department of chemistry, AVC, Tholayavattam.
Invited Talk	:	**Dr. G. Glan Devadhas**, Professor & Head, Department of EIE, Vimal Jyothi Engineering College, Kannur, Kerala.

Technical Session- II

11. 45 A.M. – 12. 45 P.M.

Introduction of Resource Person	:	**Mrs. V. Usha,** Assistant Professor, Department of Chemistry, AVC, Tholayavattam.
Invited Talk	:	**Dr. F. Andrea Mary,** Assistant Professor, Sri Ramachandra Institute of Higher Education & Research, Chennai.

Technical Session III

2.00 P.M. – 3.00 P.M. : Paper Presentation

Batch –I

Chair Person	:	**Dr.S.Ginil Mon**. Assistant Professor, Department of Chemistry, Nesamony Memorial Christian College, Marthandam.

Batch –II

Chair Person	:	**Dr.A.Christoper,** Assistant Professor, Department of Chemistry, St.Xaviers Christian College, Palayamkottai

CONTENTS

GREEN SYNTHESIS AND CHARACTERIZATION OF Ag NPs USING JUSTICIA ADHATODA L. LEAF EXTRACT

B. Jone Magadelin[1], S. AjithSinthuja[*]
Department of Chemistry, Holy Cross College (Autonomous), Nagercoil-629004

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Abstract.

Nanotechnology is the science of the manipulating matter at nanoscale has received much attention in last few years due to its multifaceted beneficial properties including medicinal, electrical, optical, chemical stability and catalytic activity. The novel properties of nanoparticles are widely deployed for various applications in medicine, cosmetics, biomedical devices and environmental remediation. Nano materials are also called as "wonder of modern medicine "due to their distinctive features such as catalytic, optical, antimicrobial, wound healing and anti-inflammatory properties. Among the available large number of nanoparticles, metal oxide nanoparticles are considered to be more promising as they exhibit unique physical, chemical and biological properties. Novel Properties and functions of nano particles are basically dependent on as size, distribution and morphology. Furthermore for the better antimicrobial and catalytic activity of nano particles there is a certain control over the shape and size of the nano particles which is achieved by using different stabilizer reducing agents and employing different synthesis method. Various physical and chemical methods are available for the synthesis of nano particle, in these methods various hazardous chemicals are used which is very toxic to our environment. Thus, a better alternative is required which can be attained by green synthesis, Green synthesis of nanoparticle is an eco-friendly approach which is in common practice.

The green synthesis is a simple alternative to chemical and physical methods due to low cost and less use of toxic chemicals. Silver has long been recognized as one of the nanoparticles having inhibitory effect on microbes present in medical and industrial process. Nanomaterials have a long list of applicability in improving human life and its environment. The synthesis and assembly of nanoparticles would define from the development of clean, nontoxic and environmentally acceptable "green chemistry" approaches for nanoparticles. Silver is an effective antimicrobial agent, exhibits low toxicity and has diverse in vitro and in vivo applications.

Dissolved silver has been known for decades to be an efficient bactericide, binding to DNA and disrupting cell replication.

Silver nanoparticles have become a promising material for their potential use as an alternative bactericide combating antibiotic resistant strains, a major hazard in hospitals.The use of environmentally benign materials like plant leaf extract, bacteria, fungi and enzymes for the synthesis of silver nanoparticles offers numerous benefits of eco-friendliness and compatibility for pharmaceutical and other biomedical applications as they do not use toxic chemicals for the synthesis protocol.Silver compounds have been used as antimicrobial compounds for coliform found in waste water. Silver nanoparticles, nanodots or nanopowder are spherical or flake high surface area metal particles having high antibacterial activity are used in wound.Silver nanoparticles are the metal of choice as they hold the promise to kill microbes effectively. Silver nanoparticles take advantages of the oligodynamic effect that silver has on microbes, whereby silver ions bind to reactive groups in bacterial cells, resulting in their precipitation and inactivation. Silver ions and silver-based compounds are highly toxic to microorganisms showing strong biocidal effects on as many as 16 species of bacteria including E. coli. Thus, silver ions, as an antibacterial component, have been used in the formulation of dental resin composites and ion exchange fibers and in coatings of medical devices.

Justiciaadhatoda belongs to family Acanthaceae, well known as “adathoda” or “Malabar nut” orVasaka or Adusa.It is native to the Indian subcontinents and has been used in Ayurvedic and Unani medicine for over 2000 years. Several ethnopharmacological reports on J. adhatoda have shown that aerial parts of the plant contain the quinazoline alkaloids, vasicine (peganine) and vasicinone, which are used against respiratory disorders. Plant leaves and stems are used as a natural remedy for pulmonary infections, rheumatism, malarial fever, gastro-intestinal disease, infarction, skin diseases, and many other illnesses in India, Nepal, Pakistan, and Sri Lanka. The herb has effective antiperiodic, astringent, diuretic, and purgative effects, and is most frequently used in the treatment of asthma, cough, bronchitis, and tuberculosis.

The present work focuses on Green synthesis, characterization and antimicrobial activity of Ag NPs Justiciaadhatoda L. leaf extract. There is an increasing demand for silver nanoparticles due to its wide applicability in various area of biological science such as in field of antimicrobial and therapeutics, biosensing, drug delivery etc. To use in bioprocess the silver nanoparticles should be biocompatible and free from toxic chemicals. In the present study we report a cost effective and environment friendly route for green synthesis of silver nanoparticles using Vasaka (Justiciaadhatoda L.) leaf extract as reducing as well as capping agent. This plant has been opted

for the present study for its known medicinal properties and it is easily available. The biosynthesized silver nanoparticles are characterized by UV–Vis spectroscopy and TEM analysis. It is observed the nanoparticles are well shaped and the average particle size is 20 nm in the range of 5–50 nm.

Keywords: Green synthesis; Antibacterial activity; Vasaka (Justiciaadhatoda L.) leaf extract; Silvernanoparticles.

STUDIES AND CHARACTERISATION OF ZINC OXIDE NANOPARTICLES FROM THE LEAVES OF NEPHELIUEM LAPPACEUM

Dr.Ginju.M.L, Assistant Professor in Chemistry, Malankara catholic College, Mariagiri.

Mail id. ginju.ml@gmail.com

Introduction:

The botanical name of Rambutan is nephelium lappaceum. The rambutan is a medium sized tropical tree in the family Sapiduceae.Rambutan fruit contains diverse nutrients but small amount of manganese having moderate content at 16% of daily value of 100g consumed.The red colour of rambutan fruit is due to the presence of Gallic, Coumaric and elegiac acids.

Experimental Methods:

Materials required:

Fresh leaves of Nephelium lappaceum, Zinc nitrate, Distilled water, Magnetic stirrer, Sodium hydroxide.

Method:

Green synthesis of Zinc oxide nanoparticles:

The extract of nephelium lappaceum was collected by taking 50 g of leaves in 200 ml of water and it is kept under 60^0 C in magnetic stirrer for two hours. Then the extract is collected in a beaker. To the 10 ml of extract 1mM of zinc nitrate dehydrate is added slowly for about 5 minutes. The the solution was maintained at the pH of 12. Finally the Zinc oxide nanoparticles are collected and filtered at the pump. The nanoparticles are carried out for analysis.

Result and Discussion:

Fig.1.UV Spectrum of Zinc Oxide nanoparticles:

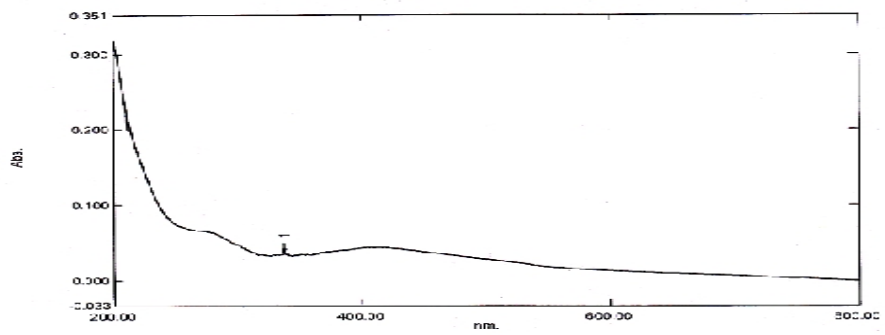


Fig.2.FTIR Spectrum of Zinc oxide nanoparticles:

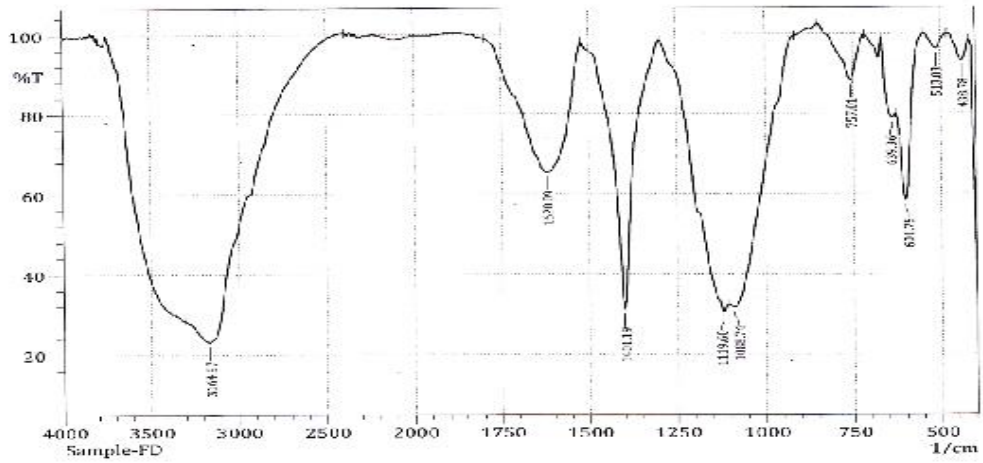
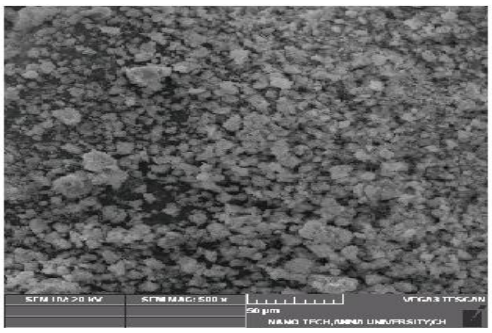


Fig.3 SEM analysis of Zinc oxide nanoparticles:



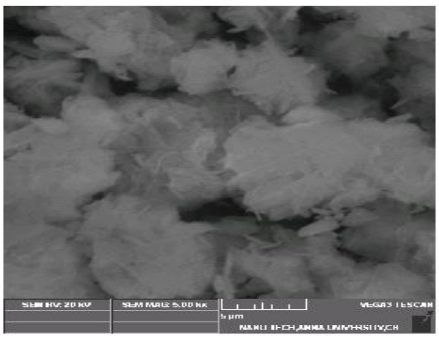
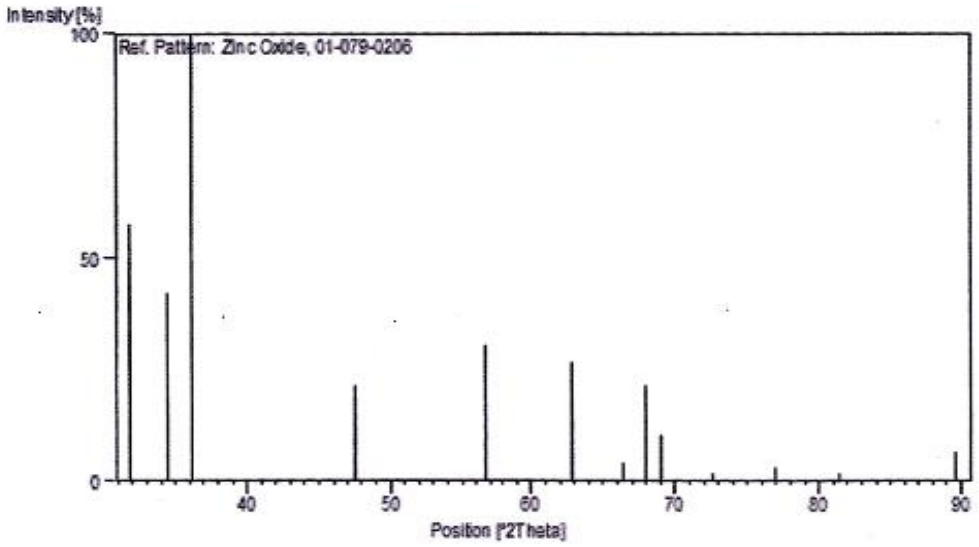


Fig.4.XRD analysis:



Conclusion

The zinc oxide nanoparticles shows different characteristics. The UV spectrum showed the presence of n-π* transition. The FTIR spectrum showed the presence of aldehydic and aromatic group. The crystalline nature of nanoparticles are analysed by XRD analysis.

Direct Microscopic Evaluation of Novel Ruthenium(II)-Phenanthroline-Benzoyl-Picolinic Acid Complex on SK-MEL-28 and Normal L6 Cell Lines

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[2*]Department of Chemistry, Holy Cross College (Autonomous), Nagercoil, Tamil Nadu.
Email: sheebadaniel@holycrossngl.edu.in

Abstract

The *in vitro*antiproliferative and cytotoxic evaluation of novel $[Ru(phen)_2(bzpic)_2]^{2+}$(phen = 1,10-phenanthrolineandbzpic = 3-benzoyl-pyridine-2-carboxylic acid) complex on SK-MEL-28 and normal L6 cell lines has been carried out by direct microscopic method. The morphological changesof cancerous SK-MEL-28 and normal L6 cell lines in the presence of $[Ru(phen)_2(bzpic)_2]^{2+}$ complex in DMEM is determined at various concentrations. The direct *in vitro*antiproliferative and cytotoxic evaluation of the synthesised complex clearly explains that the morphological changes in cells are purely based on concentrations through dose and time-dependent manner.

Keywords:$[Ru(phen)_2(bzpic)_2]^{2+}$ complex; SK-MEL-28 cell line;L6 cell line; Direct microscopic method

1.Introduction

Transition metal complexes have been extensively studied due to their potential applications in biological processes. Among the transition metal complexes, ruthenium complexes are stable and get easily accumulated in cancer tissues [1]. The most promising biological feature of ruthenium complexes include bio-distribution and are less toxic than that of cisplatin [2]. Due to its photophysical properties, charge, solubility and lipophilicity, Ru(II)-polypyridyl complexes act as potential cellular imaging for antitumor drugs, cellular targeting and therapeutic agents. Ru(II)-polypyridyl complexes non-covalently interact with biomolecules lends itself to design new therapeutic agents.Based on the literature survey, SK-MEL-28 melanoma and normal living L6 cell lines have high migratory potential and are used in the present investigation for analysing the *in vitro* antiproliferative and cytotoxic activity of $[Ru(phen)_2(bzpic)_2]^{2+}$ (phen= 1,10-phenanthroline and bzpic = 3-benzoyl-pyridine-2-carboxylic acid) complex. The synthesised $[Ru(phen)_2(bzpic)_2]^{2+}$ complex is characterized by analytical and spectroscopic techniques. The morphology of the cancerous SK-MEL-28 and normal L6 cell lines at various concentrations of $[Ru(phen)_2(bzpic)_2]^{2+}$ complexis carried out by direct microscopic observation method.

2. Materials and Methods

$RuCl_3.3H_2O$, ligands (phen and bzpic) and NH_4PF_6were procured from Sigma-Aldrich. HPLC grade solvents were used for the synthesis of the complex. SK-MEL 28 and normal L6 cell line is procured from National Centre for Cell Sciences.

The $[Ru(phen)_2(bzpic)_2]^{2+}$ complex was synthesised by refluxing$[Ru(phen)_2Cl_2]$ (1 mmol) and bzpic (2 mmol) in 20 mL of methanol for 4 h under nitrogen atmosphere. The solution was then allowed to cool at room temperature and filtered to remove any insoluble impurities. A saturated solution of NH_4PF_6 was then added dropwise into the filtrate until a dark brown precipitate was formed. The product was filtered, washed with cold water and diethyl ether and further dried in a vacuum desiccator. The complex was purified by column chromatography using silica gel as the adsorbent and a mixture of methanol and dichloromethane (2:8 ratio) as an eluent and subsequent evaporation to recover the complex. Elemental analysis: C = 66.16 %, H = 4.06 %, N = 8.90 %, O = 10.71 %. The absorption maximum (λ_{abs}^{max}) of $[Ru(phen)_2(bzpic)_2]^{2+}$ complexin CH_3CN was found to be at 224, 265, 361.5 and 445 nm.FT-IR (KBr pellet):3630, 2945, 2854, 1780, 1764, 1662, 1653, 1558, 1460, 1402, 1377, 1357, 1346, 1296, 941, 844, 725, 559, 436 and 404 cm^{-1}.^{1}H NMR (DMSO-d^6,δ ppm): [phen:8.134 (1H, d), 8.57 (1H, t), 8.768 (1H, t), 8.747 (1H, s); bzpic: 8.572 (1H, d), 8.18 (2H, t), 9.673 (1H, d) and 10.034(-OH)].^{13}CNMR(DMSO-d^6, δ ppm):190.02(C=O),179.56 (-COOH),125-151 ppm for aryl carbons.MALDI-TOF MS: *m/z* of $[Ru(phen)_2(bzpic)_2](PF_6)_2$ complex is found to be 1205.864 (M^+), 1061.2 (M^+-PF_6^-) and 915.817 (M^+ - $2PF_6^-$).

Sample solutions of $[Ru(phen)_2(bzpic)_2]^{2+}$complexwas freshly prepared for the evaluation of antiproliferative effect. The freshly prepared samples in 5 % DMEM,were initially filtered to ensure the sterility.Two-fold dilution of the freshly prepared samples were five times serially diluted as 6.5, 12.5, 25, 50, 100 µg in 100 µL of 5 % DMEM. The diluted samples were added in triplicates to the respective 96 cell well plates and incubated at 37 °C in a humidified 5 % CO_2 incubator. The 96 well tissue culture plate were observed at an interval of each 24 to 72 h in an inverted phase contrast tissue culture microscope and microscopic observation were recorded. Any changes in the morphology of the SK-MEL-28 and normal L6 cell lines were considered as indicators of antiproliferative effect.

3. Results and Discussion

The structure of the synthesized $[Ru(phen)_2(bzpic)_2]^{2+}$ complex is confirmed by elemental analysis and spectroscopic techniques. The synthesized $[Ru(phen)_2(bzpic)_2]^{2+}$ complex involves

the coordination of Ru(II) atom with phen and bzpic ligands *via* nitrogen atom of pyridine moiety, forming an octahedral complex (**Fig.1**).

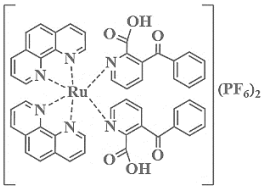

Fig. 1 Structure of $[Ru(phen)_2(bzpic)_2]^{2+}$ complex

In vitro antiproliferative and cytotoxic evaluation of$[Ru(phen)_2(bzpic)_2]^{2+}$complexon SK-MEL-28 and normal L6 cell lines at various concentrations are monitored and recorded (**Fig. 2** and **Fig. 3**). The morphological changes of SK-MEL-28 cells against the control at various concentrations of $[Ru(phen)_2(bzpic)_2]^{2+}$ complex show initial shrinkage, cluster cell formation due to chromatin condensation and finally leads to cellular vacuolization.The interaction of bzpic ligand in $[Ru(phen)_2(bzpic)_2]^{2+}$complex leads to morphological disruption. Hence the synthesised $[Ru(phen)_2(bzpic)_2]^{2+}$complex target the nucleus of the cancerous cells than the other subcellular regions. The free -COOH group present in the pyridine ring of bzpic plays a major role in the antiproliferative activity, which gets readily bind to the surface of the rapidly growing cancer cells and leads to decrease in the number of cells.

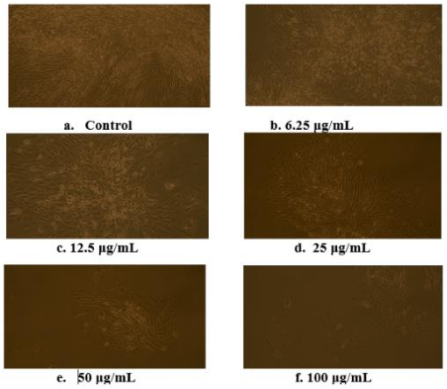

Fig. 2 Morphological changes of $[Ru(phen)_2(bzpic)_2]^{2+}$complex on SK-MEL-28 cell line at various concentrations

The cytotoxic evaluation of $[Ru(phen)_2(bzpic)_2]^{2+}$complex on normal L6 cell line at various concentrations is determined to find out the selectivity of the synthesised complex on normal non-cancerous cells. As the concentration increases from 6.25 to 100 µg/mL thespindled shaped normal L6 cell line concentrates toward inwards resulting in the rupturing of the cells. The dispersed cellular components get rounded forming a balloon like structure and leads to cellular blebbing and autophagic vacuolization followed by the numerous reduction of cells.

Hence it is clear that the changes in the cellular morphology is purely based on concentration and time-dependent manner.

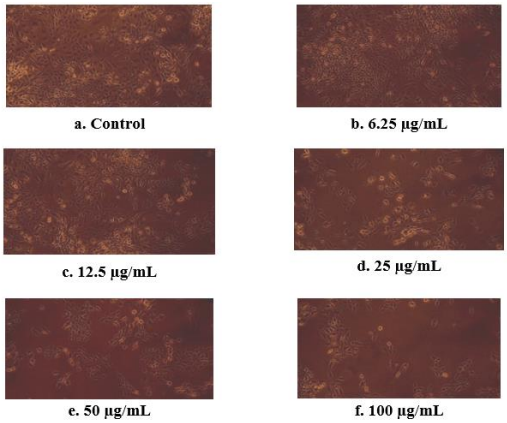

Fig.3 Morphological changes of $[Ru(phen)_2(bzpic)_2]^{2+}$complex on normal L6 cell line at various concentrations

The present investigation reveal that the $[Ru(phen)_2(bzpic)_2]^{2+}$complex containing phen ligand and the carbonyl group of bzpic ligands enter the cellular components of the L6 cell line and damage the nucleus by reducing the cytoplasm present in the cells and results in autophagic vacuolization [3].This reduction of cells due to higher concentration of the complex may damage the normal living cells and therefore leads to cytotoxic selectivity.

Conclusion

In vitro antiproliferative and cytotoxic evaluation of $[Ru(phen)_2(bzpic)_2]^{2+}$complex on SK-MEL-28 and normal L6 cell lines are analysed by direct microscopic method. The obtained microscopic images clearly picturize that the changes in the morphology of the selected cell lines are purely based on concentration through dose and time-dependent manner.

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Screening and production of biopolymer Polyhydroxybutyrates from the bacteria isolated from agricultural land

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Abstract:

Plastic pollution is the accumulation of plastic products in the environment that adversely affects wildlife, wildlife habitat, or humans.Polyhydroxybutyrates are the Biopolymers which are produced by more than three hundred different species of bacteria which can be altered as promising eco-friendly, biodegradable, biocompatible plastics. Currently they are in use in medical field especially in tissue engineering technology. Soil bacteriology is abundant with useful bacteria which produce economically important enzymes, antibiotics, secondary metabolites etc. The present study is aimed at screening and isolating Polyhydroxy butyrate producing bacteria from agricultural soil sample and production of biopolymer and sorting out the potent strain which can produce promising amount of the compound.

Keywords: Polyhydroxybutyrates, tissue engineering, Biopolymer.

Introduction:

Plastic materials originated from petrochemicals cause serious environmental problems due to their non-degradable nature. Such synthetically produced polymers are generally inexpensive, but their persistence has a significant environmental impact. With the imminent fossil fuel crisis, the alarming rate of petroleum prices and environmental impact associated with the products. They are polymers possessing properties similar to various synthetic thermoplastic like polypropylene. This makes them useful for extensive applications and future commercial mass production of biodegradable plastics that can replace plastic materials currently obtained from petroleum bases. Polyhydrocybutyratesare the biodegradable, biocompatible bioplastics which are produced by microorganisms. Some bacterial species which naturally produce PHB are Ralstoniaeutrophes, Alcaligenes, Pseudomonas, Bacillus, Rhodococcus, Staphylococcus and Micrococcus.

Over 300 heterotrophic gram-negative and gram-positive bacterial species capable of synthesizing PHAs have been isolated and identified e.g., Methylobacterium sp., Cupriavidusnecator, Bacillus sp., Pseudomonas sp., Enterobacter sp., Citrobacter sp., Escherichia sp., Klebsiellasp., Azotobacterbeijerinckii, Rhizobiumsp., A.vinelandii, A.macrocytogenes, C.necator,P.oleovorans, and Protomonasextorquens, Ralstoniaeutropha, Alcaligenseutrophus, Bacillus subtilis, Bacillus cereus, Bacillus megaterium, Azotobacter, Pseudomonas oleovoran, etc. Shape, size, structure, physical properties of these granules are differing from organism to organism. PHB degrade naturally and completely to carbon dioxide and water under natural environment by different microorganisms.

PHB has various applications such as in agriculture, bioimplants, bioplastic production, biofuel production, drugs and chemicals, food and feeds, etc. There are many applications of bioplastics as they were used for the fabrication of bottles, fibers, latex and several products of agriculture, commercial or packaging interest. Nowadays, these polymers have been used for medical application such as sutures, implants urological stents, neural and cardiovascular tissue engineering, fracture fixation, treatment of narcolepsy and alcohol addiction, drug delivery

vehicles, cell microencapsulation, support of hypophyseal cells etc The present study focus on the isolation and screening of most prominent PHB producing bacteria from agricultural land.

Methodology:

Collection of sample:

Soil samples were collected aseptically from agricultural land for the isolation of efficient polyhydroxybutrate (PHB) producing bacteria. The soil samples are collected in sterile plastic zipper (polythene) bags by digging the land.

Isolation of PHB producing bacteria:

Serial dilution method was used to isolate the bacteria by suspending 1g of soil in 99ml of distilled water. Serial dilution was done up to 10-10 dilution. 100ul of suspension from each tubes were transferred to nutrient agar plates and incubated over night.

Screening for PHB production:

Sudan black blue staining in petriplates:

After incubation, PHB producing bacteria were screened with 0.02 gm Sudan black B stain dissolved in 100ml ethanol. The plates were stained and kept undisturbed for 20 minutes. After that, excess dye is removed and plates were washed with 80% Ethanol for 30 seconds. The PHB producers appeared bluish black indicating positive result while white coloured colonies indicate negative result. Further the positive isolates were subcultured repeatedly to obtain pure colonies. (Kitamura &Doi., 1994)

Sudan black blue staining in slides:

Staining of cells with Sudan Black B smears of cells deposited on a glass slide were heat fixed and stained with 3%(w/v in 70% ethanol) solution of Sudan Black B(SIGMA) for 10 minutes, followed by immersion of the slide . The sample was counter stained with safranin (sigma 5% w/v in decolorized water) for 10 second, washed with water and dried. A few drops of immersion oil were added directly on the completely dry slide, and the cells were examined by contrast microscopy. In this staining granules are stained blue-black or blue grey, while the bacterial cytoplasm is stained light pink.

Gram's staining technique is performed to identify between gram positive and gram negative bacteria.

Maintenance of pure culture:

The media used for isolation & identification were nutrient agar. The isolated strains were sub-cultured several times under same conditions to obtain pure cultures of morphologically different bacteria. The purified strain were further characterized and stored in refrigerator. The best growth results of bacterial growth occur in nutrient agar media. These purified colonies were stored in refrigerator as stock.

Biochemical chracterisation:

The various biochemical tests like Indole, Methyl red, Vogesproskaur, Catalase, Oxidase, Citrate utilization, Triple sugar iron, Starch hydrolysis, Carbohydrate fermentation tests etcwere performed.

Production of PHB:

The bacterial cells containing the polymer were centrifuged at 10,000rpm for 10min and the pellet was washed with equal volume of acetone and ethanol to remove unwanted materials. The pellet was resuspended into 4% of sodium hypochlorite and incubated at room temperature for 30min. The whole mixture was again centrifuged and the supernatant was discarded. The cell pellet containing PHB was again washed with equal volume of acetone and ethanol. Finally the pellet containing polymer granules were dissolved in hot chloroform. The chloroform was filtered, and to filtrate 10ml of concentrated hot sulphuric acid was added. The addition of sulphuric acid converts the pellet into crotonic acid which is brown in colour. The solution was cooled and the absorbance was read at235nm against sulfuric acid as blank.

Result & Discussion:

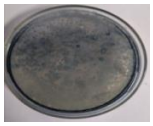

Fig 1: Sudan black blue staining in petriplate

Fig 2: Microscopic view of the isolate

Table 1: Colony morphology

BACTERIAL STRAINS	WHOLE COLONY APPEARANCE	MARGIN	ELEVATION	COLOUR	GRAM NATURE	SURFACE OF THE COLONY
SM16	IRREGULAR TO FLAT	SMOOTH	RAISED	WHITE	NEGATIVE RODS	SMOOTH
SM17	CIRCULAR	ENTIRE	CONVEX	CREAM	NEGATIVE RODS	ROUGH
SM18	IRREGULAR	LOBATE	FLAT	CREAM	NEGATIVE RODS	SMOOTH
SM19	CIRCULAR	FILAMENTOUS	FLAT	CREAM	POSITIVE RODS	SMOOTH
SM20	CIRCULAR	ENTIRE	CONVEX	CREAM	NEGATIVE RODS	SMOOTH

Table 2: Biochemical Characterisation of isolates

S.no	Test	Isolated cultures				
		SM16	SM17	SM18	SM19	SM20
1.	Carbohydrate fermentation	-	-	-	+	-
2.	Indole	+	+	+	-	+
3.	Methyl red	+	+	+	+	+
4.	Voges-proskauer	-	-	-	+	-
5.	Citrate utilization	-	-	-	+	-
6.	Nitrate reduction	+	+	+	-	+
7.	Urease test	-	-	-	+	-
8.	Starch hydrolysis	+	+	+	-	+
9.	Catalase	+	+	+	-	+
10.	Oxidase	-	-	-	+	-

The bacterial isolates were screened and isolated for PHB production, out of the numerous colonies grown under nutrient agar medium, 70-80% of the isolates showed positive result for sudden black blue staining. Out of it only five colonies were randomly selected for further studies.

PHB is a microbial polyester produced by many bacteria and stored in their cell in the form of granules, about 0.5 μm in diameter. β-hydroxybutyrate is connected by ester linkage and form PHB (Prasanna*et al.,* 2011). PHB possesses only R (alkyl group) side chains and lacks S (Sulfur) side chains) and hence reported as biodegradable materials (Anderson Jung *et al*., 2001)

Biochemical characterization of the isolates like Indole test, Methyl Red test,VogesProskaur test, Catalase test and Oxidase test, Carbohydrate fermentation tests, Triple sugar iron test were performed. The isolates were labelled as SM16, SM17, SM18, SM19& SM20. Colony morphology was studied by the growth of pure colonies in nutrient agar plates by spread plate technique. Gram stained colonies were observed under 100 X oil immersion objective lens and photographed. All the five strains were found to be rod shaped bacteria. SM16, SM17, SM18 & SM20 were found to be Gram negative rods SM19 alone was Gram positive strain. The strains were further stained with sudan black blue in slides, observed and photographed. All the strains showed PHB granules clearly under microscope.

PHB is produced by the growth of cultures in specialized medium by using trace element solution. The method followed for PHB production is sodium hypochlorite method as described by Gurubasappa*et al*., 2015.

All the five stains were grown in specialized medium for PHB production for three days. Studies state that PHB production is better achieved after 72 hours of incubation. Dry weight Molecular mass of PHB was calculated. After choloroform evaporation the petriplates shows a whitish powdery substance sticked onto it. It was scratched with the help of sterile scalpel and blade. The powdered PHB was collected into a sterile container was stored for further use. The quantitative PHB estimation is done spectroscopically. PHB standard concentration obtained from (Prayashree*et al*.,2003) .Among the five Strains SM20 showed maximum concentration i.e 186μg/ml, Concentration of SM19, SM16, SM17, SM18 were found to be 134, 110, 84, 74 μg/ml. They are tabulated and graphically represented. After estimation SM20 was found to be maximum PHB producer followed by SM19 and both were used for further anlaysis.

Analyis of PHB can be further carried out using FTIR spectra analysis and GCMS which will indicate the presence of specific functional groups of PHB. Optimization of cultures with varied carbon sources, nitrogen sources, varied pH, varied temperature etc can be done for better yield. Cheap carbon sources can be provided to obtain a cost effective yield. Molecular analysis by 16SrRNA gene sequencing helps in identification of the organism. Mass production under optimized condition and with cheap sources produces large yield of the bioplastics.

Conclusion :

Plastic rules our world because of their wide range of plastic pollution rules and spoils costal area, terrestrial area and our habitat it is the need of the hour to think about the alternative biodegradable and environmental friendly plastic. PHB will be a environmental friendly, biodegradable plastic.PHB differentiates itself from other biodegradable plastics it has unique properties like insoluble in water, highly resistant to hydrolytic degradation, oxygen permeability, UV resistant, other biodegradable plastics are moisture sensitive and water soluble. PHB is poor resistance to acidsand bases, soluble in chloroform and other chlorinated hydrocarbons and biocompatible and hence it is suitable for medical applications.

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Synthesis of Titanium Oxide Nanotubes Arrays for Hydrogen Generation (Water Splitting) using Photo Electrochemical Cells

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Abstract

In this article, Titanium oxide nanotubes fabricated by electrochemical anodization for Hydrogen Generation using Photo Electrochemical Cells are reviewed. Photo electrochemical (PEC) water splitting using nanomaterials is one of the promising techniques to generate hydrogen in an easier, cheaper and sustainable way. Nanomaterials can tune their band width by controlling its size and morphology. The TiO2 nanotubes are fabricated by electrochemical anodization method at constant DC voltage of 12V for 1 hour.The photoluminescence, crystallinity and surface morphology of prepared nanotube arrays were studied by Spectrometer, XRD and FE-SEM. Photoluminescence measurement showed a sharp peak at 405 nm corresponding to the band gap energy (3.2 eV) of bulk TiO2 anatase phase. However, humps at 391 nm and 496 nm are attributed to the free excitations whereas at 412m and 450nm is attributed to the formation of oxygen vacancy at the surface of titania nanotube arrays. XRD measurement revealed the anatase phase of TiO2 nanotube arrays and found good matching with others reported works. FESEM measurement showed well aligned formation of nanotube arrays of ~100 nm of inner diameter and ~50 nm of wall thickness of TiO2 nanotubes.The doped TiO_2nanotubes have reduced bandgap which leads to increase the efficiency of Photo Electrochemical Cell.

Keywords: Titanium oxide nanotubes; Electrochemical Anodization; Hydrogen Generation; Anodization parameters; Photo electrochemical Cells; Water Splitting

Introduction

The greatest challenge in the near future of scientific era to be addressed is the huge energy requirements. Researchers are emphasizing their efforts more on investigating clean, safe and sustainable energy resources to cure out the expected shortage of non-renewable energies and to control the pollution. Hydrogen is one such fuel with no emission of pollutants when burned in oxygen. It is a very promising renewable fuel, used in vehicles, spacecraft propulsion, aircraft and electric devices. Hydrogen is locked up in water, hydrocarbons, and other organic matter.

Techniques are introduced for the separation of hydrogen from these compounds. One of the exciting ways to extract hydrogen is water splitting process [1]. Water splitting is the process of separation of water into oxygen and hydrogen. Simplest, efficient, cheap and clean methods for the production of hydrogen are photo electrochemical and photocatalytic water splitting. In this day and age, broad materials are required to design and study modern devices, which are suitable for different possible commercial uses. The present demand for energy is increasing and fossil fuels are not a sustainable energy sources. Emission from fossil fuel is significantly degrades air quality. Solar produced Hydrogen is sustainable, storage, green solution. Light from sun when illuminated a photocatalytic agent with relevant bandgap can provide the energy needed to separate water into Hydrogen and Oxygen. Transformation of sunlight to chemical energy in the form of hydrogen is the objective of scientific and technological interests which may results in renewable source of sustainable and environment friendly energy for next generations [2]. Nanomaterials play an important role in current technologies to work with high performance devices.

Titanium Nanotubes Synthesis: Electrochemical Anodization

Among different methods for producing titanium dioxide nanostructures, the electrochemical method for fabricating titanium dioxide nanotubes (NT's) are proved to be the simplest and most effective[3]. Electrochemical synthesis methods have shown promise to synthesize a number of metaloxide nanostructures. This method has recently attracted more attention. In essence, TiO_2 nanotubes are formed onthe anode surface of Ti foil by anodic oxidation in a suitable electrolyte and co-electrode. In this process, the size of TiO2 - NT's can be controlled by adjusting the parameters of the electrochemical processing, and above all by the applied voltage [4, 5].

The experimental setup is made up of Titanium foil (from Sigma-Aldrich) of thickness 0.25mm and 99.7% as a working electrode i.e., anode and Platinum Pt as co-electrode (cathode) immersed in an electrolytic solution of 0.25wt% of ammonium fluoride (NH4F) dissolved in 99% of ethylene glycol. The constant DC voltage is applied to carry out as anodization at particular anodization time. Here the titanium foil used as anode is rinsed with acetone to get rid of impurities and is immersed in the electrolyte along with platinum as cathode. The pH of the electrolytic solution used is 4.3 and has the mortality of 0.06M.A constant power supply of 12V is connected between the electrodes as the anodization voltage. Then the experiment is repeated by increasing the anodization time. The TiO_2 nanostructure formation in an electrolyte is a result of two competing electric field assisted processes: Hydrolysis of TiO_2 and chemical dissolution of TiO_2 at the oxide/electrolyte interface [6, 7]. These two processes lead to the fabrication of vertically aligned

titanium oxide nanotubes on the surface of titanium substrate by the anodization of fluorides present in the electrolyte (mixture of ammonium fluoride and ethylene glycol. Three samples were prepared by the above method by applying the anodization potential of about 12 V for two different time periods of 30, 45 and 90 minutes respectively.

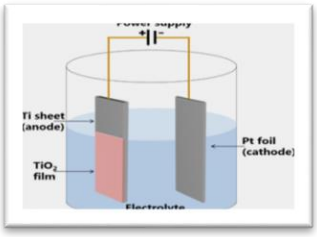

Fig1.Experimental Setup Of Electrochemical Anodization

Also another four different samples were prepared, for sample A 0.25 wt% of potassium fluoride dissolved in 99% of ethylene glycol with molarity 0.004M is used as electrolyte. For samples B,C and D the electrolyte was prepared by the dissolution of 0.004M of ethylene glycol with copper(II) nitrate solution (Cu(NO3)2 3H2O) of different concentrations (0.002M,0.003M,0.004M)[19-24]. A constant power supply of 12 V is connected between the electrodes as the anodization voltage for 1 hour and then annealed at 480^0C for one hour. The doped metal ion enhances the photo-catalytic activity byreducing electron–hole pair recombination and/or reducing the bandgap. Some has successfully improved the activity of TiO2 by doping metal ions like Au and Pt but they are very expensive and rare elements [8-13].

Result and Discussion

FEG SEM images of nanostructures prepared by varying anodization time .

Fig 2: Image of the sample anodized for 1 hour at 12V potential at different magnifications.

Figure 2 shows the top view of FEG-SEM surface structure of TiO_2 nanotube array at different madnification of 700KX and 400KX respectively. The resulting self-organized Nano porous TiO_2 had a length 200 nm and a pore diameter 100 nm and the wall thickness of the tubes are found to be 50 nm.

XRD Analysis

The x-ray diffraction pattern of TiO2 nanotube arrays recorded in the range of 100-900.The values of 2θ, d -spacing, relative intensity and FWHM are obtained from the XRD pattern. The low intensity peaks at 2θ values of 36.240, 62.080, 76.560, 79.710 and 82.400 are corresponding to the anatase phase. It has been reported that the remarkable broad peaks in the XRD pattern confirm the existence of amorphous phase [14, 15]. However, the other peaks at 2θ value of 39.540, 41.310, 54.130 and 72.400 are related to the titanium substrate itself. The obtained peaks in XRD pattern are consistent with JCPDS Card No. 021-1272.

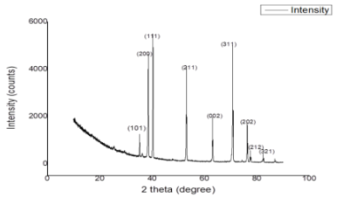

Figure 3X-ray diffraction pattern of anodic TiO_2 nanotube arrays annealed at 480 ^{0}C for 1hour

Photoluminescence (PL) Spectroscopy

Photoluminescence (PL) spectrum is recorded at excitation wavelength 320nm by using Photoluminescence Spectrometer. The surface morphology of titanium foil is measured using Field emission Scanning Electron Microscope.

By using potentiostatic anodization of two electrode configurations, self-aligned TiO_2 nanotube arrays are prepared and characterized. Figure 1a shows room-temperature photoluminescence (PL) emission spectra of undoped (sample A) TiO_2 nanotubes array on titanium foil recorded in the range of 300-600nm. A sharp PL emission peak can be clearly seen at 372 nm which is corresponding to the band gap energy (3.33 eV).The band gap energy of bulk TiO_2anatase phase is. 3.2 eV. Two humps were also observed at wavelength 496 nm and 521 nm which may be associated to the free excitations however, a small hump at 377nm and 435nm may be due to the formation of oxygen vacancy at the surface oftitania nanotube arrays.

Figure 4a and 4b PL emission spectra of pure and dissolution of copper nitrate titania nanotube

Conclusion

By anodic oxidation of TiO_2 foil, nanotube arrays have been prepared and characterized. A sharp PL emission peakat 405 nm corresponds to the band gap energy of bulk TiO_2 anatase phase. In PL spectra, small humps were also observed may be associated to the free excitations and due to the formation of oxygen vacancy at the surface of titania nanotube arrays. By XRD measurement, the anatase phase of TiO_2 nanotube arrays is confirmed at and the obtained peaks in XRD pattern were found to be consistent with JCPDS Card No. 021-1272. By FESEM measurement, well aligned formation of nanotube arrays is confirmed with ~100 nm of inner diameter of nanotubes ~50 nm of wall thickness. Finally, the prepared anatase TiO_2 nanotube arrays are well aligned and sharp PL emission peak observed at 372 nm corresponds to the band gap energy of 3.3eV bulk TiO_2. For samples B, C and D the band gap energy decreases as 2.83,2.81, 2.78eV respectively. hence, suitable for the application in Photo Electrochemical Cells for Hydrogen Generation.

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SYNTHESIS AND CHARACTERIZATION OF NEW AZO – IMINE DYE FROM 1,3,4-THIADIAZOLE

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Abstract

A new azo dye have been synthesized from 2-amino-5-phenyl-1,3,4-thiadiazole and their properties were investigated. 2-amino-5-phenyl-1,3,4-thiadiazole was introduced in condensation reactions with substituted aldehydes to obtain benzylidene imine derivative. Further these were treated with sulphanilic acid to give new 2-{[5-phenyl-1,3,4-thiadiazole-2- yl imino]3-hydroxybenzene} diazenyl benzene sulfonic acid . This derivative was further characterised by UV, FT-IR, NMR, and XRD spectral studies.

Keywords: 2-amino-5-phenyl-1,3,4-thiadiazole; benzylidene imine; sulphanilic acid.

Introduction

In an early 19th, the dyes were obtained from natural sources for coloring the fabrics. Mauveine was the first synthetic dye synthesized in 1856. By 1970, nearly 60% of the dyes were available in synthetic form. Azo compounds remain successful in drugs, dye, and cosmetics [1]. They are synthesized by diazotization reaction of a primary aromatic amine and coupled with one or more nucleophiles, mostly an amino, active methylene, and hydroxyl group where the -N=N- represents as azo group. Heterocyclic amines bearing dyes have pronounced bathochromic shift [2]. Not only for coloring properties but also azo molecules are popular for their therapeutic uses such as antiseptics [3], antimicrobial [4], antioxidant [5], anti- inflammatory [6], antiviral [7], antitubercular [8], and antitumor [9] activities. Structural aspects and a variety of biological activities of azo compounds and imine salts were the motivation for the synthesis of new azo compound and were studied.

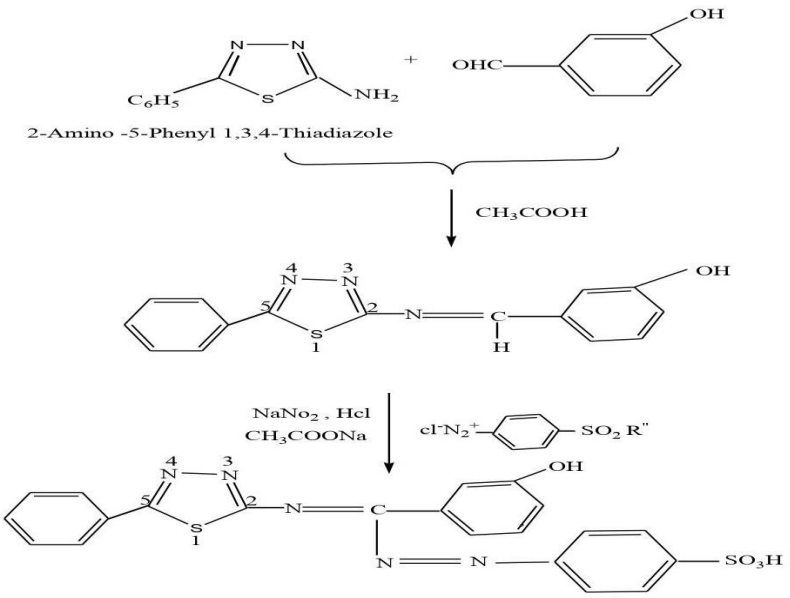
Materials and method

All the chemicals and reagents were purchased from Sigma-Aldrich. The completion of the reaction was monitored by TLC using various solvent system and iodine vapour. The IR spectra of the compound were recorded in the region of 4000-400 cm^{-1} by using KBr pallet on

FT-IR Perkin spectrometer. The ^{1}H (400 MHZ) and ^{13}C (100 MHZ) NMR spectra were recorded on a Bruker instrument in DMSO- at as solvent and TMS as an internal standard. Melting point of all the synthesized compounds was carried in open capillaries and is uncorrected.

Synthesis of 2-[5-phenyl-1, 3, 4-thiadiazole – 2- imino] 3-hydroxy benzene:

2-amino-5-aryl-1,3, 4-thiadiazole compound (0.01mole) was dissolved in 30 ml of glacial acetic acid. To this equimolar (0.01mole) quantity of 3-hydroxy benzene in 20-30 ml of ethanol was added and refluxed for 6 hours. The reaction mixture was allowed to stand for cool. After cooling, the resulting reaction mass was poured into crushed ice and left overnight. The solid benzylidene imine were separated out, filtred, washed thoroughly with petroleum ether, dried and recrystallised from hot ethanol.



Scheme: Synthesis of 2-{[5-phenyl-1,3,4-thiadiazole-2-yl imino]3-hydroxybenzene} diazenyl benzene sulfonic acid

Synthesis of 2-{[5-phenyl-1,3,4-thiadiazole-2-yl imino]3-hydroxybenzene} diazenyl benzene sulfonic acid:

The benzylidene imine (0.02mole), were dissolved in an ethanolic solution of sodium acetate (5g) with constant stirring. Sodium nitrate (0.02mole) was dissolved in H_2O and added to a well cooled solution of sulphanilic acid (0.02mole) initially dissolved in 3N Hcl (25 ml). The content were left at room temperature for 2 hours, the compound was precipitated and then filtered, washed with water, dried and recrystalized. The results obtained were analyzed by TLC.

Result and discussion

Analysis of UV-Visible spectra

The electronic spectra of the 2-{[5-phenyl-1,3,4-thiadiazole-2-yl imino]3- hydroxybenzene} diazenyl benzene sulfonic acid were investigated in a solvent ethanol. The UV spectra of compound showed two maxima for π- π* and n- π* transition and showed red shift due to conjugation. The electronic transition of compound showed two intense maxima at 285 nm and 342 nm, which can be attributed to π- π* and n- π* electronic transitions of – N=N- and – CH=N- moieties were obtained.

FT-IR Spectra

The FT-IR spectrum of the 2-{[5-phenyl-1,3,4-thiadiazole-2-yl imino]3- hydroxybenzene} diazenyl benzene sulfonic acid showed characteristic vibrations at 1650 cm^{-1} for the imine group, and 3202 cm^{-1} for the H- bonded –OH group. The occurrence of the azo group is shown by the 1527 cm^{-1} bands and 1376 cm^{-1} for the S=O group. The bands at 1287 cm^{-1} represent the presence of the C-N group.

^{1}H NMR Spectra

^{1}H NMR spectra of the 2-{[5-phenyl-1,3,4-thiadiazole-2-yl imino]3-hydroxybenzene} diazenyl benzene sulfonic acid were recorded in DMSO-d6 at ambient temperature. ^{1}H NMR spectra confirm the structures of the synthesized azo dye spectra gave bands at (2. 51) for solvent (DMSO-d6). A singlet at δ 4.525 ppm for O-H proton, a singlet at δ 6.619 ppm, equivalent to 4H, is due to the aromatic protons. A singlet at δ 7.566 ppm equivalent to 4H and δ 7.833 ppm equivalent to 1H is due to aromatic protons.

^{13}C NMR Spectra

^{13}C NMR spectra, the resonances in the region δ˜169.38 ppm(C-OH) carbon and δ

156.56 ppm(C=N) were assigned the imine carbon. The aromatic carbon located at the region δ˜ 122.18-131.58 ppm. The carbon of (C-N), carbon located at the region δ˜40.52 ppm.

Powder XRD Analysis

The powder XRD pattern of the 2-{[5-phenyl-1,3,4-thiadiazole-2-yl imino]3- hydroxybenzene} diazenyl benzene sulfonic acid has been made with the help of X- ray diffractometer with Cu as anode material, K- alpha[A^{o}]=1.540 and the generator settings 30mA, 40 KV. The above

compound posses sharp peaks indicates their crystalline calculated using Scherer's formula. XRD shows that the crystallite size of compound is found to be 124.3 nm, suggested that the compounds to be crystalline.

Conclusion

The present study describes the synthesis of 2-{[5-phenyl-1,3,4-thiadiazole – 2- imino] 3-hydroxy benzene}diazenyl benzene sulfonic acid were synthesized and characterised. The constitution of these compounds assigned on the basis of UV, IR, ^{1}H ^{13}C NMR, spectra were found to be in correlation with the desired structure. Powder XRD Analysis were studied.

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SYNTHESIS AND ANTIMICROBIAL STUDIES OF A NOVEL SERIES OF FERROCENYL CHALCONES

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ABSTRACT

A series of novel chalcones were synthesized via Claisen-Schmidt condensation of substituted acetophenones and ferrocene aldehyde. These newly synthesized compounds were characterized by physical, chemical and spectral analysis data and are further screened for their antimicrobial activity. The newly synthesized chalcones showed moderate to good antimicrobial activity.

Keywords: substituted acetophenones ,ferrocenealdehyde ,Chalcones, Antimicrobial Activity.

INTRODUCTION

Chalcones are the α,β-unsaturated carbonyl compounds. Since a long time different researchers are utilizing their valuable time for synthesizing the chalcone moieties. This dedication of huge number of researchers supposed to be attracted due to the striking features of chalcones. Chalcones exhibits various biological activities such as antimalerial [1], antiviral [2], anticancer [3] and other activities [4-5]. In addition to these features chalcones are also acting as an intermediate for the synthesis of various biologically active heterocycles such as pyrimidines, pyrazolines, isoxazolines, flavonoids, benzodiazepines [6-8] etc. In continuation to this persuasion, we synthesized some novel chalcones via Claisen-Schmidt condensation of substituted acetophenones and *ferrocene aldehyde*, so that this will be the precious addition to the existing biologically active Chalcones.

MATERIALS AND METHODS

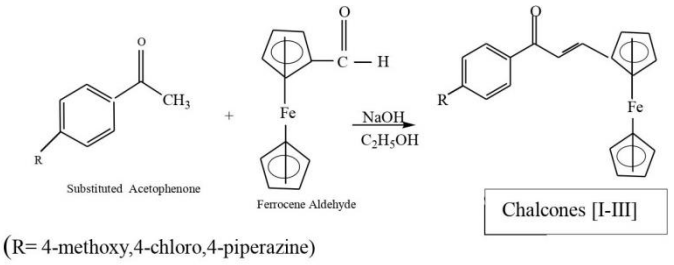
Melting points were determined digital melting point apparetus. The completion of the reaction was monitored by TLC using various solvent system and iodine vapour. IR spectra were recorded on FT – IR spectrometer (perkin Elmer) using KBr disc method . The ^{1}H (400MHz) and ^{13}C (100MHz) NMR spectra were recorded on a Bruker instrument in $CDCl_3$. Chemical shifts obtained in δ unit relative to TMS an internal standard were obtained.

General Procedure for synthesis of Chalcones:

To a mixture of substituted acetophenones (0.01 mol) and ferrocenealdehyde (0.01 mol) in ethanol (40 ml) was added 40% solution of sodium hydroxide (5ml). The reaction mixture was

then stirred for 4hrs after completion of reaction (monitored by TLC) the reaction mixture was poured into ice cold solution of water. The solid obtained washed with water and recrystalised from ethanol,melting point were taken in digital melting point apparetus.

Scheme– I.Synthesis of Chalcones



(R= 4-methoxy,4-chloro,4-piperazine)

RESULTS AND DISCUSSION

A variety of novel chalcones were synthesized via Claisen-Schmidt condensation of substituted acetophenones and ferrocene aldehyde. The reaction proceeded at room temperature. Work up procedure is simple and yield of the product is excellent.

All the newly synthesized chalcones were subjected for antimicrobial studies and exhibited moderate to good activity.

1-(4'-chloro phenyl)-3-(dicyclopentadienyl iron)-2-propene-1-one*[I] :*

UV(λ_{max},nm:299-569) ;IR(KBr,υ_{max},cm^{-1}):498(Fe-cp),1404(Ar-C=C),1655(CH=CH-CO),829(C-Cl);

^{1}H NMR (400MHz,$CDCl_3$):4.5(d,2H,2CH ,J-38.2H_Z),7.0-7.9(m,8H,Ar-H),4.1(s,C-Cl).

^{13}C NMR (100MHz,$CDCl_3$):69.87(C-Cl),188.43(C=O),118.48-147.53(aromatic cmpds)..

1-(4'-methoxy phenyl)-3-(dicyclopentadienyl iron)-2-propene-1- one.[II]: UV(λ_{max},nm:301-381);IR(KBr,υ_{max},cm^{-1}):498(Fe-cp),1466(Ar-C=C),1650(CH=CHCO),2839(OCH_3); ^{1}H NMR (400MHz,$CDCl_3$):4.5(d,2H,2CH,J-48.8 H_Z),6.9-7.7(m,9H,Ar-H),3.8(s,3H,OCH_3). ^{13}C NMR (100MHz,$CDCl_3$):55.50(OCH_3),188.13(C=O),113.76-16313.(aromatic cmpds).

1-(4'-piperazine phenyl)-3-(dicyclopentadienyl iron)-2-propene-1-one. *[III]:*

UV(λ_{max},nm:397-566);IR(KBr,υ_{max},cm^{-1}):499(Fe-cp),1572(Ar-C=C),1644(CH=CH-CO),1572(N-H);

^{1}H NMR (400MHz,$CDCl_3$):4.5(d,2H,2CH,J-53.6 H_Z),6.9-7.9(m,11H,Ar-H),3.5(s,1H,Aliphatic NH).

^{13}CNMR(100MHz,$CDCl_3$):26.21(C-N),187.61(C=O),113-154.37(aromaticcmpds).

Table:1. Physical data of synthesized compounds (I-III)

Entry	*Molecular formula*	*Yield (%)*	*Melting point (°C)*	*Elemental Analysis%*					
				C		*H*		*O*	
				Found	*Calcd*	*Found*	*Calcd*	*Found*	*Calcd*
I	$C_{19}H_{15}FeClO$	79	152	65.07	65.10	4.28	4.43	4.56	4.74
II	$C_{20}H_{18}FeO_2$	87	139	69.39	65.15	4.33	4.48	9.25	9.34
III	$C_{23}H_{24}FeN_2O$	86	142	69.40	69.02	6.63	6.72	4.42	4.48

Antibacterial and Antifungal Activities

Antimicrobial activity of synthesized compounds is reported in Table :2.Compounds were screened for in vitro against two positive (streptococus mutans MTCC916,Bacillus subtillis MTCC113) and two gram negative (Klebsilla pneumonia MTCC530,Proteus vulgaris MTCC426) bacteria for antibacterial and three fungal strains (Aspergillus flavus MTCC 535, Aspergillus niger MTCC 281, Rhizopus stolonifer MTCC162) for antifungal activity respectively broth microdilution method. Minimum inhibitory concentration (MIC) was determined and compared with standard drugs streptomycin.

Table:2. Antimicrobial data of compounds[I-III].

Cpd. no	**Minimum inhibition concentration in milli meter (mm)**						
	Gram + ve	**Gram +ve**	**Gram -ve**	**Gram -ve**	**Fungal strains**		
	streptococus mutans	**Bacillus subtillis**	**Klebsilla pneumonia**	**Proteus vulgaris**	**Aspergillus flavus**	**Aspergillus niger**	**Rhizopus stolonifer**
I	16	15	12	---	---	13	---
II	15	14	14	13	---	13	---
III	12	13	15	17	14	15	---
PC	20	21	20	20	15	18	20
NC	---	---	---	---	---	---	---

PC-positive control (streptomycin in 25 microgram),NC-negative contro (plain disc)

The antibacterial activity of chalcone compound [I],R= 4-Cl was moderatively active towards Bacillus subtilis and Klebsilla pneumoniae it was inactive with Proteus vulgaris.Compound [II] with R= 4-OCH_3 was moderatively active towards all the four bacterial strains.The compound [III] R= 4-Piperazine showed high activity for Klebsilla pneumonia and with Proteus vulgaris. Antifungal studies of the chalcone compounds[I-III] showed high activity for compound [III] with Aspergillus flavus and Aspergillus niger..

CONCLUSION

In conclusion, here we have reported some novel chalcones using ferrocene aldehyde for the first time possessing good to moderate antimicrobial activity via simple procedure within minutes at room temperature. The newly synthesized chalcones were confirmed by spectral analysis.

Acknowledgments

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PHYSICO CHEMICAL ANALYSIS OF SOIL SAMPLES OF MELPURAM

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Abstract:

Soil is one of the most important resources of nature. Stress on land zone developed by the increasing population combined with other factors often leads to erosion of soil. The soil testing is to understand the nature and qualities of the soil samples. The soil samples collected near low and high yield fruits, coconut, rubber and teak of Melpuram area. The soil testing mainly involves the determination of soil pH, electrical conductivity, available nitrogen, available phosphorous and available potassium by physico-chemical methods. The knowledge of the nutrition composition of soil samples are the essential requirements to the proper understanding of soil development as well as improving the soil fertility of the different areas of Melpuram. Interactions of soil mineralogy and physico-chemical properties play an important role in soil productivity of soil minerals.

Keywords: Physicochemical Analysis, Micro and macro nutrients.

1. Introduction:

Soil physico chemical properties deteriorates to the change in land use especially from agriculture and forest[1]. The change in physico chemical properties of soil leads to infertile or barren soil that does not support normal growth of vegetation for years[2]. A soil aggregate status usually deteriorates rapidly if soil is repeatedly cropped with annuals that supply little organic matter to the soil, require extensive cultivation and provide minimal vegetative cover [3]. The rubber industry and cashew nut industry is a main income source of the people of Melpuram. The extinct of the paddy fields and banana planting is a chaos for future generation. pH is a most important physical properties of soil. It is having great effects on solute concentration and absorption in soil[4].

2. Study Area:

The soil sample were collected from eight different high and low yield trees of melpuram Kanyakumari District, Tamilnadu, India (Figure 1). The soil samples were collected at random in

sterile polyethylene bags (bought to the laboratory) and stored aseptically to avoid contaminations, and immediately transported to the laboratory.

3. Materials and Methods:

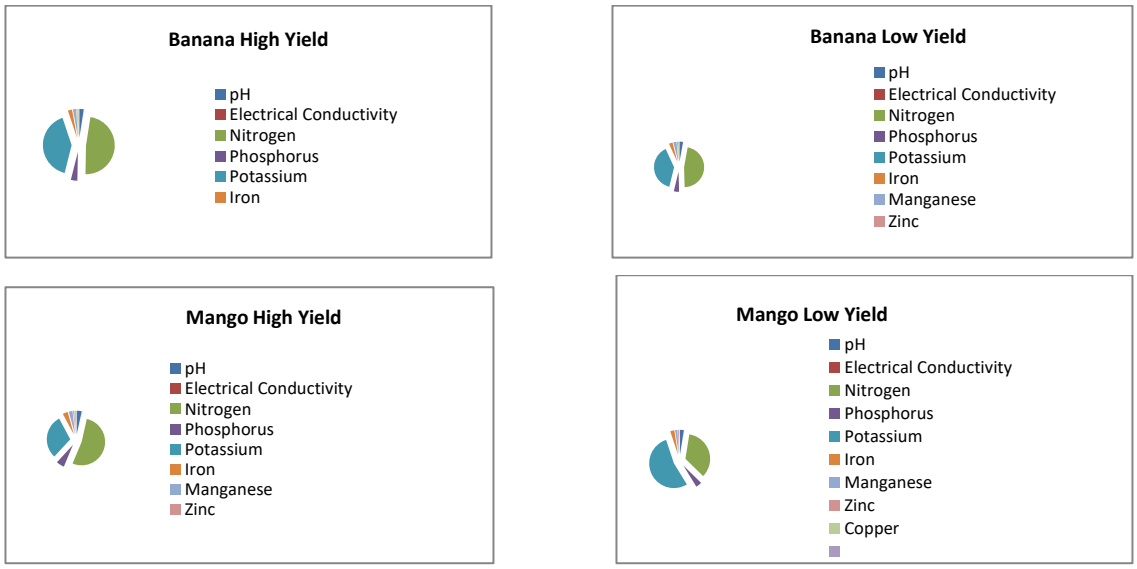
The collected different soil samples (Figure 2) were air dried in shade under room temperature for seven days. The processed soil samples were used for further analysis. The different methods were used for the physico chemical analysis of soil samples of Melpuram. The amount of organic matter presents in the soil sample and can be determined by walkley and black volumetric method. The available nitrogen can be determined by the alkaline permanganate method called Kjeldahl's method[5-8].

Figure 2.Different soil samples of Melpuram.

4. RESULTS AND DISCUSSSION

The processed soil samples were analyzed for physico-chemical parameters like pH, electrical conductivity, available nitrogen, phosphorus, potassium and micronutrients such as iron, manganese, copper and zinc. In this study varying physico-chemical factors were analyzed the soil samples of Melpuram Village.

4.1. Comparative physico chemical analysis of low and high yield of soil samples



The above pie charts clearly represented the comparison of physico chemical parameters like pH, Electrical conductivity, Macronutrients (N,P,K) and micro nutrients(Fe, Mn,Cu, Zn) in low and high yield of coconut, teak, banana and mango.

Salinity varied from 0.5 ‰ to 11‰. The pH remained alkaline with the maximum value during summer and minimum value during post monsoon. The organic carbon content varied from 0.061% to 0.522%, nitrogen content varied from 0.012 % to 0.052 %, total phosphorus content ranged between 0.03% and 0.09%. The percentage of sand, silt and clay were 85.4% to96.8 %, 1.2% to11.9% and 1.1% to 8.8% respectively[9].

5.SUMMARY

The soil samples were collected from eight different areas near the high and low yield of coconut, teak, banana and mango soil samples of Melpuram. The physico chemical parameters such as pH, electrical conductivity, available nitrogen, phosphorus, potassium and micronutrients such as iron, manganese, copper and zinc were analyzed in the soil samples. In this study, maximum pH (6.3) was observed in the soil sample near the high yield coconut tree and minimum p^H of (5.6) was observed in the in soil sample near the teak tree. The pH of soil samples of Melpuram village is acidic nature. Based on the results, the maximum EC of 0.17 d sm^{-1} was observed in the soil sample near the coconut tree and minimum of 0.06 d sm^{-1} in the soil sample near the teak tree. Based on the results observed, the maximum nitrogen content of 111 Kg ha^{-1} was observed near the high yield banana tree soil samples. On the other hand, the minimum range of 63 Kg ha^{-1} was observed near the high yield teak tree soil samples. The variations of nitrogen content in soils were seen in the soil samples of Melpuram are due to the availability soil organic matter

The maximum phosphorous content of 23.3 Kg ha^{-1} was observed near the high yield teak tree soil samples. On the other hand, the minimum range of 8.5 Kg ha^{-1} was observed near the high yield banana tree soil samples. The variations of phosphorous content in soils were seen in the soil samples of Melpuram are due to the availability soil organic matter. The high organic matter has better supplies of organic phosphate present in the soil samples. The variations of potassium in soils were decreased slightly in high yield soil samples due to the increase in the depth of the region. On some sample sites, the depth is increased due to soil erosion. The least amount of soil organic matter is leads to soil erosion. The maximum copper, content of 1.51Kg ha^{-1} was observed near the high yield banana tree soil samples. On the other hand, the minimum range of 0.82Kg ha^{-1} was observed near the low yield mango tree soil samples. The variations of copper in soil samples of low and high yield due to the increased rate of organic and humic substances. High level of zinc accumulation was due to the potential source of contamination in soil samples leads to the back wash of metals in rainy season. The variations of iron in soils were due to the high concentration of iron oxide minerals enriched in some sample sites of Melpuram. The manganese variation was due to the influence of enrichment of soil minerals and strong wind. Interactions of soil mineralogy and physico-chemical properties play an important role in soil productivity of soil minerals.

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A novel ZnO/MgO composite for photocatalytic degradation of Quinalphos in visible light

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Abstract:

Nowadays, pesticides are widely used for the protection of food crops, but at the same time pesticide residues have brought serious harm to human health and the environment. Therefore, with growing environmental concerns and consciousness, there is a requirement for the elimination of pesticide and its residues from local and industrial contaminants with a cost effective technology. Taking this into consideration, photo catalytic degradation of pesticides using ZnO/MgO nanoparticles is regarded as a trending and powerful solution, for degrading such type of pollutants. This study mainly reveals the degradation of Quinalphos on an easily fabricated nano particle, i.e. ZnO/MgO under visible light. Moreover, the degradation was confirmed by UV-Vis spectrum. The accessibility of fabrication and enhanced photo catalytic performance of ZnO/MgO photo catalyst can be favourable and promising technology in ecological application to treat water contaminants.

Key words: Pesticide, Semiconductor nano particles, environmental remediation.

Introduction:

The practice of applying pesticides on food crops generally practiced in Indian agriculture to upgrade crop productivity, their by destroying unwanted insects and manage disease vectors. But, their unregulated and indiscriminate application evolves a serious health and environmental issues. Among pesticides, organophosphorous pesticides are the most commonly used pesticide in the world [1]. Quinalphos sediments present in the soil percolates in to the water streams and eventually reaches the ocean triggering environmental damage. Semiconductor photocatalyst is administered in the degradation of organic pollutants in water due to its durability low cost, low toxicity, remarkable chemical and photo chemical stability. ZnO is a semiconductor proclaimed to be extensively used in the photocatalytic degradation of several organic pollutants. MgO is also a dynamic semiconductor catalyst to breakdown organic pollutants. ZnO/MgO nanocomposite is utilised as an effective photocatalyst for the degradation of toxic and harmful organic contaminants in water [2]. Toxic azo dyes, industrial pollutants, pharmaceutical micro pollutants, pesticide and its residues, can be break down with the aid of ZnO/MgO nanocomposite.

Preparation of photocatalyst:

1. Preparation of ZnO:

2g of zinc acetate is weighed and it is dissolved in 40ml of sodium hydroxide solution. Then, the solution is stirred for one hour using a magnetic stirrer. The clear solution lies above the solid was discarded. The suspension was centrifuged. The centrifuged solution was dried on a hot plate at 80°C and weighed.

2. Preparation of MgO:

2g of magnesium chloride is weighed and it is dissolved in 40ml of sodium hydroxide solution. Then, the solution is stirred for one hour using a magnetic stirrer. The clear solution lies above the solid was discarded. The suspension was centrifuged. The centrifuged solution was dried on a hot plate at 80°C and weighed.

3. Preparation of ZnO/MgO:

ZnO/MgO nanocomposite was synthesised by mixing prepared Zno and MgO in suitable proportion. To the above mixture required amount of magnesium chloride is dissolved in 40ml of sodium hydroxide was added. The above solution was stirred for one hour and the suspension was centrifuged. The result was dried on a hot plate at 80ºc to get suitable nanocomposite for degradation studies.

Experiment:

The stock solution for Quinalphos was prepared and photocatalyst is added to the solution. Before irradiating to radiation, the reaction solution was mixed using a magnetic stirrer for 30 minutes to assure the equilibrium of the working solution. Subsequently the diffusion was kept under sunlight and detected. The aqueous solution was stirred all over the experiment until the solution becomes clear. The percentage of degradation was evaluated using the formula given below:

$$\textbf{\% of degradation} = \frac{C_\circ - C}{C_\circ} \times 100$$

Where, C_0 is the initial concentration of the solution and c is the concentration of the solution after photocatalytic degradation.

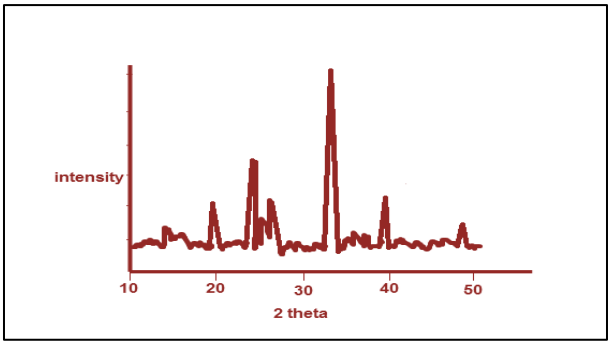
Result and discussion:

1. XRD analysis:

X-ray diffraction (XRD) is used to determine the crystalline size. In distinction to this evaluation, we can identify the peak intensity, position, width and full width at half maximum data. Using Debye-Scherrer formula the diameter of the particle was calculated.

$$d = 0.89\ \lambda / \beta \cos\Theta$$

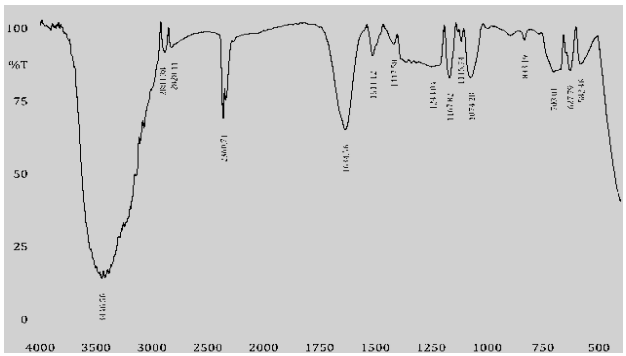
The average size of the synthesised ZnO/MgO nanocomposite was 32.1nm.



XRD OF ZnO/MgO nanocomposite

2. FT-IR analysis:

FT-IR analysis showed broad spectrum at 3446.56cm^{-1} and 3437.8 cm^{-1} due to OH stretching in ZnO/MgO. Peaks appeared at 2883.38cm is due to the residual organic component in ZnO/MgO. Peaks at 1511.12, 1417.58 cm^{-1} stipulate the presence of metal carbonyl. The peak at 582.46 and 833.19 cm^{-1} may be due to Zn-O and Mg-O bonds which assure the formation of pure and composite form of synthesised metal oxide [3].



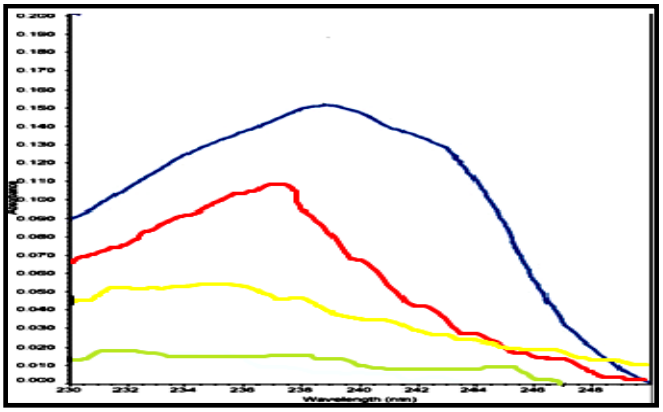
FT-IR of ZnO/MgO Nanocomposite

3. Photocatalytic degradation studies:

The out comings acquired in this investigation is very interesting in terms of identification of ZnO/MgO nanoparticle for degrading quinalphos in visible light. The colour of the test solution changes from turbid pale blue to colourless clear solution. This declares the complete degradation of the pesticide solution.

4. UV-Visible spectrum:

The most extreme uv-visible absorption is at 238nm. The absorption peak of the spectra diminishes at an incredible rate and almost disappears for 40 minutes light illumination.



UV-Visible spectrum of ZnO/MgO nanocomposite

Conclusion:

It can be concluded that ZnO/MgO photocatalyst not only enhances the degradation, but also effectively remove toxic pesticide (quinalphos) and their by products. Thus the photo catalytic performance of ZnO/MgO catalyst is a favourable and promising technique to treat water contaminants.

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Synthesis and Structural, Optical Properties of Zr-doped CdSe Nanoparticles

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Abstract

The present work, Zr-doped CdSe nanoparticles, was successfully synthesized using a wet chemical method. The influence of Zr dopant incorporated in CdSe lattice structure, optical properties were evaluated by using XRD, UV analysis. XRD analysis suggested the synthesized samples were formed in cubic phase crystalline structure. The average grain size of Zr-doped CdSe nanoparticles was found to be 1.8nm.The absorption spectrum of Zr-doped CdSe nanoparticles were blue shifted than the bulk materials. Band Gap energy was found to be 3.03eV due to quantum size effect. Zr dopant was reduced the particle size which enhance the activity of nanomaterials.

Keywords: Nanoparticles, Quantum Confinement, Semiconductor, CdSe, Incorporation

Introduction

The II-VI group semiconducting nano scale materials illustrated various properties than the bulk materials due to quantum confinement effect[1]. The semiconducting materials like CdSe, CdS, ZnSe, ZnS, CdTe etc, have been synthesized by using various methods such as chemical method[2,3], hydrothermal route[4,5], solvothermal method[6,7] etc. Among various semiconducting nanoparticles, crush has been shown towards CdSe nanoparticles because of availability of discrete energy level, size dependent optical properties, tunable bandgap, good chemically stability and easy preparation technique[8]. Based on the size and shape, quantum dots exhibit unique electronic and optical properties, which are extremely important in various fields and applications, such as solar cell[9], photocatalytic activity[10], and antimicrobial activity[11]. CdSe nanoparticles are synthesized in various crystalline structures like zinc blende and wurtzite within the form of cubic and hexagonal phase structure[12]. At present most of the researchers reported the optical, thermal and structural properties of CdSe nanoparticles. Doping mechanism is involved to enhance the activity of semiconducting materials. Metal, non metal and rare earth metal is involved in the doping process. In addition, impurities can create the lattice distortion which changes the bandgap of host materials. Mainly most of the research focuses on the doping of transition metals like Fe, Co, Zn, Ti, Ni, Ti, Zr, Mo etc[13,14]. In this metal is doped in the CdSe crystal lattice, which reduces the particle's size and enhances the activity of host materials.

Preparation of Zr-doped CdSe Nps

0.1M cadmium chloride was prepared by using deionised water in the presence of 0.3M TGA and the pH of the solution was adjusted in the range of 7-8 using 1M NaOH solution. The prepared 0.1M sodium selenite solution was added to the above mixture and pH also maintained at 7-8. An equal volume of the mixture was discharged in 500ml beaker and stirred by using a magnetic stirrer. During this reaction, yellowish orange color solution appeared that confirms the formation of TGA protected CdSe nanoparticles. After, to prepare the 0.06M of zirconium oxy chloride solution were preferred by using deionised water in the presence of 0.3M TGA and the pH of the solution was adjusted 7-8. TGA is used as a capping agent. After this solution was added to above mixture by drop wise and continuously stirred for 2hours at room temperature. The appearance of red color solution due to the formation of TGA protected Zr-doped CdSe nanoparticles and precipitate by the addition of propanal. Finally got red color precipitate and filtered and washed with ethanol and deionised water[15].

Result and Discussion

XRD analysis

The average size and crystalline structure of undoped and Ti-doped CdSe nanoparticles were evaluated from the XRD pattern. Figure.1 Illustrates the XRD spectrum of Zr-doped CdSe nanoparticles. The peaks was observed at 25.555°, 42.366° and 49.741° corresponds to (111), (220) and (311) plane of cubic phase crystalline structure **[16,17]** as given in table 1. Which agreement with the standard JCPDS files no. 09-0191. The broadening of peaks was confirms the synthesized sample in nanoscale range. The average grain size was estimated from Scherrer formula[18]

$$D = K\lambda/\beta Cos\theta \text{----------} 1$$

Where, θ is the angle of reflection, β is the full width half maximum; λ is the wavelength of X-ray. The average particles size of Zr-doped CdSe NPs was 1.8nm. Depends on the FWHM value, particles size could be changed. . The Zr^{4+} ion was easily substitute in the Cd^{2+} lattice site, due to the ionic radius of Zr^{4+} ion (0.72Å) is lower than the Cd^{2+} (0.97Å).

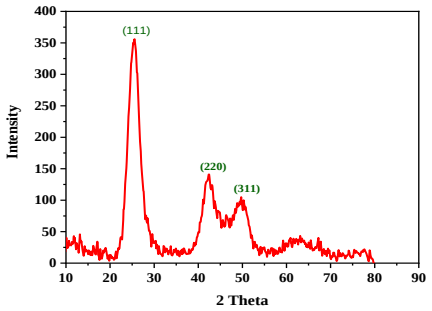

Fig.1. XRD pattern of Zr-doped CdSe Nps

Optical properties

The UV-absorption spectrum is taken at room temperature at a fixed wavelength range of 200 nm to 700 nm. The absorption spectrum of undoped and Ti-doped CdSe Nps was depicted in figure 2. The absorption band of Zr-doped CdSe Nps was observed at 301nm. The absorption edge was move to the lower wavelength region than the bulk materials which indicates the blue shift according to quantum confinement effect[19].

Band Gap energy can be estimated by using Tauc plot[20]

$$\alpha h\nu = A(h\nu - Eg)^{1/2} \text{----------2}$$

Where, A is the constant, h is the plank constant, ν is the frequency of photons, and Eg is the band gap. It could be plotted against the hν Vs $(\alpha h\nu)^2$ and extrapolating the straight line of X-axisis used to find out bandgap energy of the prepared sample. Figure. 3 Show the Tauc plot of dopant free and Zr-doped CdSe nanoparticles at different concentration. This plot reveals the bandgap of Zr-doped CdSe Nps in the range of 3.03eV. Bandgap energy was decreases with increases the activity of synthesized sample.

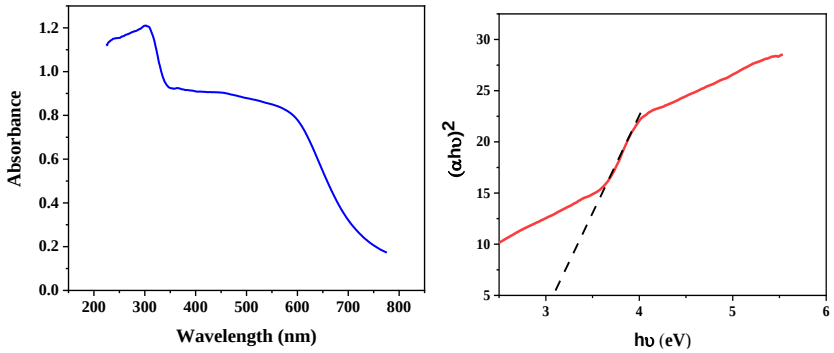

Fig. 2. UV-visible spectrum and Tauc plot of Zr-doped CdSe Nps

Conclusion

The undoped and Ti-doped CdSe Nps were prepared by a wet chemical method. The cubic phase crystallite structure of the synthesized sample was confirmed by XRD analysis. The average size of Zr-doped CdSe Nps 1.8nm .Optical properties reveals the blue shift than the bulk materials. Bandgap energy evaluated from Tauc plot was 3.03ev and its lower than the undoped CdSe Nps..

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Assembly of copper-quinoxaline-polyoxometalate hybrid metal organic framework and its application towards the photodegradation studies

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Abstract:

Synthesis of organic-inorganic hybrid POM material,[Cu(diphqx)$_6$(HPW$_{12}$O$_{40}$)] using Keggin type 12-tungstophosphoric acid polyoxometalatesupportedwith the organic ligand 2,3-diphenylquinoxaline (diphqx) incorporated with the hybrid inorganic copper (II) ion has been reported. The synthesized hybrid compound is further analyzed by physical techniques such as UV-Visible, FTIR, Spectrofluorophotometer, FE-SEM, EDAX and XRD. Further the photocatalytic performance of the compound [Cu(diphqx)$_6$(HPW$_{12}$O$_{40}$)] was checked by taking the photo-degradation of antipsychotic drug chlorpromazine aqueous suspension under visible light illumination as a model system. An environmental friendly method for the removal of hazardous organic moiety in chlorpromazine by organic-inorganic hybrid POM material has been developed.

Keywords: 12-tungstophosphoric acid,organic ligand 2,3-diphenylquinoxaline

Introduction:

Polyoxometalates(POMs) are widely used as oxidation catalysts as well as acid catalysts [*1*]. Keggin-type POMs have been widely regarded as important building blocks in the formation of organic-inorganic hybrids. The development of hybrid organic-inorganic materials has emerged due their significance in applied fields. It is often statedthat there are a number of similarities between POMs andsemiconductor metal oxides. The photochemistry of POMscan be regarded as a model for the photochemical processes on semiconductor metal oxide surfaces [*2*]. Recent literature survey on POM based hybrid materials research such as hybrid frameworks constructed from tetrapyridylporphyrin and bimetallic oxide clusters [3] found many applications. Fascinatingly, the quinoxaline derivatives have paid tremendous interest in various biological and medicinal applications. Therefore, design and development of novel quinoxaline derivatives *via* simple eco-friendly and green route is major concern to our research team. With the continuation of our research work, we made an attempt for the

fabrication of novel quinoxaline and POM based organic-inorganic hybrid material incorporating copper II ions.Chlorpromazine(CPZ) is a tricyclic heteroaromatic compoundpredominantly used as psychotropic agents. Removal of these moieties from the atmosphere is a great challenge to the environmentalists. Herein, attempts have been made to destroy the CPZ residues with the aid of photo-degradation methods by organic - inorganic hybrid based copper supported polyoxometalate towards antipsychotic drug chlorpromazine.

Materials and methods

All the chemicals were purchased from reputed firms and used without further purification. UV-vis spectra were recorded by UV-1800 Shimadzu and Fourier transform infrared (FTIR) spectra were recorded by an IR Affinity-1 Shimadzu FTIR spectrophotometer using KBr pellets, under atmospheric conditions. The emission spectra were recorded by Shimadzu made Spectrofluorophotometer RF-6000. ^{1}H and ^{13}C-NMR spectra were recorded on a Bruker 300 MHz NMR instrument with $CDCl_3$-d_6 as solvent and TMS as internal reference. Crystallinity and textural patterns of the catalysts were studied by XRD analysis using a PAN analytic X-ray diffractometer employing with Cu-Kα (1.504 A°) radiation. Microscopy Surface morphology of the catalyst was captured by SEM with EDAX FEI Quanta FEG 200 - High Resolution of Scanning Electron Microscope.

Preparation of the photo catalyst

The Keggin type heteropoly acid, $H_3[PW_{12}O_{40}]$ was prepared using the method reported in the literature [4]. 2,3-diphenylquinoxalines was prepared by the protocol reported in the literature [5,6].The hybrid material $[Cu(diphqx)_6(HPW_{12}O_{40})]$ was prepared by the reported procedure [7]. The synthesised compound was characterised by the analytical techniques.

Result and Discussion:

The photocatalytic performance of as-prepared $[Cu(diphqx)_6(HPW_{12}O_{40})]$ was carried out towards the photo-degradation of antipsychotic drug chlorpromazine aqueous suspension under visible light illumination. The time-temporal UV-Vis absorption spectra in Fig. 1 portrays the CPZ photo-degradation progress in the presence of 50 mg $[Cu(diphqx)_6(HPW_{12}O_{40})]$ under visible light illumination. It is observed that the major characteristic absorption peak of CPZ at 305 nm decreases gradually with increasing the visible light irradiation time. After 70 and 80 min, the intensity of the 305 nm peak vanished equal to zero, suggested that the complete photo-degradation of CPZ. There are no extra peaks corresponding to the intermediates were

observed which revealed that the $[Cu(diphqx)_6(HPW_{12}O_{40})]$ does not change the CPZ degradation pathway.

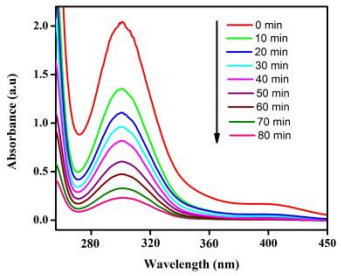

Figure 1. Time-dependent absorption spectrum of CPZ in the presence $[Cu(diphqx)_6(HPW_{12}O_{40})]$ under visible light irradiation

The photocatalytic efficacy of $[Cu(diphqx)_6(HPW_{12}O_{40})]$ was further compared to the commercially available TiO_2, CuO, ZnO and the results are presented in Fig. 2. No noticeable degradation was found in the absence of catalyst and / or light irradiation. Commercial TiO_2 and CuO show the degradation efficiency of 32 % and 40 % respectively of CPZ solution under visible light illumination. $[Cu(diphqx)_6(HPW_{12}O_{40})]$ shows superior photocatalytic performances towards the photo-degradation of the hazardous residue CPZ.

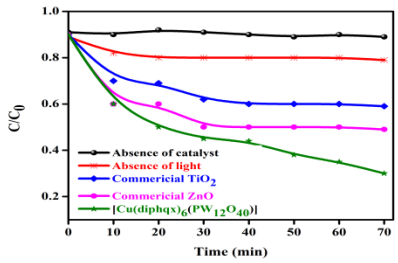

Figure 2. Effect of different catalysts on the photo-degradation of CPZ

The stability and recycling ability is the primary concern of the catalyst owing to its practical application. We evaluated the reusability tests of $[Cu(diphqx)_6(HPW_{12}O_{40})]$. As seen $[Cu(diphqx)_6(HPW_{12}O_{40})]$ displayed above 90% of degradation efficiency even after 5^{th} cycle of their usage.The general mechanism for the photo-degradation of the drug residue chlorpromazine reported in the literature [8, 9]

Summary

In conclusion, we developed a simple route for the hydrothermal synthesis of organic-inorganic hybrid POM materials *viz*., [Co(diphqx)$_6$(HPW$_{12}$O$_{40}$)] and [Cu(diphqx)$_6$(HPW$_{12}$O$_{40}$)]. The POM is Keggin type of 12-tungstophosphoric acid which supports with the organic ligand 2,3-diphenylquinoxaline (diphqx). The hybrid inorganic metal ion is copper (II). The synthesized hybrid compound is further analyzed by physical techniques such as UV-Visible, FTIR, Spectrofluorophotometer, FE-SEM, EDAX and XRD. Further the photocatalytic performance of the compound [Cu(diphqx)$_6$(HPW$_{12}$O$_{40}$)] was checked by taking the photo-degradation of antipsychotic drug chlorpromazine aqueous suspension under visible light illumination as a model system. The performance of the catalyst provides an environmental friendly method for the removal of hazardous organic moiety.

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GREEN SYNTHESIS OF COPPER NANOPARTICLES USING LAWSONIA INERMIS (HENNA)LEAF EXTRACT

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Abstract

Synthesis of nanomaterial with the desired quality and properties is one of the key issues in current nanotechnology. The green synthesis of metallic nanoparticles has received hike in attention due to the development of eco-friendly technologies in materials science.In the present study, synthesis of copper nanoparticles were done using *LawsoniaInermis* leaves extract and the amalgamated copper nanoparticles were characterized by SEM, and EDAX. The optical characterization were carried out using UV –Vis Spectrophotometer.The synthesized copper nanoparticles can be used for various applications such as due to its eco-friendly, non-toxic and compatibility medicine.

Keywords: Copper Nanoparticles, *Lawsoniainermis*, Copper sulphate pentahydrate.

Introduction

Copper Nanoparticles amalgamate has attracted particular interest, compared with other nanoparticles, as their useful properties are achievable at costs lower than silver and gold. Copper nanoparticles are highly reactive due to their high surface, volume ratio, and easily interact with other particles(1). The green technology for the synthesis of nanoparticles were given major consideration due to its eco-friendliness.In recent, green synthesis of copper nanoparticles was accomplished using plantextract.These nanoparticles have drawn the attention of researcher considering the fact that of their broad applications in area like mechanics, optical, biomedical sciences, electronic, drug-quality delivery, catalysis(2), photo-electrochemical applications, and nonlinear optical device(3).The present work was carried out to synthesis copper nanoparticles using *LawsoniaInermis*leaf extract.

Materials and Methods

Materials

The following analytical materials were used without further purification: Copper (II) sulphate pentahydrate ($CuSO_4.5H_2O$) and Sodium hydroxide (NaOH) and *Lawsoniainermis*leaf

Methods

Preparation of the leaf extract:

The *Lawsoniainermis*leaves were collected, washed thoroughly, dried in dark and powered. 1 gram of powered leaves is boiled with 20mL of double distilled water at 80°C for 30 min. The extract was filtered through Whatsman No.1 filter paper and used subsequently for analysis.

Synthesis of Copper Nanoprticles:

For the copper nanoparticles synthesis, 10mL of *Lawsoniainermis*plant leaves extract was added into 100mL of 10mM Copper Sulphate Pentahydrate solution and 100mL of 10mM Sodium Hydroxide solution. And kept in magnetic stirring for 3 hours at room temperature. A colour change of the solution was noted by visual examination, this confirmed the formation of CuNPs.

Characterization of Copper Nanoparticles

The copper nanoparticles were synthesized by using Copper sulphate pentahydrate as a precursor and *Lawsoniainermis* leaf extract as a reducing agent. The change of colour from blue to brown indicates the formation of copper nanoparticles. The copper nanoparticles solution obtained was washed with double distilled water and finally with ethanol to remove impurities. The copper nanoparticles are dried at hot air oven at 80℃.The characterization of copper nanoparticles was done using UV-VIS Spectrophotometer, Scanning Electron Microscope and Energy Dispersive X-ray.

Result and discussion

Visual Inspection

After stirring for 3 hours, the reaction mixture change its colour from blue to brown colour, that can be shown in figure 1. The formation of brown colour shows that the reduction of Cu^{+} ions.

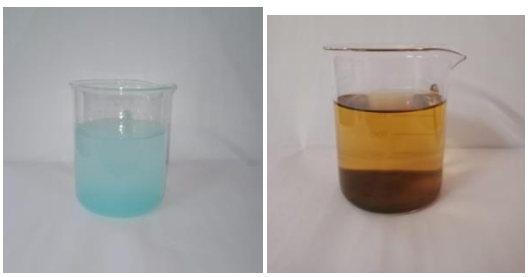

Figure 1: Copper sulphate pentahydrate and copper nanoparticles solution

Optical characterization (UV-Vis spectroscopy) of Copper Nanoparticles

The brown coloredcopper nano powder was insoluble in water and practically in every organic solvents. UV – Visible absorption results affirmed the formation of copper nanoparticles arranged in liquid by reduction method, The absorption peak observed at 268nm is the peak of copper nanoparticles.

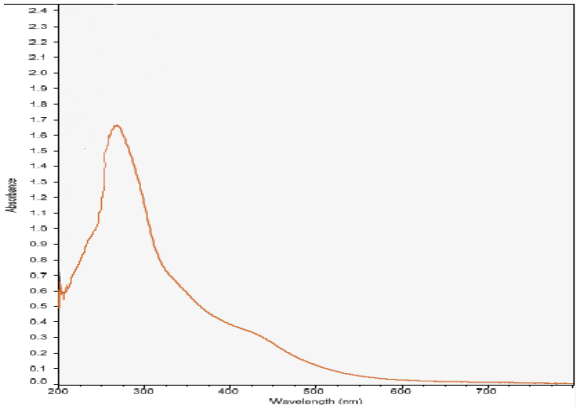

Figure 2: UV – Visible absorbance spectrum of copper nnnoparticles

Scanning Electron Microscopy (SEM)Analysis

Morphology of integrated copper nanoparticles was described by SEM investigation. It tends to be see that the CuNPs shaped are very much scattered and equally disseminated toward all path. SEM pictures of those mixtures has clearly shown that the majority of the particles are gravel shaped in morphology.

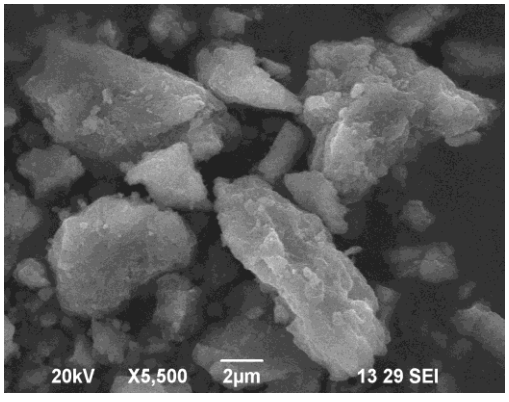

Figure 3: SEM micrographs of copper nanoparticles

Energy dispersive X-ray (EDAX) Analysis

The Energy dispersive X-ray (EDAX) studies indicate the presence of element present in the sample.EDS analysis confirms that the copper nanoparticles synthesized using *LawsoniaInermis*leaves extract have the copper element with carbon and oxygen. This

aggregation may be due to the presence of secondary metabolites in the leaf extract of *LawsoniaInermis*leaves. The weight of copper present in the sample is 36.39%, carbon is 20.43% and oxygen is 43.19%.

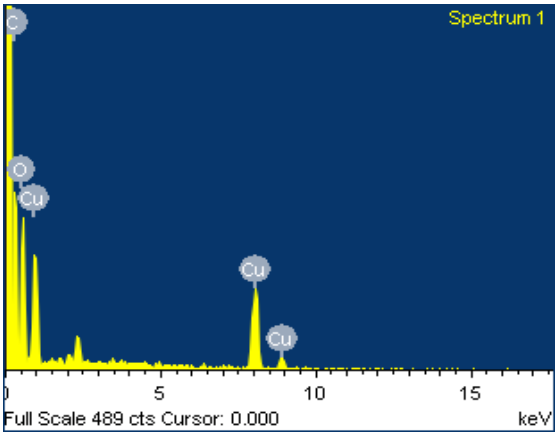

Figure 4: EDX of copper nanoparticles

Conclusion

The green copper nanoparticles were synthesized by using *Lawsoniainermis* leaf extract. From the above results we can able to conclude that, *LawsoniaInermis*extract can synthesis copper nanoparticles in an easy, less toxic, eco-friendly and cost effective manner. In this study very less amount of chemicals were used for the synthesis for copper nanoparticles and hence it is green technology.

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"MOLECULAR CHARACTERIZATION OF BIOACTIVE COMPOUNDS FROM TWO MARINE MACROALGAE Sargassam and Gracilaria Species"

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Abstract:

Macro-algal metabolites are attracting the enormous attention, as they are known for their pharmacological properties. In addition, seaweeds are found to have different biological activities including antibacterial, antioxidant, antitumor, antiviral and anti-inflammatory characteristics. Free radicals have been reported to play an important role in affecting human health by causing many diseases. Thin layer Chromatography analysis of bioactive compounds, the solvent extracts from Sargassum Species have the RF value of 0.71 cm (pheophytin a) in Algae extract, 0.88 cm in (carotene) Elution 1, 0.84 cm (carotene) Elution 2, 0.74 cm (pheophytin b) Elution 3, 0.49 cm (xanthophylls) Elution 4 respectively. Rf values of separated pigments were calculated and compared to standard Rf values. The antimicrobial and antioxidant activity was evaluated for the marine seaweed Sargassum Species. Different solvent Elution 1 and Elution 2 were used for seaweed extraction to envisage the antibacterial activity against both Gram positive and Gram negative bacteria viz., Escherichia coli, Pseudomonas aeruginosa, Bacillus subtilis and Staphylococcus.

1. INTRODUCTION

Macroalgae or commonly known as seaweed can be categorized into three divisions which are green algae (Chlorophyta), red algae (Rhodophyta) and brown algae (Phaeophyta). This is due to the compounds that are responsible for the antimicrobial properties such as acrylic acid and diterpenoids in the green algae. Emergence of resistance pathogenic microorganisms to majority of antibiotics has enhanced morbidity and mortality rate. Clinical and health problem that arise from antibiotic resistance and multi-resistant bacteria are becoming harder and eventually impossible to treat. Pharmaceutical company had done their best in overcoming this problem by producing better and enhanced drugs over the time. The usage of seaweed as pharmaceutical products provides a more cost effective and proactive solution.

The antimicrobial compounds derived from macroalgae consist of diverse groups of terpenols, sterols, polysaccharides, dibutenolides, peptides and proteins metabolites. Compounds with antibacterial activity have been detected in green, brown and red algae. Marine algae were reported to produce a wide variety of bioactive secondary metabolites as antimicrobial, antifeedant, antihelmintic, cytotoxic and the bioactive substances included alkaloids,

polyketides, cyclic peptide, polysaccharide, phlorotannins, diterpenoids, sterols, quinones, lipids and glycerols. Seaweeds are considered as a source of bioactive compounds as they are able to produce a great variety of secondary metabolites characterised by a broad spectrum of biological activities.

Red algae was widely used in several fields, including food, feed, pharmacy and industrial point of view. The chemical analysis showed that red algae contained terpenoid, acetogenic, and aromatic compounds, which have a wide range of biological activities, such as anti-micobial, anti-inflammatory and antiviral. The objectives of this research was to evaluate the effect of extraction solvent and time on antibacterial activity of red algae (Gracilariaverrucosa), and to explore the bioactive compound contained within Gracilariaverrucosa. The method in this study used descriptive reseacher. Those secondary metabolites may be approximated as antibacterial substances studied by S.Dayuti (2017).

Vivek.K.Bajpai, et al (2016) studied chromatographic techniques have significant role in natural products chemistry as well as contributed gramatically in the discovery of novel and innovative compounds of pharmaceutical and biomedical importance. This study focused on step-by-step visual demonstration of fractionation and isolation of biologically active plant secondary metabolites using columnchromatographic techniques

The present investigation deals with different crude seaweed extracts was determined by qualitative, quantitative and antimicrobial activity of Antimicrobial, Antioxidant and GCMS indicates that the presence of active constituents in the seaweed, which can be exploited for the production of innovation drugs for the benefits of the humanity.

2. MATERIALS AND METHODS

2.1. Sampling and Collection site:

The seaweeds was collected from open field of sea by diving and hand-picking from the rocky substratum at depth of 2.7 m along thesubtidal areas at kurumbanai, kanyakumari (district) during the month of December.

2.2 Preparation of extract

The marine macro algae Padinatetrastromatica was collected from Rasthacadu in Bay of Bengal nearKanyakumari. The collected algae were shade dried and pulverized to powder in a mixer grinder. About 200 grams of the algal powder were weighed, transferred to flask and continuously extracted with methanol in soxhlet apparatus for 24 hours. After one day of

extraction, the crude mass was taken and filtered in whatmann No.1 filter paper. The filtrate was then concentrated using rotor vac evaporator and the concentrated materials were weighed to get the crude material. The crude material was diluted and subjected to chromatographic techniques. The extracts contains all the non-polar, mid polar and high polar components.

2.3 Extraction of compounds

The crushed powder was mixed with methanol and kept overnight. Next day the algal extract was stirred vigorously with overhead stirrer at 60°C. Then the extract was filtered and concentrated using Rotorvac. The concentrated extract was now ready for isolation of pure compound.

2.4 Separation and identification of the compounds

2.4.1 Thin Layer Chromatography

Thin layer chromatography was used to calculate the Rf value of the active molecules present in the extracted samples. In TLC, the molecules in the mixture were separated on the basis of their differences in solubility and partition co efficient in a binary solvent system. Silica gel coated plates (Merck -10×6cm) and the developing solvent (n-hexane: ethyl acetate) in a ratio of 7:3 were used for TLC .Initially the chromatography sheets were pre-saturated with the solvent. 5µl of the sample was then carefully applied on the plates and the samples were allowed to dry. The loaded plates were then placed in a pre-saturated tank with caution such that the applied sample does not dip in the solvent system. The set up was left undisturbed and the solvent was allowed to move up till it reached 9cm.The plates were then removed from the tank and the spots were marked immediately. The RF values were noted in the TLC plates and calculated by the standard formula given below,

[Rf = Distance moved by the pigment / Distance moved by the solvent]

2.4.2 Isolation of active molecules using Column chromatography

Column chromatography is a method of separating the compounds according to their density. A glass column cleaned with acetone and initially packed with glass wool or cotton at the bottom end for separation and purification. Silica gel (230-400 mesh) mixed with the solvent n-hexane was poured immediately in to the column after continuous stirring without any breakage or bubbles. The column was left undisturbed for one day for proper binding of silica and later 5ml of the crude extract was loaded in the column. After the binding of extracts in the silica column, the eluting solvent n-hexane and ethyl acetate in the ratio 7:3 was added

frequently for separation and purification of active molecules from crude extract. The fractions obtained were collected and stored in the bottles under 4-10 ℃ for further use.

2.5 Antimicrobial assay

2.5.1 Agar diffusion disc – Variant

The bacteria were sub cultured to Muller Hinton Agar for 24 h prior to use. One loop of each test organism was suspended in 5 ml Trypticase Nutrient Broth solution separately. Muller – Hinton Agar (MHA) was surface inoculated with the suspension of the respective organism. The disks impregnated with the crude extracts of the seaweeds were placed on the MHA medium with suitable apace and the plates were incubated at 32° C for 24 hours. Ampicillin was used as a positive and respective solvents were used as a negative control.

2.5.2 Agar diffusion well – Variant

The well diffusion assay was performed a sterilized Muller Hinton Agar medium was poured into sterilizedPetri dishes. Nutrient Broth containing 0.1 ml of 48 hours incubated cultures of the respective bacterial strains was spread separately on the agar medium. Wells were made using stainless steel sterilized cork borer aseptic conditions. Subsequently, 250 μl of crude extracts were loaded into corresponding wells. The standard antibiotic Ampicillin was used in order to compare the result. The plates were incubated for 24 hrs at 32° C and the diameter of the zone of complete inhibition of the bacteria was measured around the each well and reading were recorded in millimeters.

2.6 Analysis by GC-MS

The Gas Chromatography–Mass Spectrometry (GC–MS) analysis was performed with a GC–MS (Shimadzu QP-2010 Plus – Tokyo, Japan) of thermal Desportion System TD 20. The system was equipped with HP-5MS capillary column of 30 m × 0.25 mm and 0.25 μm of film thickness. The ionization energy used in the present study was about 70 eV. Helium gas (99.999% purity) was used as a carrier gas at a constant flow rate of 1.21 ml/min. One μl of samples was injected in the split mode with 10:0 ratios. The GC injector and MS transfer line temperatures were set at 230 and 280 °C respectively. The ion source temperature was constantly maintained at 300 °C. Oven temperature programme was initially set at 100 °C with a hold time of 2 min. Further, it was ramped to 200 °C (at 5 °C/min) with the hold time of 5 min and to 235 °C (at 10 °C/min) with the hold time of 10 min. The resulting peaks were analyzed in inbuilt mass spectrum library such as NIST05.LIB and WILEY8.LIB.

3. RESULTS & DISCUSSION

3.1 Isolation of active molecules from algal extract using Colum Chromatography

Five gram of crude extract of Sargassumsps was packed with 30g of Silica gel (60-120 mesh) using 2.4 diameter Column with mixture of ethyl acetate and hexane. The Column was eluted with increasing solvent polarity from hexane to ethyl acetate. Five elution were separated at different fractions in brown algae. Two elutions were separated in red algae. The diameter of Column was 2.4 cm and Column bed height was 20 cm.

3.2 Analysis of Bioactive compounds by TLC

Thin layer chromatography of different solvant elution extracts reveales the presence of various bioactive compounds. Sargassumsps have the RF value of 0. 71cm (pheophytina) in algae extract, 0.88 cm in (carotene) Elution 1,0.84 cm (carotene) Elution 2, 0. 74 cm (pheophytin b) Elution 3, 0.49 cm (xanthophylls) Elution 4 respectively. Rf values of separated pigments were calculated and compared to standard Rf values.Thin layer Chromatography (TLC) is one of the most popular and widely used separation techniques because of it's ease of used, cost effectiveness, high sensitivity, peed of separation as well as its capacity to analysis simutineously the result are so suggested, the extract of S.ilicifolium has some bio active compounds and pigments such as Pheophytin a, Pheophytin b, Carotene, Xanthophylls and agreeing with (Chandrappa, 2012).

3.3 Antimicrobial Assay

3.3.1 Antibacterial activity of Agar Diffusion Disc Variant

Five solvent extracts from Sargassumsps were tested for antibacterial activity against six pathogens. The inhibition zone are seen around sterile disc impregnated with organic solvent extracts of Sargassumsps Ampicillin was used as positive control, and the pure organic solvent was used as a negative control.

Brown algae extract showed stronger activities against gram positive bacteria (Bacillus subtilis). Then gram negative bacteria (Escherichia coli and pseudomoanas). The brown algae extract of Sargassumsps exhibited promising inhibition effect against Bacillus subtilis (0.8), E. Coli (1.5), Streptococcus (0.9), Pseudomoanas (0.8), Entrobacter (0.8), Staphylococcus (0.8).

The Elution one of Sargassumsps exhibited promising inhibition effect against Bacillus subtilis (0.9), E.Coli (0.8), Streptococcus (0.8), Pseudomoanas (1.1), Entrobacter (0.8), Staphylococcus (0.8). The Elution two of Sargassumsps exhibited promising inhibition effect against Bacillus subtilis (0.8), E. Coli (0.7), Streptococcus (0.8), Pseudomoanas (0.9), Entrobacter (0.8), Staphylococcus (0.8).

The Elution three of Sargassumsps exhibited promising inhibition effect against Bacillus subtilis (0.8), E. Coli (0.9), Streptococcus (0.8), Pseudomoanas (0.8), Entrobacter (0.8), Staphylococcus (0.9). The Elution four of Sargassumsps exhibited promising inhibition effect against Bacillus subtilis (1.2), E. Coli (1.1), Streptococcus (0.9), Pseudomoanas (1.1), Entrobacter (1.1), Staphylococcus (1.4) was recorded .

The Brown algae extract of Sargassumspsexhibited promising inhibition effect against Bacillus (0.8), E.Coli (0.8), Streptococcus (0.8), Entrobacter (0.8), Pseudomonus (0.8) and Staphylococcus (0.8). The red algae extract of Gracilariaspsexhibited promising inhibition effect against Bacillus (0.9), E.Coli (0.9), Streptococcus (0.9), Entrobacter (0.8), Pseudomonus(0.8) and Staphylococcus (0.8) was recorded .

3.3.2 Antibacterial activity of Agar Diffusion Well Variant

Antibacterial activity of different solvent extract Sargassumsps tested against six pathogens bacteria by diffusion well variant method. Ampicillin was used as a positive control and the pure organic solvent was used as a negative control. The study clearly showed that the Elution was effect in inhibiting the growth of the bacteria pathogens. The Elution showed the highest zone of Inhibition was 2.1 cm for E.Coli and Staphylococcus. Elution 1 of Sargassumsps Showed the higher Inhibition activity Entrobacter (1.6) > Staphylococcus (1.2) >E.Coli (1.1) > Bacillus subtilis (1.0) >Pseudomoanas (0.9). Elution 3 of Sargassumsps showed the higher Inhibition activity Staphylococcus (1.4) >Entrobacter (1.2) >E.Coli and Bacillus subtilis (1.0) >Pseudomoanas (0.9).

Elution 5 of Sargassumsps showed the higher zone of Inhibition activity E.Coli and *Staphylococcus* (2.1) >*Entrobacte*r and Pseudomoanas (2) > Bacillus subtilis (1.4) was recorded as in Table 5. The Brown algae extract of Sargassumspsexhibited promising inhibition effect against Bacillus (1.0), E.Coli (2.0), Streptococcus (1.4), Entrobacter (1.2), *Pseudomonus* (1.0) and Staphylococcus (1.2). The red algae extract of *Gracilariasps*exhibited promising inhibition effect against Bacillus (0.8*), E.Coli* (0.9), *Streptococcus* (1.3), Entrobacter (1.0), *Pseudomonus*(0.8) and Staphylococcus (0.8) was recorded.

In this study, the Chloroform extracts of S.ilicifolium were found more active, when compare with Petroleum ether, Ethanol, Ethyl acetate and aqueous extracts that confirms the previous finding of (Jeyanthi et al., 2012). The crude extracts of tested *S.ilicifolium*showed a significant antimicrobial activity against Gram positive and Gram negative. Antimicrobial activity of brown seaweed *sargassumilicifolium*showed significant activity against gram

positive and Gram negative bacteria, which confirms the present investigation by (Bhacuni et al., 2005).

4. Conclusion

Marine algae are the valuable sources of marine ecosystem. It acts as the source bioactive metabolites that produce a range of antimicrobial potentials. From the study, it was confirmed that the antibacterial activity of *Sargasssum* and *Gracilaria* Species was high against gram positive and gram negative strains. Different solvent with different polarity may result in extraction of different type of biologically active compound from seaweed. These bioactive compounds may go and bind to the cell wall of the microbe leading to inhabitation of its growth. The observations of this study suggested that the Elution 2 and Elution 1 extract of *Sargasssum*and *Gracilaria* Species showed highest potential activity against human pathogens.

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SYNTHESIS ,CHARACTERIZATION OF IRON OXIDE NANOPARTICLE PREPARED FROM RAW CARICA PAPAYA LEAF EXTRACT AND ITS ANTI – INFLAMMATORY ACTIVITY

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Abstract

In this study iron oxide nanoparticles are synthesized by the reduction of Iron Chloride using raw carica papaya leaf extract. The synthesized iron oxide nanoparticles were characterized by XRD and SEM with EDAX The XRD study shows the particles are crystalline in nature. From the EDAX data the atomic weight percentage of iron was found to 29.37% .Further, the synthesized iron oxide nanoparticle were analysed for anti-inflammatory activity. The IC50 value of standard was 68.8 and for nanoparticle 51.64. The synthesized iron oxide nanoparticle shows high inhibitory activity.

Key words: iron oxide nanoparticle, XRD, anti- inflammatory

Introdution:

Currently, a large number of physical, chemical, biological and hybrid methods are available to synthesise different types of nanoparticles(1). Green synthesis of nanoparticles makes use of environmental friendly, non-toxic and safe reagents.(2).Iron oxide nanoparticle are also useful because of their availability, robustness and high surface area. Additonally , they have wide applications in industry, including biosensors, magnetic storage, biotechnonlogy, biomedicine, catalysis, thin films, drug delivery and hyperthermia(3)(4).Plant extract contains various phytochemicals such as polyphenols, flavanoids, terpenoids which are responsible for the reduction and formation of stabilized nanoparticles(5). In this work iron oxide nanoparticles were synthesized by green method using carica papaya leaf extract as both capping and reducing agent and studying its anti- inflammatory activity.

Materials and Methods:

Preparation of plant extract:

Fresh leaves of carica papaya are washed with distilled water . Then the leaves were cut in to pieces and boiled in deionised water at 80^0c for 30 min and filtered. The filtrate was used for further analysis.

Synthesis of iron oxide nanoparticle:

Ferric (III) chloride anhydrous was used for the synthesis of Iron Oxide nanoparticle. 50ml of papaya leaf extract was added dropwise to 50ml of 0.1 M Iron (III) Chloride solution in the room temperature and 1M NaOH was added till the pH became 11. Then the solution was stirred continously for 30 min in a magnetic stirrer, and the intense black colored solution indicate the formation of nanoparticle. It is centrifuged at 8000 rpm ,washed with ethanol and water and dried in hot air oven at 80^0c.(6)

Characterisation of iron oxide nanoparticle:

XRD patterns were recorded by an x-ray diffractometer by using cu target operated at 40KV and 30mA.The morphology were determined using scanning electron microscope run at voltage 20 Kv.

Anti-inflammatory activity:

The reaction mixture (0.5 ml) consisted of 0.4 ml bovine serum albumin (3% aqueous solution) and varying concentrations of test sample. The samples were incubated at 37ºC for 20 min and 2.5 ml phosphate buffered saline (pH 6.3) was added to each tube and and then heated at 80ºC for 10 min. The absorbance was measured using spectrophotometer at 660nm.The percentage inhibition of protein denaturation was calculated as follows(7)(8).

Percentage of inhibition = [(Abs Control – Abs Sample) / Abs control)] x100

Result and Discussion:

Characterisaton:

The XRD data was shown in fig 1.The average crystalline size were calculated using Debye scherrer equation and found to be 2.22nm. The EDAX spectrum contains intense peak of Fe and O atom. The atomic weight percentage of Fe atom was found to be 29.37% and for 0 atom 76.03%

.(Fig2) .The morphology of synthesized nanoparticle was not uniform in nature it shows flake like structure(fig 3).

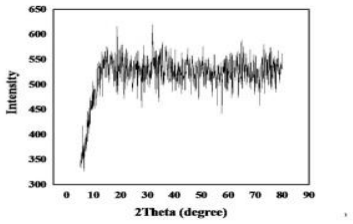

Fig1: XRD data of iron oxide nanoparticle

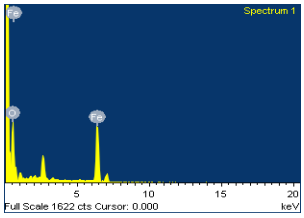

Fig 2: EDAX for iron oxide nanopaticle

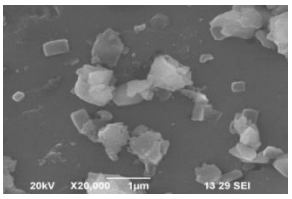

Fig3: SEM image of iron oxide nanoparticle

Anti- inflammatory activity:

Diclofenac was used as a standard for the analysis. The percentage of inhibition increases by increasing the concentration of the sample. The iron oxide nanoparticle shows lowest IC50 value 51.64 when compared to the standard, Diclofenac. The iron oxide nanoparticle exihibit high inhibitory activity than the standard. Anti-inflammatory activity of standard as well as iron oxide nanoparticle was shown in table 1&2.

Standard	Concentration (µg)	OD at 660nm	% of inhibition
Control	-	0.745	-
Diclofenac	6.25	0.655	12.08
	12.5	0.631	15.3
	25	0.545	36.69
	50	0.403	45.9
	100	0.277	62.81
IC50	68.8		

Table 1: Anti- inflammatory activity of standard Diclofenac

Standard	Concentration (µg)	OD at 660nm	%of inhibition
Control	-	0.896	-
Iron Oxide NPs	6.25	0.827	7.70
	12.5	0.824	8.03
	25	0.734	18.08
	50	0.601	32.92
	100	0.472	47.32
IC50	51.64		

Table 2: Anti-inflammatory activity of iron oxide nanoparticle.

Conclusion: In this study eco friendly iron oxide nanoparticles were synthesized and confirmed by XRD and SEM with EDAX. The iron oxide nanoparticle exihibit high inhibitory activity when compared to the standard. so it is used for the treatment of various kind of inflammations.

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Adsorption isotherm studies on the removal of Rhodamine B dye from aqueous solution using indigenously prepared activated carbon

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Abstract

In the present study deals with the preparation and characterization of microporous carbon from Sugarcane Bagasse (SCBC) for the application towards the removal Rhodamine B (RhB) dye by adsorption and the results were compared with Commercial Activated Charcoal (CAC). The effect of various experimental parameters like initial concentration of RhB dye, contact time, dose of adsorbent and pH of the solution on the removal of dye by adsorption using SCBC and CAC adsorbents.The result in the present study indicates that SCBC could be used as a cost effective adsorbent for the removal of Rhodamine B dye from waste water instead of CAC.

Keywords: Adsorption; Activated Carbon; Rhodamine B; Waste water treatment

1. Introduction

Textile, food, cosmetic and pharmaceutical businesses release fairly treated or untreated waters to the environment which may result in the pollution of the receiving waters. These wastewaters may impede aquatic live (including plants and animals). The consumption of water containing a trace or low concentration of dye is unsafe for different usages. Untreated water can result in un-aesthetic conditions in the received water. The overall consumption of dye by the textile business globally is above 107 kg per year. Since hazardous dyes are difficult to treat, their removal has been the focus of numerous ongoing research aiming to develop cost-effective and efficient technologies.

Activated carbon (AC) with high specific surface area and porosity has been found as the most promising candidate for textile wastewater treatment.

2. Materials and Methods

All the chemicals and reagents are analar grade used as received

3. Preparation of activated carbon from Sugarcane Bagasse biomass

All the chemicals and reagents are analytical grade used without any further purification. The dried sugarcane bagasse were physically activated by carbonization in a muffle furnace in the absence of air by placing the sample in a well-sealed stainless steel tube at 300°C for 30 min. The carbonized raw materials were then powdered well and sieved by molecular sieves.

3. Results and Discussion

3.1 Effect of initial concentration on the removal of RhB dye

Adsorption studies of RhB dye on CAC and SCBC at a fixed dose of adsorbent ($4gL^{-1}$ CAC and SCBC) at different initial concentrations of dye (range:100–200 ppm for CAC and 15–24 ppm for SCBC) and contact time (30 min. for both EGBC and CAC) and at solution pH (7.1), fixed particle size for CAC and SCBC (90 micron) at a temperature 30 ± 1^0C were carried out is shown in Figure 1.

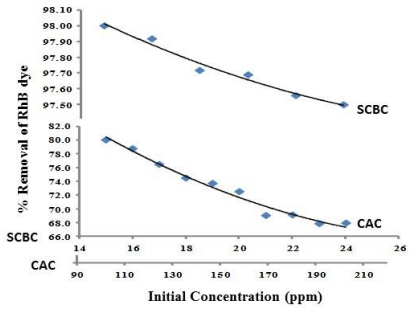

Figure 1Effect of Initial concentration for the removal of RhB dye by adsorption onto CAC and SCBC

Figure 1 indicates that the increase in initial concentration of BCP dye resulted in a reduction in the percentage removal. It was observed that, the percentage removal of RhB dye decreases exponentially with the increase in the initial concentration. This may be due to reduction in immediate solute adsorption, owing to the lack of available active sites on the adsorbents surface compared to the relatively large number of active sites required for high initial concentration of RhB dye.

3.2 Adsorption isotherm

The study of adsorption isotherm has been of importance and significance in the treatment of water and the waste water by the adsorption technique, as they provide an approximate estimation of the adsorption capacities of the adsorbents. The equilibrium data for the removal of RhB dye by adsorption an CAC and EGBC at 30 ± 1^0C (Table 1) were used in fitting the Freundlich and Langmuir isotherms.

$$\textit{Freundlich isotherm} = \log (x/m) = \log K + 1/n \log C_e$$

$$\textit{Langmuir isotherm} = C_e/q_e = 1/Q_o b + C_e/Q_o$$

where, Freundlich constants K and 1/n are the measures of adsorption capacity and intensity of adsorption, respectively; q_e is the amount of dye adsorbed per unit mass of the adsorbent (in mgg^{-1}) at equilibrium *ie.*,q_e = (x/m) ; x=(c_i – c_e), C_i and C_e, initial and final equilibrium concentration of dye, respectively in ppm, m=mass of adsorbent, in gL^{-1}, Q_o is the monolayer adsorption capacity in (mgg^{-1}) and b is the Langmuir constant related to the energy of adsorption (in Lmg^{-1}). The data obtained from the adsorption experiments by varying the initial concentration were fitted with Freundlich and Langmuir isotherms. These two isotherms plots are found to be linear and the values are given in Table 1(as evidenced from the values which are close to unity) indicating the applicability of these two adsorption isotherms for the removal of BCP dye by adsorption on CAC and SCBC and a formation of monolayer of RhB dye on the surface of the adsorbents. Further, the essential characteristics of Langmuir isotherm can be described by separation factor, R_L, which is defined by Weber and Chakravarthy – as described by others as given below

$$R_L = 1/ (1+ bC_i)$$

where, C_i is the optimum initial concentration of Bromocresol Purple dye (ppm) and b is the Langmuir constant (Lmg^{-1}).

The separation factor R_L indicates the shape of isotherm and nature of adsorption process as given in Table 3. In the present study the R_L values were computed and given below:

R_L Value	**Nature of Process**
$R_L > 1$	Unfavourable
$R_L = 1$	Linear
$0 < R_L < 1$	Favourable
$R_L = 0$	Irreversible

The results of correction analysis of adsorption data *viz.*, correlation coefficient and the Freundlich and Langmuir constants and adsorption capacity (Q_o, (1/n) log K, b and R_L) are givenin Table1. The results of statistical analysis of adsorption data reveal that both the Freundlich and Langmuir adsorption isotherms are applicable and the correlations are statistically significant. The values of R_L observed are found to be fraction, in the range of 0 to 1 (0.068 for CAC and 0.108 for EGBC) indicating that the adsorption process is favourable.

Table – 1 Results of Correlation Analysis of adsorption data for the removal of RhB dye by adsorption on CAC and SCBC at 30 ^{0}C.

Correlation Analysis	CAC	EGBC
Freundlich isotherm		
Correlation coefficient	0.998	0.983
Slope	0.736	0.293
Intercept	1.170	0.337
k	14.81	2.173
Δq (%)	0.004	0.012
Langmuir isotherm		
Correlation coefficient	0.985	0.994
Slope	0.007	0.199
Intercept	0.070	0.428
Q_o	148.08	5.029
b	0.097	0.464
R_L	0.068	0.108
Δq (%)	0.009	0.027

4. Conclusions

The present study deals with the removal of RhB dye on CAC) and SCBC) by batch adsorption technique. The percentage removal of RhB dye on these adsorbents (CAC and SCBC) is found to decrease with increase in initial concentration and the amount of RhB dye adsorbed increases with increase in initial concentration. Langmuir and Freundlich Isotherm models were tested and found to be applicable. Monolayer adsorption of RhB dye occurs on the surface of the adsorbents. Monolayer adsorption capacity was determined and found to be maximum in CAC.

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THERMAL STUDY AND X-RAY DIFFRACTION STUDY OF CHELATING METAL COMPLEX

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ABSTRACT

Chelates are used for the elimination of harmful radioactive and heavy metal toxicity from the body. Some of the chelating agents such as ethylenediaminetetraacetic acid, ethylenediamine, and 1,2-trans-cyclohexylenedinitrilotetraacetic acid are used in the elimination of harmful radioactive metals from the body. Chelates used in food preservation. Fruit, fruit juice, foodstuffs, etc., are now preserved with the help of chelating compounds. Supplementation of essential trace elements is an area of increasing interest in the field of human and veterinary pharmacology. In the present work synthesis of tris N-methyl ethylene diamine iron complex. The synthesized complex was characterized by thermo gravimetric analysis and differential thermal analysis and X-ray diffraction.

KEY WORDS: Chelate, Electronic absorption, Poly dentate, Thermal stability, XRD

INTRODUCTION

Many essential biological chemicals are chelates. Chelates play important roles in oxygen transport and in photosynthesis. Furthermore, many biological catalysts (enzymes) are chelates. In addition to their significance in living organisms, chelates are also economically important, both as products in themselves and as agents in the production of other chemicals. A chelate is a chemical compound composed of a metal ion and a chelating agent. A chelating agent is a substance whose molecules can form several bonds to a single metal ion. Metals are an integral part of many structural and functional components in the body and the critical role of metals in physiological and pathological processes has always been of interest to researchers. Unfolding the latter has inspirednewer therapeutic strategies based on alteration of the metal concentrations in specific body organs and/or entire body evolving branches such as metallotoxicology and metallopharmacology. The use of metals to restore the normal healthy physiology of the body either by direct administration of essential metals. [1,2]

MATERIALS AND METHODS

Preparation of Metal Complexes

The complex $[Fe(CH_3NHCH_2CH_2NH_2)]^{2+}$ was prepared from ferrous sulfate heptahydrate

and N- methylethylenediamine. 2 mM aqueous solution of metal salt was stirred in a beaker and 6 mM of N- methylethylenediamine was added drop by drop. With order to get proper mixing continuous stirring,

2 ml of ethyl alcohol was added for complete precipitation then transferred into a Petri dish to remove solvent in incubator at 45°C. After 3 days, a dark green-colored complex was formed.[3]

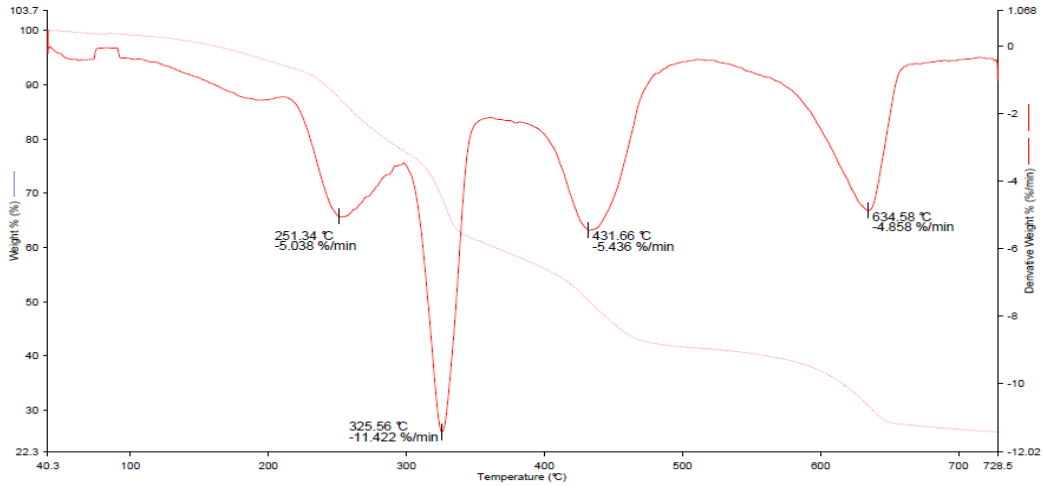
$3CH_3NHCH_2CH_2NH_2 + FeSO_4 \rightarrow [Fe(CH_3NHCH_2CH_2NH_2)_3]SO_4$

N-Methylethylenediamine

Where meen → N-methylethylenediamine

Thermal Analysis

Thermal methods mainly used to determine the stability of the complex and intermediate. From the spectrum



(Fig.1) TGA & DTA of tris N-methyl ethylenediamine iron complex

The chelating tris N-methyl ethylenediamine iron complex **(Fig.1)** exhibits four endothermic peaks **.** The complex is stable up to 251.34 °C. The ligand N-methyl ethylenediamine liberates at this temperature, by the loss of 20% weight. Upon increasing the temperature the remaining ethylenediamine gets liberates at 431.66 °C and 325.56 °C by the loss of weight 20% respectively. At 634.58°C ferrous sulphate dissociate into SO_3 and FeO. Above the temperature, stable metal oxide has appeared.[3,4]

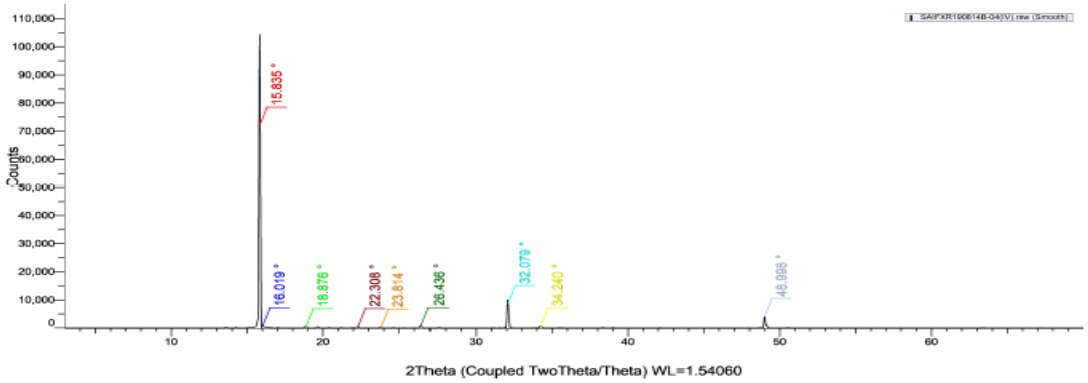
POWDER X-RAY DIFFRACTION STUDY

The X-ray diffraction method is the most powerful technique available for the examination of the complex in the solid-state. X-ray diffraction is used to obtain information about the structure and composition. When X-Rays are scattered by the ordered environment in a crystal, interference (both constructive and destructive) takes place.

Among the scattered ray, the distances between the scattered centers are of the same order of magnitude as the wavelength of the radiation. Diffraction is the result. Average crystalline sizes of the complexes and hkl planes are given in **(Table 1)**

Table 1 XRD data of tris N-methylethylenediamine iron complex

Complex	2θ Angle (degree)	θ Radian	Sin θ	Sin^2 θ	Ratio 1	Ratio 2	m	hkl	Average particle size D(nm)
$[Fe(meen)_3]^{2+}$	15.835	0.1381	0.1376	0.01893	1	2	2	110	80
	32.079	0.2798	0.2761	0.07623	4.0269	8.0538	8	220	
	48.998	0.4275	0.4145	0.1718	2.2537	4.5074	5	201	



(Fig.2) XRD Spectrum of $[Fe(meen)_3]^{2+}$ Complex

The XRD patterns of chelating tris N-methylethylenediamine Fe (II) complex are shown in (**Fig.2)**. The chelating Fe(II) complex shows that the sharp peaks at 15.835°, 32.079°, 48.998°, and 21.474° **(Table.1)**. This indicates the complex is high quality and polycrystalline. It exhibits a 100% intensity peak at 15.835°. The complex also exhibits additional small peaks, which is due to chelation. The hkl plane of the complex is calculated by the $\sin^2\theta$ method. The high intense peak with hkl planes is 15.835°(110), 32.079° (220), and 48.998° (201). The crystalline sizes are predicted for prominent peaks for the synthesized chelating complexes by using Debye-Scherrer's formula**.** The complex with an average crystalline size is 80.[5,6]

CONLUSION

Thermal analysis plays an important role for determining the stability of the complex, stability of the intermediate, melting point, and structure and decomposition pattern of the metal complex. The residue appears was the respective metal oxides MO. The decomposition pattern of all the chelating complexes confirms the proposed stoichiometry. The X-Ray diffraction method is the most powerful technique available for the examination of complex in the solid state. X-Ray diffraction is used to obtain information about the structure and composition. The XRD patterns of the chelating complex shows the sharp peaks indicates all the complexes are high quality and polycrystalline in nature.

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Kinetic studies on the removal of Aniline Blue dye using activated carbon from palm spathe: A comparative study with commercial activated carbon

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Abstract

In the present study low cost adsorbent (activated carbon) has been prepared from palm spathe (PSAC) and utilised it for the removal of Aniline Blue (AB) dye in aqueous solution. The surface functional groups of the PSA carbon was analysed by FTIR. The extent of dye removal increased with decrease in the initial concentration and increased with increase in contact time, amount of adsorbent and initial pH. The kinetics of adsorption was found to be first order with regard to intra-particle diffusion as rate determining step.

Keywords: Adsorption; Activated Carbon; Aniline Blue dye; Waste water treatment

1.Introduction

In recent decades, water pollution has become a serious threat to the environmental system, therefore, reducing pollutants from industrial wastewater before discharging to the environment is necessary. The industrial wastewater usually contains several organic and toxic substances that can be harmful to human and aquatic life. Dyes are the first known contaminants in the industrial wastewater streams. Various industries such as food processing, paper, cosmetics, leather, textiles, printing and pharmaceuticals discharge large amounts of wastewater containing dyes polluted with toxic compounds into the environment. Annually, it is estimated that 50,000 tons of organic dyes are disposed of worldwide. Therefore, it is necessary to remove the dyes from industrial wastewater streams before entering the environment.

Numerous methods have been used to remove various dyes from aqueous solutions and industrial wastewaters, among which nanofiltration, ozonation, flocculation, reverse osmosis, adsorption, electrochemical and biological degradation, chemical oxidation, and photocatalytic

degradation are the most extensively used methods. Despite to establishing such methods, attempts to find suitable methods with high efficiency, low cost and ease of process are scarce. Adsorption is one of the methods received a lot of attention due to its advantages such as being cheap, having process flexibility with no sludge production, the process simplicity, efficiency and high speed. In adsorption process, various adsorbents such as activated carbon, natural fibers, carbon nanotubes, zeolites, polymeric materials and magnetic nanocomposites have been used. However, there is a room for new challenges in the development of novel materials as adsorbents in the water treatment process. In this study we investigate the adsorption ability of palm spathe carbon towards aniline blue dye from aqueous solution by batch experiment.

2. Materials and Methods

All the chemicals and reagents are analytical grade used without any further purification.

2.1 Preparation of palm spatheactivated carbon

The palm spathe were collected locally and dried in the absence of sun light. The dried palm spathe were physically activated by carbonization in a muffle furnace in the absence of air by placing the sample in a well-sealed stainless steel tube at 600°C for 45 min. The carbonized raw materials were then powdered well and sieved by molecular sieves.

3. Results and Discussion

The uptake of Aniline blue over the adsorbents CAC and PSAC were investigated at different range of initial concentration, keeping contact time, dose of adsorbent, initial pH and particle size fixed (Figure 1). The extent of dye removal increased with decrease in the initial concentration and keep constant at high concentrations. This may be due to reduction in immediate solute adsorption, owing to the lack of available active sites on the adsorbents surface compared to the relatively large number of active sites required for high initial concentration of AB dye.

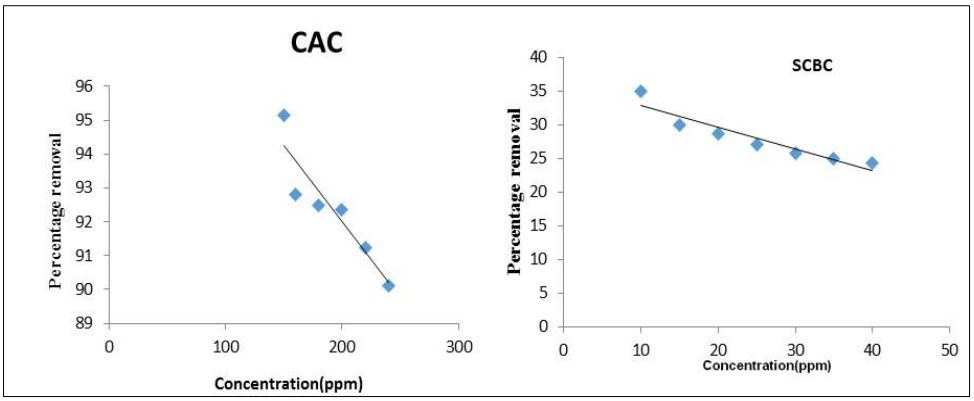

Figure 1. Effect of initial concentration on the removal of AB dye on PSAC

3.2 Kinetic studies

The kinetic models are used to determine the rate of adsorption process. The experimental data are fitted to the following kinetic models.

Natarajan and Khalaf equation: $Log\ (C_i/C_t) = kt / 2.303$

Bhattacharya and Venkobachar equation: $Log\ [1 – U\ (t)] = -kt / 2.303$

Where $U\ (t) = (C_i-C_t) / (C_i-C_e)$

Lagergren equation: $Log\ (q_e-q_t) = log\ q_e – kt/2.303$

Experimental data for the studies of kinetics of adsorption of PSAC on CAC are given in the Table 1.

Table1: Kinetic parameters on the extend removal of AB dye on PSAC

Parameter	CAC	PSAC
Natarajan and Khalaf equation		
k Value	0.0150	-0.0096
Intercept	1.3017	0.8337
r Value	0.7153	0.4459
Lagergren equation		
k Value	-0.0156	0.0179
Intercept	0.7343	0.3236
r Value	0.6726	0.6365
Bhattacharya and Venkobachar equation		
k Value	0.0022	0.0077
Intercept	2.9215	-0.111
r Value	0.8999	0.6204

All the linear correlations were found to be statistically significant (as evidenced by r values close to unity) and indicate that applicability of kinetic equations. . The linear kinetic plots

observed to be linear and the computed r (correlation coefficient) values which are very close to unity as shown in Table 1 indicate the applicability of these first order kinetic equations and the first order nature of the adsorption process of AB dye.

4. Conclusions

The present study deals with the removal of AB dye on CAC and PSAC by batch adsorption technique. The percentage removal of AB dye on these adsorbents (CAC and PSAC) is found to decrease with increase in initial concentration and the amount of AB dye adsorbed increases with increase in initial concentration. Adsorption data are modeled with various first order kinetic equations like Natarajan-Khalaf, Lagergren and Bhattacharya and Venkobachar equations. The intra particle diffusion model is found to be applicable. This indicates that the AB dye adsorption on CAC and PSAC is first order with the intra-particle diffusion as one of rate determining steps.

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CHARACTERIZATION OF TiO_2 DOPED WITH CeO_2 (TiO_2-Ce) NANOCOMPOSITE TO ENHANCE ITS ANTIBACTERIAL ACTIVITY

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Abstract

TiO_2-CeO_2 (TiO2-Ce) Nanocomposite were synthesized by sol–gel route using chemical method. The crystalline nanocomposites were obtained after Calcinated at 600 °C for 6 hours. N2-BET study revealed the huge surface area (0.03 cm2g-1) and pore size (2.28 nm) of TiO_2. Which decreased after impregnation of Ceria. In the Scanning Electron Microscopy analysis particles were found to be spherical shape. The energy dispersive X-ray (EDX) spectrum of TiO_2-CeO_2 (TiO_2-Ce) Nanocomposite is shown Ti, O, and Ce peaks are obviously found in the spectra, confirming the presence of Cerium and Titanium. The agar well diffusion assay is used to confirm the inhibition zone of bacteria The TiO_2-CeO_2 (TiO_2-Ce) Nanocomposite showed the antibacterial activity when tested against the pathogens only gram negative bacteria such as Pseudomonas. Further the synthesized nanocomposite was characterized by using X-ray powder diffraction (XRD), scanning electron microscopy with energy dispersive X-ray spectroscopy (SEM-EDX), Brunauer-Emmett-Teller (BET) method using N2 adsorption–desorption studies, UV–Visible absorption spectroscopy (UV), Fourier transform infrared spectroscopy (FTIR) were investigated.

Key words: Chemical method, TiO_2-CeO_2 (TiO2-Ce) Nanocomposite, and Pseudomonas.

INTRODUCTION

Nowadays, composite materials are considered to be among the most promising nanomaterials. Metal oxides have attracted increasing attention as potential oxidation catalysts owing to their unique redox properties and high oxygen storage capacity. Metal oxide nanopowders are being widely investigated for their various interesting physical and chemical properties, especially in catalytic and adsorption processes concerned with environmental issues.Cerium oxide due to its unique physical and chemical properties, has been recently attracted the attention of many investigators. Studies on the application of cerium oxide, especially in the form of the

nanoparticulate materials, in various fields like catalysis, photocatalysis . Solid oxide fuel cells, optics and etc., clearly indicates its wide industrial potentials.TiO_2 is an extensively used and studied antibacterial activity since of its desired properties like immovability, low cost, favourable absorption of light, suitable band positions and inertness. Though, the bandgap of TiO_2 is large. This can be achieved by reducing the bandgap of available materials like TiO_2 by doping with various cations or anions or by coupling with other materials having a lower bandgap. Various attempts have been made to reduce the bandgap of TiO_2 by doping various transition metal ions like V, Cr, Fe, Co, Ni and Cu. However, conflicting results have been reported, with both increase and decrease in activity, when compared with TiO_2.

MATERIALS AND METHODS

Nanocomposite of CeO_2-TiO_2(TiO_2-Ce) were synthesized successfully with sol gel route by using Chemical method in an aqueous solution of polyacrylamide. The pH of the aqueous solution of polyacrylamide was adjusted to 12.7 using aqueous ammonia. Polyacrylamide was added during the catalyst preparation to limit the growth of the catalyst particles; Titanium (IV) isopropoxide and ammonium ceric nitrate. Fine were taken as the source of titanium and cerium respectively. Titanium(IV) isopropoxide dissolved in dichloromethane and ammonium ceric nitrate dissolved in doubly distilled water were added drop wise to the basic polyacrylamide solution at the rate of 1.5 ml per min and 0.5 ml per min respectively under vigorous stirring. The obtained gel was stirred for 12 h and then washed 3 times with doubly distilled water and ethanol. It was then dried in hotairoven at 100^0C and calcined for 6hrs at 600^0C. Finally prepared by TiO_2-CeO_2(TiO_2-Ce) Nanocomposite.

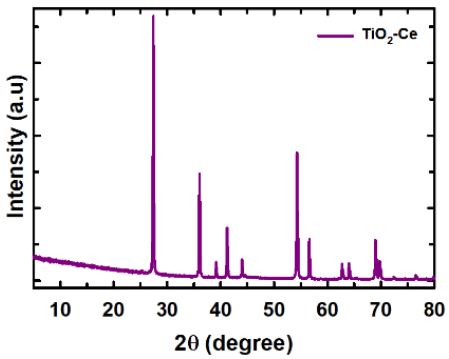

Fig 1-XRDimage of TiO_2-CeO_2(TiO_2-Ce) Nanocomposite

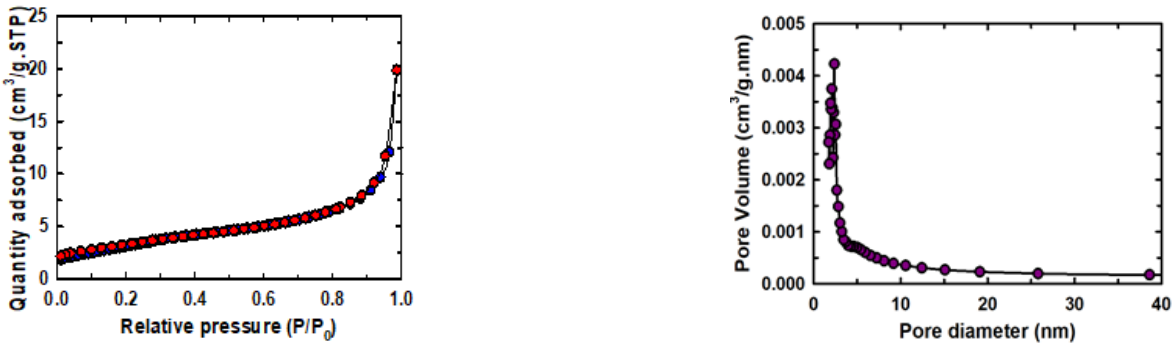

Fig 2-BET image of TiO2-CeO2 (TiO2-Ce) Nanocomposite

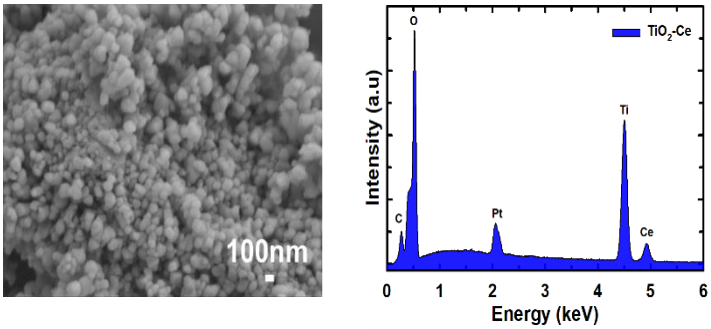

Fig 3 - SEM-EDX image of TiO_2-CeO_2 (TiO_2-Ce) Nanocomposite

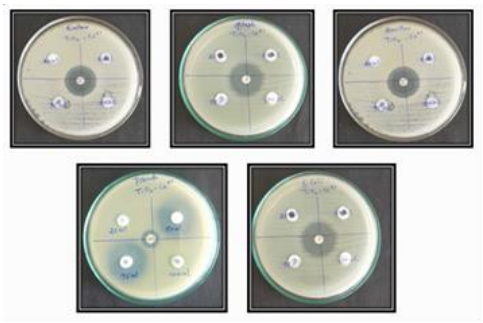

Fig 4: Antibacterial activity image of TiO_2-CeO_2 (TiO_2-Ce) Nanocomposite

CONCLUSION

The TiO_2-CeO_2(TiO_2-Ce) Nanocompositewere synthesized successfully with sol gel route by using Chemical method. The chemical properties of synthesized TiO_2-CeO_2 (TiO_2-Ce) Nanocompositewere investigated by XRD, SEM, UV, FTIR and BET analysis indicating the properties of synthesized TiO_2-CeO_2(TiO_2-Ce) Nanocomposite. The crystalline nanocomposites were obtained after Calcinated at 600°C for 6 hours. N_2-BET study revealed the huge surface area (0.03 cm^2g^{-1}) and pore size (2.28 nm) of TiO_2. Which decreased after impregnation of Ceria. In the Scanning Electron Microscopy analysis particles were found to be spherical shape. The energy dispersive X-ray (EDX) spectrum of TiO_2-CeO_2(TiO_2-Ce)

Nanocompositeis shown Ti, O, and Ce peaks are obviously found in the spectra, confirming the presence of Cerium and Titanium. The agar well diffusion assay is used to confirm the inhibition zone of bacteria The TiO_2-CeO_2(TiO_2-Ce) Nano composite showed the antibacterial activity when tested against the pathogens only gram negative bacteria such as *Pseodomonous*. This study also shows that Antibacterial activity with high recombination rate to a suitable material will enhance its activity.

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SCREENING AND PRODUCTION OF BIOPOLYMER POLYHYDROXYBUTYRATES FROM THE BACTERIA ISOLATED FROM AGRICULTURAL LAND

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Abstract:

Plastic pollution is the accumulation of plastic products in the environment that adversely affects wildlife, wildlife habitat, or humans. Polyhydroxybutyrates are the Biopolymers which are produced by more than three hundred different species of bacteria which can be altered as promising eco-friendly, biodegradable, biocompatible plastics. Currently they are in use in medical field especially in tissue engineering technology. Soil bacteriology is abundant with useful bacteria which produce economically important enzymes, antibiotics, secondary metabolites etc. The present study is aimed at screening and isolating Polyhydroxy butyrate producing bacteria from agricultural soil sample and production of biopolymer and sorting out the potent strain which can produce promising amount of the compound.

Keywords: Polyhydroxybutyrates, tissue engineering, Biopolymer.

Introduction:

Plastic materials originated from petrochemicals cause serious environmental problems existing as xenobioticswhichexist in the environment for such along period and they are not biodegradable.Polyhydrocybutyratesare the biodegradable, biocompatible bioplastics which are produced by microorganisms. Some bacterial species which naturally produce PHB are *Ralstoniaeutropha, Alcaligens, Pseudomonas, Bacillus, Rhodococcus, Staphylococcus and Micrococcus.* Shape, size, structure, physical properties of these granules are differing from organism to organism. PHB degrade naturally and completely to carbon dioxide and water under natural environment by different microorganisms.

PHB has various applications such as in agriculture, bioimplants, bioplastic production, biofuel production, drugs and chemicals, food and feeds, etc. Nowadays, these polymers have been used for medical application such as sutures, implants urological stents, neural and cardiovascular tissue engineering, fracture fixation, treatment of narcolepsy and alcohol addiction, drug delivery vehicles, cell microencapsulation, support of hypophyseal cells etc The present study focus on the isolation and screening of most prominent PHB producing bacteria from agricultural land.

Methodology:

Collection of sample**:**

Soil samples were collected aseptically from agricultural land for the isolation of efficient polyhydroxybutrate (PHB) producing bacteria. The soil samples are collected in sterile plastic zipper (polythene) bags by digging the land.

Isolation of PHB producing bacteria:

Serial dilution method was used to isolate the bacteria by suspending 1g of soil in 99ml of distilled water. Serial dilution was done up to 10-10 dilution. 100ul of suspension from each tubes were transferred to nutrient agar plates and incubated over night.

Screening for PHB production:

Sudan black blue staining in petriplates:

After incubation, PHB producing bacteria were screened with 0.02 gm Sudan black B stain dissolved in 100ml ethanol. The plates were stained and kept undisturbed for 20 minutes. After that, excess dye is removed and plates were washed with 80% Ethanol for 30 seconds. The PHB producers appeared bluish black indicating positive result while white coloured colonies indicate negative result. Further the positive isolates were subcultured repeatedly to obtain pure colonies.

Sudan black blue staining in slides:

Staining of cells with Sudan Black B smears of cells deposited on a glass slide were heat fixed and stained with 3%(w/v in 70% ethanol) solution of Sudan Black B(SIGMA) for 10 minutes, followed by immersion of the slide . The sample was counter stained with safranin (sigma 5% w/v in decolorized water) for 10 second, washed with water and dried. In this staining granules are stained blue-black or blue grey, while the bacterial cytoplasm is stained light pink.

Gram's staining technique was performed to distinguish between gram positive and gram negative bacteria.

Biochemical chracterisation:

The various biochemical tests like Indole, Methyl red, Vogesproskaur, Catalase, Oxidase, Citrate utilization, Triple sugar iron, Starch hydrolysis, Carbohydrate fermentation tests etcwere performed.

Production of PHB:

The bacterial cells containing the polymer were centrifuged at 10,000rpm for 10min and the pellet was washed with equal volume of acetone and ethanol to remove unwanted materials. The pellet was resuspended into 4% of sodium hypochlorite and incubated at room temperature for 30min. The whole mixture was again centrifuged and the supernatant was discarded. The cell pellet containing PHB was again washed with equal volume of acetone and ethanol. Finally the pellet containing polymer granules were dissolved in hot chloroform. The chloroform was filtered, and to filtrate 10ml of concentrated hot sulphuric acid was added. The addition of sulphuric acid converts the pellet into crotonic acid which is brown in colour. The solution was cooled and the absorbance was read at235nm against sulfuric acid as blank.

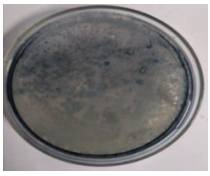

Fig 1: Sudan black blue staining

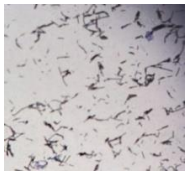

Fig 2: Microscopic view of bacteria

Result & Discussion:

Table 1: Colony morphology

BACTERIAL STRAINS	WHOLE COLON APPEARANCE	MARGIN	ELEVATION	COLOUR	GRAM NATURE	SURFACE OF THE COLONY
SM16	IRREGULAR TO FLAT	SMOOTH	RAISED	WHITE	NEGATIVE RODS	SMOOTH
SM17	CIRCULAR	ENTIRE	CONVEX	CREAM	NEGATIVE RODS	ROUGH
SM18	IRREGULAR	LOBATE	FLAT	CREAM	NEGATIVE RODS	SMOOTH
SM19	CIRCULAR	FILAMENTOUS	FLAT	CREAM	POSITIVE RODS	SMOOTH
SM20	CIRCULAR	ENTIRE	CONVEX	CREAM	NEGATIVE RODS	SMOOTH

Table 2: Biochemical characterisation of isolates

S.No	Test	Isolated cultures				
		SM16	SM17	SM18	SM19	SM20
1.	Carbohydrate fermentation	-	-	-	+	-
2.	Indole	+	+	+	-	+
3.	Methyl red	+	+	+	+	+
4.	Voges-proskaur	-	-	-	+	-
5.	Citrate utilization	-	-	-	+	-
6.	Nitrate reduction	+	+	+	-	+
7.	Urease test	-	-	-	+	-
8.	Starch hydrolysis	+	+	+	-	+
9.	Catalase	+	+	+	-	+
10.	Oxidase	-	-	-	+	-

The bacterial isolates were screened and isolated for PHB production, out of the numerous colonies grown under nutrient agar medium, 70-80% of the isolates showed positive result for sudden black blue staining. Out of it only five colonies were randomly selected for further studies.

PHB is a microbial polyester produced by many bacteria and stored in their cell in the form of granules, about 0.5 μm in diameter. β-hydroxybutyrate is connected by ester linkage and form PHB (Prasanna*et al*., 2011). PHB possesses only R (alkyl group) side chains and lacks S (Sulfur) side chains) and hence reported as biodegradable materials (Anderson Jung *et al*., 2001)

Biochemical characterization of the isolates like Indole test, Methyl Red test,VogesProskaur test, Catalase test and Oxidase test, Carbohydrate fermentation tests, Triple sugar iron test were performed. The isolates were labelled as SM16, SM17, SM18, SM19& SM20. Colony morphology was studied by the growth of pure colonies in nutrient agar plates by spread plate technique. Gram stained colonies were observed under 100 X oil immersion objective lens and photographed. All the five strains were found to be rod shaped bacteria. SM16, SM17, SM18 & SM20 were found to be Gram negative rods SM19 alone was Gram positive strain. The strains were further stained with sudan black blue in slides, observed and photographed. All the strains showed PHB granules clearly under microscope.

PHB is produced by the growth of cultures in specialized medium by using trace element solution. The method followed for PHB production is sodium hypochlorite method as described by Gurubasappa*et al*., 2015.

All the five stains were grown in specialized medium for PHB production for three days. Studies state that PHB production is better achieved after 72 hours of incubation. Dry weight Molecular mass of PHB was calculated. After choloroform evaporation the petriplates shows a whitish powdery substance sticked onto it. It was scratched with the help of sterile scalpel and blade. The powdered PHB was collected into a sterile container was stored for further use. The quantitative PHB estimation is done spectroscopically. PHB standard concentration obtained from (Prayashree*et al*.,2003) .Among the five Strains SM20 showed maximum concentration i.e 186µg/ml, Concentration of SM19, SM16, SM17, SM18 were found to be 134, 110, 84, 74 µg/ml. They are tabulated and graphically represented. After estimation SM20 was found to be maximum PHB producer followed by SM19 and both were used for further anlaysis.

Analyis of PHB can be further carried out using FTIR spectra analysis and GCMS which will indicate the presence of specific functional groups of PHB. Optimization of cultures with varied carbon sources, nitrogen sources, varied pH, varied temperature etc can be done for better yield. Cheap carbon sources can be provided to obtain a cost effective yield. Molecular analysis by 16SrRNA gene sequencing helps in identification of the organism. Mass production under optimized condition and with cheap sources produces large yield of the bioplastics.

Conclusion :

Plastic rules our world because of their wide range of plastic pollution rules and spoils costal area, terrestrial area and our habitat it is the need of the hour to think about the alternative biodegradable and environmental friendly plastic. PHB will be a environmental friendly, biodegradable plastic.PHB differentiates itself from other biodegradable plastics it has unique properties like insoluble in water, highly resistant to hydrolytic degradation, oxygen permeability, UV resistant, other biodegradable plastics are moisture sensitive and water soluble. PHB is poor resistance to acidsand bases, soluble in chloroform and other chlorinated hydrocarbons and biocompatible and hence it is suitable for medical applications.

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Molecular geometry, HOMO-LUMO and DFT calculations of2-[2-(4-methoxyphenylamino)-4-phenylaminothiazol-5-oyl]naphthalene

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In this work, density functional theory (DFT) of 2-[2-(4-methoxyphenylamino)-4-phenylaminothiazol-5-oyl]naphthalene was carried out using Gaussian ’09 program. The optimized geometry and electronic parameters of the compound was performed using B3LYP/6-31G basis set. The calculated values of geometrical parameters were comparable with the theoretical values. The Mulliken atomic charge explains the charge distribution of the atoms. The presence of HOMO-LUMO energy gap confirms the electron transfer within the molecule. Furthermore, the electronic parameters of2-[2-(4-methoxyphenylamino)-4-phenylaminothiazol-5-oyl]naphthalene reveals that, it acts as a soft molecule.

Keywords: DFT, Gaussian, Mulliken charges, HOMO, LUMO

Heterocyclic compounds have played an important role in pharmaceutical chemistry due to their biological activities. The synthesis of various heterocyclic compounds are known for their anti-infective, especially antibacterial and antifungal activities[1].Naphthalene constitutes a flexible and multifaceted platform in medicinal chemistry. This scaffold emerges as a promising moiety in drug design due to its diverse biological activities generated from structural modifications. Various antagonistic activities were reported for naphthalene-based compounds such as antimicrobial, anticancer, antiviral, anticonvulsant, antitubercular, and anti-inflammatory. A series of naphthalene derivatives were synthesized and found to possess a wide spectrum of biological activity[2]. Among the various types of heterocyclic compounds, thiazole derivatives have received considerable attention towards synthetic medicinal chemists as they are endowed with wide range of therapeutic properties and applications. The thiazole ring embrace of both sulphur and nitrogen are accessible and they have boundless applications in agriculture and medicinal chemistry[3,4].Compounds containing thiazole nucleus are unique molecules reported to possess an array of biological activities such as antibacterial, antifungal, antitumor, anti-inflammatory, anticonvulsant, anthelmintic activity, etc.Thiazoloyl naphthalene derivatives are fascinating chemical products used in the field of medicine as they have been found to possess a wide spectrum of biodynamic properties. Thiazoloyl naphthalene analogs have been attracted a great deal of interest due to their biological and commercial importance. The study of naphthyl thiazoles is therefore, of practical and theoretical importance. A density functional theory of different thiazoloyl naphthalene derivatives have been calculated by using DFT/B3LYP method.

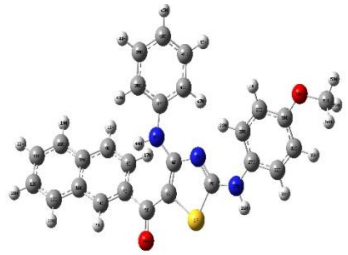
In recent years, among the computational methods calculating the electronic structure of molecular systems, experimental values of molecular geometry, vibrational frequencies, atomic charges, dipole moment, thermo dynamical properties etc. Accordingly, the synthesis and bioactivity screening of2-[2-(4-methoxyphenylamino)-4-phenylamino thiazol-5-oyl]naphthalenehave been reported in the present work.

Results and Discussion

Molecular Geometry

The geometrical parameters bond lengths and bond angles were compared with obtainable experimental data.The optimized bond lengths and bond angles of 2-[2-(4-methoxyphenylamino)-4-phenylaminothiazol-5-oyl]naphthalene molecule were calculated at B3LYP level with 631G basis set. The B3LYP method shows that the compound is convenient to available experimental data. The statistical treatment of data shows that the calculations of bond lengths using B3LYP/631G is better than the RHF/6-31G. The accordance of bond lengths and bond angles is good for 2-[2-(4-methoxyphenylamino)-4-phenylamino thiazol-5-oyl]naphthalene.

Figure.1: Optimized structure of 2-[2-(4-methoxyphenylamino)-4-phenylaminothiazol-5-oyl]naphthalene



Bond order analysis

The bond order of2-[2-(4-methoxyphenylamino)-4-phenylaminothiazol-5-oyl]naphthaleneis shown in **Table 1**.

Bond	Bond Length (A^0)	Bond	BondLength (A^0)
S1-C2	1.8246	C50 – C51	1.4509
C2 – N3	1.3915	C51 – H52	1.0967
N3 – C4	1.3848	C51 – H53	1.0892
C4 – C5	1.4120	C51 – H54	1.0967
C5- C6	1.4420	C29 – C30	1.4021
C6 – O24	1.2658	C30 – H31	1.4001
C7 – C8	1.4308	N23 – C25	1.4011
C4 – C9	1.4300	C25 – C26	1.4023
C15 – H16	1.4233	C25 – C27	1.4028
C9– H18	1.0851	C26 – C28	1.3904
C15– C10	1.3733	C26 – H29	1.0834
C12 – C13	1.3806	C27 – C30	1.3900
C10– H11	1.3808	C27 – H31	1.0801
C2 – O25	1.3588	C28 – C32	1.3933
C11– H28	1.0855	C28 – H33	1.0800
C12 – H21	1.4600	C30 – H35	1.0847
C13– H22	1.0860	C38 – C43	1.4068

Bond order is associated with bond strength. Bonds with higher bond order values have short bond length and vice versa. The investigation of bond order may envisage that the weakest bonds may be cleaved better, and they have a relatively low pi bond character. Bond between S1 and C2 possesses higher bond length 1.8246 in B3LYP method.

Electronic properties

The electronic property of2-[2-(4-methoxyphenylamino)-4-

phenylaminothiazol-5-oyl]naphthalene is discussed by examining the energy gap between HOMO and LUMO. Many organic molecules having conjugated pi electrons are characterized by large values of molecular first hyper polarizabilities by means of vibrational spectroscopy. The energies of highest occupied molecular orbitals (HOMO) and lowest occupied molecular orbitals (LUMO) of 2-[2-(4-methoxyphenylamino)-4-phenylaminothiazol-5-oyl]naphthalene were calculated. From the energy gap between HOMO and LUMO, the kinetic stability, optical polarizability, chemical reactivity and chemical hardness and softness of the molecule were calculated. the positive phase indicates red and the negative phase is green. It is distinct from the figure; the HOMO is located on naphthalene ring while LUMO is located on thiazole ring. The experimental and theoretical studies of electronic absorption spectrum of2-[2-(4-methoxyphenylamino)-4-phenylaminothiazol-5-oyl]naphthalenewere made to explained. The energy value of HOMO is-0.23867 and LUMO is -0.03703 respectively. The value of energy separation between the HOMO and LUMO is 0.20164a.u.The energy gap between HOMO-LUMO explains the consequent charge transfer within the molecule, which impacts the biological activity of the molecule.

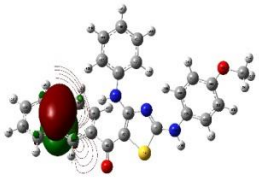
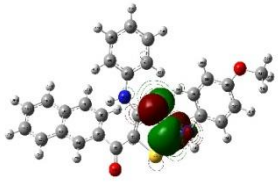


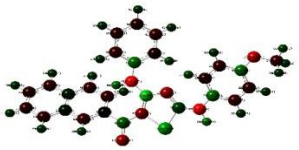
Figure.2:HOMO of 2-[2-(4-methoxyphenylamino)-4-phenylaminothiazol-5-oyl]naphthalene

Figure.3:LUMO of 2-[2-(4-methoxyphenylamino)-4-phenylaminothiazol-5-oyl]naphthalene



Mulliken Atomic Charges

The bonding structure and molecular conformation was resolved by electronic charge of the atom. Mulliken atomic charge values possesses an important part in the quantum chemical calculation since atomic charges effect, dipole effect, electronic structure, polarizability and a lot of properties were studied. The Mulliken atomic charges of all hydrogens and sulphur are positive, oxygen and nitrogen atoms containing are of negative charge. In case of carbon, they may be positive or negative based on the electronegativity of the nearest atom. The Mulliken charge distribution is shown in **Figure.4**.



Vibrational Assignments

The vibrational assignments of fundamental modes of 2-[2-(4-methoxy-phenylamino)-4-phenylaminothiazol-5-oyl]naphthalene are calculated based on B3LYP/6-31G basis set. The aromatic

compounds exhibit C-H stretching vibrations in the region 3100-3000cm^{-1}. The calculated band at3209 cm^{-1}and 3217 cm^{-1} is due to asymmetric stretching of phenyl and naphthalene group. Calculated band at 1732 cm^{-1} is due to C = O stretching vibration. Calculated band at 1625 cm^{-1} is due to C=N stretching vibration. Calculated band at 1514 cm^{-1} is due to C-N in-plane bending vibration. Calculated band at 1255 cm^{-1} is due to C-O-C asymmetric stretching vibration. The ring C-C stretching vibrations appears in the region 1625- 1400cm^{-1}. Skeletal vibration takes place because of C-C vibrations. In the present work the frequencies are observed at 1613 cm^{-1}, 1536cm^{-1}, 1394cm^{-1} as skeletal vibration. The in-plane C-H bending of aromatic compounds vibrations appears in the region 1400 –-1050 cm^{-1}. In the present work the frequencies are observed at 1424 cm^{-1}, 1378cm^{-1}, 1311cm^{-1}, 1286cm^{-1}, 1198 cm^{-1}, 1113 cm^{-1} and 1042 cm^{-1}.The C-H out-plane bending vibrational frequencies observed at 994 cm^{-1},859 cm^{-1} and 825 cm^{-1}. The vibrational assignments computed by B3LYP/6-31G method is in good agreement with literature observation.

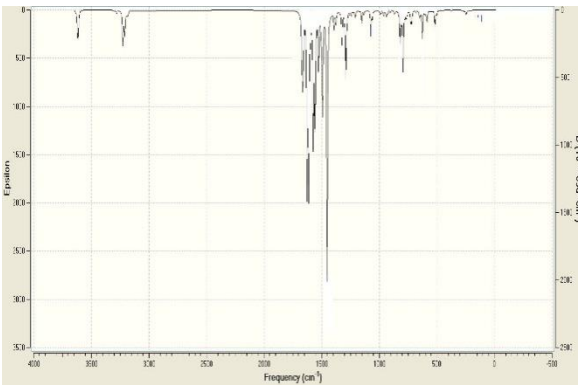


Figure.5: Theoretical IR spectra of2-[2-(4-methoxy-phenylamino)-4-phenyl aminothiazol-5-oyl]naphthalene

Conclusion

In the present work, complete vibrational analysis has been made for the compound 2-[2-(4-methoxy-phenylamino)-4-phenyl-aminothiazol-5-oyl]naphthalene and it have been found to agree well with the literature reported values. The FT-IR spectra of the titled compound have been theoretically computed by DFT method by using B3LYP/6-31G basis set. The Mullikencharge analysis explains the possibilities of hydrogen bonding. The HOMO-LUMO energy gap shows that the charge transfer occurs within the molecule and was found that the titled compound is biologically active.

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SYNTHESIS AND CHARACTERIZATION OF TiO_2 DOPED WITH MONTMORILLONITE FOR TESTING ITS ANTIBACTERIAL ACTIVITY

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2. Associate Professor, Department Of Chemistry & Research, Annai Velankanni College Tholayavattam - 629157

Abstract

Recent research has shown that nano composites can be synthesized from a steatite mineral, montmorillonite layered chitosan, with a variety of polymeric host matrixes. Montmorillonite nanoclays within a metallic media have been an unexplored alternative to the existing methods of nano composite deposition. The nano composite coating were successfully prepared by the effective dispersing of nanoparticles in chitosan were characterized by x-ray diffraction, scanning electron microscopy, UV-visible spectroscopy studied were investigated. These methods are especially suitable for the preparation of nanometric chitosan particles Recently we developed a novel template procedure to synthesis chitosan with surface area value that are considerably higher than those obtained by most of the other techniques referred to above. Subsequent thermal treatment of the dried composite causes chitosan nanoparticles to form in the montmorillonite. Profile scanning electron microscopy images further showed a heavily striated stack of aligned montmorillonite layered chitosan throughout the profile of the chitosan. Nanocomposite will be effective for adsorption of dyes from aqueous solutions. Evaluating the antibacterial performance of TiO_2/MMT nanocomposite. The results showed that the TiO_2 nanocomposite was uniformly dispersed in the polymer matrix and the particles remained their average size (20 - 150 nm) before incorporation into the polymer matrix.

Key words: Nanocomposite, doping, polymer matrix, Antibacterial activity

INTRODUCTION

Titanium dioxide (TiO2), a well-known photocatalyst, has been extensively investigated for the degradation of organic pollutants under ultraviolet irradiation in wastewater and in air because of its photostability, nontoxicity, high activity, and relatively low cost. The polymer acts as a surface topping specialist when nanoparticles are implanted in them. The nanocomposites obtained display of upgraded optical properties. Nanocomposites are a special class of materials having unique properties and the wide application potential in diverse areas. Novel properties of nanocomposites can be obtained by successfully joined characteristics of parent constituents in a single material.

The enhancement in photocatalytic activity of TiO_2 with MMT composites has been associated with the changes in their structural, textural, and optical properties, such as surface area, particle size, the formation of a specific crystalline phase, and low band gap energy. The main difference between gram-positive and gram-negative bacteria is that the protein Gram-positive bacteria have thicker cell walls containing many layers (consisting of peptidoglycan and acid teichoic) while protein Gram-negative bacteria have a thinner cell wall that contains many layers (consisting only of peptidoglycan)

MATERIALS

Titanium dioxide (TiO2), Montmorillonite (MMT) was purchased from Sigma-Aldrich, USA. All the chemicals were of analytical grade. Water was purified by passing deionised water through a double demonized system.

PREPARATION:

2grms of titanium dioxide is mixed with 1grm of MMT and it is mixed with 100ml of distilled water. This mixture is then introduced into a mechanical shaker and stirred for about 24hrs. Then the substance is filtered and the filtrate is collected in a watch glass. The filtrate is then introduced in an oven and heated for around 2hrs, a fine powder was obtained. Again the substance is introduced in muffle furnace and heat the sample at 800 o C for around 10hrs.

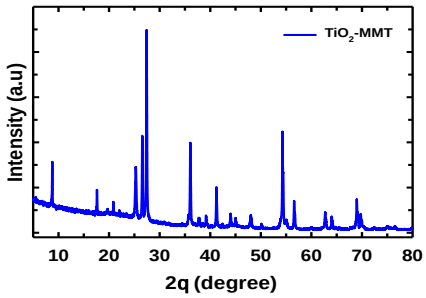

Fig 1-XRD image of TiO_2-MMT Nanocomposite

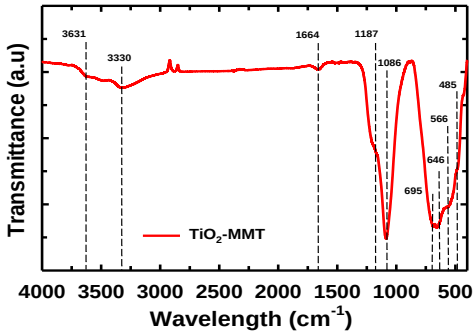

Fig 2-FTIR image of TiO_2-MMT Nanocomposite

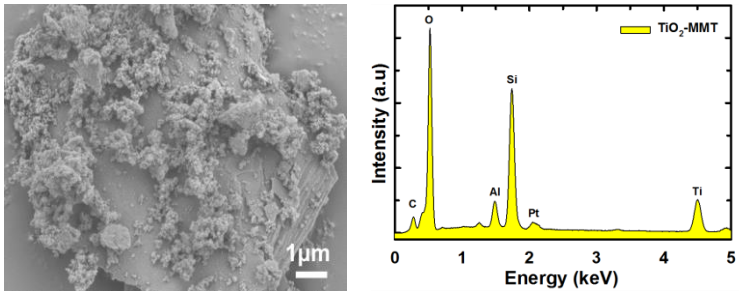

Fig 3 - SEM-EDX image of TiO_2-MMT Nanocomposite

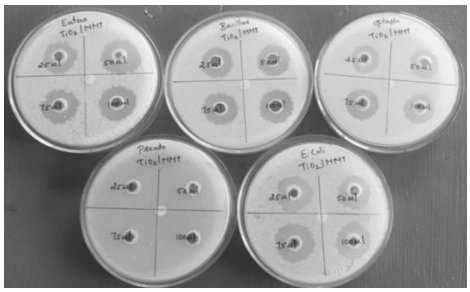

Fig 4: Antibacterial activity image of TiO_2-MMT Nanocomposite

Antimicrobial activity of TiO_2 nanoparticle with Montmorillonite nanocomposite has very strong inhibitory action against Grampositive and Gram-negative bacteria. The Gram negative bacteria such as Pseudomonas, Escherichiacoli, and then the Gram-positive bacteria such as Bacillus, subtilis & Staphylococcus. Here the zone of inhibition is more for both TiO_2 nanoparticle and TiO_2 with Montmorillonite nanocomposite

CONCLUSION

In this investigation, biodegradable active films based on polymer TiO_2 nanoparticle and TiO_2 with Montmorillonite nanocomposite were successfully prepared using a simple eco-friendly approach. The nanocomposite films showed significant antibacterial activity bacteria. Based on our research, it can be concluded that the incorporation of the TiO_2 with Montmorillonite nanocomposite increased the antibacterial activity against both Grampositive and Gram-negative bacteria

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EXPERIMENTAL AND COMPUTATIONAL (DFT) STUDIES OF 4-(NAPHTH-2-YL)-2-(ISOPROPYLAMINO)THIAZOLE

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Abstract

The compound 4-(naphth-2-yl)-2-(isopropylamino)thiazole was synthesized from 2-bromoacetylnaphthalene and characterized by FT-IR spectra. DFT methods for 4-(naphth-2-yl)-2-(isopropylamino)thiazole compound was done using Gaussian '09 program package using B3LYP method with 6-31G basis set, which has been successfully applied in order to derive the optimized geometries such as bond lengths,bond angle, dihedral angle, atomic charges, hardness and softness of the titled compound. The IR spectra are obtained and assigned by vibrational analysis and found to be reliable compared with the experimental results. The Mulliken atomic charge explains the charge distribution of the atoms.The calculated HOMO-LUMO energy gap also confirm the charge transfer occuring within the molecule.

Keywords: B3LYP, DFT, Gaussian, HOMO, LUMO, Mullikencharges.

INTRODUCTION

Heterocyclic compounds are core elements of a wide range of natural products. The heterocyclic compounds may consist of five-, six- or seven-membered rings which contain one or more heteroatoms. They owe their importance in the biological system due to uniqueness in their structural skeleton parts. They are naturally found in vitamins, nucleic acid, hormones, antibiotics etc. Nitrogen containing heterocyclic compounds are important place in the medicinal chemistry and of these, indoles, pyrimidine, pyrrole, thiazole and pyridine constitute the most important family of heterocyclic compounds[1].Natural heterocyclic compounds can also be prepared by chemical synthesis. Consequently, it may be used as templates for the development of new drugs by the pharmaceutical industry and have played a central role in the development of the field of organic chemistry. The literature survey shows the compounds containing Naphthalene ring exhibit a variety of therapeutic activities including antioxidant, anti-inflammatory, antitumor, antiviral, antituberculosis and antimicrobial activities[2]. The compounds containing thiazole, pyrazole and isoxazole ring and its derivatives are another multifaceted nucleus possessing a wide range of biological activities. Therefore, the present study is undertaken to design novel molecules through coupling of Naphthalene ring with thiazole ring and the resultant molecules are expected to exhibit antioxidant and anticancer activities.

EXPERIMENTAL

The reagents and solvents used were purchased from Sigma Aldrich. 2-

Bromoacetyl naphthalene was suspended in hot ethanol. N-Phenyl Thiourea was added and heated, a clear solution is obtained. Which soon deposited some crystals. The crystals are filtered off and boiled in water containing sodium acetate which was then filtered and dried. The crude product was crystallized from ethanol.

COMPUTATIONAL METHOD

All calculations were performed using Gaussian program package and the vibrational modes were assigned by means of visual inspection using Gaussian view program. The geometry optimization of the title compound was carried out using B3LYP method with 6-31G basis set.

RESULT AND DISCUSSION

Molecular geometry

Gaussian09 method is used to find the optimized molecular geometry of 4-(naphth-2-yl)-2-(isopropylamino)thiazole. The optimized molecular structure together with the numbering scheme for 4-(naphth-2-yl)-2-(isopropylamino)thiazole is shown in Figure.1

Figure 1-Optimized structure of 4-(naphth-2-yl)-2-(isopropylamino)thiazole

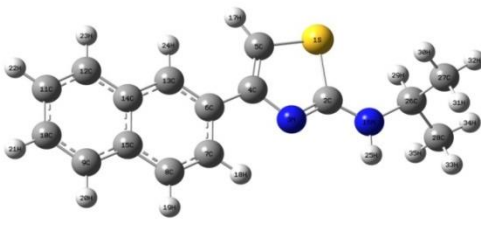


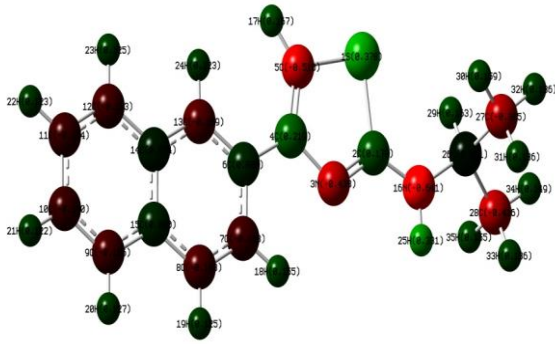
Table 1- Optimized geometrical parameters of 4-(naphth-2-yl)-2-(isopropylamino)thiazole

PARAMETERS	BOND LENGTH	PARAMETERS	BOND ANGLE
$S_1 – C_2$	1.84	$S_1 – C_2 – C_3$	115.64
$C_2 – N_3$	1.30	$C_5 – S_1 – C_2$	111.91
$N_3 – C_4$	1.40	$C_2 – N_3 – C_4$	117.75
$C_4 – C_5$	1.36	$N_3 – C_4 – C_5$	118.09
$C_5 – S_1$	1.80	$C_4 – C_5 – H_7$	122.07
$C_4 – C_6$	1.47	$N_3 – C_2 - N_{16}$	130.00
$C_6 – C_7$	1.42	$S_1 – C_2 – N_1$	126.40
$C_7 – C_8$	1.37	$C_2 – N_{16} - H_{25}$	124.36
$C_8 – C_{15}$	1.42	$N_3 – C_4 – C_6$	116.30
$C_{15} – C_9$	1.42	$C_{13} – C_6 – C_1$	123.47
$C_9 – C_{10}$	1.38	$C_6 - C_7 – C_8$	123.57
$C_{10} – C_{11}$	1.42	$C_6 – C_7 – H_1$	120.79
$C_{11} – C_{12}$	1.38	$C_7 – C_8 – C_1$	120.06
$C_{12} – C_{14}$	1.42	$C_7 – C_8 – H_1$	120.30
$C_{14} – C_{15}$	1.43	$C_8 – C_{15} – C_9$	118.29
$C_{14} – C_{13}$	1.41	$C_{15} – C_8 - H_{19}$	116.13
$C_{13} – C_6$	1.41	$C_8 - C_{15} - C_9$	123.12
$C_{26} – C_{27}$	1.40	$C_{15} – C_8 - H_{19}$	117.81
$C_{27} – C_{28}$	1.39	$C_8 – C_{15} - C_{14}$	119.74
$C_{28} – C_{29}$	1.39	$C_{15} – C_9 - C_{10}$	119.15
$C_{29} – C_{30}$	1.40	$C_{15} – C_9 - H_{20}$	120.04
$C_{30} – C_{31}$	1.39	$C_9 – C_{10} - H_{21}$	129.43
$C_{31} – C_{26}$	1.40	$C_9 – C_{10} - C_{11}$	118.09
$N_{16} – H_{25}$	1.01	$C_{10} – C_{11} - H_{22}$	120.63
$C_5 – H_{17}$	1.07	$C_{10} – C_{11} - C_{12}$	118.79
$C_7 – H_{18}$	1.08	$C_{11} – C_{12} - C_{14}$	120.69
$C_8 – H_{19}$	1.08	$C_{11} – C_{12} - H_{23}$	120.58
$C_9 – H_{20}$	1.08	$H_{22} – C_{12} - C_{14}$	120.52

Mulliken atomic charges

Dipole moment, molecular polarisability, electronic structure can be determined by mulliken atomic charge calculation. The charge distribution structure of 4-(naphth-2-yl)-2-(isopropylamino)thiazole are shown in Figure.2. The bonding capability of a molecule is based on the electronic charge on the chelating atoms. To find reliability of the results, the mulliken population investigation has been calculated using B3LYP/6-31G basis set. In our compound, the mulliken charge of the all hydrogen carries positive charge and nitrogen having negativecharge.

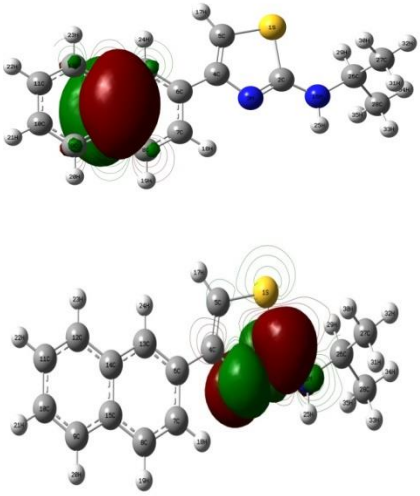
Figure 2- Mulliken atomic structure of 4-(naphth-2-yl)-2-(isopropylamino)thiazole



Frontier molecular orbital analysis

Molecular orbital theory incorporates the wave like characteristics of electrons in describing the bending behaviour.The bonding between the atoms is described as a combination of atomic orbitals. The most important frontier molecular orbitals(HOMO) and (LUMO).The HOMO-LUMO analysis has been carried out to explain the charge transfer within the molecule. The relative energy of the molecular orbitals have been calculated and a graphical representation of HOMO-LUMO of 4-(naphth-2-yl)-2-(isopropylamino)thiazole are given in Figure.3. The energies of HOMO-LUMO are 0.16788 and -0.17552 respectively and energy gap ΔE is 0.00764. The lower HOMO-LUMO energy gap explained the eventual charge transfer interactions taking place within the molecule, which influences the bioactivity of the molecule. The graphical representation of HOMO-LUMO of 4-(naphth-2-yl)-2-(isopropylamino)thiazole are given in. Figure.3

Figure 3- HOMO-LUMO of 4-(naphth-2-yl)-2-(isopropylamino)thiazole



Vibrational Assignment

The spectroscopic signature of the title compound was performed by FT-IR spectra. B3LYP/6-31G method was used to calculate the theoretical vibrational frequency. The theoretically predicted vibrational frequencies displays a good agreement with the experimental IR spectra.

The calculated band at 3573 cm is assigned due to NH stretching, and experimentally it is assigned at 3464 cm^{-}

[1].The calculated band at 3141cm-1 is due to C-H stretching of phenyl ring and it is close to experimental value 3126 cm-1.The bands in the range of 1597 to 1092 cm-1 are due to CH bending vibration. The C-S stretching vibration is likely in the region 710-685 cm-1 which is closely connected to the experimental values.

Figure 4. Theoritical IR spectrum of 4-(naphth-2-yl)-2-(isopropylamino)thiazole

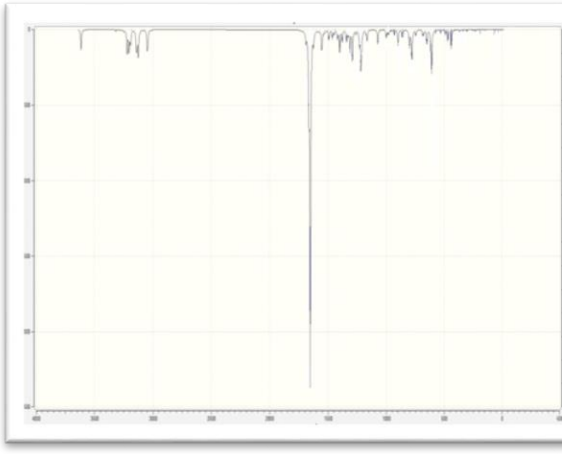
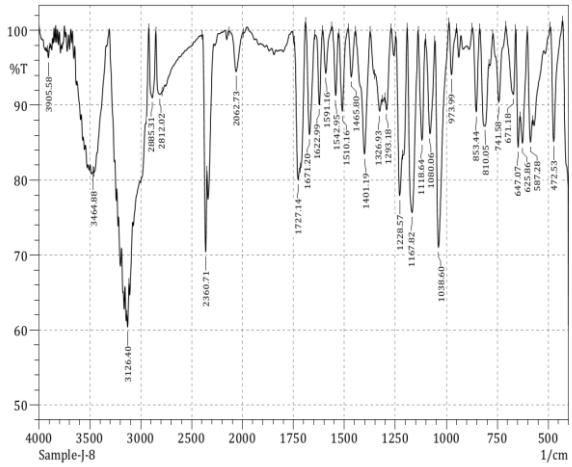


Figure 5- Experimental IR spectrum of 4-(naphth-2-yl)-2-(isopropylamino)thiazole



CONCLUSION

The compound 4-(naphth-2-yl)-2-(isopropylamino)thiazole has been synthesised and characterised by FT-IR spectra. Vibrational assignment was obtained theoretically by using DFT method. It was found that there is good contract of theoretical and experimental datas. The activity of the title compound was proved by HOMO-LUMO energy gap.

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TLC SCREENING AND EVALUATION OF ANTIBACTERIAL ACTIVITY OF *Catharanthus roseus*

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Abstract

Catharanthus roseus was investigated from the ancient time for their active compounds and their therapeutic effect. The plant contains enormous bioactive constituents of various medical applications. Vinca alkaloid has set a milestone in the history of modern medicine. In this study, thin layer chromatography, the Rf values of leaf extracts of *C.roseus* were determined by using standard procedure. Among the above results revealed the methanol (0.5), acetone (0.7) and diethylether (0.7) extracts shown the presence of active compounds. The minimum inhibitory concentration of *C.roseus* plant extract was tested by broth dilution method. The plant extract were tested three pathogenic bacterial strains, two gram negative (*Pseudomonas sps* and *E.coli*) and one gram positive bacteria (*Staphylococcus aureus*). Methanolic extracts showed consistently better antibacterial activity than other two extracts. The minimum bacterial concentration revealed that the methanol and acetone extracts showed potential antibacterial activity against the tested pathogenic bacteria (*Staphylococcus aureus* and *Pseudomonas sps*).

Key words: *Catharanthus roseus,* Thin layer chromatography, MIC, MBC

Introduction

Medicinal plants grow naturally around us. Over centuries, cultures around the world have learned how to use plants to fight illness and maintain health. The research for new therapeutic treatments for various disease conditions is expanding. In many poor countries, plants have been looked at as a very promising source of new lead compounds for drug discovery and dement (Kong *et al.,* 2003). *Catharanthus roseus*(L.) which is an important medicinal plant of the family Apocynaceae. *C.roseus* which is pridely known as the Madagascar periwinkle is found to be a species of *Catharanthus* native and also endemic to Madagascar. It is a popular ornamental plant found in gardens and homes across the world.

Classification

Kingdom	: Plantae	Family	: Apocynaceae
Phylum	: Magnoliophyta.	Species	: roseus
Class	: Magnoliopsida	Binomial name	: *Catharanthus roseus*
Order	: Gentianellas		

Catharanthus roseus has repeatedly escaped from cultivation and become naturalized in natural areas where it grows creating monospecific stands and displacing native vegetation. It is regarded as an environmental weed and as an invasive plant species impacting principally coastal habitats on sandy soil. It is listed among the 100 most invasive plants in south eastern Queensland (weeds of Australia, 2015).

The synonyms of the plant name include *Vincarosea, Ammocallis rosea and Lochnera rosea*, other English names occasionally used for the plant include Cape periwinkle, Rose periwinkle, Rosy periwinkle and Old Maid. It is cultivated mainly for its alkaloids, which are having anticancer activities. The *Catharanthus roseus*have shown a more potent antidiabetic activity, antioxidant activity and cytotoxic activity. It is used to treat many of the fatal diseases. It contains a abundance of useful alkaloids, used in diabetes, blood pressure, asthma, constipation, cancer, and menstrual problem. The anticancerous compounds of *catharanthus roseus*namely Vinblastine and Vincristine are broadly used as medicine to cure various cancers. According to the reports shown by The American society of Health System Pharmacists in 2015, Vincristine and Vinblastine are known for Inhibiting cell mitosis.

*Catharanthus roseus*is an annual evergreen sub herb or herbaceous plant growing to 1m tall and secretes milky latex. The roots extent up to 70 cm in depth. Stems are cylindrical, longitudinally ridged or narrowly winged, green or dark red, pubescent at least when young. The leaves are oval to oblong 2.5-9.0 cm long and 1-3.5 cm broad, glossy green above and pale green below with a pale midrib and a short petiole about 1-1.8 cm long. They are arranged in the opposite pairs. The flowers are pentamerous, actinomorphic and white to dark pink with a dark red center, with a basal tube about 2.5-3 cm long and a corolla about 2-5 cm diameter with five petals like lobes. The fruit is a pair of follicles about 2-4 cm long and 3 mm broad with numerous black seeds.

Materials and Methods

Healthy leaves of *Catharanthus roseus* were collected from Marthandam, Kanyakumari District. Leaves were shade dried and then powdered using homogenizer and stored in an airtight containers in the laboratory until used. The shade dried leaf powder, were used for the solvent extraction. About 25g of powdered sample was extracted with 150ml of solvents such as methanol, acetone

and diethyl ether. They were placed in a shaker for 5 days and the extract was collected from the conical flask by filtration. The obtained extracts were kept in a water bath at 60°C, resulting solvent to be evaporate from the sample. Thus the filtrate was concentrated and stored.

Thin Layer Chromatography

TLC glass plates were washed and dried in an oven. About20g of silica gel was dissolved in 50ml of distilled water. The slurry was poured into TLC plate to 0.25mm thickness. The plates were allowed to air-dry. The plates were kept in TLC chamber and the samples were spotted on the plate using a capillary tube. After applying the samples on the TLC plate it was placed in a TLC chamber containing the solvent system (known as mobile phase).By the capillary action the solvent is drawn up by the plate and it is developed. The developed plate was marked and allowed to air dry for few minutes. Qualitative evaluation of separated substance was carried out by calculation of Rf values.

Minimum Inhibitory Concentration

Take 7 test tubes and marked as 2, 3, 4, 5, $+^{ve}$ and $-^{ve}$ control, mark the plant extract tubes 1.Transfer 2ml of Nutrient broth into the empty test tubes (2, 3, 4, 5, $+^{ve}$ and $-^{ve}$control) starting with $-^{ve}$control. Transfer 2 ml from tube A to tube 2, mix well and from 2 to 3, mix well and repeat this for 4 and 5, then reject 2 ml from test tube 5.Add 0.2ml culture to all tube expect negative control (tubes A, 2,3,4,5 and $+^{ve}$ control).Incubate the tubes at 37°C for 24 hrs and determine the bacterial growth.

Minimum Bacterial Concentration

A loopful of broth from each test tube not showing growth, was inoculated into nutrient agar plate and incubate at 37°C for 24 hrs. The MBC were recorded as the lowest concentration of the extract that did not permit any visible bacteria colony growth on the appropriate agar plate after the period of incubation.

Result and Discussion

Thin layer Chromatography

TLC analysis of *Catharanthus roseus*shown, the presence of compounds in methanol, acetone and diethyl ether extracts. Rf values of plant extracts are 0.5 cm in methanol, 0.7 cm in acetone and

0.7 cm in diethyl ether respectively. The result revealed the presence of compounds in *Catharanthus roseus.*

S.No	Plant extracts of *Catharanthus roseus*	Rf value (cm)
1.	Methanol	0.5cm
2.	Acetone	0.7cm
3.	Diethyl ether	0.7cm

Table: Rf values of Thin layer Chromatography

TLC is one of the simplest, fastest, easiest and least expensive of several chromatographic techniques used in qualitative and quantitative analysis to separate organic compounds and to test the purity of compounds.Susmitha sudevan *et al.*, 2017 reported that the methanol extract of leaf and contain alkaloids, flavonoids, lipids and terpenoids in the Rf value of 0.45, 0.5, 1.2 and 0.66. Chromatographical analysis of *C.roseus* revealed that the presence of terpenoids, lipids, alkaloids and flavonoids. In this study, Rf values was calculated. The methanolic extract of *Catharanthus roseus* contains lowest Rf value 0.5cm ,In rosea extract of Acetone and Diethylether has highest Rf value was 0.7cm.

Minimum Inhibitory Concentration (MIC)

Extracts found to have inhibitory effects were tested for determination of minimum inhibitory concentration (MIC) by two-fold broth dilution method against clinical bacterial species (*Staphylococcus aureus, Pseudomonas sps* and *E.coli*). Methanol, acetone and diethylether extracts of *Catharanthus roseus* have very high MIC values. MIC values of methanol extract against *E.coli* (375µg/ml), *Staphylococcus aureus* (375µg/ml) and *Pseudomonas sps* (187.5µg/ml). MIC values of acetone extract against *E.coli* (750µg/ml), *Staphylococcus aureus* (187.5µg/ml) and *Pseudomonas sps* (625µg/ml). MIC values of diethyl ether against *E.coli* (281.2µg/ml), *Staphylococcus aureus* (625µg/ml) and *Pseudomonas sps* (281.2µg/ml). Methanolic extracts showed consistently better antibacterial activity than other
two extracts.

Minimum Inhibitory Concentration (MIC) is the lowest concentration of the antibacterial agent required to inhibit the growth of microorganisms. Minimum Bacterial Concentration is the lowest concentration of the antimicrobial agent required to kill microorganisms. Clinically, MIC is not only used to determine the amount of antibiotic that the

patient receive, but also the type of antibiotic used. This lower the opportunity for microbial resistance to specific antimicrobial agents. Pankaj Goyal *et al*., reported that the leaf extracts were found to have very low MIC values as compared with their parts. Ethanolic extracts showed consistently better antibacterial activity than methanolic extracts. The best MIC value (256µg/ml) for the dried leaf extract was seen against *Staphylococcus aureus* while it was 1024µg/ml for *Klebsiella pneumoniae* and 4096 µg/ ml for *Salmonella paratyphi*, though end-
points were not reached in case of *E.coli* and *B. subtilis*.

Minimum Bacterial Concentration

The Minimum Bacterial Concentration was confirmed by absence of bacterial growth of the tested strains streaked on the nutrient agar plate form inhibition zone, corresponding to their lowest MIC values. Diethyl ether (250µg/ml) extract showed bacterial growth against *E.coli*. Inhibition of bacterial concentration was observed in methanol (250µg/ml) and acetone (250µg/ml) extracts against the tested pathogenic bacteria (*Staphylococcus aureus* and *Pseudomonas sps*).

Table: Minimum Inhibitory Concentration

Concentration (µg/ml)	Methanol			Acetone			Diethylether		
	E.coli	*S. aureus*	*P. sp*	*E.co*	*S. aureu*	*P. sps*	*E.col*	*S. aureu*	*P. sps*
1000	-	-	-	-	-	+	-	+	-
500	-	+	-	+	-	+	+	-	+
250	+	-	-	+	-	-	+	-	+
125	+	+	+	+	+	+	+	+	+
62.5	+	+	+	+	+	+	-	+	-
+ve(c)	+	+	+	+	+	+	+	+	+
-ve(c)	-	-	-	-	-	-	-	-	-
MICvalue (µg/ml)	375	375	18 7.5	750	187.5	62	281.	625	281.

Plant extracts	Concentration(µg/ml	Pathogens	Bacterial growth
Methanol	250	*Pseudomonas sps*	-
Acetone	250	*Staphylococcus aureus*	-
Diethylether	250	*E.coli*	+

Table:Minimum Bacterial Concentration of plant extracts

Conclusion

From this study we conclude that *C.roseus* possess biologically active compounds such as antimicrobials. This study was done using *C.roseus* leaf extracts such as methanol, acetone and diethyl ether extracts. Among these extracts methanol extract was found to be the best in all the studies. In this study, it was generally observed that *Catharanthus roseus* have brought about the possibility of utilization of plant extracts, which has provided scientific evidence for the development of antibacterial products and treatment of bacterial infection.

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SYNTHESIS, SPECTRAL CHARACTERIZATION, DFT CALCULATIONS AND VIBRATIONAL ASSIGNMENTS OF (2-DIMETHYLAMINO-4-PHENYLTHIAZOL-5-YL)NAPHTHALENE-2-YLMETHANONE

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ABSTRACT

With an end goal to assess and plan quick, precise density functional theory (DFT) strategies for (2-dimethylamino-4-phenylthiazol-5-yl)naphthalene-2-ylmethanone compound was finished utilizing Gaussion' 09 program using B3LYP technique with the 6-31G premise set, which has been effectively applied to determine the optimized geometry, bonding features, vibrational wave numbers, NBO analysis andMulliken population investigation on nuclear charges in the ground state. Improved calculations of the particle have been depicted and gather with the trial esteems. The FT-IR spectra are gotten and allocated by vibrational analysis and observed to be solid contrasted and the literature observation. The determined most elevated involved highest occupied molecular orbital (HOMO) and lowest unoccupied molecular orbital (LUMO) energy gaps additionally confirm that charge move happens inside the particle.

Keywords: DFT, Gaussion, B3LYP, FT-IR, HOMO, LUMO

Thiazole is a aromatic five–membered heterocyclics, found in numerous incredible organically dynamic medications like antimicrobial medication, antiretroviral drug, antifungal medication and so on. It is a fundamental platform found in numerous normal mixtures as nutrient alkaloids, anabolic steroids, flavones. The thiazole core is essential for the nutrient B (thiamine) structure[1-2]. Naphthalene center is profoundly adaptable, present in numerous significant normal items and regular medications. Normally naphthalene subordinates can be segregated from different therapeutic plants and marine items. Naphthalene subsidiaries observed to be utilized again different remedial regions like malignant growth, insane issues, CNS related problems, aggravation, diabetes, hormonal irregularity, renal issues and so forth[3].The primary goal of this paper is to present, more precise vibrational

assignments, bond lengths, bond angles and HOMO-LUMO of (2-dimethylamino-4-phenylthiazol-5-yl)naphthalen-2-ylmethanone utilizing DFT/B3LYP strategy. a precise report on vibrational spectra and structure of the compound is done.

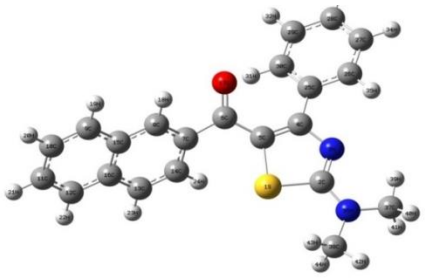
Computational details

The DFT calculations using Gaussian 09 program package at the B3LYP level with standard 3-21G basic set[4]. Molecular geometry of optimized structural and electronic parameters was used to the vibrational frequency and DFT calculation level to confirm the structure as minima.

Results and Discussion

Molecular geometry

The Self-Consistent Field (SCF) energy of target compound at B3LYP level with in the basis set 3-21G is found to be -1431.8a.u; with dipole moment 5.4457 Debye. The bond length of C6-C7 is greater compared to other carbon - carbon bond length due to the electronegativity of nitrogen atom[5].



Optimized structure of (2-dimethylamino-4-phenylthiazol-5-yl)naphthalen-2-ylmethanone

The S1-C5 bond distance is the longest, while C30-H31 is the shortest. The bond angle H42-C38-H44 is less (108.62^0) than the bond angle C5-C4-C6 is high (130.70). H39-C37-H40; H40-C37-H41; H42-C38-H44: H44-C38-H43 the values are slightly drifted from the normal bond angle 120^0 resulted by the nearby sulphur atom present in the thiazole ring and nitrogen connected

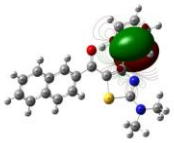
by the dimethyl amine group.

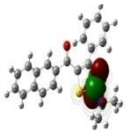
Table 1: Optimized Bond length(Å), Bond angle(^{0}) & Dihedral angle(^{0}) data of (2-dimethylamino-4-phenylthiazol-5-yl)naphthalen-2-ylmethanone

Para meters	Bond length(Å)	Para meters	Bond angle(⁰)	Para meters	Dihedral angle(⁰)
S1-C2	1.8290	S1-C2-N3	113.880	S1-C2-N36-C37	173.631
S1-C5	1.8505	C5-C4-C6	130.706	C25-C4-C5-S1	176.663
C6-C7	1.4980	C5-C6-O17	120.929	O17-C6-C5-S1	150.281
C6-O17	1.2591	C25-C30-H31	120.056	H20-C10-C11-C12	179.907
C30-H31	1.0813	N3-C2-N36	124.744	H33-C28-C29-H32	0.315
N36-C37	1.4699	H42-C38-H44	108.629	C2-N36-C37-H40	126.743

Frontier molecular orbital studies

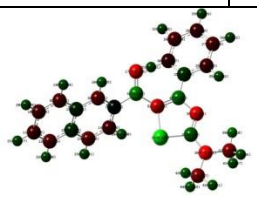
HOMO& LUMO of (2-dimethylamino-4-phenylthiazol-5-yl)naphthalen-2-ylmethanone





The difference between HOMO (Highest Occupied Molecular Orbital) and LUMO (Lowest Unoccupied Molecular Orbital) is called Energy gap (ΔE). In the target compound, HOMO = -0.2299, LUMO = -0.0273; Energy gap = HOMO-LUMO =0.2026. Energies of HOMO – LUMO of (2-dimethylamino-4-phenylthiazol-5-yl)naphthalen-2-ylmethanone calculated at B3LYP/6-31G level.

Mulliken charge distribution

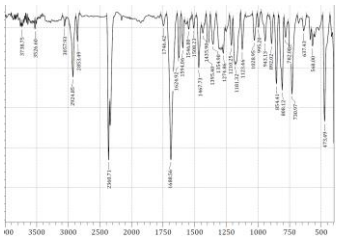


It was the important role of bonding structure, molecular conformation and electronic charge of the atom, according to quandam chemical calculation of effort of dipole moment, electronic structure, molecular polarizability etc. The values are show that N3 (-0.453), N36 (-0.541), O17 (-0.436), S1 (0.428) etc. The Mulliken atomic charge of all hydrogen atoms is positive, all the nitrogen and oxygen are negative charges and sulphur is positive.

Vibrational assignments

The spectral assignments of the target compound(2-dimethylamino-4 phenylthiazol-5-yl)naphthalen-2 ylmethanone has been made on the IR spectra are based on B3LYP/3-21G method.

The elemental analysis of the molecular composition of the compound was found to be $C_{22}H_{18}N_2OS$. The calculated band at 3191 cm^{-1} is due to symmetric C-H stretching of phenyl group and experimentally it is assigned at 3057 cm^{-1}. In the range of 1663 cm^{-1} C-C stretching in phenyl group and experimentally it is assigned at 1688 cm^{-1}. Inplane of C=O stretching is experimentally observed around 1594 cm^{-1} which is in close agreement with the calculated frequency 1597 cm-1. The band in the range 720 $cm^{-1}$are assigned for N-C bending vibrations which are close agreement with the experimental value of 730 cm^{-1}. The C=O and S-C bending vibrations which are close agreement with the experimental value (854 cm^{-1})



Conclusion

The investigation of the paper is vibrational assignments of (2-dimethylamino-4-phenylthiazol-5-yl)naphthalen-2-ylmethanone utilizing DFT technique (B3LYP) with 3-21G premise set.The optimized molecular geometry, bond lengths, bond angles, dihedral angles and atomic charges are calculated in the ground state. Nuclear charge distribution weredetermined by deciding the electron population of the molecule. The energy of Highest Occupied Molecular Orbital (HOMO) and Lowest Unoccupied Molecular Orbital (LUMO) studies clarified the energy gap and reactivity of the particle.

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ADSORPTION AND EQUILIBRIUM STUDIES OF ALIZARIN RED DYE ON GROUND NUT SHELL ACTIVATED CARBON AND THEIR CHARACTERIZATION

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ABSTRACT

In the study groundnut shells were used to prepare activate carbon by ammonium chloride treatment method. Adsorption technique proved to be an efficient and economical process for the treatment of dye-bearing effluents. But the efficiency of the process lies in choosing the suitable adsorbent. So, we select groundnut shells is the material used to prepare activated carbon. To characterise the activate carbon from groundnut shells using SEM, FTIR and TGA study. The equilibrium data they were tested by the linear, Freundlich and Langmuir models. The dye adsorbing capacity of the activated carbon is detected by using UV spectra.

Key Word: Activated carbon, Groundnut shell, Freundlich, Langmuir

INTRODUCTION

Discharge of heavy metals into environment has become a matter of concern over the last few decades. The heavy metals like lead, mercury, zinc, aluminium, arsenic, nickel, chromium, cobalt etc. are the common pollutants present in the environment from various natural and industrial sources. The main sources of mercury emissions to land, water and air are the processes of ore mining and smelting (in particular Cu and Zn smelting), burning of fossil fuels (mainly coal), industrial production processes (Hg cell chlor-alkali processes for the production of Cl2 and caustic soda) and consumption related discharges (including waste incineration) [1]. chemical precipitation, ion exchange, adsorption, membrane processes and evaporation that require high capital investment and running costs.

MATERIALS AND METHODS

Collection and Preparation of Activated carbon

All chemicals used were of analytical grade. Groundnut Shell was obtained from a local area near Tholayavattam, Kanyakumari District and was pre-treated according to the method reported in the literature. The Groundnut Shell was washed with deionized water to remove dirt. This clean and dry shells is soaked in saturated ammonium chloride solution nearly 24 hours for Activation. The dried shells are fill it in a clean and dry silica crucible and keep it inside the Muffle Furnace at 500°C for 2 hours. The Activated carbon is powered by using mortar and pistol. The powdered carbon is sieved in the mesh in the range between 250µm and 150µm in order to increase its surface area.

Preparation of Adsorbate

Adsorption Studies: The amount of adsorption at time t, qt (mg g-1), was obtained as follows:

$$qt=(C0-Ct)\ xV/M \quad \text{.....(1)}$$

RESULTS AND DISCUSSIONS

FTIR- Spectroscopy

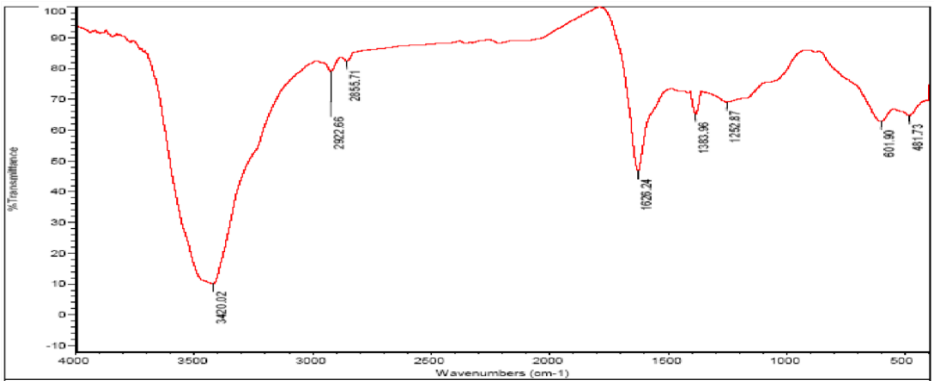

Fig 4: FT-IR spectroscopy of Groundnut Shell AC

The FT-IR spectroscopic study of the produced carbon is shown in Fig 4. A wide band of maximum peak can be noticed at 3420 cm-1 due to the absorption of water molecules as result of an O-H stretching mode of hydroxyl groups and adsorbed water, while the band at 2922cm-1 is attributed to

C-H interaction with the surface of the carbon. In the region 1300-1750 cm-1, amides can be distinguished on surface of the activated carbon which has two peaks at 1626 and 1383 cm-1. Moreover, the band at 1383 cm-1 may be attributed to the aromatic carbon–carbon stretching vibration. Peak at 601 cm-1 is assigned to the out-of-plane C-H bending mode. These spectra were also suggested to be due to alkaline groups of cyclic ketones and their derivatives added during activation.

SCANNING ELECTRON MICROSCOPE ANALYSIS (SEM)

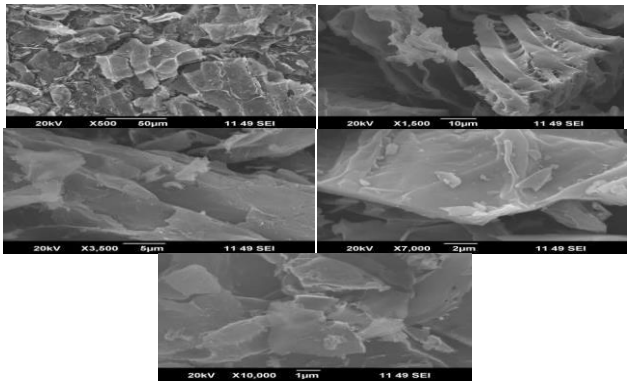

Fig 5: SEM analysis of Groundnut Shell AC

The surface physical morphology of activated carbon was observed by a scanning electron microscopy (SEM). The pore characteristics of the activated carbon studied were analysed using SEM. Clear differences in porosity and particle shape were observed, and representative images are shown in Fig. 5. In general, the pores chemically activated carbons were observe by SEM showed a large number of micropores present. 0

TGA/DTA Analysis

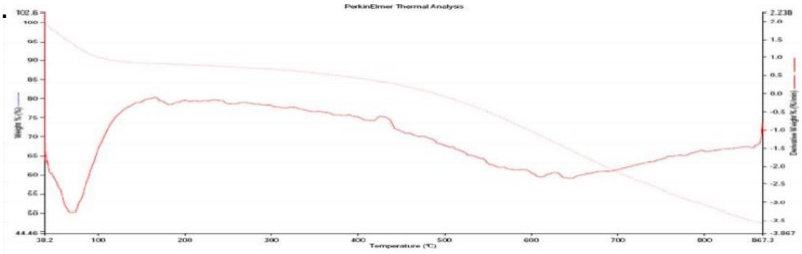

Fig 6: TGA/DTA Analysis of groundnut shell AC

Previously, it has been shown that when carbon is activated in the presence of oxygen (a physical process), levels of gases containing oxygen such as H2O, CO, CO2, and SO2 increase [108, 109]. A high thermal stability was observed for all activated carbons, and loss of mass was detected at higher temperatures

CONCLUSION

The adsorption of Alizarin Red from aqueous solution using Groundnut Shell AC has been investigated, under different reaction conditions in batch and equilibrium mode. The fitness of Langmuir model in the present system shows the formation of monolayer coverage of the adsorbate at the outer space of the adsorbent. The FT-IR spectroscopic study a wide band of maximum peak can be noticed at 3420 cm-1 due to the absorption of water molecules as result of an O-H stretching mode of hydroxyl groups and adsorbed water, while the band at 2922 cm-1 is attributed to C-H interaction with the surface of the carbon. In the region 1300-1750 cm-1, amides can be distinguished on surface of the activated carbon which has two peaks at 1626 and 1383 cm-1. The pore characteristics of the activated carbon studied were analysed using SEM. The evolution of volatiles as temperature increased resulted in a broad exothermic band.. The data reported here should be useful for the design and fabrication of an economically viable treatment process using batch (or) stirred tank reactors and also, it's revealed that the agricultural waste of Groundnut Shell AC was used as low-cost alternatives in wastewater treatment for dye removal.

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SOLAR ENHANCED DEGRADATION OF CONGO-RED DYE USING NANOPHOTOCATALYST UNDER VISIBLE LIGHT

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ABSTRACT

The present work aims to modify the photocatalytic activity of bare TiO_2 by doping with sulphur and nitrogen which could extend its absorption towards visible region. Visible light efficient S-N doped TiO_2 photocatalyst in the nano form was prepared by sol-gel method using titanium (IV) isopropoxide as precursor. The synthesized photocatalyst was characterized using various techniques such as X-ray diffraction (XRD), UV-Vis diffuse reflectance spectroscopic analysis, and SEM-EDX. The XRD data has shown that the phase structure of the photocatalyst is in anatase form and is not distracted by the dopants. SEM-EDX confirmed the incorporation of dopants on the TiO_2 lattice. The decreased band gap level of S-N doped TiO_2 was confirmed by UV-DRS. These results clearly elucidate that this method practically effective and the catalyst is recovered easily,thus minimizing the operating costs.

Keywords: Visible light, Sol-gel method, Degradation, Mineralization.

1. INTRODUCTION

Azo dyes are the emerging pollutants in textile wastewaters. However, the conventional methods are inefficient for degradation of recalcitrant compounds in wastewater. Nowadays, advanced oxidation processes (AOPs) are utilized for degradation and mineralization of emerging pollutants [1]. Among AOPs, attention has been paid to photocatalytic degradation of organic compounds by semiconductors including oxides, sulfides,etc[2]. Nowadays research has been carried on nano-sized TiO_2 semiconductor due to its enormous applications on photo catalysis, sensor devices and also in dye-sensitized solarcells[3]. Unfortunately, TiO_2 gets activated with UV light since it has a wide large band gap greater than 3.0 eV and has lesser application as UV light corresponds to about 3% in the solar spectrum [4]. Hence, research is being carried out to decrease the band gap separation in titania and hence its response towards visible light region is increased [5]. These limitations are overcome by doping with non-metals (C, N and S) so that light absorption of TiO_2 in the visible region is increased [6]. Titanium dioxide doped with anions is a very effective recent approach to modify its morphology[7], minimize the recombination centers, and also to extend its light absorption towards visible

region [9]. The main objective of this study is to prepare S-N doped TiO_2 nanoparticles through conventional sol-gel method. The photocatalysts were characterized by X-ray diffraction analysis (XRD), UV–visible diffuse reflectance spectroscopy (DRS), FT-IR analysis, HR-SEM with EDAX analysis. The activities of synthesised S-N doped TiO_2 photocatalyst were examined using Congo red dye as the pollutant with the use of solar irradiation.

2. MATERIAL AND METHODS

2.1.Preparation of S-N doped TiO_2 photocatalyst

Sol-gel method was adopted to prepare S-N doped TiO_2 nanoparticles using titanium (IV) isopropoxideas titanium precursor and thioureaacts as a very good source of both nitrogen and sulphur. A desired amount of titanium (IV) isopropoxide was mixed with deionized water and stirred for two hours. A white gel of TiO_2 formed was dried at 80^o C for 24 hrs. The above prepared TiO_2 was manually mixed with thiourea in 4:1 ratio. The mixed material was calcined in ceramic crucible at 600˚C for 2 hours [10].

2.2Characterization

The particle size and phase structure of the prepared photocatalyst were analyzed using powder XRD. The band gap energy and absorption edge is investigated using UV-DRS analysis and $BaSO_4$ as the reference. The surface morphology along with its elemental composition is analyzed by SEM equipped with an Energy Dispersive X-ray (EDS) Spectrophotometer operated at 30kV.

2.3.Photocatalytic degradation studies

To quantify the degradation efficiency of the prepared photocatalyst, spectrophotometric monitoring was carried out using spectrophotometer. Photocatalytic experiments were carried out using Congo red dye as a model compound for a concentration 20ppm.100mL of dye solution along with 200 mg of S-N doped TiO_2 was taken in a beaker and stirring was carried out magnetically in dark for about 30 min, at pH=6.5, to attain adsorption-desorption equilibrium. Subsequently, the solution was irradiated under sunlight. Aliquots (2ml) were withdrawn from the solution at regular intervals and centrifuged for spectrophotometric determination at λ_{max}=500nm, which corresponds to the maximum absorbance of the dye. The degradation efficiencywascalculatedbytheformula,

$$\%Degradation = (C_0-C_t)/C_0 \times 100 \text{---------- (1)}$$

3.RESULTS AND DISCUSSION

Structure and Size analysis

Fig.1 shows the most intense peak is located at 25.15. The crystallite size of the sample was calculated by the Debye Scherrer formula,

$D=K\lambda/\beta\cos\theta$

Where D is the crystalline size in nano metre, K is the shape factor, 2θ is the diffraction angle,λ is the wavelength of the X-ray radiation, and β is the full width at half maximum of the diffraction peak. By applying Debye Scherer equation, the crystallite size of the synthesized S-N doped TiO_2 catalysts was found to be 34nm.

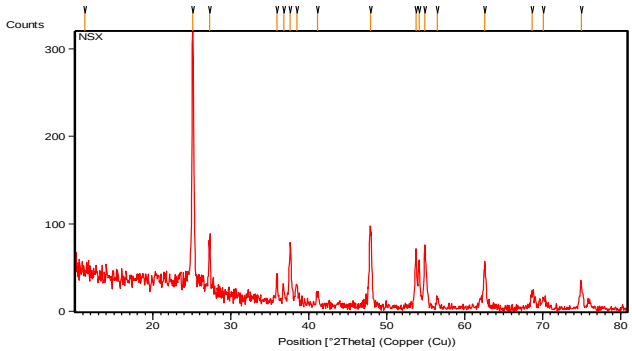

Fig.1.X-ray diffraction (XRD) patterns of S-N doped TiO_2.

SEM with EDAX analysis

Fig. 2 shows the S-N doped TiO_2 nanoparticles appeared to be porous spherical particles. Fig. 3 shows the EDX analysis of S-N doped TiO_2.The peaks correspond only for the presence of Ti, O, N and S which confirmed the formation of the S-N doped TiO_2.

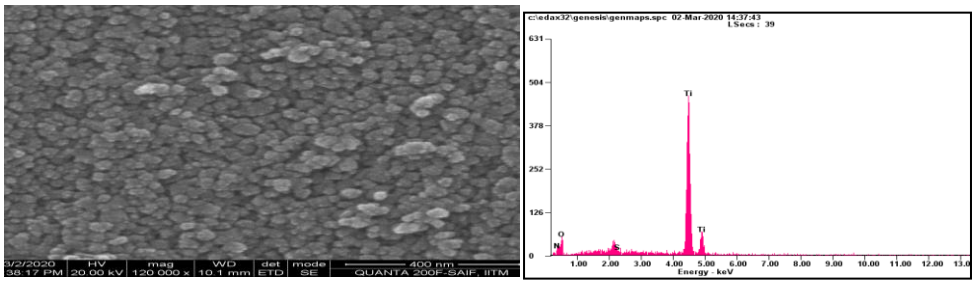

Fig.2.SEM images of TiO_2Fig. 3. EDAX analysis of N,S doped TiO_2

Photocatalytic degradation studies on Congo red

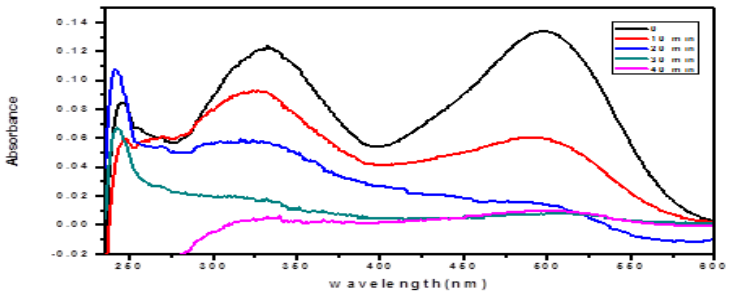

Fig. 4 UV- Absorption spectra of dye under visible light by using S-N doped TiO_2

The UV-Visible absorption spectra of Congo red showed one band at 500 nm which is in the visible region and two other absorption bands in the UV region at wavelengths 333 and 244 nm respectively. The irradiation of aqueous solution of Congo red with photocatalyst showed decrease in the intensity of all the bands with time T. This confirms the complete degradation of dye.

4.CONCLUSION

It can be concluded that doping TiO_2 with sulphur and nitrogen is a good route to increase the degradation of emerging pollutants using visible light at a low cost.

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ASSESSMENT OF HEAVY METAL POLLUTION IN RIVER MOLLUSC SAMPLES

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Abstract

The concentration of heavy metals such as Al, B, Cd, Co, Cr, Cu, Fe, Mg, Mn, Ni, Pb and Zn were studied in river molluscs collected from 20 different sites of Kanyakumari district. The heavy metal concentration was measured using Inductively coupled plasma optical emission spectrometer (ICP-OES). The heavy metal concentration was higher in Valliyar river near Eraniel and lower in Viyanoor river. All the studied heavy metals are below the limits for mollusc proposed by world health organization and safe within the limits for human consumption in the studied mollusc.

Key words : River molluscs, Heavy metal, Environment, Viyanoor river, Kanyakumari.

Introduction

Heavy metal pollution in aquatic ecosystems has been recognized as a serious environmental issue. In many cases, heavy metals occur in natural water bodies at levels below their toxic thresholds. However, due to their nondegradable nature, such low concentrations may still cause toxic effects after uptake and subsequent bioaccumulation by organisms[1]. Heavy metal toxicity in aquatic organisms, in association with the long residence time within food chains and the potential risk of human exposure, makes it necessary to monitor the levels of these contaminants in marine organisms[2]. Many benthic organisms accumulate trace metals to the levels reflecting those in the environment. Tissue metal concentrations can reflect contamination, and molluscs in particular may therefore be sensitive biomonitors of anthropogenic metal inputs[3]. It is well known that molluscs accumulate organic and metallic pollutants at concentrations several orders of magnitude above those observed in the field environment[4].

Study Area

The present study was carried out in Kanyakumari District, Tamilnadu, India. It lies between North latitude 8°5' 21.93" and East longitudes 77°31' 11.81". The district is located in the southern meridian region of the state. Total geographical area of the district is 1684 sq.kms.

Materials and Methods

15 g of mollusc samples was taken and the ashing was done at 500°C for 16 hrs. After cooling, 2 ml of nitric acid (HNO_3) and 10 ml of 1 molar hydrochloric acid (HCl) were added. After digestion, samples were filtered using Whatman filter paper No. 41, and the filtrate is made up to 25 ml with distilled water. Heavy metal concentrations were analyzed by Inductively coupled plasma optical emission spectrometer (ICP-OES).

Figure -1 Map showing the study area

Figure - 2 Sample Collection

Results and Discussion

Heavy metals are harmful to aquatic organisms and human health at certain levels of exposure because they are non – degradable. In the present study aluminium concentration of the river mollusc samples were in range from (13.26 ppm to 25.64 ppm). Boron values of all locations ranged from 1.231 ppm to 1.735 ppm. Cadmium concentration of the river mollusc samples were in range from (0.034 ppm to 0.088 ppm). The concentration of Cobalt level varied from 0.021 ppm to 0.075 ppm. The chromium concentration of river mollusc samples varied from 0.028 ppm to 0.085 ppm. The concentration of Copper in river mollusc samples varied from 0.012 ppm to 0.078 ppm. The iron and magnesium level of analyzed river mollusc samples recorded as within the desirable limit prescribed by WHO. The manganese concentration of

river mollusc samples varied from 0.234 ppm to 0.985 ppm. The concentration of Nickel level varied from 0.028 ppm to 0.097 ppm. The concentration of lead level varied from 0.027 ppm to 0.094 ppm. The zinc concentration in all river mollusc samples were found within permissible range.

Conclusion

The study has established that total heavy metal concentration was higher in Valliyar river near Eraniel. This may be due the industrial chemical pollution. The minimum concentration was recorded in Viyanoor river. The data indices are lower than recommended level in all the river molluscs. Therefore, the molluscs do not pose any significant impact over the environment.

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ELECTRONIC STRUCTURE, HOMO-LUMO and DFT calculations of 4-(1-ethylbenzimidazol-2-yl)-2-(methylphenylamino)thiazole

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Abstract

The compound 4-(1-ethylbenzimidazol-2-yl)-2-(methylphenylamino)thiazole was expected to have many biological activities which was synthesized from 1,2-diaminobenzene and lactic acid. Thiazole moiety present in the compound is found to possess anticancer, anti-HIV activities. Theoretical information on the optimized geometry, vibrational frequencies and atomic charges in the ground state were determined by means of Density Functional Theory (DFT) using standard B3LYP/6-31G basis set with Gaussian ’09 software. The results indicate the B3LYP method is able to provide satisfactory results for predicting vibrational frequencies and structural parameters. Mulliken population analysis was performed on the atomic charges and the HOMO-LUMO energies were calculated.

Keywords: B3LYP, DFT, HOMO, LUMO, Gaussian

Introduction

Benzimidazoles are an important group of heterocyclic compounds which are biologically active. Benzimidazole possess many biological activities such as antimicrobial, anti-fungal, antiviral, anti-inflammatory, anti-oxidant, anticancer and anti-ulcerative etc. because of these properties of benzimidazole, it was more important for the development of many important pharmaceutical compounds.Benzimidazole is naturally occurred in cyanocobalamin and several commercialized drugs such as mebendazole, astemizole and emedastine difumarate.

Like, thiazole or thiazolyl moiety present in any compound will show biological activities such as antihypertensive, anticancer, antifungal, anti-HIV, antimicrobial, antidiabetic and anticonvulsant activities.When benzimidazole ring is coupled with several

heterocyclic molecule like thiazole, which enhance the biological activity of the compound. Literature survey reveales that when one biodynamic heterocyclic system was coupled with another, a molecule with enhanced biological activity was produced. The chemistry of these kind of linked biheterocycles has been a fascinating field of investigation in medicinal chemistry as they have been found to exhibit enhanced biological profile.

Result and discussion

Optimized structure

The optimized structure of the titled compound is shown in fig.1. From the optimized structure bond length and bond angle of4-(1-ethylbenzimidazol-2-yl)-2-(methylphenylamino)thiazole is collected using B3LYP level with 6-31G basis set.

Figure 1- Optimized structure of 4-(1-ethylbenzimidazol-2-yl)-2-(methylphenylamino)thiazole.

From the above structure we can get the bond length data of the compound.

Table-1.Bond length of 4-(1-ethylbenzimidazol-2-yl)-2-(phenylamino)thiazole

ATOM	BOND LENGTH(A^o)
S_1-C_2	1.8503
C_2-N_3	1.3064
N_3-C_4	1.3977
C_4-C_5	1.3694
C_5-S_1	1.8049
C_5-H_{19}	1.0765
C_6-N_7	1.3309
C_9-H_{22}	1.0851
C_9-C_{10}	1.4143
N_{12}-C_6	1.4085
C_{15}-H_{24}	1.0966
C_{15}-C_{16}	1.5356
C_2-N_{17}	1.3685
N_{17}-H_{18}	1.0129
C_{30}-C_{31}	1.3989
C_{33}-H_{38}	1.0852

Experimental

Computational details

The DFT computation of 4-(1-ethylbenzimidazol-2-yl)-2-(phenylamino)thiazole was carried out using

Gaussian ’09 program software using B3LYP/6-31G basis set.

Mulliken Atomic Charge

The bonding structure and molecular conformation was resolved by electronic charge of the atom. The net atomic charge was obtained from Mulliken charge analysis. In the titled compound the magnitude of C atom was found to be positive and negative and the O atom exhibit negative and Hatom exhibit positive. The magnitude of N atom is found to be negative. Mulliken charge distribution of the titled compound was shown in fig.2.

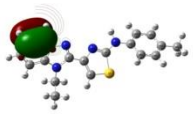
Figure 2- Mulliken charge distribution of 4-(1-ethylbenzimidazol-2-yl)-2-(phenylamino) thiazole.

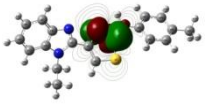
HOMO-LUMO Energy gap

The HOMO-LUMO analysis has been carried out to explain about the charge transfer occur with in the molecule. HOMO orbital is act as electron donor and LUMO is act as electron acceptor. The energy gap between the HOMO and LUMO is about 0.2183eV.

Figure 3- HOMO of 4-(1-ethylbenzimidazol-2-yl)-2-(phenylamino) thiazole

Figure 4- LUMO of 4-(1-ethylbenzimidazol-2-yl)-2-(phenylamino)thiazole

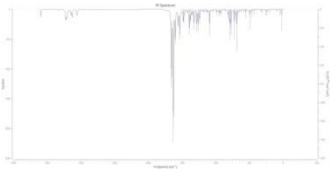




Vibrational analysis

The vibrational spectral analysis of 4-(1-ethylbenzimidazol-2-yl)-2-(phenylamino) thiazole was carried out based on B3LYP/6-31G basis set. From this the C-H stretching in the region 3228 cm^{-1} . The C-H assymmetric stretching was observed in the region 3189 cm^{-1}. The C-C stretching in 1673 , C-H bending in 1559 cm^{-1}(phenyl ring), C- H bending in the region 1462 cm^{-1} (ethyl group),C-N stretching at 1394 cm^{-1} and N-H stretching at 527 cm^{-1}.

Figure 5- Theoretical FT-IR spectrum of 4-(1-ethylbenzimidazol-2-yl)-2-(phenylamino) thiazole



Conclusion

The structure 4-(1-ethylbenzimidazol-2-yl)-2-(phenylamino)thiazole was optimized by DFT using B3LYP/6-31G basis set. The optimized geometry and vibrational frequencies are found to agree well with the literature reported values. The Mulliken charge analysis explains about the charge distribution along the molecule. The HOMO-LUMO energy gap shows that charge transfer occur within the molecule.

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GC-MS analysis of green synthesised nanoparticles using Annona muricata (soursop)

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Abstract

Biologically synthesized nanoparticles have been broadly used in the field of medicine. Research in nanotechnology highlights the possibility of green chemistry pathways to produce technologically important nanomaterials. An investigation was undertaken to study the bioactive constituents present in silver nanoparticles which are synthesised using the leaves of *Annona muricata*. Gas chromatography-mass spectroscopy (GC-MS) studies is used to identify the bio active compounds present in the compound under investigation. The results revealed the presence of alkaloids, terpenoids, flavonoids, tannins, steroids and phenols. GC-MS analysis showed the presence of 12 bioactive compounds, of which Tridecanoic acid, Selenocyanic acid, Cyclobarbital, Vitamin E are the major bio-chemical compounds.

Introduction

Utilization of plant sources to treat various maladies is archaic. Synthesis of efficient pharmaceutics from natural products is now a trendsetter, considering the fact that it causes less severe side effects than the synthetic ones [1]. Plants produce a distinct set of secondary metabolites like phenols, alkaloids, terpenoids, saponins etc [2] which offers chemotherapeutic and chemo-preventive effects. Annona muricata is a tropical plant species belonging to family Annonaceae and also known as Graviola. The medicinal uses of the Annonaceae family were reported long time ago and since then, this species has attracted the attention due to its bioactivity and traditional uses[3]. Annona muricata widely acknowledged as “Graviola”, “Soursop”, “Guanabana”, is a small about 5 to 6 meter in height tropical, evergreen fruit tree, belonging to the Annonaceae family, with large, glossy, dark green leaves. Leaves of Annona muricata, bountiful with flavonoids, isoquinoline alkaloids and annonaceousacetogenins, has been used to treat a lot of ailments inclusive of inflammation, diabetes and cancer [4]. Different parts of the plants, especially its leaves, are known to have health benefits. Annona muricata leaves are usually used as alternative therapy to cure cancer and parasitic infection. Soursop extract has antimicrobial and fungicidal properties when used against oral microbiota [5].

Materials and Methods

Preparation of extract

The leaves of plant Annona muricata are collected from the plains of Kanyakumari district. The samples were washed in running tap water to remove the dirt and dehydrated to remove the moisture content. The biomaterials are dried in shade and powdered. It is then sieved using a sieve mesh opening size,20 μm to get fine powder and this is kept separately for further experiments. The aqueous extract of the Annona muricatasamples were prepared by adding 50ml of distilled water in to the sample and kept in a magnetic stirrer for 24 hours, and then it is filtered using a Whatman filter. The pH and colour change was noted

Synthesis of silver nanoparticles

The 100ml of the extract was mixed with 150ml of 1mm silver nitrate solution (silver nitrate in water provides silver ions for the reaction), and then the mixture was incubated at 25℃ in the dark (to avoid photochemical activation of silver nitrate). The observation was silvery brown precipitation after 20 minutes which indicates the formation of silver nanoparticles. The formed product was washed well in double distilled water, dried and stored for further study.

Gas chromatography-Mass spectrometry (GC-MS)

GC-MS analysis was performed using The JEOL GCMATE II GC-MS with Data system is a high resolution, double focusing instrument. The solvent delay was 0 to 2 minutes, and the total GC/MS running time was 36 min. The relative percentage amount of eachcomponent was calculated by comparing its average peak area to the total areas. Identification of components: Interpretation of mass spectrum GCMS was conducted using data base of National Institute Standard and Technology and Wiley spectra Libraries. The molecular weight, molecular formula and the number of hits used to identify the name of the compound from NIST and Wiley spectra Libraries.

Results and Discussion

Most of all secondary metabolites such as Flavonoids, glycosides, steroids, alkaloids, terpenoids were detected in the seed extract. During GC-MS analysis 12 peaks were observed (Fig. 1), the chemical nature of which has been elaborated in Table 1. GCMS results of the silver nanoparticles dopped with Annona muricata shows the presence of some of the important bioactive compounds such as 5,6,7-Trinitro-1,4-benzodioxane, Butanedioic acid, Ethanol, maltose, Methanol, alpha-d-glucopyranoside, Diazene, 2-Pentenoic acid, Benzaldehyde, 4(1H)-

Pyrimidinone, 1,3,5-Triazine and Vitamin E. These compound possess antibacterial, antidiabetic, antioxidant, anti-cancer activity, These findings support the traditional use of Annona muricata in treatment of various diseases. Further studies are needed to isolate active part of the extract as well as to elucidate their exact mechanism of action.

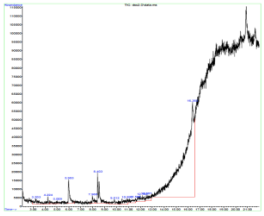

*Figure **Error! No text of specified style in document.**-1. GCMS Chromatogram of Annona muricata silver nanopartilces*

Table:1 Bioactive compounds detected from the Annona muricata silver nanoparticles

Peak	RT	Area%	Molecular Weight	Molecular Formula	Compound
1	3.203	1.43	215.04	C8H7BrO2	5,6,7-Trinitro-1,4-benzodioxane
2	4.224	0.89	118.09	C4H6O4	Butanedioic acid
3	5.009	0.70	46.07	C2H6O	Ethanol
4	5.983	2.58	342.30	C12H22O11	maltose
5	7.968	0.92	32.042	CH3OH	Methanol
6	8.403	4.07	179.15	C6H11O6-	alpha-d-glucopyranoside
7	9.812	1.28	30.030	H2N2	Diazene
8	10.89(	1.74	100.12	C5H8O2	2-Pentenoic acid
9	11.58(	1.24	106.12	C6H5CHO	Benzaldehyde
10	12.16(	1.82	96.09	C4H4N2O	4(1H)-Pyrimidinone
11	12.507	1.42	81.08	C3H3N3	1,3,5-Triazine
12	16.383	8.92	430.7	C29H50O2	Vitamin E

Conclusion

Outcomes of the present study concluded that the Annona muricata extract renders a quicker, safer and an eco-friendly route to synthesize silver nanoparticles.The results of this study confirmed the presence of various bioactive compounds in the Annona muricata silver nanoparticles. The chromatographic analysisof Annona muricatasilver nanoparticles consists of various Alkaloids, Terpenoids, Saponins, and Phenolics which are accountable for many biological activities. This study reveals that the Annona muricatasiver nanoparticles shows growth inhibition against bacteria. From this study we can conclude that Annona muricata silver nanoparticles can be used as a potential durg.

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HPTLC FINGER PRINTING ANALYSIS OF *LIMONIA ACIDISSIMA L* FRUIT AND LEAF EXTRACTS OF *SIMAROUBA GLAUCA DC*

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ABSTRACT

Recently there is an emerging trend in research to support the biological activities of medicinal plants. High performance thin layer chromatography is an important tool for qualitatively identify the bioactive components present in the plant extracts or herbal drug. The aim of the present work is to elucidate the alkaloid constituent in the acetone and methanol extracts of *Limonia acidissima L* fruit and *Simarouba glauca DC* leaf a most important traditional medicinal plant species. The result shows that different Rf values in the range of 0.25 to 0.95. The current study overlays boulevard for *Limonia acidissima L and Simarouba glauca DC* to provide a direction for further exploration in precluding communicable and noncommunicable ailments.

Key words: Alkaloid, HPTLC, *Limonia acidissima L*, *Simarouba glauca DC.*

I. INTRODUCTION

Natural products of plant origin are widely recognized in the pharmaceutical industry for their broad structural diversity as well as their wide range of pharmacological activities [1,2]. The subject of phytochemistry is concerned with the enormous variety of organic substances that are elaborated and accumulated by plants and deals with structures of these substances, biosynthesis, turnover, and metabolism, their natural distribution, and their biological function [3,4]. HPTLC is rational for expansion of chromatographic fingerprints to determine major active constituents of medicinal plants. The separation and resolution are much better, and the results are much more reliable and reproducible than TLC. The construction of chromatographic fingerprints plays an important role in the quality control of complex herbal medicines [5]. The plant used in the present study is *Limonia acidissima Linn.* (Rutacace) and *Simarouba glauca* DC (Simaroubaceace) is distributed in India, Pakistan, Sri Lanka and Southeast Asia [6].It is used in traditional medicine for the treatment of various ailments such as asthma, cardiac debility, dysentery, diarrhea, hepatitis, and tumors [7].

II. MATERIALS AND METHODS

The mobile phase for fingerprinting of alkaloids consisted of toluene-ethyl acetate-dimethylamine in the volume ratio of 8:2:1 (v/v) and Dragendorff reagent was used for derivatization of alkaloids. 20 ml of mobile phase was used per chromatography. Linear ascending develop-ment was carried out in 20 cm x 10 cm twin trough glass chamber (Camag, Muttenz, Switzerland) saturated with filter paper whatman no: 1 in the mobile phase. The optimized chamber saturation time for mobile phase was 20 min at room temperature (25 0 C ± 2) at relative humidity of 60% ± 5. The length of chromatogram run was 8.0 cm. Subsequent to the scanning, TLC plates were dried in a current of air with the help of an air dryer.

III. RESULTS AND DISCUSSIONS

The finger printing profile for *Limonia acidissima L* fruit and *Simarouba glauca DC* leaf extract is presented in the figure 1.

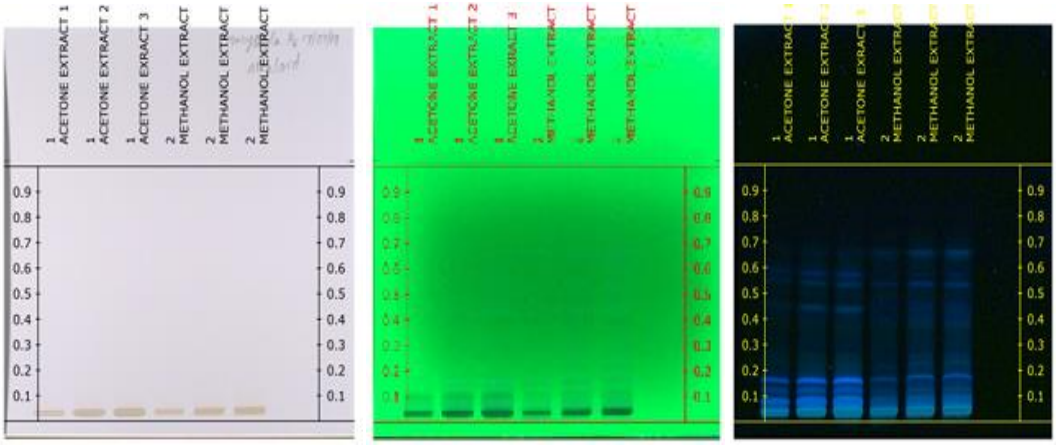

Figure 1: HPTLC fingerprinting profile of *Limonia acidissima L* fruit and *Simarouba glauca DC* for alkaloids after derivatisation

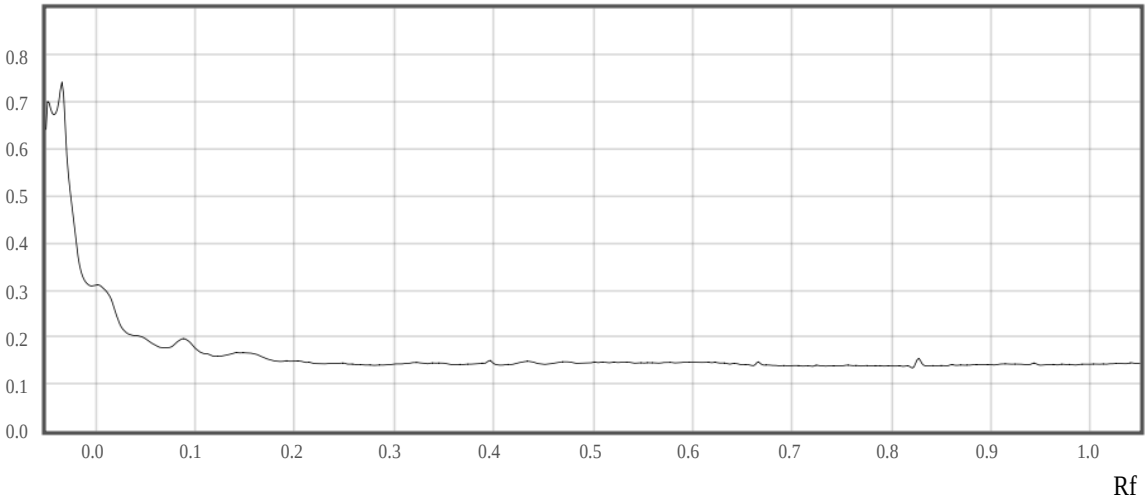

Fig 2: HPTLC – chromatogram of acetone extract of *Limonia acidissima L at* 366 *nm*

The fingerprinting chromatogram of acetone extracts *Limonia acidissima L* fruit at 366 nm is given in the figure 2. It shows five peaks in the range of 0.09, 0.4, 0.69, 0.83 and 0.95 respectively.

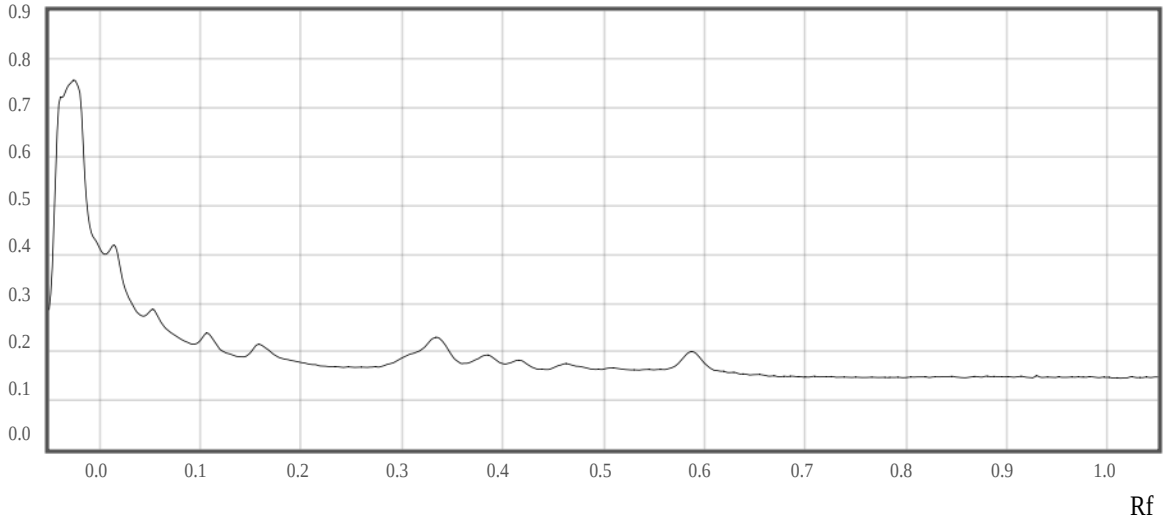

Fig 3: HPTLC – chromatogram of methanol extract of *Simarouba glauca DC* leaf at 366nm

The figure 3 shows the chromatogram of methanol extracts at 366 nm, it shows the 7 peaks in the Rf values ranges from 0.1 to 0.06 respectively.

Table 1: Rf values of *Limonia acidissima L* fruit and leaf extracts of *Simarouba glauca DC*

Peak	Peak area (AU)	Rf
1	0.51	0.09
2	0.3	0.1
3	0.19	0.25
4	0.2	0.33
5	0.43	0.34
6	0.43	0.4
7	0.19	0.45
8	0.19	0.59
9	0.42	0.69
10	0.41	0.83
11	0.19	0.95

IV.CONCLUSION

The study suggests that the acetone extracts of *Limonia acidissima L* fruit and methanol extracts of *Simarouba glauca DC* have several secondary metabolites of medicinal importance and thus justifies medicinal usage. This may be a reason for its better healing property

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SYNTHESIS AND CHARACTERISATION OF SILVER NANOPARTICLES USING A GREEN APPROACH

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ABSTRACT

Nanoparticle synthesis using a green approach is gaining attention nowadays because of the presence of biologically active plant secondary metabolites and also their unique biological applications. This study reports a facile, eco-friendly, reliable, and cost-effective synthesis of silver nanoparticles using the aqueous leaf extract of *Artocarpus altilis (Breadfruit)* and their characterisation. Silver nanoparticles were synthesized using the aqueous leaf extract of *Artocarpus altilis*, which acted as a reducing and capping agent. The biosynthesized *Artocarpus altilis* silver nanoparticles were characterized using different techniques, such as UV–visible spectroscopy, Fourier transform infrared (FTIR) spectroscopy and X-ray diffraction (XRD).

INTRODUCTION

Nanotechnology is one of the most active research areas in modern materials science. Nanoparticles exhibit new or improved properties based on specific characteristics such as size, distribution and morphology[1]. Nanoparticles are of great interest due to their extremely small size and large surface to volume ratio, which lead to both chemical and physical variances in their properties compared to the majority of the same chemical composition.

There have been impressive developments in the field of nanotechnology in the recent past years, with numerous methodologies developed to synthesize nanoparticles of particular shape and size depending on specific requirements. New applications of nanoparticles and nanomaterials are increasing rapidly [2]. In recent years, the development of effective green chemistry methods employing natural reducing, capping, and stabilizing agents to prepare silver nanoparticles with required morphology and size, has become a major focus of researchers[3-4]. Biological methods can be used to synthesize silver nanoparticles without the use of any harsh, toxic and expensive chemical substances. The bio-reduction of metal ions by combinations of biomolecules found in the extracts of certain organisms (e.g.,

enzymes/proteins, amino acids, polysaccharides, and vitamins) are environmentally good but chemically complex[5-6]. Many studies have reported fruitful synthesis of silver nanoparticles using biological organisms such as bacteria and fungi as well as plants [7].

Silver nanoparticles are used for purification and quality management of air, biosensing, imaging, and drug delivery systems. Biologically synthesized silver nanoparticles have many applications like coatings for solar energy absorption and intercalation material for electrical batteries, as optical receptors, as catalysts in chemical reactions, for bio-labelling, and as antimicrobials and also in anticancer therapy[8].

RESULTS AND DISCUSSION MATERIAL AND METHODS

0.01M $AgNO_3$ stock solution,0.001M $AgNO_3$ working solution, Breadfruit (*Artocarpus altilis*) plant leaf extract, Distiller water, Whatman no.1 Filter paper, Magnetic stirrer, Conical flask and beaker.

PREPARATION OF LEAF EXTRACT:

Fresh leaves of Breadfruit (*Artocarpus altilis*) plant were collected and the leaves were properly washed with distilled water, and cut into 1.0 inches size. 25g of leaf was fine chopped into small pieces and shade dried. The dried leaves are then grinded using Mortar and Pestle. After grinding, the leaf was mixed with deionized water in equal volume (1:1) and heated for 45 minutes. Then the extract was filtered through Whatmans filter paper. Then the extract was cooled and was kept at 4 ^{0}C in the refrigerator overnight.

PREPARATION OF METAL SOLUTION:

For 5mM Silver Nitrate solution, 0.084 g Silver Nitrate was dissolved in 100 ml distilled water.

SYNTHESIS OF SILVER NANOPARTICLES:

50 ml of Breadfruit (*Artocarpus altilis*) plant leaf extract was mixed with 50 ml of 5mM aqueous silver nitrate solution in 1:1 proportion and kept at room temperature for 24 hours for the development of reddish brown color. To attain much smaller particles, solution was centrifuged at a rate of 10,000 rpm for 10 minutes and examined supernatant for the synthesized particles. The obtained AgNps were centrifuged at 10,000 rpm for 30 min in order to remove unwanted silver ions and impurities. The process was repeated thrice and extracted AgNps were further subjected to different characterization techniques such as UV-Visible spectroscopy, FTIR and XRD.

Schematic representation of phyto mediated synthesis of Ag NPs

UV-VISIBLE SPECTROSCOPY ANALYSIS

The absorption spectrum of resultant AgNps was recorded between 300-700 nm. The absorption spectrum of brownish red of the colloidal solution showed a surface Plasmon absorption band with the maximum around 400 nm, indicating the presence of spherical or nearly spherical AgNps in the process.

FTIR SPECTRUM ANALYSIS

FT-IR analysis (Tensor-27 -Bruker) was done in the diffuse reflectance mode operated at a resolution of 4 cm-1 in the range of 400 to 4,000 cm-1 for the evaluation of functional groups involved in the synthesis of silver nanoparticles. The IR peaks for AgNPs appeared at 3349, 3063, 2351, 1609, 1441, 1396, 1237 and 1156 cm^{-1}, respectively. The overall data of FTIR analysis confirms the presence of protein and phenol groups in the sample of AgNps.

XRD ANALYSIS

XRD study was done to analyze the crystalline nature and average crystallite domain size. The XRD pattern of AgNps showed a number of Bragg reflections which could be indexed on the basis of the face centered cubic structure of silver. The observed diffraction peak broadening is probably due to the effect of nanosized particles and biological macromolecules of extracts. The XRD pattern of AgNps had shown the diffraction peaks at 38.12, 44.46, 64.8 and 77.5 degrees indicating the presence of (111), (200), (220) and (311) lattice planes as indexed in JCPDS data 04-0783.

CONCLUSION

As green synthesis of nanoparticles is gaining importance, the synthesis and some of the characterisation of silver nanoparticles from Artocarpus altilis is done. As silver nanoparticles are used in a variety of applications our next studies will be concentrating in its further

characterization and biological activities.

ACKNOWLEDGEMENT

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SYNTHESIS OF ACTIVATED CARBON FROM TAPIOCA PEEL (SECOND LAYER) AND ITS CHARACTERIZATION

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Abstract

Tapioca is one of the most important commodities in India, an agricultural country. Tapioca peel is an agricultural waste from the food and starch processing industries. In this study, this solid waste was used as the precursor for activated carbon preparation by thermal carbonization using KOH-activation method. The materials selected were initially physically activated at temperature ranging at 600^0 C in muffle furnace with a holding time of 1 hr and the carbonized material thus obtained was soaked in 1N KOH, in 1:1 ratio for overnight and was followed by physical activation at 300^0 C for 2 hrs in muffle furnace. The properties of the activated carbon were found by FT-IR, TGA/DTA, and SEM. The results shows that the Tapioca peels carbon could be employed as a low cost alternative to commercial activated carbon in the removal of dyes from wastewater.

Key words: Tapioca, industries, activation, activated carbon

INTRODUCTION

Activated carbon is the most popular for the removal of pollutants from wastewater among all the sorbent materials proposed. ACs are carbons of highly micro porous form with both high internal surface area and porosity, and commercially the most common adsorbents used for the removal of organic compounds from air and water streams. They also often serve as catalysts and catalyst supports. Any cheap material, with a high carbon content and low inorganics, can be used as a raw material for the production of AC. agricultural by-products have proved to be promising raw materials for the production of ACs because of their availability at a low price. They can be used for the production of AC with a high adsorption capacity, considerable mechanical strength, and low ash content.

MATERIALS AND METHODS

SYNTHESIS OF ACTIVATED CARBON

The tapioca peel was collected from the nearby Tholayavattam in Kanyakumari District, Tamilnadu, India. Then it was washed thoroughly with water to get rid of dust particles. Then it was dried under the direct sunlight to remove the excess moisture. Then the dried peel was placed in a muffle furnacefor 1 h at 600^0C.After the sample thus obtained were soaked in 1M KOH in 1:1 ratio for 24 hrs followed by weighing the sample in order to know the impregnation of 1M KOH to the sample and is followed by activation in muffle furnace at temperature 300ºC for 2hr. The carbonized material was washed with distilled water to remove the free alkalis and dried at 100±5ºC 2hrs and weighed to calculate the yield.

RESULT AND DISCUSION

FTIR Spectroscopy

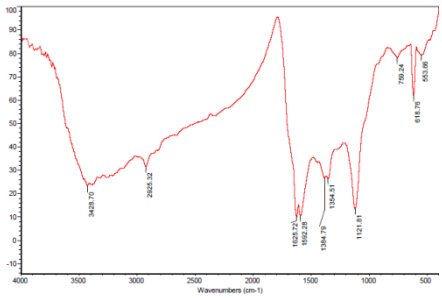

Fig 1: FTIR Spectrum of Activated carbon from Tapioca Peel at 600^{O}C

Characterization using FTIR showed that based on the spectrum it was indicated the presence of OH group stretching at wave number of 3428 cm^{-1} (stretching vibration) with low signal. Similarly, at wave number of 2925 cm-^{1}, it showed C–H bonds of the aromatic ring with moderate intensity. Then the wave numbers of 1625 cm^{-1}showed the C=C bonds of an alkene compound type, while 1592 cm^{-1}showed the C=C bonds of the aromatic ring compound type, this is supported by the presence of C–O at wave number of 1121 cm^{-1}. The absorption band at 1121 cm^{-1} is described to either Si-O or C-O stretching in alcohol, ether or hydroxyl groups. The band at 1121 cm^{-1} can also be associated with ether C-O symmetric and asymmetric stretching vibration (-C-O-C- ring). Peak at 618cm^{-1} are assigned to the out-of-plane C-H bending mode.

Thermogravimetric Analysis

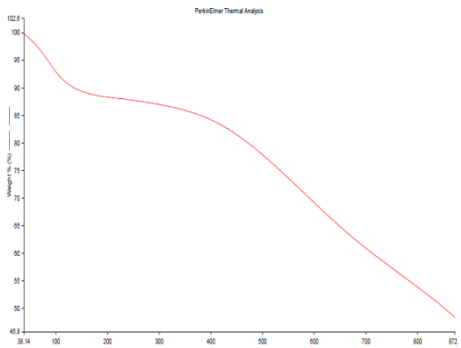

Fig 2: TGA Curves of Activated carbon from Tapioca peel at 600℃

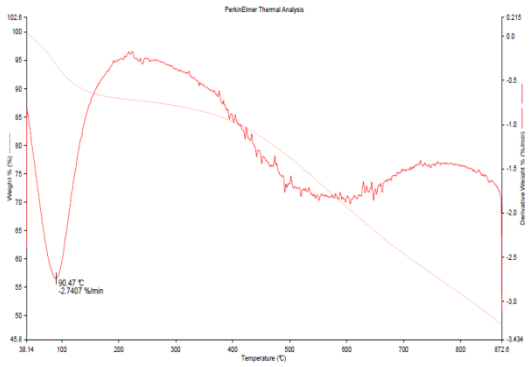

Fig 3: DTA Curves of Activated carbon from Tapioca peelat 600℃

A weight loss of about 45% occurs up to 81.35°C for the sample activated by KOH. It is known that this weight loss is because of water formed from dehydration of KOH. 40% of weight loss, which is rather slow, has occurred between 150 - 430°C. Rate of weight loss has decreased between 440 - 700°C. The reason for the appearance of weight loss in the KOHactivated sample, though it has not been seen for the original sample to the temperature of 440°C, is again because of dehydration of KOH and loss of H. The TGA/DTA values for the adsorbents evaluated are shown in Fig. 5. In all cases, the first endothermic event was due to water loss and the second event was due to loss of mass. The evolution of volatiles as temperature increased resulted in a broad exothermic band.

Scanning Electron Microscopy (SEM)

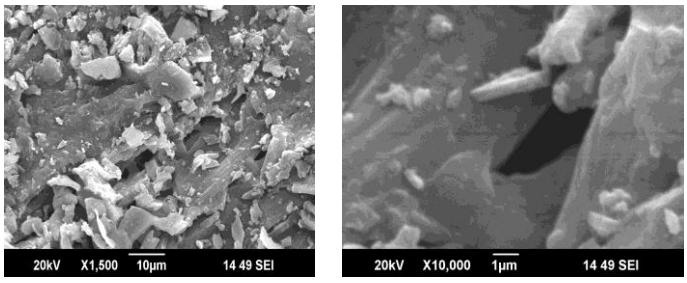

Fig 4: SEM Analysis of Activated carbon from Tapioca peelat 600℃

The surface physical morphology of activated carbon was observed by a scanning electron microscopy (SEM). Clear differences in porosity and particle shape were observed, and

representative images are shown in Fig.7. These differences are very important primarily when adsorbents are applied, since the pores can be selective. May be these micro pores are leaving directly from the surface of the particle.

CONCLUSION

Activated carbon from Tapioca peelwas successfully synthesized and chemically activated by using KOH as activating agent. FT-IR results indicated The adsorption capacity of activated carbon was considerably affected by its surface functional groups. SEM micrograph showed that the adsorbents surface was irregular, rough and highly porous, indicating the possibility of its good adsorption properties.The TGA/DTA values for the adsorbents the first endothermic event was due to water loss and the second event was due to loss of mass. It's revealed that the agricultural waste of Tapioca peel AC were used as low-cost alternatives in wastewater treatment and the data reported here should be useful for the design and fabrication of an economically viable treatment process using batch (or) stirred tank reactors.Due to the presence of high surface area, porosity, decolorizing power the activated carbon prepared from the agricultural waste Tapioca peel, can be used for a variety of environmental application, dye removal, wastewater treatment and adsorption process too.

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SYNTHESIS AND CHARACTERIZATION OF QUINOLINE SCHIFF BASE DERIVATIVES

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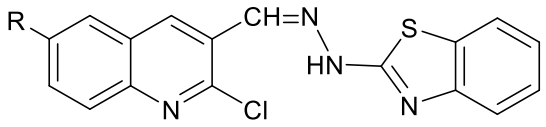
Abstract: A series of N-Benzothiazol-2-yl-N'-(2-chloroquinolin-3-ylmethylene)-hydrazine (**3a-d**) Schiff bases were synthesised by the refluxing of the versatile compound 2-chloro-quinoline-3-carbaldehyde **(1a-d)** and 2-hydrazinobenzthiazole in methanol. The reaction is completed in 4-4.5 hrs with 74-85 % yields. Their structures were confirmed by IR, ^{1}H NMR, MS spectra and elemental analysis.

1. Introduction:

Heterocyclic compounds have great applicability in pharmaceutics because they have specific chemical reactivity and provide false synthons in biosynthetic process or block the normal functioning of biological receptors.[1] Most of the alkaloids, pigments (such as indigo, haemoglobin, anthocyanin etc.) some well-known drugs (like penicillin, streptomycin, sulphathiazole, pyrenthrin, rotenmone, strychnine, reserpine etc.) consists of heterocyclic ring system. Many workers have reported the application of heterocyclic compounds for the two decades. Maximum of these compounds have been using in the pharmaceutical field.[2,3] Among the heterocyclic compounds, quinoline and their derivatives are receiving increasing importance due to their wide range of biological and pharmacological activities.[4] Particularly, making of schiff base compounds, the condensation products of an amine and a ketone or aldehyde, are very effective tool in medicinal field.[5-9] The greatest advantage of many Schiff base compounds is that they can be conventionally and easily synthesized from relatively simple methodology.

We hereby report the synthesis of *N*-Benzothiazol-2-yl-*N*'-(2-chloroquinolin-3-ylmethylene)-hydrazine **(3a-d)** and characterization have been studied.



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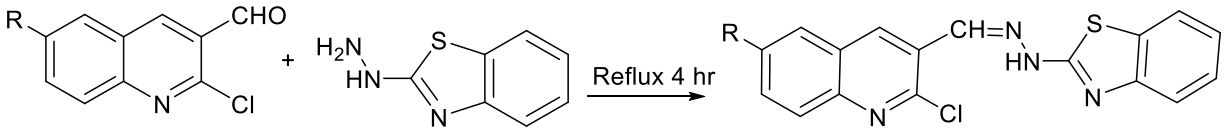
2. Results and discussion

2.1 Synthesis of *N*-Benzothiazol-2-yl-*N*'-(2-chloroquinolin-3-ylmethylene)-hydrazine

Substituted 2-chloro-quinoline-3-carbaldehyde **(1b)** (0.0205 g, 0.1 mole) was dissolved in methanol and 2-hydrazinobenzthiazole **(2)** (0.0165g, 0.01mole) was also dissolved using methanol and mixed each other by portion-wise with stirring. The resulting mixture was refluxed at 60˚C for four hours and cooled down the mixture to room temperature. The separated solid was filtered and recrystallized from the mixture of chloroform and methanol. Finally, we received the desired product. The IR spectrum of the **(3b)** the sharp peak at 1620 cm^{-1} attributed to nitrile –CN. The peak at 740 cm^{-1} indicates the aromatic CH bonds. (800-900 cm^{-1}) for C-Cl. Disappearance of 1688 cm-1 peak is confirmed the formation of the product. The NMR spectra of **(3b)** shows that 1.2 ppm for (CH=N), 7.0 To 8.5 ppm for aromatic C-H Bonds, 2.47 ppm for methyl proton. Calculated molecular weight of the compound **(3b)** is confirmed by the sharp peak in mass spectrum at 353.



1a-d **2** **3a-d**

R = a) H b) CH_3 c) Cl d) NO_2

3. Experimental

N-Benzothiazol-2-yl-N'-(2-chloro-quinolin-3-ylmethylene)-hydrazine (3a)

Yield : 82%; mp : >270 ^{o}CIR (KBr, ν_{max} cm^{-1}) : 2360,1550,1049, 906, 748; ^{1}HNMR (DMSO-d_6)(δ_{max} ppm): 7.1 to 8.3 (m, 8H, aromatic protons), 8.52 (s, 1H, C**H**=N), 8.9 (s, 1H, C_4-H)12.6 (bs,

1H, NH). Anal. Cacld.for $C_{17}H_{11}ClN_4S$. C, 60.27; H, 3.27; Cl, 10.46; N, 16.54; S, 9.46. Found : C, 59.98; H, 3.16; Cl, 10.22; N, 15.94; S, 9.02.

***N*-Benzothiazol-2-yl-*N*'-(2-chloro-6-methylquinolin-3-ylmethylene)-hydrazine (3b)**

Yield : 85%; mp : >270 ºC; IR (KBr, ν_{max} cm^{-1}) : 2306,1543,1056, 887, 741; ^{1}HNMR (DMSO-d_6)(δ_{max} ppm): 2.5 (s, 3H, CH_3-)7.1 to 8.3 (m, 7H, aromatic protons), 8.5 (s, 1H, C**H**=N), 8.7 (s, 1H, C_4-H), 12.6 (bs, 1H, NH). MS (*m/e*): 353 (M+1) Anal. Cacld.for $C_{18}H_{13}ClN_4S$. C, 61.27; H, 3.71; Cl, 10.05; N, 15.88; S, 9.09. Found : C, 60.92; H, 3.61; Cl, 10.02; N, 15.72; S, 9.02.

***N*-Benzothiazol-2-yl-*N*'-(2,6-dichloro-quinolin-3-ylmethylene)-hydrazine (3c)**

Yield : 78%; mp : >270 ºC; IR (KBr, ν_{max} cm^{-1}) : 2314,1548,1052, 888, 746; ^{1}HNMR (DMSO-d_6)(δ_{max} ppm): 7.1 to 8.3 (m, 7H, aromatic protons), 8.6 (s, 1H, C**H**=N), 8.9 (s, 1H, C_4-H), 12.6 (bs, 1H, NH). Anal. Cacld.for $C_{17}H_{10}Cl_2N_4S$. C, 54.70; H, 2.70; Cl, 19.00; N, 15.01; S, 8.59. Found : C, 54.68; H, 2.61; Cl, 18.92; N, 14.92; S, 8.52.

Synthesis of *N*-Benzothiazol-2-yl-*N*'-(2-chloro-6nitro-quinolin-3-ylmethylene)-hydrazine (3d)

Yield : 74%; mp : >270 ºC; IR (KBr, ν_{max} cm^{-1}) : 2321,1553,1056, 884, 748; ^{1}HNMR (DMSO-d_6)(δ_{max} ppm): 7.1 to 8.3 (m, 7H, aromatic protons), 8.6 (s, 1H, C**H**=N), 8.9 (s, 1H, C_4-H), 12.6 (bs, 1H, NH). Anal. Cacld.for $C17H10ClN_5O_2S$. C, 53.20; H, 2.63; Cl, 9.24; N, 18.25; O, 8.34; S, 8.35. Found : C, 52.98; H, 2.61; Cl, 9.16; N, 18.02; S, 8.22.

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COMPARATIVE STUDY OF ADSORPTION CAPACITY OF VIRGIN AND MODIFIED CHITOSAN IN THE REMOVAL OF HEAVY METAL ZINC

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ABSTRACT

Chitosan a natural bio polymer composed of a linear poly saccharide of (1-4) –linked 2-amino 2-deoxy B-D glucopyranose which is one of the major structural elements, that forms the exoskeleton of crustacean shrimps. The present study focuses the adsorption capacity of virgin Chitosan and modified chitosan in the removal of heavy metal Zinc. EDAX to find the elemental analyses. The removal efficiencies dependent on their initial concentration, contact time, pH, temperature and the quantity of adsorbents. The synthesized adsorbents are characterized by SEM and EDAX. The maximum percentage of Zinc removal by using chitosan, chitosan Fe_3O_4 nanoparticles 90%, 95% respectively

Introduction

Aqueous solution with heavy metals represents an important environmental Problem, due to their toxic effect and accumulation tendency through food chains. Among heavy metals, lead (II) and Zn (II) are highly noticeable and should be removed from aqueous environments-[1,2]. Zinc exposures causes depression, lethargy; neurological signs and increased thirst. [3]

Chitosan, a biodegradable and biocompatible polymer is a modified natural carbohydrate and the second most abundant polysaccharide in nature. It can be synthesized by the partial N-deacetylation of chitin, a natural biopolymer derived from crustacean shells such as crabs, shrimps and lobsters. [4] The present study focuses on removing heavy metal such us Zinc by using chitosan and chitosan Fe_3O_4 nanoparticles.

Materials and methods

Preparation of chitosan – Fe_3O_4 Nanoparticles

Chitosan was synthesized by demineralization, deproteination and deacetylation of Chitin. About 200 mg of 85% deacetylated chitosan Powder and Iron oxide were made in to a gel using 2-5 ml of

formaldehyde. The mixture was stirred using magnetic stirrer for about 1 hour. Finally chitosan encapsulated Iron oxide nanoparticles obtained.

SEM/EDAX Analysis

Surface morphology was studied with an electron microscope. Chitosan, chitosan – Fe_3O_4 Nanoparticles was examined by scanning electron microscopy (SEM) having a magnification range of 5000 and accelerating voltage 20 KV and EDAX to detect the elements.

Batch mode Adsorption studies

The adsorption of heavy metals on chitosan and chitosan Fe_3O_4 was studied by batch equilibrium studies.

A known weight of chitosan, chitosan Fe_3O_4 nanoparticles adsorbent was equilibrated with 100ml of the heavy metal (Zn) solution of known concentration (10, 20, 30, 40, 50, 60ppm) in-6 stoppered borosil glass flask at a fixed temperature in a orbital shaker for a known period of time. After equilibration the sample was filtered using whatman No.1 filter paper.

The effect of several parameters such as P^H, Concentration and adsorbent dose on the adsorption was studied.

Metal ion removal (%) = $(C_0\text{-}C_e/C_0)X100$

C_0-initial metal ion concentration of test solution mg/l

C_e-final equilibrium Conc.of test soln, mg/I

Results and Discussion

The scanning Election Microscope (SEM) images shown in Fig 1(a), and 1(b) shows the nature of the modified adsorbent before and after adsorption. Fig 1(a) shows unoccupied pores on the adsorbent before adsorption while Fig 1(b) shows the morphology of the adsorbent after the loading of Zn (II) ions. Fig 1(b) shows the outer pores are covered by Zn (II) ions.

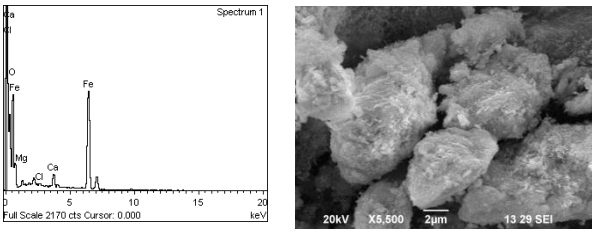

Fig 1a EDAX /SEM Image of before adsorption

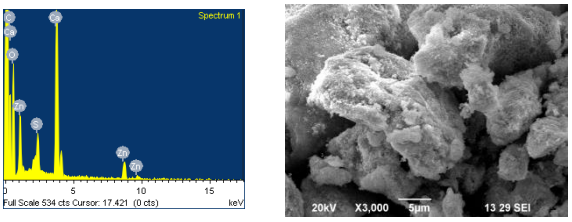

Fig 1b EDAX /SEM Image of after adsorption

Effect of initial metal ion concentration

The initial concentration of metal ions in aqueous solutions affected on metal adsorption. In the present study the initial metal conventrations from 10 to 60mg/l have affected both chitosan and chitosan Fe_3O_4 nanoparticlesadsorbent. Fig(2) shows that when the initial metal concentration increased, the percentage adsorption of heavy metals decreased. This could be attributed to the metal particle size used in

the experiment, and the lowest adsorption metals was observed with a high initial concentration of metals. At high concentrations the competitive dispersion of metal ions has increased at the sites available adsorbent surface; these pores are closed and metal ions are prevented from passing deep in to the adsorbent pores, which means that adsorption occurs only on the surface. The maximum percentage of Zinc removal by using chitosan, chitosan Fe_3O_4 nanoparticles 90%, 95% respectively

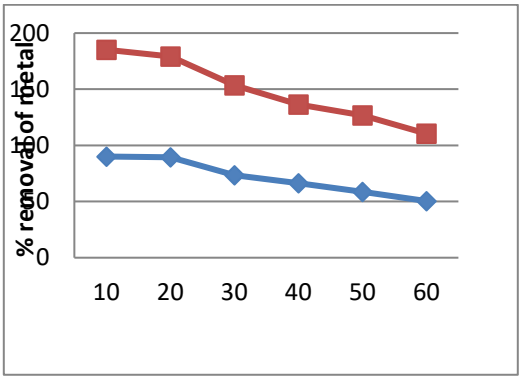

Fig 5 Effect of Concentration on Adsorption of Zinc

Conclusions

The present investigation is carried out to study the suitability of novel chitosan chitosan - Fe_3O_4 nanoparticles for theremoval of heavy metal Zinc from the waste water.Influence of process parameters such as PH, adsorbent dosage, initial metal ion concentration were at moderate levels such that they can affect the removal efficiencies of the heavy metals were concerned. EDAX to find the elemental analyses. The maximum percentage of Zinc removal by using chitosan, chitosan Fe_3O_4 nanoparticles 90%, 95% respectively

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COMPARISON OF XRD PATTERNS OF IRON OXIDE NANOPARTICLES OBTAINED FROM A FEW MEDICINAL PLANT EXTRACTS AND SEM CHARACTERIZATION OF CHITOSAN IRON OXIDE NANOCOMPOSITE

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Abstract

Iron oxide nanoparticles have been synthesized in a green method using some medicinal plant extracts. Most of the medicinal plant extracts contain important constituents likealkaloids, glycosides, organic acids, resins, volatile oils, sugars, amino acids, proteins and enzymes, tannins, plant pigments oils and waxes, and inorganic ingredients. These constituents present in plants help in reducing metal salts to their corresponding nano particles. In the present study some of the medicinal plants likeAcalypha indica, Euphorbia hirta, Cleome viscosa, Cassia occidentalis and Ecbolium lingustrinum were collected, shade dried and extracted using ethyl alcohol. These extracts were used to reduce anhydrous iron (III) chloride to iron oxide nanoparticles. The resulting iron oxide nanoparticles were characterized using XRD spectrum. The results shows the formation of iron oxide nanoparticles. All the XRD peaks were found to be sharp which indicates the crystalline nature of the iron oxide nanoparticles. The SEM images of nanochitosan and iron oxide doped chitosan were recorded. The average particlesize of the chitosan and iron oxide doped chitosan nanoparticles lie between 1μm to 2 μm.

Key words

Nanoparticles, green method, resins, metal salts, *Euphorbia hirta.*

Introduction

Particles ranging in size from 1 – 100 nm are called as nanoparticles. The difference in physical and chemical properties of nanoparticles is because of the significant number of particles at the surface. They form a bridge between bulk materials and molecular sized particles.Plants during their growth process undergo a series of metabolic and biochemical process which decides

their chemical composition. Different parts and different species of plant extracts vary in chemical composition.

The leaves of the plants contain alkaloids, flavonoids, reducing sugars, phenols and also showed presence of amino acids and physiological activities [1].Metal/ metal oxide nano-particles can be synthesized in an environmentally friendly method by using medicinal plant extracts. Usage of harsh and toxic reducing chemicals which pollute the environment can be avoided by using naturally available cheap medicinal plant extracts. This is one of the implementations of green Chemistry principles [2, 3].

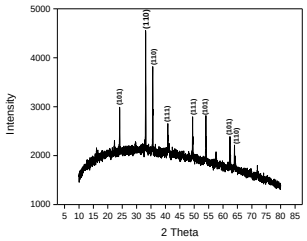
Materials and methods

Medicinal plants for the present study were collected from Kurusady Village, Nagercoil, and Tamilnadu. The plants selected were *Acalypha indica, Cassia occidentalis, Cleome viscose, Ecbolium ligustrinum, Euphorbia hirta*. Fresh and healthy plants free from contamination were collected, washed thoroughly in water and allowed to drain and shade dried. Only the leaves of the plants were taken for the study. The dried leaves were powdered and extracted using soxhlet extracter using ethyl alcohol as the solvent. Anhydrous Ferric (III) chloride salt was purchased from Merck. 20g of Ferric (III) chloride was mixed with 25ml of *Acalypha indica, Cassia occidentalis, Cleome viscosa, Ecbolium ligustrinum, Euphorbia hirta* respectively. The resulting solution was heated to 80^{o}C with continuous stirring in a magnetic stirrer for one hour and thirty minutes. The iron oxide nanoparticles formed were centrifuged calcined at 800^{0}C, dried and packed in an air tight container.The formation of nanoparticles were confirmed using XRD and SEM techniques.

Results and discussion

The XRD patterns of the iron oxide nanoparticles synthesised using various plant extracts are shown in figures 1,2,3,4 and 5. The sharp XRD patterns shows that the iron oxide nanoparticles synthesised using various sources are crystalline in nature. The interplanar distances are found to be 67.0106, 79.5944, 79.5944, 63.8993, 67.4952nm respectively for nanoparticles synthesised using *Euphorbia hirta, Cassia occidentalis, Ecbolium ligustrinum, Acalypha indica, Cleome viscosa extracts*. The XRD pattern shows peaks with d_{hkl} values at (111),(311), (101) and (332). The

values shows that Fe_3O_4 crystals possess magnetite structure. It can also be concluded that all the five plant extracts can be used as green reagents for the synthesis of iron oxide nanoparticles.



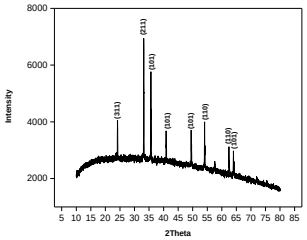


Fig. 1 XRD spectrum of iron oxide (*Euphorbia hirta)*Fig.2: XRD spectrum of iron oxide (Cassiaoccidentalis)

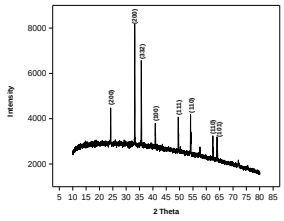


Fig.3: XRD spectrum of iron oxideFig.4: XRD spectrum of iron oxide*(Acalypha (Ecbolium lingustrinum) indica)*

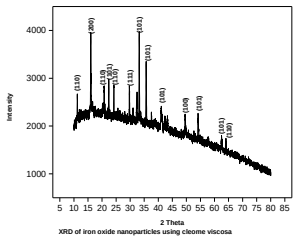


Fig.5: XRD spectrum of iron oxide (*Cleome viscosa)*

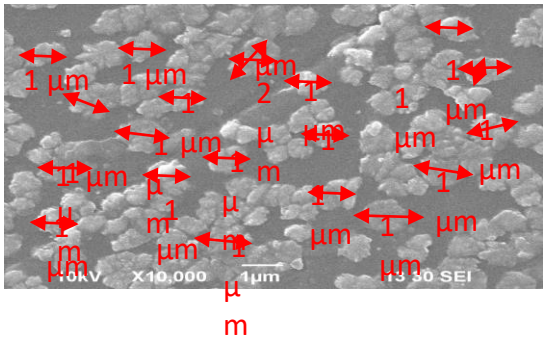


Fig.6 SEM image of chitosan

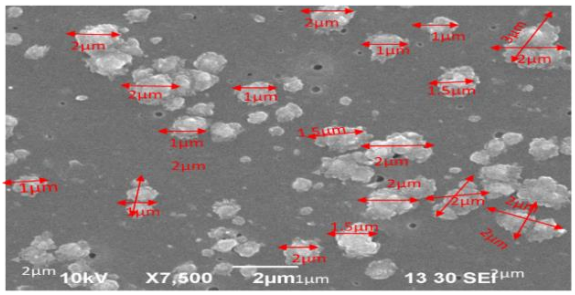


Fig.7 SEM image of iron oxide doped chitosan

Figures 6 and 7 show the SEM images of nanochitosan and iron oxide doped chitosan. The size of the particles are found to be inbetween 1 to 2µm.

Conclusion

Iron oxide nanoparticles are synthesised using medicinal plant extracts as green reducing agents from Iron (III) chloride.*XRD patterns of the nanoparticles shows that* all the five plant extracts*Euphorbia hirta, Cassia occidentalis,Ecbolium ligustrinum,Acalypha indica, Cleome viscosa extracts* are found to be good reducing agents. The nanoparticles synthesised are crystalline in nature. The SEM images shows that the particle size of the nanoparticles lie between 1 to 2 µm.

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PHYTOCHEMICAL SCREENING, ANTIBACTERIAL ACTIVITY ACTIVITY OF *Pisidium guajava L.*

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Abstract

Plants have been used for medicinal purpose from ancient times. Among many countries, India is one of the richest ancient repositories of medicinal plants. From the time of immortal Medicinal plants are used in treatment of many diseases, they are considered safe and effective. In this study we analyzed 'Pisidium guajava L.' plant phytochemical activity with various solvents, antibacterial and antioxidant activity against **Staphylococcus aureus, Escherichia coli, Klebsiella pneumoniae, Pseudomonas**. Psidium guajava L. have a significant antibacterial activity against both gram positive and gram negative bacteria.

Key words: psidium guajava L., Staphylococcus aureus, Escherichia coli, Klebsiella pneumoniae, Pseudomonas.

Introduction

Medicinal plants are the 'back bone' of traditional remedy plants have been a rich source of drugs because they produce wide array of bioactive molecule most of which probably evolved as chemical defense against predation or infection. Herbs are widely exploited in the traditional medicine and their curative potentials are well documented. Antibacterial active principle isolated from higher plants is appeared to be one of the important alternative approaches to contain antibiotic resistance and the management of disease. The constituents of *guava* include vitamins, tannins, phenolic compounds, flavonoids, essential oils, sesquiterpene alcohols and tri terpenoid acids. Some of the therapeutic activities of *guava* leaf extract are analgesic, anti-inflammatory, anti-microbial, hepatoprotective and anti-oxidant, due to the presence of phenolic group.

General Characters Of *Psidium Guajava. L*

The plant has a wide spreading network of branches. Mostly its branches are curved which display opposite leaves with the small petioles of about 3 to 16 cm. The leaves are wide and clear green in color and have clear and prominent veins [5,6]. The plant produces white flowers with incurved petals having a nice fragrant. Flowers have four to six petals and yellow colored anthers and

pollination occurs by the insects. Guava fruit ranges from small to medium sized with 3 to 6 cm length. It has pear like shape and yellow color in ripen condition. It has a musky special odor when ripened which is strong but pleasant. Its pulp is slightly darker in color which contains slightly yellowish seeds. The size of seeds is very small and they are easily chewable. The guava bark is thin and has green colored spots.

Scientific Classification Of *Psidium Guajava. L*

Kingdom	:	Plantae	Family	:	Myrtaceae
Clade	:	Angiosperms	Genus	:	Psidium
Order	:	Myrtales	Species	:	P. guajava .L

Medicinal Uses Of *Guajava*

Pisidium guajava L. is consumed not only as food but also as folk medicine in subtropical areas all over the world due to its pharmacologic activities. Medicinal plants find a very important place in medical systems almost in the entire world.

It is well known that guava is frequently employed in numerous parts of the world for the cure of a lot of sickness like diarrhea, reducing fever, dysentery, gastroenteritis, hypertension, diabetes, caries, pain relief and wounds. It's also used as food and in the preparation of food products. It is also used in house construction and toys making.

Guava contains high content of organic and inorganic compounds like secondary metabolites e.g. antioxidant, polyphenols, antiviral compounds and anti-inflammatory compounds. Guava has a lot of compounds which have anti cancerous activities. It has a number of vitamins and minerals.

Phenolic compounds like flavonoids also find an important place in the guava. Lycopene and flavonoids are important antioxidants. They help in the cure of cancerous cells and help to prevent skin aging before time. Guava can affect the myocardium inotropism. Guava skin extract Can Control Level Of Diabetes After 21 Days Treatment.

Materials And Methods

Collection of plant material:

The fresh and tender leaves of *Psidium guajava L.* is collected, dried in shade under room temperature for six to ten days and then crushed into coarse powdery substance using mortar and pestle. The powdery substance was dried again and sieved to get fine powder using the fine plastic sieve, which was then stored in an air tight bottle in the laboratory until required. The sample for the study was collected from our surroundings.

Preparation of solvent extract:

The dried plant material was pulverized into fine powder using a grinder. About 50g of powdered material was extracted with 250ml of solvents such as acetone, ethanol, methanol and distilled water. They were placed in shaker for 3 days, and the extract was collected from the conical flask by filtration. Then the plant extract kept in a water bath at 60°C to evaporate the solvent from the solution. The container was allowed to air tight for 72 hours and filtrate thus obtained was concentrated using a vacuum operation and stored in reagent bottle.

Phytochemical Analysis:

Freshly prepared extract of the powdered leaves was subjected to phytochemical analysis to find the presence of the following Phyto constituents such as flavonoids, alkaloids, carbohydrates, tannins, saponins, steroids, proteins, amino acid, terpenoids by standard methods. The sample were tested for the presence of various Phytochemicals.

Test for alkaloid

To 1 ml of the filtrate, a drop of Mayer's reagent was added along the side of the test tube. The test solution was observed for the presence of black or green precipitate.

Test for tannin

1 ml of sample was taken and 1 ml of ferric chloride was added. The test solution was then observed for the presence of black or green precipitate.

Test for saponin

2 ml of extract was added to 5 ml distilled water and shaken vigorously for a stable per resistant broth. The brothing was mixed with 3 drops of olive oil and shaken vigorously and observed for the formation of emulsion.

Test for carbohydrate

1 ml of the extract was treated with 2-3 drops of 1% alcoholic alpha-naphthol and 2 ml concentrated sulphuric acid. This was added along the sides of the test tube. (Violet ring at the junction of two layers).

Test for terpenoids

5 ml of the sample was mixed with 2 ml of chloroform and concentrated sulphuric acid was added to form layer, it was observed for the formation of reddish-brown coloration at the inter phase.

Test for flavonoids

5 ml dilute ammonia solution were added to a protein of the aqueous filtrate of each sample followed by addition of concentrated sulphuric acid. It was observed for the formation of yellow coloration.

Test for steroids

1 ml of aqueous extract was dissolved in 10 ml of chloroform and equal volume of concentrated sulphuric acid was added sides of the test tube. The upper turns red a sulphuric acid layer showed yellow with green fluorescence. This indicates the presence of steroids.

Test for amino acids

1 ml of extract was treated with few drops of Ninhydrin reagent. Appearance of purple color shows the presence of amino acids.

Test for phenols

1 ml of each extract was dissolved in water or separately with a few ml of neutral ferric chloride solution. Any change in color indicated the presence of phenolic compounds.

Test for protein

1 ml of dilute extract, 1 ml of 5% copper sulphate and 1% sodium hydroxide was added. Formation of deep color blue and confirmed the presence of protein.

Thin Layer Chromatography

The thin layer chromatography (TLC) is widely used separation techniques and is the simplest and cheapest method to isolate and analyze mixture of plant compounds.

Procedure:

Silica gel is prepared by mixing 20mg of silica gel in 50 ml of methanol and chloroform in the ratio 2:1. This slurry, the stationary phase is coated as the thin layer on TLC plates. Then the plates were air dried.

Sample application:

0.5 µl of sample was applied to the dried plates by means of capillary tube. The spot should be generally placed above 1.5 cm from bottom edges of the plate.

Plate development:

The solvent which is the mobile phase (Toluene, Ethyl acetate, Chloroform) was taken in a TLC chamber. It was closed with a glass plate and strand for an hour. After saturation, the TLC plates with the sample is placed vertically on the tank it should be noted that the sample spot should not touch the solvent. Then the tank was covered again and the set up was kept about 4-5 hrs., until the mobile phase travels more than ¾ of the plate. Then solvent print was immediately

marked and allowed to air dry. After drying plate was kept in a chamber containing iodine till the brown spots develops.

Panel of Microorganisms:

A board of organisms comprising 1 gram-positive bacteria (*Staphylococcus aureus)* and 3 gram-negative bacteria (*Escherichia coli, Klebsiella pneumoniae, Pseudomonas*) was selected to test the guava extracts ability to inhibit the growth.

Antibacterial Activity

Antibacterial susceptibility testing was done using the well-diffusion method according to the National Committee for Clinical Laboratory Standards. The plant extracts were tested on Muller Hinton II plates to detect the presence of antibacterial activity. Prior to pouring the medium, 1 ml bacterial culture was added to each plate. 5 mm diameter wells were punched into the medium using a sterile borer. The plates are allowed 3 to 5 min to dry the excess moisture. Fifty µL aliquots of each test extract was dispensed into each well after the inoculation of the plates with bacteria. For each bacterial strain, controls were maintained where pure solvents were maintained instead of the extract. The plates are placed in the incubator set to 37°C. A ruler was used to measure the inhibition zones in millimeters.

Result and Discussion

Phytochemical screening of leaf extracts:

Acetone, ethanol, methanol and distilled water extracts were subjected for qualitative phytochemical analysis. Leaf extracts of *Psidium guajava L*. were tested forphytochemical analysis such as alkaloids, tannin, saponin,carbohydrate, terpenoids, flavonoids, steroids, amino acids, phenols, proteins.

Qualitative analysis of *Psidium guajava L.*

Fresh leaf extract of *Psidium guajava L*. have revealed the presence of alkaloids, tannin, saponin, carbohydrate, terpenoids, steroids, phenols, proteins. The compound aminoacid is absent in all the four extracts. Ethanolic extract is absent in saponin, amino acid and protein compounds. Acetone is only present in alkaloids. Methanolic extract lack the presence of alkaloids, flavonoids and amino acid. Distilled water extract revealed the presence of saponin, tannin, carbohydrate, phenols. (Table 1 & Fig 1) shows the summarized phytochemical screening of chemical constituents of *Psidium guajava L*. extract under study on qualitative basis.

S. No	Phytochemical	Ethanc	Methanc	Aceton	water
1	Alkaloids	+	-	+	-
2	Tannin	+	+	-	+
3	Saponin	-	+	-	+
4	Carbohydrate	+	+	-	+
5	Terpenoids	+	+	-	-
6	Flavonoids	+	-	-	-
7	Phenol	+	+	-	+
8	Amino acid	-	-	-	-
9	Protein	-	+	-	-
10	Steroids	+	+	-	-

Table: 1 Phytochemical analysis of *Psidium guajava L.* (+) Present (-) Absent

Thin layer chromatography

Thin layer chromatography in *Psidium guajava L.* results in Identification of single band in all the four extract such as acetone, ethanol, methanol and distilled water with Rf values of 2.5, 2.3, 1.8, 1.4 (Table: 2) **Rf values of different extracts of *Psidium guajava L*.**

S.No	Plant	Solvent extract	No. of spots	Color of the spots	Rf Value
1	Psidium guajava L.	Ethanol	1	Green	2.5
2		Methanol	1	Green	2.3
3		Acetone	1	Green	1.8
4		water	1	green	1.4

Table: 2 Thin layer chromatography

The Rf value can be calculated by the given formula,

$$Rf = \frac{Distance\ travelled\ by\ the\ solute}{Distance\ travelled\ by\ the\ solvent}$$

Antibacterial activity of *Psidium guajava L.*

The extract of *Psidium guajava L.* was screened for their antibacterial activity against different strains of bacteria such as (*E.coli*, *Staphylococcus*, *Pseudomonas*, *Klebsiella*). The antibacterial activity was shown in the form of zone of inhibition as given in (Table 3 & Fig 1).

Methanolic extract of *Psidium guajava L.* exhibit (9mm) strong activity against *E.coli and Klebsiella*. Ethanolic extract exhibit (9mm) strong activity against *Staphylococcus*. Acetone extract of *Psidium guajava L.* exhibit (6mm) moderate activity against *Pseudomonas*. Distilled water extract of *Psidium guajava L.* was poorly resistant to all the selected bacteria. The antibacterial study reveals that all the four extract is highly resistant to gram-negative bacteria (*E. coli, Klebsiella, Pseudomonas*).

Microorganism	Zone of inhibition in (mm)			
	Ethanol	Methanol	Acetone	Water
Staphylococcus	9	6	4	3
Pseudomonas	7	7	6	3
Klebsiella	8	9	5	4
E.coli	7	9	5	4

Table: 3 Antibacterial activity of *Psidium guajava L.*

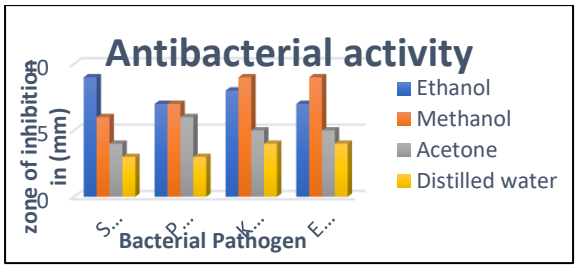

Fig 1: Antibacterial activity of *Psidium guajava L.*

Summary and Conclusion

Medicinal plants are the 'back bone' of traditional remedy. Plants have been a rich source of drugs because they produce wide array of bioactive molecule, most of which probably evolved as chemical defense against predation or infection (Sarkars*et al*., 2013). Herbs are widely exploited in the traditional medicine and their curative potentials are well documented.

Psidium guajava L. is a folk medicine in subtropical areas all over the world due to its pharmacologic activities. Guava leaves are used as an herbal tea and the leaf extract as a supplement. Guava is highly for the treatment of blood pressure, hypertension and heart disease. Guava contain adequate fiber and hypoglycemic in nature which helps to control cholesterol levels and blood pressure. It also contains vitamin A, vitamin C, folic acid, potassium, copper, manganese, fibre etc.

In order to reveal such property, the present work was focused on phytochemical screening, thin layer chromatography and antibacterial activity.

The above-mentioned assays showed the characteristic results and the obtained results were shown in the form of tables and figures.

Phytochemical screening of plant sample showed the presence and absence of phytochemical such as alkaloids, tannin, saponin, carbohydrate, terpenoids, flavonoids, phenol, amino acid, protein, steroids in ethanol, methanol, acetone and distilled water.

The antibacterial activity was assessed against four bacterial strains *E.coli, Pseudomonas, Staphylococcus, Klebsiella* species and generated by inoculating a loopful of culture in separate 100 ml nutrient broth and incubating in shaker at 37°C over night. Then organisms were seeded in Muller Hinton agar plates. Chloramphenicol antibiotic disc was used as control against all the four organisms.

In the present study it was found that *staphylococcus, klebsiella, E.coli* are highly sensitive to methanol and ethanol and poorly sensitive to distilled water. *Pseudomonas, staphylococcus, E.coli and klebsiella* are moderately sensitive to acetone. Methanol extract has better resistance zone in all the organism. This study indicates acetone, ethanol and methanol of *Psidium guajava L*. has showed maximum activity when compared to distilled water extract.

We conclude that the *Psidium guajava L*. have a significant antibacterial activity against gram-positive and gram-negative bacteria. The demonstration of antibacterial activity may help to discover new chemical class of antibiotic substance that could show a sensitive against infectious disease and chemotherapy control.

The TLC analysis of leaf powder extract of *Psidium guajava L*. can be used as a diagnostic tool for the correct identification of the plant and it is useful as a phytochemical marker and also a good estimator of genetic variability in plant populations. The present study reveals that the guava contains various pigments which can be screened and further investigated to study the anticancer and anti-inflammatory effects.

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EFFECT OF pH MODULATION ON HYDROXY PROPYL ALPHA CYCLODEXTRIN COMPLEXATION WITH STIGMASTEROL

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Abstract

Stigmasterol is a phytosterol having high pharmacological property used in the treatment of various ailments including cancer. Its efficacy is restricted due to it's low aqueous solubility. To enhance the aqueous solubility of stigmasterol, inclusion complex with Hydroxy Propyl α-cyclodextrin (HPα-CD) is carried out at different pH ~ 4,6,7 and 9. This research work investigates the appropriate pH for the formation of stable inclusion complex between stigmasterol and HPα-CD. The liquid inclusion complexes at varied concentration in different pH medium were prepared and characterized using UV-Vis spectroscopy.The calculated stability constants are found to be 692, 651,553 and 443 M^{-1} at pH 4, 6, 7 and 9 respectively byBenesi-Hilderbrand equation. From the stability constants it is clear that pH~4 is favorable for stigmasterol:HPα-CD inclusion complex and this enhances solubility.

Introduction

Stigmasterol is an unsaturated phytosterol and is found in many vegetables, including legumes, nuts, seeds, herbs, and edible oils(1). Stigmasterol inhibits the survival of human umbilical vein endothelial cells (HUVECs) and iPSC-derived cardiomyocytes (2). Stigmasterol suppresses the development of various cancers(3). Hence stigmasterol is potent bioactive agent with significant therapeutic efficacy. This documented effectiveness of stigmasterol is restricted due to its chalky taste and poor solubility. To overcome this problem stigmasterol may be complexed with different compounds which would enhance their physicochemical properties.Cyclodextrins(CD's) are cyclic oligomersobtained by enzymatic transformer of starchThey are crystalline, homogeneous and nonhygroscopic substances which are torus – like macro – rings(4). This peculiar structure allows various substrates to be included in the cavity via non covalent bonds to form inclusion complexes. Interactions between CDs and guest molecules are accompanied by pH adjustments.

1. Materials and Methods

1.1. Preparation of liquid inclusion complex of Stigmasterol and HPα-CD

About 0.0089g of stigmasterol is accurately weighed and dissolved in 10ml solution maintained at pH~4. About 0.043g of HP α-CD is dissolved in 30ml of distilled water in a 250 ml beaker. Liquid inclusion complexes were synthesised by varying the concentration of HPα-CD and stigmasterol from $2x10^{-3}$M to $1x10^{-3}$M. Similarly for pH~6,7,9 stigmasterol was dissolved in respective pH solutions and inclusion complexes are prepared(5).

1.2. UV-VIS spectroscopy

Absorbance values were recorded for the liquid inclusion complexes of stigmasterol with HPα-CD using UV-1800, (Shimadzu) spectrophotometer(5).

2. Results and Discuusion

2.1. Absorption studies on stigmasterol: HPα-CDinclusion complex

Absorption spectra of stigmasterol at different pH ~4,6,7 and 9 values on varying the concentration of HPα-CD are recorded and shown in fig.1. (a,b,c,d). The absorption spectra of pH~4 possess a significant single band while on increasing the pH, all the other spectrum show a triple band. The absorbance value increases with increasing HPα -CD concentration, while the concentration of stigmasterol is kept constant.

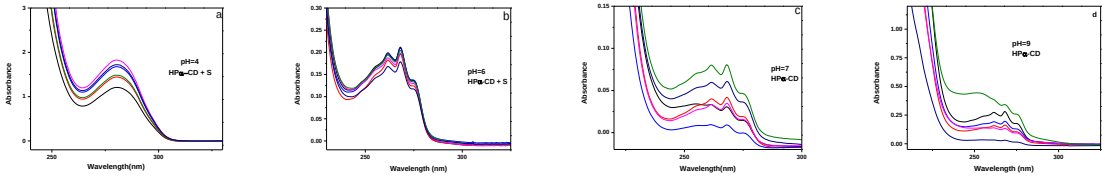

Fig.1 Absorption spectra of stigmasterol:HPα-CD at (a) pH~4 (b) pH~6 (c) pH~7 and (d) pH~9

Comparing the absorption spectrum of stigmasterol at different concentrations of HPα-CD, the absorbance decreases gradually on increase of pH medium. These results reflect the changes in the ionization of stigmasterol as a function of pH. Stigmasterol is ionised in acidic media at pH~4 than at other pH values. So at pH-4, stigmasterol strongly binds with the cavity of HPα-CD, forming stable inclusion complex and enhancing the solubility of stigmasterol. The absorbance and λ_{max} values of stigmasterol:HPα-CD inclusion complexes at different pH levels are tabulated and shown in Table 1:a,b,c and d.

Table :1a Absorption spectral data of stigmasterol:HPα-CD inclusion complex at pH~4

Con. of HPα CD	pH = 4					
	λ_{max}	Absorbanc	A - A_0	$\frac{1}{A-A_0}$	log ∈	$\frac{1}{[HP\alpha - CD}$
0	264.5	0.7869			4.3812	0
0.002	264.5	0.9435	0.1566	6.38	4.3810	500
0.004	264.5	0.9776	0.1907	5.24	4.396	250
0.006	264.5	1.1016	0.3147	3.17	4.448	166.
0.008	264.5	1.1371	0.3502	2.85	4.462	125
0.010	264.5	1.1986	0.4114	2.42	4.485	100

Table :1b Absorption spectral data of stigmasterol:HPα-CD inclusion complex at pH~6

Con. of HPα CD	pH = 6					
	λ_{max}	Absorbanc	A - A_0	$\frac{1}{A-A_0}$	log ∈	$\frac{1}{[HP\alpha - CD}$
0	261.5	0.1681			3.63	0
	265.5	0.1555			3.620	
	268	0.1790			3.659	
0.002	261.5	0.1825	0.0144	69.44	3.66	500
	265.5	0.1673	0.0118	84.74	3.630	
	268	0.1963	0.0173	57.80	3.699	
0.004	261.5	0.1875	0.019	51.54	3.68	250
	265.5	0.1726	0.017	58.47	3.643	
	268	0.1984	0.019	51.54	3.704	
0.006	261.5	0.1941	0.026	38.46	3.69	166.6
	265.5	0.1782	0.0227	44.05	3.657	
	268	0.2044	0.025	39.37	3.717	

0.008	261.5	0.1964	0.0288	35.33	3.700	125
	265.5	0.1815	0.026	38.46	3.665	
	268	0.2101	0.0311	32.15	3.729	
0.010	261.5	0.1989	0.0308	32.46	3.705	100
	265.5	0.1825	0.027	37.03	3.667	
	268	0.2119	0.0329	30.39	3.732	

Table :1cAbsorption spectral data of stigmasterol:HPα-CD inclusion complex at pH~7

Con. of HP α CD	pH = 7					
	λ_{max}	Absorbance	A - A_0	$\frac{1}{A-A_0}$	log ∈	$\frac{1}{[HP\alpha - CD]}$
0	261	0.0095			2.383	0
	265.5	0.0057			2.161	
	268	0.0091			2.365	
0.002	261	0.0334	0.0239	12.852	2.930	500
	265.5	0.0274	0.0217	46.08	2.843	
	268	0.0349	0.0258	38.75	2.949	
0.004	261	0.4000	.0305	32.78	4.008	250
	265.5	0.0333	0.0276	36.23	2.928	
	268	0.0419	0.0328	30.48	3.028	
0.006	261	0.0597	0.0502	19.92	3.182	166.6
	265.5	0.0527	0.0470	21.27	3.128	
	268	0.0607	0.0516	19.37	3.189	
0.008	261	0.0802	0.0707	14.14	3.310	125
	265.5	0.0687	.0630	15.87	3.243	
	268	0.0807	0.0716	13.96	3.313	
0.010	261	0.0875	0.0780	12.82	3.348	100
	265.5	0.0754	.0697	14.34	3.283	
	268	0.0866	.0775	12.90	3.344	

Table :1d Absorption spectral data of stigmasterol:HPα-CD inclusion complex at pH~9

Con. of HP α - CD	pH = 9					
	λ_{max}	Absorbance	A - A_0	$\frac{1}{A-A_0}$	log ∈	$\frac{1}{[HP\alpha - CD]}$
0	261	0.1388			2.46	0
	265.5	0.137			2.40	
	268	0.1343			2.44	
0.002	261	0.1390	0.000	5000	2.46	500
	265.5	0.1417	0.018	55.55	2.46	
	268	0.1635	0.029	34.24	2.53	
0.004	261	0.1583	0.019	51	2.51	250
	265.5	0.1725	0.490	2.04	2.55	
	268	0.1960	6.172	16.20	2.61	
0.006	261	0.1925	0.055	18	2.60	166.6
	265.5	0.2426	0.119	8.4	2.70	
	268	0.2813	0.147	6.80	2.76	
0.008	261	0.2741	0.135	7.39	2.75	125
	265.5	0.3353	0.211	4.72	2.84	
	268	0.3419	0.208	4.8	2.85	
0.010	261	0.3852	0.216	4.05	2.90	100
	265.5	0.3370	0.217	4.6	2.84	
	268	0.3821	0.248	4.03	2.90	

Determination of Binding constant

The HPα -CD dependence of stigmasterol on absorption can be analysed using Benesi-Hilderbrand(6) plot as given by

$$\frac{1}{\mathrm{A}-A_0}=\frac{1}{\mathrm{A}'-A_0}+\frac{1}{\mathrm{Kb}\,[\mathrm{A}'-A_0][\mathrm{HP}\alpha-\mathrm{CD}]}$$

Where A_0,A' are the absorbances in the absence and presence of HPα -CD respectively, Kb is the binding constant and $[\mathrm{HP}\alpha - CD]$ represents the concentration of HPα -CD.

Fig. 2 a, b, c and d are the plots of $\frac{1}{\mathrm{A}-\mathrm{A}0}\ Vs\ \frac{1}{[\mathrm{HP}\propto-\mathrm{CD}]}$ for stigmasterol:HPα-CD inclusion complex at pH~ 4, 6, 7 and 9 respectively. The obtained plot gives a linear relation indicating the formation of stigmasterol: HPα -CD inclusion complex. respectively.

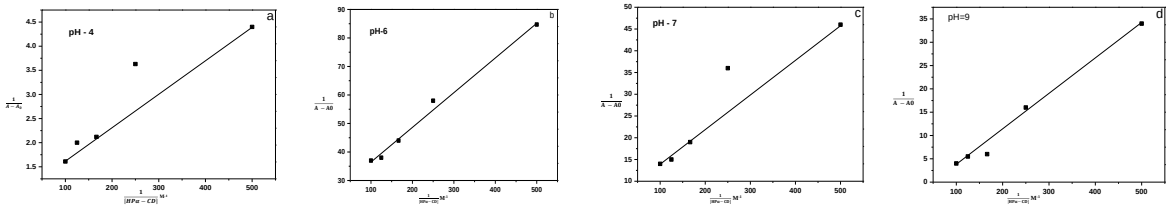

Fig.2 a, b, c and d :Benesi Hildebrand plot of stigmasterol:HP α -CD at (a)pH~4, (b)pH~6, (c)pH~7 and (d)pH~9

From the Fig.2 (a-d) it is inferred that the solubility of stigmasterol increases linearly with the increase of HPα-CD concentration. The slopes of the straight lines all pH values are calculated to be less than 1, indicating that the complexes formed are of 1:1 molar ratio. The slopes were found to be 0.0069 (pH~4) and 0.1223 (pH~6) 0.0832 (pH~7) and0.0772 (pH~9). The apparent stability constant of complexes K_b are calculated from the slope. K_b of stigmasterol:HPα -CD is found to be 692, 651,553 and 443 M^{-1} at pH 4, 6, 7 and 9 respectively.

3. Conclusion

The present study confirms the pH modulation on cyclodextrin inclusion complexes thereby increasing the solubility of stigmasterol, inturn bioavailability. It is evident that the most favourable pH for increasing the solubility of the stigmasterol is at pH ~4 and less favourable at pH~9. The obtained results reveal the effect of pH on the formation of encapsulation of stigmasterol into the cavity of CD.

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Green Synthesis and characterization of Nano Particles

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ABSTRACT:- The present investigation has been aimed to synthesize and characterize the nanocomposites by using onion extract as reducing agent. The synthesized nanocomposites were characterized by UV-VIS spectrophotometer, scanning electron microscope (SEM), The results revealed that the onion extract was found to be a successful reducing agent for the synthesis of nanoparticles as nanocomposite. The synthesized nanoparticles were initially confirmed by visual observation by colour change. The metal ions were reduced during the exposure to aqueous extract of onion. Further, the nanocomposites were structurally and chemically characterized by various techniques.Key words: green, onion, Ag/ZnO, nanocomposites, synthesis, characterization

INTRODUCTION:

Nanocomposites are composites in which at least one of the phases shows dimensions in the nanometre range. Nanocomposite materials have emerged as suitable alternatives to overcome limitations of microcomposites and monolithics, while posing preparation challenges related to the control of elemental composition and stoichiometry in the nanocluster phase. They are reported to be the materials of 21st century in the view of possessing design uniqueness and property combinations that are not found in conventional composites. The general understanding of these properties is yet to be reached Nanocomposites are composites containing different compositions or structures, where at least one of the constituent is in the nanoscale regime. In other words, nanocomposites are materials that are created by introducing nanomaterials (often referred to as filler) into a macroscopic sample material (often referred to as the matrix).

Nanocomposites can be classified based on their matrix materials into three different categories i.e. metal matrix nanocomposites, ceramic matrix nanocomposites and polymer matrix nanocomposites. Nanocomposite of insulating materials such as glasses, ceramics or polymers with embedded metal nanoparticles are under focus because of their special structural, mechanical, electrical, linear and nonlinear optical properties. Among the nanocomposites, metal-glass nanocomposite materials exhibit interesting novel properties which include

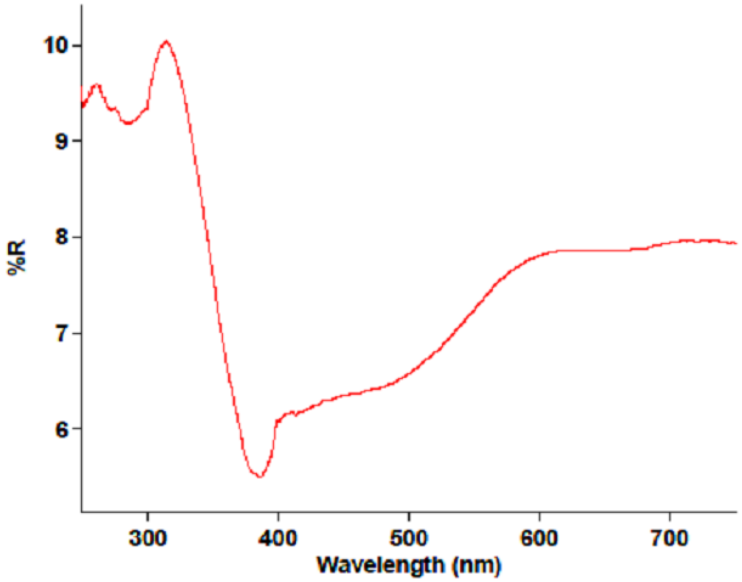
nonlinear optical behaviour, increased mechanical strength, high refractive index, electrical resistivity etc. Such nanocomposites containing metal nanoparticles dispersed in glass matrices have also drawn attention because of their second order non-linear effects and have applications in developing high speed and low power optical devices for future communication systems. Thus, the aim of the present work was to synthesize and characterization of Ag/ZnO nanocomposites.

Materials and Methods

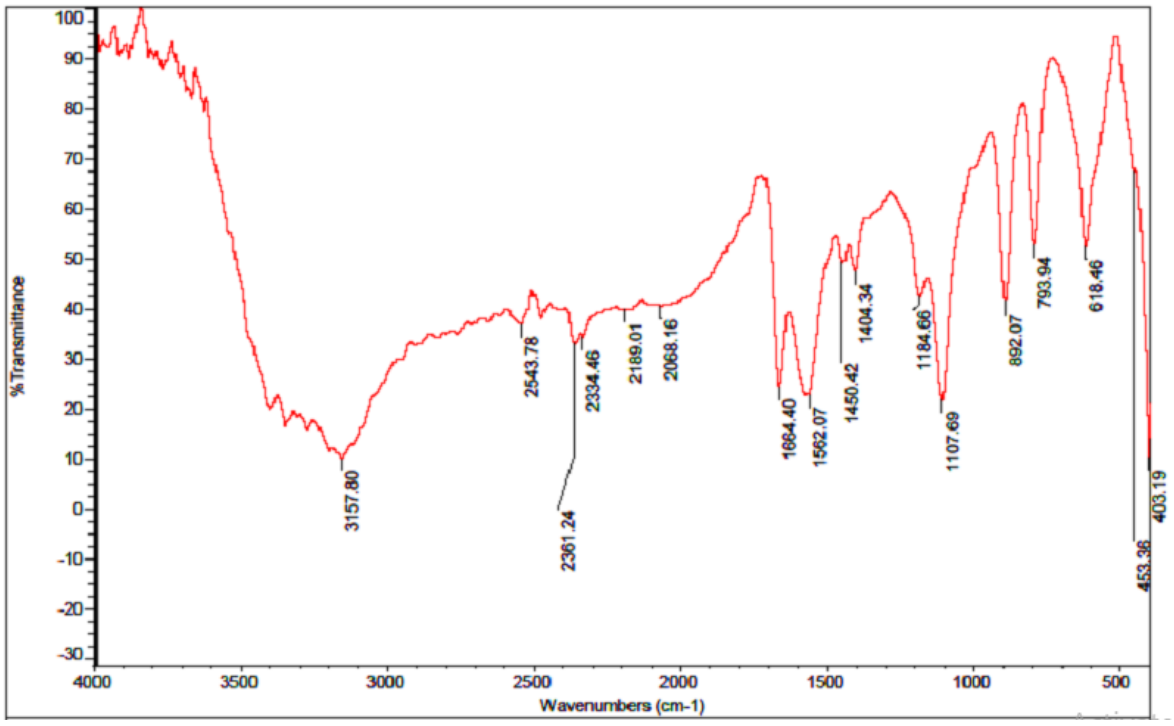
The onion bulbs were washed with sterile distilled water and the outer covering of the bulb was manually peeled off and the fleshy part of the onion was rewashed with sterile distilled water. A part of 10 g of the onion bulb was cut into small pieces and ground using mortar and pestle with distilled water. The extraction was filtered using cloth and then Whatmann No.1 filter paper. The obtained onion extract was used for the synthesis of different nanoparticles. The nanocomposite was synthesized by mixing of 10ml of onion extract and 1mM pure metals (silver nitrate and zinc nitrate). The content was incubated at room temperature for 24 hours. After the incubation period, the content was centrifuged at 10,000 rpm for 20 minutes. The pellet was collected and air dried. To 1mg of sample, 2.5 ml of 100% ethanol and 2.5 ml of double distilled water were added.. The mixture was centrifuged at 8000 rpm for 10minutes. The pellet was collected and air dried. The nanocomposites thus obtained were purified by repeated centrifugation at 10000 rpm at 25°C for 10 minutes.

The synthesized nanocomposites were characterized by UV-Visible spectroscopy Scanning Electron Microscopy, Fourier Transform Infrared Spectroscopy

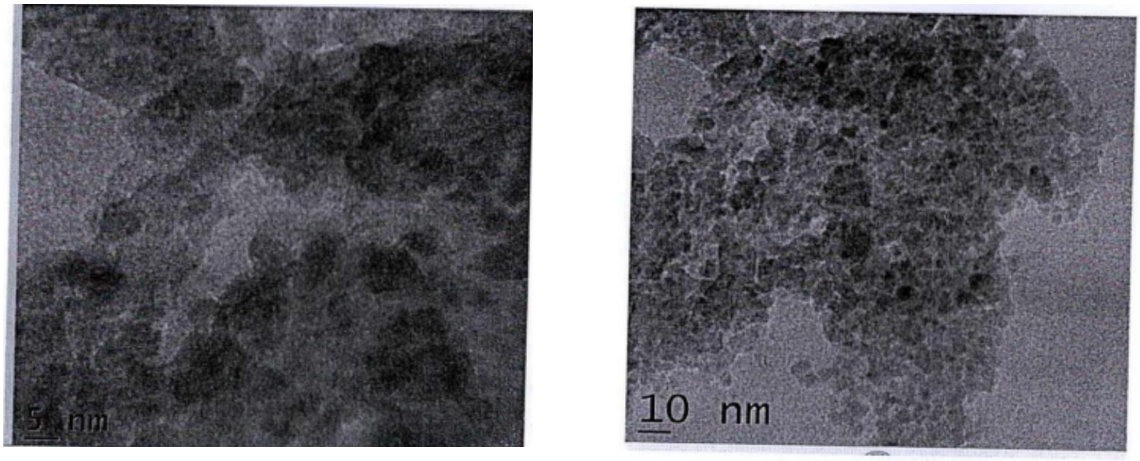
UV-VISIBLE SPECTROSCOPY ANALYSIS The reduction of metal ions in the onion extract was further confirmed by UV-Vis Spectrophotometer. UV-Vis absorption spectrum of nanocomposites was shown in Fig. The absorption spectrum of nanocomposite nanoparticles was maximum at 396nm.



FOURIER TRANSFORM INFRARED SPECTROSCOPY (FTIR) ANALYSIS FTIR analysis is unique for the identification of various functional groups. FTIR analysis was carried out to identify the biomolecules which were responsible for the reduction of metal ions into their respective nanoparticles in the presence of onion extract



SCANNING ELECTRON MICROSCOPE (SEM) ANALYSIS The surface morphology of the nanoparticles was characterized using Scanning Electron Microscopy. The onion extracts mediated nanocomposites found as agglomerate in nature.



Based on the findings of present study, it is clear that the onion extract was found to be a successful reducing agent for the synthesis of nanocomposite. Surface morphology of the synthesized nanocomposites nanoparticles were identified from SEM electron micrograph and identified as agglomerate in nature.

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PREPARATION OF SILVER NANOPARTICLES FROM FRESH LEAF EXTRACT OF EUCALYPTUS GLOBULUS AND ITS PHYTOCHEMICAL ANALYSIS

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Abstract

Silver nanoparticles were synthesized using fresh leaf extract of Eucalyptus globulus as a stabilizing and reducing agents, and Silver Nitrate as a precursor. Green synthesis was relevant as low cast, less toxic and environment friendly. The allocation of Silver Nanoparticles were mixed from different concentrations (1 Mm, 2 Mm, 3 Mm) with the leaf extract of 25 ml. These prepared silver nanoparticles were characterized using UV-Visible, FT-IR, SEM, and XRD. The Phytochemical screening ofEucalyptus globulus were evaluated using two different solvent namely,aqueous extract and ethanol extract.

Keywords: Eucalyptus globulus, Ag nanoparticle.

Introduction

Preparation of silver nanoparticles by physical and chemical approaches [1] eliminate hazardous materials. To avoid this, environment friendly green synthesis of nanoparticles by using biomolecules such as plant extract, bacteria, and fungi were developed in the field of nanotechnology. This biomolecules are rich in polyphenols, flavonoids, and tannic acid [2] which act as reducing and stabilizing agent in the synthesis of metal nanoparticles. Silver nanoparticles are very useful in thermal, electrical conductivity, and biological properties. The plant leaves Eucalyptus globulus, also known as Blue Gum, is the main source of eucalyptus oil used globally. Leaves are steam distilled to extract the oil, which is relieve symptoms of the common cold[3]. The leaves also contain flavonoids and tannins. The antibacterial and antimicrobial activity of eucalyptus has been harnessed for use in some mouthwash and dental preparations.

2.Materials and Methods

2.1Preparation of leaf extract from Eucalyptus globulus

Silver nitrate, Double distilled water were purchased from S A CHEMICALS, Tirunelveli. Eucalyptus globulus were collected from karungal. The Eucalyptus globulus leaves were collected

and washed with distilled water. Take 10g fresh leaf of Eucalyptus globulus in 250 ml beaker and it was kept at 70^0c on magnetic stirrer. The extract was filtered and stored.

2.2 Preparation of green silver nanoparticles

Preparation of Silver nanoparticles was carried out using Silver Nitrate as a precursor.1mM of $AgNO_3$ was taken in a beaker .This setup was stirred at 70^0c on magnetic stirrer for 2 hours. Add 20 ml of prepared Eucalyptus globulus leaf extract in burette and added dropwise in beaker. The solution allowed to cool and centrifuged 7000 rpm, Nanoparticles are washed with deionized water and are allowed to dry oven at 80^0c for 3 hours.

2.3 Screening of Phytochemicals

1.**Salkowski test:** To 1 ml of test solution 5 ml of chloroform was added and them few drops of conc.H_2SO_4 to the above mixture and mix well. Allow the mixture to stand some time brown colour in the lower level indicates the presence of steroids, if bluish brown then indicates the presence of steroids.

2. Test for phytosterol: To 1 ml of test solution a few drops of acetic anhydride and conH_2SO_4 was added and mix well. Allow the mixture to stand for some time, Bluish colour indicates the presence of phytosterol.

3. Alkaline Reagent Test: Extract were treated with few drops of sodium hydroxide solution. Formation of intense yellow colour which become colorless on addition of dilue acid indicates the presence of flavonoids.

4. Test for Tannins: Few drops of neutral $FeCl_3$ solution and 5 ml of distilled water was added to the test solution. Bluish green colour indicates the presence of tannins.

5. Test for sugar: To 1 ml of test solution add few drops of Molish reagent violet colour indicates the presence of sugar.

6. Foam Test: 1 ml of test solution was shaken with 2ml of water. If foam produced persists for 10 minutes it indicates the presence of saponins.

4. Result and discussion

UV-Vis Spectroscopy and X-Ray Diffraction

The optical properties of silver nanoparticles prepared from fresh leaf extract were studied by absorption spectroscopy.Formation of silver nanoparticles indicate the colour changes from pale yellow to brown colour, later black in colour.The reaction was maximum for48 hour's incubation.The colour change is due to the surface Plasmon resonance phenomenon. Silver nanoparticles were observed around in 442nm.

Figure 1: UV-Visible and X-ray diffraction spectrum of Silver nanoparticle

The peaks were recorded from 200-800 at 2 theta scale and the diffraction peaks observed at 23.54^0, 27.83^0, 32.26^0, 33.92^0, 38.10^0 , 46.24^0 corresponds to the crystal lattice plane of (111), (200), (211) , (211), (220) and (311). It has some unassigned peaks which were due to the presence of biomolecules in the nanoparticles. The important peaks are observed at 23.54^0, 27.83^0 and 46.24^0 matches the plane value of (111),(200),(311), which was in crystalline nature and further on the basis that can be revealed as FCC structure of silver [4]. The average crystallite size of synthesized silver nanoparticles is calculated by Scherrer equation and found be 32.10 nm.

FT-IR gives the information about functional groups present in the silver nanoparticles. A broad peak at about 3425 cm^{-1} due to the stretching vibration of hydroxyl group. The absorption band at 2854 cm^{-1} could be assigned to aliphatic C-H stretching vibrations [5], and the peak at 1720 cm^{-1}corresponds to carbonyl groups from dimerized saturated aliphatic acid. The absorption band at 1612 cm^{-1}can be attributed to C=C stretching vibrations of aromatic ring. The peak at 1396 cm^{-1}can due to O-H bending vibrations of polyols such as flavonoids present in the leaf.The bands at 800-600 cm^{-1}region correspond to C-H out of plane bend which are characteristic of aromatic phenols. The present study suggests the role of phenols in the reduction of Ag ions to silver nanoparticles

Phytochemical Analysis: Phytochemical screening to detect the presence of bioactive agents was performed by standard procedures. After the addition of specific reagents to the test solution, the tests were detected by visual observation of colour change or precipitate formation.

Table 1: Phytochemical investigation of Aerial parts of the Eucalyptus globules

S.No	Phytochemical test	Detection of compounds	Aqueous Extract	Ethanol Extract
1	Salkwoski test	Steroids	+	_
2	Mayer' Test	Alkaloid	_	_
3	Test for Flavanoids	Flavanoids	+	+
4	Test for Tannins	Tannins	+	+
5	Test for sugar	Sugar	+	+
6	Foam Test	Saponins	+	_
7	$Fecl_3$	Phenol	+	+
8	Test for Xanthoprotein	Xanthoprotein	–	+
9	Test for Triterpenoids	Triterpenoids	_	+

SEM Analysis is employed to predict the size and shape of the nanoparticles. It was observed that the particles are spherical in shape with a uniform size about 25-35 nm. The particle size obtained from SEM images is well correlated with the particle size determined from XRD using according to theScherrer formula and the average crystallite size of synthesized nanoparticles was around 32.10 nm.

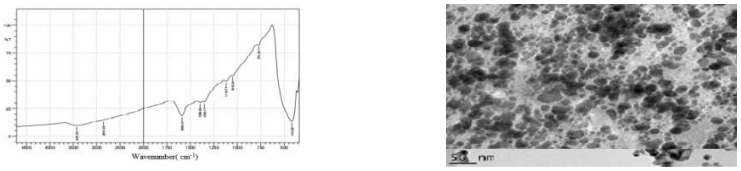

Figure 2:FT-IR spectrum and SEM analysis of Silver nanoparticles

Conclusion

Green synthesis Silver nanoparticles were synthesized using fresh leaf extract of Eucalyptus globulus as a stabilizing. These prepared silver nanoparticles were characterized using UV-Visible, FT-IR, SEM, and XRD. The phytochemical analysis of aqueous extract gave the positive result for Steroids,Tannins, Flavonoids, Saponin, Sugar, Phenol, Saponin and ethanol extract gave the positive result for FlavonoidsTannins,Sugar, Phenol, Xanthoprotein and Triterpenoids.

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ANTIMICROBIAL ASSAY OF PLANT EXTRACT OF *Euphorbia hirta*

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Abstract :

This study was carried out with an objective to investigate the antimicrobial potentials of leaf extracts *Euphorbia hirta* . Medicinal plants also called Medicinal herbs, have been discovered and used in traditional medicine practices since prehistoric times. Plants synthesise hundreds of chemical compounds for functions including defence against insects fungi, diseases and herbivorous mammals. Medicinal plants are widely used in non-industrialized societies, mainly because they are readily available and cheaper than modern medicines.

1. Introduction :

The plant Euphorbia hirtabelongs to famaly Euphorbiaceae. The plant is commonly called as Dudhi (ver: Hindi). It is an annual herb and native to ntropical countries(John Sons and Wiley *et al 1982)* , has cylindrical stem often reddish in color and especially younger parts are enveloped with yellowish bristly hairs. The greenish or reddish leaves (5 cm long) have oppositely arranged lanceolate and tiny dense round clusters of flowers like appearance. The green flowers constitute the inflorescence type which is a peculiar feature of the euphorbias. When the leaves are cut, the stem yields milky or white juice (*Owerri Nigeria 2005*) . The plant contains tannins, related polyphenols, terpenes, anthocyanins, alkaloids, steroids like ß-sito-sterol, ß-amyrin and glycosides. The plant extracts are employed in the cure of respiratory tract inflammations and asthma (*Scalbert A 1991).*

It is also employed in the management of chronic bronchitis, cough, other pulmonary complications in Mauritius and also employed as ear drops and in the regimen of boils, sore and in supporting wound healing. It is extensively employed in Angola in contrast to dysentery and diarrhea, chiefly amoebic dysentery *(Igoli.J 2016*) . The leaves are used to treat various diseases as antipyretic, carminative, diuretic, purgative etc. Our work is directed to investigate antimicrobial activity of Euphorbia hirta leaves. Since there is no scientific

study to substantiate thetraditional claim on antimicrobial activity of the plant, the present study is being taken up.

Modern medicine now tends to use the active ingredients of plant rather then whole plant. The phytochemicals may be synthesized,compound or otherwise transformed to make pharmaceuticals. Few traditional remedied, however, have translated into modern drugs, although there is containing reasearch into the efficacy and possible adaptation of traditional herbal treatement.

Latest research investigation observed that the bioactive & antioxidant potentials of these plants are attributed to the presence of polyphenols, flavonoids, lignins, alkaloids, terphenoids, corotenoids, vitamins and so forth. (P.K.Vayalil, 2002, G.A. Agbor, P. Mambegna *et al.,).* They help in maintaining the nutritional quality & shelf life of foods by inhibiting lipid oxidation, minimizing rancidity, and removing toxic oxidative products (M. Valko, D. Leibfritz *et al.*, J.K. Grover *et al).* Similarly, Phenolic compounds play important role in antioxidant activity and resistance against pests and other species dissemination.

In fact, a single plant may have diversity of phytochemicals ranging from bitter compounds that stimulate digestion system phenolic compounds for antioxidants and many others pharmacological properties, antibacterial, and antifungal, tannins that work as natural antibiotics, diuretic substances ackaloids etc (Miguel 2010).

Despite the government's mammoth expenses on the livelihood of common people, the provision of balanced food and modern healthcare to rural people is still a far-reaching goal. Hence, it is recommended that researchers should resort to forms of nutraceuticals mainly in the native plant species to over come the constraints of human necessities phytochemicals and minerals ingredients are necessary for virtually all reactions to occur in the body. While each has its own unique properties, they work synergistically to ensure reactions in the body occur appropriately.

The fruit has a laxative effect and the daily uses of dried fig enhanced the antioxidant capacity in plasma. Similarity, Jamun belongs to Myrtaceae family and is considered the richest nutritional source. It contains flavonoids, tannins, triterpenoids, Carotenoids, and Sitosterols. The extracts of this plant exhibited various activities including cytotoxic, anti-inflammatory, anticancer, and antidiabetic activities. (S.Caver, *et al., 2011*)

2. Materials and methods :

Collection And Ereparation Of Plant Materials

Fresh leaves of *Euphorbia hirta* were collected from uncultivated farm lands located in the south eastern part of near Nattalam, Kanayakumari District, Tamil Nadu. Both the plants were identified by Botanist Dr.Usha Sree Devi Kumari college. The Voucher Specimens were deposited in the laboratory of Annai Velankanni College, Tholayavattam finely powered plant materials were stored at room temperature for further studies.

Preparation Of Solvent Extract

The dried plant material was pulverized into powder using a grinder. About 50g of powered materials was extracted with 250ml of solvent such as acetone, methanol, water and chloroform. They were placed in shaker for 3 days and the extract was collected from the conical flask by filtration. Then the plant extract kept a water both at 60^0C to evaporate the solvent from the solution. The container was allowed to air tight for 72 hours and filtrate thus obtained was concentrated in reagent bottle (Awaad *et al* 2012).

ANTIMICROBIAL ACTIVITY (KIRBY – BAUER METHOD)

Collection Of Test Organism And Preparatio Of Stock Culture

Test of organisms were received from Department of Microbiology, vivek Laboratory, Nagercoil and reconfirmed by gram staining and sub culturing in appropriate selective media.

EQUIPMENTS

Autoclave, laminar air flow, hot air oven, micropipettes, inoculation loop, disc tips, cotton swaps, glass were petric plates and test tubes

CHEMICAL

70% ethanol, methanol, microbiology media ingredients like Muller Hinton ager, beef extracts, Yeast extracts peptone, sodium chloride, nutrient broth, Methanol and aqueous extracts of *Mentha arvensis* and *Leucas Cephalotes*.

MEDIA COMPOSITION

Sodium Chloride	:	5g	Beef extract	:	3g
Peptone	:	5g	P^H	:	7.0
Yeast	:	2g	Distilled water		

MICROORGANISM

E.coli, staphylo coccus aureus, Bacillus Subtillis, Psedomonas

SOLVENT EXTRACTION

The leaves of *Euphoribia hirta* was air dried and powdered. About 250g of this powder was extracted with acetone, ethanol, Methanol, water and chloroform in a sox let apparatus. The

extraction process was continued for 8 hours. The solvents were evaporated under reduced pressure. After determining the Yields, the sediments extracts were stored at 4^0C until further use.

DISC DIFFUSION METHOD

❖ The antimicrobial assay was performed by agar disc diffusion method Bauer et al., 1966. The molten Muller Hinton Agar was inoculated with 100μ of the inoculums($1x10^3$ CFU) and poured in to the petri plate. For disc diffusion method, the disc (6mm) was saturated 100μ of the compound (extracts from native plant) allowed to dry and was introduced on the upper layer of the seeded agar plate. The plates were inoculated over night at 37^0C. Microbial growth was determined by measuring the diameter of zone of inhibition. The result was obtained by measuring the zone diameter. The antimicrobial activity was evaluated of there to plant *Euphoribia hirta.*

3. Result :

The antimicrobial activity of *Euphorbia hirta*, done against selected Microbes like, *E.coli Staphylococcus aureus, Bacillus subtilis, Sudomonas*. The plate shows highest antimicrobial activity against E.coli ans Psudomonas.

4. Disscusion :

The main objective of the present study was to evaluate the ability of the plant extract to inhibit the growth of pathogenic bacteria with and without antibiotics and non-antibiotics drugs and to determine their ability to enhance the activity to enhance the activity of antibiotics or non-antibiotics drugs. Several studies have reported these antimicrobial activities of *Euphorbia hirta.*

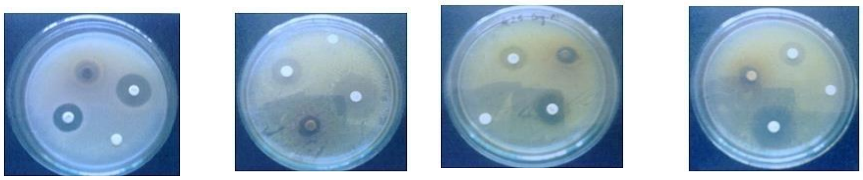
Many naturally occurring compounds found in plant, herbs, and spices have been shown to possess antimicrobial functions and serve as a source of antimicrobial agents against pathogens. Plants are important sources of potentially useful structures for the development of new chemotherapeutic agents. These findings help to identify the active components responsible for the development of drugs for therapeutic uses.

Earlier attempts on antimicrobial activity on other species of *Euphorbia hirta* (Akinjogunla et al., 2010) have shown promising results against variety of microbial flora. In the present investigation initial screening of the experimental plant for possible antimicrobial activities was done using crud methanol extract. Nearly all of the identified compounds from

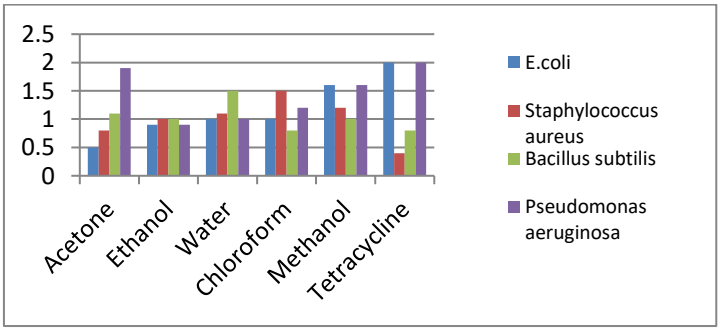
plants that are active against microorganism are aromatic or saturated organic compounds and most often obtained through ethanol extractive.

Table : 1 Antimicrobial activity of Leaf extract of *Euphorbia hirta*

Sl. No	Microorganism	Antimicrobial activity of *Euphorbia hirta*					
		Acetone	Ethanol	Water	Chloroform	Methanol	Tetracycline
1.	*E.coli*	0.5	0.9	1	1	1.6	2
2.	*Stphylococcus aureus*	0.8	1	1.1	1.5	1.2	0.4
3.	*Bacillus subtilis*	1.1	1	1.5	0.8	1	0.8
4.	*Pseudomonas aeruginosa*	1.9	0.9	1	1.2	1.6	2



Antimicrobial activity of Leaf extract of *Euphorbia hirta*



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Synthesis and Characterization of ZnO/Al_2O_3 Nanocomposite by sol –gel method

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ABSTRACT

ZnO/Al_2O_3 nanocomposite was synthesized by using simple sol-gel method and were charecterized by X-Ray Diffraction (XRD) and scanning Electron Microscopy(SEM).X-Ray Diffraction reveals that the prepared ZnO/Al_2O_3 nanocomposite has hexagonal phase.Average size of the ZnO/ Al_2O_3 nanocomposite was determined as 25-50nm.The morphology and shape of ZnO/ Al_2O_3 nanocomposite was studied by scanning electron microscopy.The particle was found to have spherical shape in specific region.

KEYWORDS:Nanocomposite,SEM,XRD,Sol-gel.

I. INTRODUCTION

Nanoscience and nano technology are the study and application of extremely small things and can be used across the other science fields such as Chemistry , Biology , Physics ,Material science .Nano technology deals with materials in the size of 0.1 to 100nm[1] . It is also inherent that these materials should display different property such as electrical conductance . Nano technology words matter at dimension in the nano meter scale length (1-100nm) and thus can be used for a broad range of applications and the creation of various types of nano materials and nano device[2]. Nano particles can be broadly classified into two groups. Organic and Inorganic nano particles[3]. Organic nano particles include carbon nano particles, Inorganic nano particles include magnetic nano particles, noble metal nano particles and semi conductor nano particles.

Nanocomposite is defined as the composite material in which atleast one component is in the nano meter size scale.A combination of two or more different materials is that are fixed in an effort to blend the best properties of both[4].

Aluminium oxide also known as nanosized alumina occurs in the form of spherical nanoparticles and in the form of oriented or indirected fibres.Nanoscale colloidal alumina particles are in small diameters of 2-10nm[5].It has a high specific surface area of more than $100m^2$ /g.The application of Aluminium oxide includes absorbent,sorbent of the ions of the metals from solutions of their salts and composites,abrasives,refractories[6].Aluminium oxide is used for its hardness and strength.$Al_2O_3$is also used for dehydration of alcohols to alkenes.

II. Materials and Methods:

All reagents and compounds are in analytical grade 4g aluminium nitrate and 1g zinc acetate was added in 87g mixed solvent (ethanol:water). 8 g polyvinyl alcohol(PVA) was added to the above solution. The obtained solution was stirred well and the sol formed it was heated to 80^0 C to form a homogenous gel. The gel was heated to 110^0C with constant stirring for 1 hour. The solvent was evaporated completely and dried gel was obtained.The dried gel was then pyrollized at 500^0C for 5 h to form nanocomposite [7].

III. RESULT AND DISCUSSION

XRD ANALYSIS

The phase purity and composition of the particles obtained by a sol-gel process was examined by XRD . Fig (1) shows a typical XRD pattern of ZnO/ Al_2O_3nano composites prepared in this work . A number of Bragg reflections with 2θ values of 25.86 , 32.54 , 35.90 , 49.12 and 56.27 were observed corresponding to 220 , 100 , 002 , 102 and 101 planes . Average size of the ZnO / Al_2O_3 was determined as 25-50 nm . All diffraction peaks indexed corresponds to the hexagonal phase of ZnO / Al_2O_3nano composites. The sharp peaks of revealed the good crystalline in nature of the samples.

The average particle size of the Zinc oxide nano particle calculated using Debye Scherer's equation

Where, $D = \frac{k\lambda}{\beta cos\theta}$

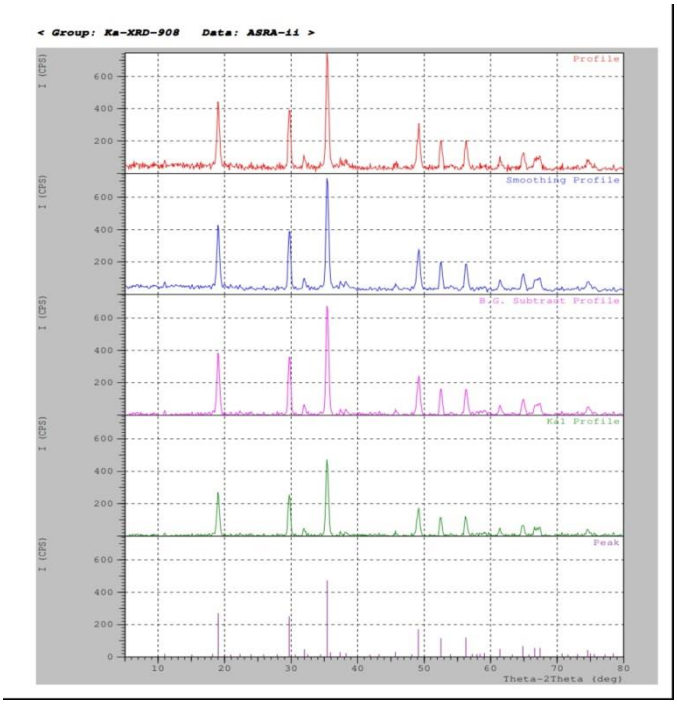

Fig. 1 XRD Analysis of ZnO/ Al_2O_3Nano Composite

D→ Particle size in nanometer

λ → X-ray wavelength

k→ Scherer's constant (0.94)

β→ Full width half maximum

θ → Bragg's angle of reflection

SEM Analysis

The surface morphology and shape of ZnO / Al_2O_3nano composites were studied by scanning micro electron microscopy fig[2] shows the SEM image of ZnO/Al2O3 nanocomposite. The particle was found rod shaped the agglomeration of the particle was seen in SEM images.

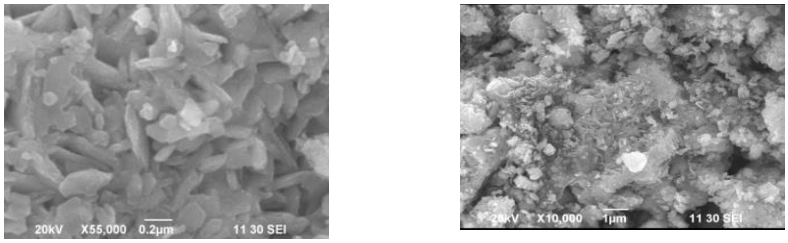

Fig. 2 SEM Analysis of ZnO/ Al_2O_3Nano Composite

CONCLUSION

ZnO/ Al_2O_3 Nano Composite was synthesized by sol- gel method. The synthesized nano composite were characterized by x- ray diffraction analysis (XRD) and scanning electro micro scopy (SEM). The synthesized nano particle have hexagonal phase with an average size 25-50nm. The morphology and shape of ZnO/ Al_2O_3nano composite were studied by scanning electron microscopy. It shows that spherical shape in specific region.

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GREEN SYNTHESIS AND CHARACTERIZATION OF IRON OXIDE NANOPARTICLES FROM SESBANIA GRANDIFLORA LEAF EXTRACT AND ITS ANTIMICROBIAL ACTIVITIES

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Abstract:

The present study was aimed at synthesizing iron oxide nanoparticles from aqueous leaf extract of agati. The synthesized nanoparticles were characterized by XRD, FTIR, EDAX & SEM. In addition the antibacterial and antifungal activity was carried against gram positive and gram negative bacteria and fungi. The zone of inhibition shows good antibacterial activity towards Staphylococcus aureus and good antifungal activity towards Aspergillus flavus.

Keywords: Sesbania Grandiflora, Antibacterial activity, Antifungal activity, Aspergillus flavus,Staphylococcusaureus.

Introduction:

The advances in nanotechnology have led to the great development in various fields including nanoparticles, nanotubes and nanowires synthesis [1]. The synthesis of metal oxide nanoparticles using plants is a very economic method when compared to other methods. Hence plant mediated synthesis of metal oxide nanoparticles is a field of current importance [2-3].

Sesbania grandiflora (also known as agati) belongs to the family of Fabaceae [4]. It is commonly known as Hummingbird Tree, Butterfly Tree in English. Sesbania grandiflora has been known to have antimicrobial activities[5,6]. S. grandiflora has been known to have hypolipidemic, antibacterial, free radical scavenging, anti-ulcer, anti-urolithiatic, hepatoprotective and chemo preventive activities, antifungal, anti-inflammatory and antitumorigenic activities [7].

Materials and Methods:

Preparation of the leaf extract:

The collected fresh leaves of agathi was washed well with tap water. Then the leaves was gently wiped with the filter paper and about 20 gms of leaves were added with 100ml of distilled water and kept in the hot plate at 60^{o} C until the colour of the water turned to

green. Then the extract was cooled, filtered using Whatman number 1 filter paper and then stored for further experimental analysis [8].

Preparation of Nanoparticles:

20 ml of leaf extract was taken in the beaker and heated in the hot plate at 60^{o}C. Then 5g of ferrous chloride was added to the heated leaf extract and stirred well using a glass rod until the mixture was turned to reddish brown colour paste form. The paste was collected carefully in ceramic crucibles and kept in a muffle furnace at 500^{o}C for 2h. After 2hrs, the synthesized metal oxide nanoparticles present in the crucible was taken in a powdered form and then stored in an airtight container for further experimental work [8].

Characterization of Iron Oxide nanoparticles:

The sample was characterized by XRD, FT-IR, SEM and EDAX. In XRD the average particle size to be calculated from the diffractogram using Debye-Scherrer's formula. The FT-IR spectrum was recorded in the solid phase using the KBr pellet technique in the range of 400-4000cm^{-1}. It helps to identify the functional group present in the sample. The morphology of the sample was analysed by scanning electron microscope (SEM). The EDAX technique reveals the elements present in the given sample. The antibacterial and antifungal activities were determined by agar disc diffusion (Kirby-Bauer) method.

Result and Discussion:

In XRD, the sharp and narrow peak indicates the presence of crystallized nanoparticles. The patterns are assigned to the spherical shape. The crystal size of the iron oxide nanoparticle is around 12 nm in (Fig-1). The FTIR spectrum shows a broad peak around 3419cm^{-1} showed the OH stretching bond vibration whereas the peaks at 1117 cm^{-1} is corresponding to the C-O stretching vibrational group. C=O Carbonyl stretching vibration of alkene was seen at 1623cm^{-1}.A peak at 557 cm^{-1}, which is corresponding to the Fe-O stretching bond (Fig-2). The result of the EDAX spectrum showed the presence of 3 elements as; Fe, O, Cl and the percentage of each element are 45.44%, 36.26%, 18.31% in (Fig-3 and Table-1). The result of SEM analysis revealed that the surface morphology of Iron oxide nanoparticles. The increased size of Iron oxide nanoparticles occurs by agglomeration. The Iron oxide nanoparticles synthesized from Sesbania Grandiflora leaf extract were spherical in shape in (Fig-4)

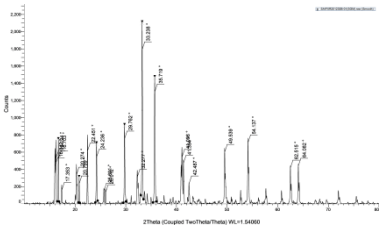


Figure-1

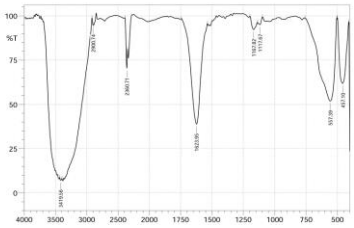


Figure-2

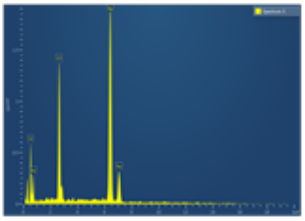
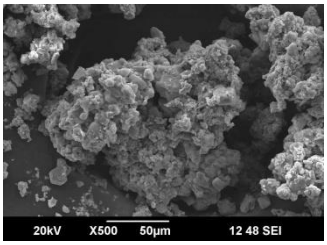


Figure-3



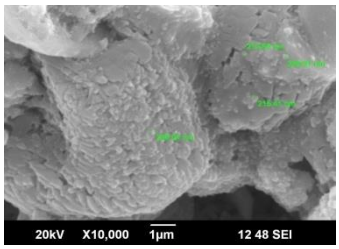


Figure- 4. SEM images of Iron oxide nanoparticles

Element	Line Type	Wt%	Atomic %
O	K series	15.4	36.26
Cl	K series	17.23	18.31
Fe	K series	67.37	45.44
Total:		100	100

Table-1 shows the EDAX analysis of Iron oxide nanoparticles

Figure- 5 shows the antibacterial activity of Iron oxide nanoparticles

Figure- 6 shows the antifungal activity of Iron oxide nanoparticles

In antibacterial activity, the zone of inhibition found higher in Staphylococcus aureus. Thus indicating good antibacterial activity whereas in antifungal activity, the zone of inhibition found higher in Aspergillus flavus and indicates good antifungal activity in (Fig- 5, 6 and Table-2)

Organisms		Iron Oxide	Positive	Negative
Bacteria	Bacillus subtilis	8 mm	15 mm	-
	Staphylococcus aureus	13 mm	12 mm	-
	E.Coli	8 mm	9 mm	-
	Pseudomonas aeruginosa	7 mm	10 mm	-
Fungi	Aspergillus niger	-	8 mm	-
	Aspergillus flavus	9 mm	18 mm	-

Table: 2 shows the antibacterial and antifungal activity of Iron oxide nanoparticles

Conclusion:

Iron oxide nanoparticle was synthesized from the leaf extract of Sesbania grandiflora and characterized by XRD, FTIR, EDAX and SEM studies. The particle size of iron oxide nanoparticle is around 12nm. The antibacterial activity of NPs indicates good antibacterial activity towards Staphylococcus aureus and good antifungal activity towards Aspergillus flavus.

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SCREENING AND IDENTIFICATION OF PROTEASE PRODUCING BACTERIA FROM LEATHERINDUSTRY WASTE SOIL

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ABSTRACT

Soil bacteriology is abundant with many beneficial bacteria which can produce many extracellular and intracellular enzymes. These enzymes are applied in many fields esp. in industries by large scale production.The current study was carried out to isolate protease producing bacteria from soil samples collected from leather industry waste soil. The isolation was done by serial dilution and pour plate methods. All the isolates were screened for proteolytic activity on skim milk agar plate. A total of three from ten different bacteria were screened based on the diameter of zone of proteolysis. Biochemicalcharacterization and molecular characterizationof the organism through 16SrRNA gene sequencing is done to identify the organism. BLAST analysis is helpful to interpret the genus of the organism. The significant isolate was identified using standard identification parameters and selected for further analytical studies.

Keywords: Protease, 16SRNA gene sequencing, BLAST analysis

INTRODUCTION

Protease is an enzyme that catalyses the breakdown of protein into smaller peptide fractions and amino acids, a process known as proteolysis. Protease can be found in animal, plant, bacteria, archae and viruses (Rani K et al., 2012). Proteases are abundant in nature, and microbes serve as a source of these enzymes due to their rapid growth, limited space requirements, and ease with which they can be genetically manipulated to generate new enzymes. Proteases are one of the three most common types of industrial enzymes and are used in detergents, the leather industry, the food industry, the pharmaceutical industry, biotechnology, and bioremediation processes. Proteases are most commonly found in laundry detergents, where they aid in the removal of protein-based stains from clothing. Proteases can also be used in the textile industry to remove the stiff and dull gum layer of raw silk fiber to improve luster and softness.Enzymes such as protease and lipase are used in the leather industry to soften fibers, improve quality, and provide alternatives to chemical methods (Dayanandan et al., 2003). This enzyme is primarily produced in bacteria by strains of the genus Bacillus, specifically B. licheniformis, B. horikoshii, B. sphaericus, B. furmis, B. alcalophilus, and B. subtilis (Ellaiah et al., 2011).Bacillus species are the primary producers of extracellular proteases, and industrial sectors frequently use B. subtilis to produce a variety of enzymes (Dubal et al., 2008)Proteases are also important components in biopharmaceutical products like contact-lens enzyme cleaners. The aim of this study was to isolate a newer source of protease producing bacteria from a local soil sample.

Methodology:

SAMPLE COLLECTION

Soil samples were collected from Leather industry waste soil of different places of Chennai, India. Soils were taken from 2-3 cm depth and kept in sterile plastic bag at 4˚C with date and time.

ISOLATION OF BACTERIA

Bacteria were isolated for protease enzyme using a serial dilution method described by Sjodahl et al., (2002). 1 gram of soil sample was added to 9 ml of sterile distilled water and serial dilution up to 10 ⁻⁶ dilution was performed in an aseptic environment in a laminar airflow chamber. 0.1 mL of each dilution was spread on Skim milk agar medium plates. Inoculated plates were incubated at 37ºC for 48 hours. Nutrient agar slants of bacterial isolates were prepared and maintained at 40º C.

SCREENING OF BACTERIA

The sample culture was poured on skim milk agar medium containing Skim milk powder 2.0%; peptone, 0.5% and agar 1.5% and then incubated at 37°C for 24 h. The clear zone of skim milk hydrolysis (Figure 1) was an indication of protease secretion as described by Folasade et al. (2005). The isolates were selected on the basis of larger zone on skim milk agar medium and further confirmed through batch wise submerged fermentation and the best one was selected for further study.

IDENTIFICATION OF BACTERIA

The identification of bacteria was carried out by morphological studies i.e. staining including Gram staining, motility test Acid Fast test, Endospore staining. Cultural characterization on skim milk agar plates like colony morphology that is shape, size, margin, elevation, opacity, texture and pigmentation.

The higher yielding strain was identified by of 16S rRNA gene sequence analysis.

BIOCHEMICAL CHARACTERIZATION& 16SRNA gene sequencing:

Biochemical test includes catalase test, oxidase test, carbohydrate fermentation test ,indole, methyl red, citrate utilization test, VogesProskauer test,H2S production test, Starch hydrolysis test, urease production test, nitrate reduction test (Aneja K R).

The higher yielding strain was identified by of 16S rRNA gene sequence analysis. The sequence is run under BLAST tool to identify the organism

RESULTS AND DISCUSSION:

Totally nine Leather industry waste samples were collected and processed by serial dilution and pour plate method for the isolation of proteolytic bacteria. A total 10 different bacterial strains were isolated on the basis of zone of proteolysis. All isolates were primarily screened for protease production on skim milk agar plate method. Among 10 isolates, 3 isolates were showing significant inhibitor zone (Table 1). Among these, strain P-5 exhibited maximum zone of proteolysis. This strain was identified by 16 S rRna gene sequence analysis.

Figure1. - Zone of hydrolysis by P-5 on skim milk agar plate

Isolates	Zone of inhibition (mm)
P-1	14
P-2	**25**
P-3	15
P-4	12
P-5	**33**
P-6	11
P-7	11
P-8	12
P-9	**20**
P-10	13

Table 1. Determination of zone of proteolysis

IDENTIFICATION OF BACTERIA

Bacterial strain producing protease enzymes were isolated from a leather industry waste soil isolated from Pallavaram, Chennai. The bacteria were identified based on morphological characterizations using Bergeys manual, (Buchanan RE et al., 1974). The results showed that the strain bacterium and identified to be a strain of *Bacillus* (Kim et al., 1998). (Table 2)

S.No	Biochemical tests	Results		
		P-2	**P-5**	**P-9**
1	Catalase Test	Positive	Positive	Positive
2	Oxidase Test	Positive	Negative	Positive
3	Urease Test	Negative	Positive	Negative
4	Indole Test	Positive	Negative	Positive
5	Methyl Red	Negative	Positive	Negative
6	VogesProskauer Test	Negative	Negative	Positive
7	Nitrate Reduction Test	Negative	Negative	Positive
8	Citrate	Positive	Positive	Negative
9	TSI test	Negative	Negative	Positive
10	Starch Hydrolysis	Positive	Positive	Negative
11	Casein Hydrolysis	Positive	Positive	Negative
12	Glucose	Fermentation	Non Fermentation	Fermentation
13	Sucrose	Fermentation	Fermentation	Fermentation
14	Lactose	Non Fermentation	Non Fermentation	Fermentation

Table.2 Biochemical tests for Bacillus subtilis.

Appearance of transparent zones around the colonies in a skim milk agar plate (opaque background) indicated protease production. Out of the 10 isolates, three were observed to be protease producer as indicate by clear zone around colonies. Among protease producing isolates, P-2,P-5,P-9 exhibited best proteolytic ability by hydrolysis of casein on skim milk agar plate (Figure 1).

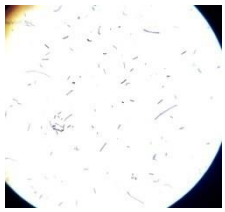

Fig -2 Gram Positive rod shaped organism

CONCLUSION

Protease occurs naturally in all organisms and is an essential constituent for all the existing live forms. Microorganisms such as bacteria and fungi and yeast are the main source of protease enzyme. Here *Bacillus* sp. P-2, P-5,P-9 was isolated from leather industry waste soil and can be used for protease production as protease has an enormous application in different industries. The pilot scale production of protease, fermentation methodology to be adopted for maximum production and assay of enzyme kinetics at various steps is still to be studied.

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ISOLATION, SCREENING AND IDENTIFICATION OF CELLULASE PRODUCING MICROBES FROM COIR INDUSTRY WASTE

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Abstract

Background: Cellulose is the extremely abundant biomass and most prevalent agricultural waste on earth. In green plants cellulase is an important structural component of the primary cell wall. It is a glucose unit connected by β-1, 4 linkages. Cellulases are produced by both bacteria and fungi for biological degradation of cellulose. Cellulases have captivated the attention of many due to the diversity of their applications. Cellulases are used in many industrial purposes, including textile and laundry, food and fodder, pulp and paper. Cellulases also play an important role in senescence of plants and in host-parasite relationships for invading the plant cell wall. The present study was aimed to isolate cellulase from bacterial sources.
Methodology: To isolate the Cellulase producing bacteria from coir industry soil waste. These soil samples were subjected to suitable different dilution. Then, streaked on different nutrients agar petri-dishes having carboxymethyl cellulose (CMC) as an inducer. After screening, three colonies were isolated, capable of producing a good amount of cellulose. Screening was done using congo red staining and confirmation was done by several biochemical analysis. The activity was determined in the nutrient media after harvesting bacterial cells by centrifugation.
Result: The highest enzyme producing bacteria was identified after biochemical analysis, 16s rRNA sequencing, BLAST analysis and phylogenetic tree analysis.

Keywords: Cellulase, CMC agar, Optimization, 16srRNA, BLAST

Introduction

Enzymes are the catalysts which are pivotal in all living entities and can govern all the biological processes. Mainly the industrial enzymes are produced from the primary sources like animal tissue, plants and highly from microbes. Cellulose is the extremely abundant biomass and most prevalent agricultural waste on earth [Aparna, 2013]. Although, it is proved fact that proper degradation of lignocellulosic substrates requires a perplexing complex set of enzymes such as laccases, exoglucanases, endoglucanases, peroxidases, fucosidosis [De Lima Brossi, 2016] xylanases and β-glucosidases Variety of microbes that are present in nature like many bacterial and fungal species secretes different types of lignocellulolytic enzymes which help in degradation of lignocellulosic biomass into simple sugars. These sugars can be further converted into biofuels and other platform chemicals [PreetiVyas and Ashwani Kumar, 2018]. Cellulase plays a major role in the textile industry for 'bio-polishing' fabrics and producing stonewashed look of denims.Cellulases are used in many industrial purposes, including textile and laundry, food and fodder, pulp and paper. Cellulases have captivated the attention of many due to the diversity of their applications. It is very common in household laundry detergents for improving fabric softness and brightness [Bharathi and Kanaka, 2015]. *Clostridium, Cellulomonas, Bacillus, Ruminococcus, Bacteroides, Acetovibrio, Streptomyces,* and*Paenibacillus*are some of the bacterial Genera have been found to produce

different types of cellulase when incubated under aerobic or anaerobic conditions [Vimal et al. 2016]. An attempt has been made in the present study to isolate, identify, and analyse cellulase producing bacteria from coir industry waste.

Methodology

Sample collection

The soil samples were collected from the coir industries of Samathuvapuram, Kolachal, Thoothor. The samples were collected in sterile bags and stored in refrigerators less than 4^0 C until used.

Isolation and screening of cellulolytic bacteria

Traditional serial dilution and agar plating method was used for the isolation of cellulolytic bacteria. The medium used for cellulolytic bacteria contains 1.0% peptone, 1.0% of carboxymethylcellulose (CMC), 0.2% K_2HPO_4, 1.0% agar, 0.003% $MgSO_4.7H_2O$, 0.25% $(NH_4)_2S0_4$ and 0.2% gelatin at pH 7. The plates were incubated for 48 hours at 30^0C.

Screening of Bacteria

The incubated CMC agar plates were flooded with 1% congo red and allowed to stand for 15 min at room temperature. 1M NaCl was thoroughly used for counterstaining the plates. Clear zones appeared around the growing bacterial colonies indicating the cellulose hydrolysis. The colonies with clear zones have been selected for the identification and cellulase production. By repeated streaking, isolate the pure culture and store it at 4^0C.

Screening of bacteria - Morphology

The identification of bacteria was carried out by morphological studies i.e. staining including motility test, Acid Fast test. Cultural characterization on CMC agar plates were done, like colony morphology that is shape, size, margin, elevation, opacity, texture and pigmentation.

Identification of bacteria by Biochemical tests

The bacterial isolates were identified by means of morphological examinations and some biochemical characterizations. The isolates were subjected to colony morphology. Gram staining, endospore formation and staining, catalase production, MRVP reaction, indole production, starch hydrolysis and citrate utilization. The results were compared with Bergey's manual of determinative Bacteriology.

Identification of bacteria by 16 S rRNA Sequencing

The strain was screened based on the above traits and the efficient isolate was sent to Rajiv Gandhi Centre for Biotechnology, Thiruvananthapuram for molecular characterization based on 16S rRNA sequencing. The sequence is run under the BLAST tool to identify the organism.

Results and Discussion

Total of 13 positive isolates of cellulase producing bacteria were obtained from coir industry soil samples of three different industries. All isolates were primarily screened for cellulase production on Carboxymethylcellulase agar plate method. Out of these three isolates showed maximum zone of clearance after staining with congo red dye. Among these, strain S-3 exhibited the maximum zone of cellulolytic activity (Table 1). This strain was identified by 16s rRNA gene sequence analysis.

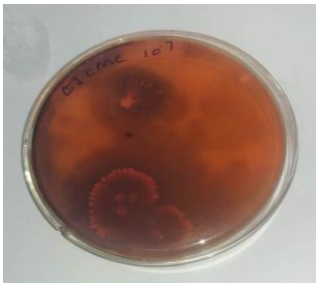

Fig: Zone of hydrolysis of S-3 strain on CMC

Isolates	Zone of inhibition (mm)
S-1	17
S-2	11
S-3	**29**
S-4	12
S-5	**33**
S-6	20
S-7	**32**
S-8	23
S-9	20
S-10	17
S-11	27
S-12	22
S-13	10

Table: Zone of Clearance and hydrolytic capacity

IDENTIFICATION OF BACTERIA

Cellulase producing bacterial strain was isolated from the coir industry waste soil from Thoothoor, Kanyakumari. The bacteria were identified based on the morphological characterization followed by the Bergey's manual. By the analysis the result shows that the strain bacterium is identified to be a strain of *Bacillus*. (Table 2)

S.No	**Biochemical tests**	**Results**		
		S-3	**S-5**	**S-7**
1.	Catalase Test	Positive	Positive	Positive
2.	Oxidase Test	Negative	Negative	Positive
3.	Urease Test	Positive	Positive	Negative
4.	Indole Test	Negative	Negative	Negative
5.	Methyl Red	Negative	Negative	Negative
6.	VogesProskauer Test	Positive	Positive	Positive
7.	Citrate	Positive	Positive	Positive
8.	TSI test	Negative	Positive	Positive
9.	Starch Hydrolysis	Positive	Positive	Positive
10.	Casein Hydrolysis	Positive	Positive	Positive
11.	Glucose	Fermentation	Fermentation	Fermentation
12.	Sucrose	Fermentation	Non Fermentation	Fermentation
13.	Lactose	Fermentation	Non Fermentation	Non Fermentation

Table:2 Biochemical analysis of Bacillus

The three bacterial isolates around thirteen positive colonies gave the maximum ratio of clear zone on CMC agar plates. It determined that these bacterial isolates demonstrated potential ability to degrade CMC. Among cellulase producing strains S-3, S-5, S-7 has the best cellulolytic ability by hydrolysis of CMC on CMC agar plates (Fig:1).

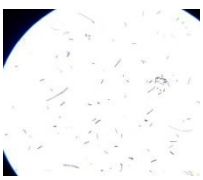

Fig: 2 Gram positive rod shaped bacteria

Conclusion

Several microorganisms have been discovered for decades which have the capacity to convert cellulose into simple sugars but the need of newly isolated degrading microorganisms still continues. In the present study, cellulose producing bacteria were from coir industry soils collected from different places having chances of more cellulase production. A total of 13 isolates showed cellulase production on my primary screening. Out those six isolates were selected for secondary screening. Ultimately three isolates showing more cellulase production by zone activity, were identified as *Bacillus species* using various tests including 16S rRNA sequencing. Cellulase produced by these bacteria can be used for various industrial purposes.

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RENEWABLE ENERGY SOURCES FOR SUSTAINABLE DEVELOPMENT

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Abstract

The development of a nation largely depends on the availability of energy. Without energy we can't able to live in this world. As per the world scenario only 18% of energy is taken from renewable energy (RE). Nowadays the use of energy have been increased due to standard of living of human begins and enhancement of population. The aim of the report is to focus that for the sustainable development the use of RE is should be enhance as compared to non-RE because of greater love of nature and higher environmental consciousness.

Keywords: Renewable, Conventional, planet, power

1. Introduction

Energy is defined as the capacity of a body or substance to do work. RE is energy from sources that are naturally available and time limit. Renewable resources are virtually inexhaustible in duration but limited in the amount of energy that is available per unit of time [1]. The major advantages of using RE sources are pollution free and hence it reduces the greenhouse gas emissions. The principal RE (Sustainable energy) sources are solar, wind, biomass geothermal, hydropower and tidal. The word sustainability [2] was given a universally accepted definition in the 1987 Report of the United Nations World Commission on Environment and Development as: "meeting the needs of the present without compromising the ability of future generations to meet their own needs".

International RE Agency has planned to enhance the use of RE in global interest. More than 80 per cent of all new electricity capacity added in 2021 was renewable, with solar and wind accounting for 91 per cent of new renewables. Every year on the birthday (August 20) of former Prime Minister Rajiv Gandhi the Ministry for New & RE Sources celebrate Indian Akshay Urja Day. The aim of the day is to promote the awareness campaign aimed at enlightening the people about the benefits of RE sources in their lives as well as that of our blue planet. India is the third-largest consumer of electricity in the world next to China and America. It is also the third-largest producer of RE next to China and America with 136GW out of 373GW of total energy capacity

generated from renewable resources. The Indian government target is set to achieve production of 225GW energy through green resources. Interestingly, India is the only country in the entire world to have a separate ministry for the development of RE resources. Government of India promotes innovation to adopt RE sources to produce power for the electricity grid and for several standalone applications and decentralized power production [3].

RE is less carbon-intensive and more sustainable energy system and becoming increasingly popular due to the adverse environmental effects of greenhouse gas emissions from the use of fossil fuels and unpredictable, high and fluctuating energy prices. The growth of RE is convincing in recent years, mainly because of sharp cost reductions for solar and wind power. According to International energy agency estimate, renewable electricity generation will be increased by more than 33 percent by 2022

2. Renewable energy

. Solar energy is one of the best RE sources available because it is one the cleanest sources of energy. Solar power is the conversion of sunlight into electricity either directly by using photovoltaics or concentrated solar power [1]. Solar energy is collected by different type of collectors like compound parabolic concentrator, parabolic through concentrator, flat-plate collector and evacuated-tube collector. Solar water heater, solar cookers (Box type cookers, Dish type cookers), solar cooling, solar air conditioning, solar refrigeration, solar desalination, crop dryers (Integrated solar dryers, Distributed solar dryers, Mixed mode solar dryers), photovoltaics, salt production and solar ponds are the different application of solar energy.

Wind energy can be harnessed by rotational forces causes by wind action in order to produce mechanical energy by the grinding of wing mills and wind vanes. This collision can be used to convert the mechanical energy into electrical energy. Wind results from differences in air temperature, density, and pressure from the uneven solar heating of the earth's surface. Like ocean currents, wind currents act as giant heat exchangers, cooling the tropics and warming the poles. Wind electric energy systems are connected to grid, without need for energy storage facility. Wind energy available free of cost in nature, non-polluting, zero emission of NO_x, SO_2, CO_2, CO, non-depleting and can run a generator.

One of the promising sources of RE is biomass. It helps to utilize wood and agriculture wastes which is available free of cost. Biomass is the feedstock used to produce bioenergy. Bioenergy is a general term for energy derived from materials such as straw, wood, or animal

wastes. Such materials can be burned directly to produce heat or power, and also can be converted into liquid biofuels. Geothermal heat is the only RE source created naturally by the Earth itself. The energy can be extracted from earth's interior in the form of heat. Volcanoes, geysers and hot springs are visible signs of the large amount of heat lying in earth interior. The energy from earth's interior is almost inexhaustible Hydropower or water power is power derived from the energy of falling water or fast running water, which may be harnessed for useful purposes. Flowing water creates energy that can be captured and turned into electricity. The most common type of hydroelectric power plant uses a dam on a river to store water in a reservoir. Tides are produced by gravitational attraction of moon and the sun acting on the rotating earth. Tides are periodic rise and fall of the water level in the oceans due to various positions of rotating moon and sun. Oceans cover 71% of earth's surface. The water level difference is cause in oceans due to the ties and tides contain a large amount of potential energy. The difference in the level between the high and the low tide is called the tidal range and the tidal range of 5-15 m can be easily used to drive turbine coupled with generator to generate electric power.

3. Why RE **source important**

A major difference between conventional (non-renewable) and renewable sources of energy (other than geothermal) is reliability. Electricity can be generated at the dispatcher's whim up to a plant's rated capacity for a generator fueled by fossil and biomass fuels, nuclear power, and geothermal energy. This is not true for other sources. Hydropower depends on rainfall, which affects the water level behind a dam. Wind and solar power depend on whether the wind is blowing or the sun is shining. Though tidal energy is predictable, there is no guarantee that peaks in electricity generation coincide with peaks in electricity demand. Wind, solar, tidal, and wave sources can certainly be tied into an electricity distribution grid and contribute to the electricity pool weather permitting, but they can only displace, not replace, conventional sources of energy unless backup sources of standby power are available to guarantee their reliability[4-5].

Hazard can be defined as any source of potential damage. These sources can be either natural or man-made. A natural event that causes harm to humans is called a natural hazard. Similarly, if the source of hazard is man-made and it causes threat to humans it is called a man-made hazard. Natural Hazards are the result of naturally occurring processes that have been

operating since the formation of the Earth. These are mostly geological processes. The natural hazards are earthquakes, Volcanic eruptions, Tsunami, Landslides, Floods, Droughts, Hurricanes, Tornadoes, Asteroid impacts. If these processes do not cause damage to humans, then they are simply natural events. However, if they affect humans negatively, then they are termed as natural hazards. Now coming to man-made hazards, these are generated by humans and affect them negatively. Some of the man-made hazards are Nuclear, Biological, Chemical, Fire, Travel (road, rail, air, water), Epidemic (Covid), Terrorism, etc. In history nuclear accident occurred on March 11, 2011 in Fukushima, Japan. The accident took place in reactors 1, 2, and 3 of 6 reactors of Fukushima Daiichi nuclear power plants. The reactors were boiling water reactors. The accident was a core meltdown resulting in release of radioactivity into the atmosphere. The accident was a result of station blackout caused by seismic and tsunami. Other nuclear accident took place in reactor 4 of the Chernobyl plant (boiling water pressure tube type reactor) in Soviet Union of Russia and unit 2 of the two Three Mile Island nuclear reactors (pressurized water reactor) in Pennsylvania, United States. In order to reduce to above man made hazards RE sources is needed.

4. Conclusion

There are two sides regarding the use of energy resources, like a coin. On the one side, there is the opportunity to use conventional, easily accessed but environmentally-unhealthy resources; and other hand, there is a choice of non-conventional, technology-oriented energy but environmentally-healthy resources. It is a battle that comes along with political, economic, environmental and even personal pros and cons. RE resources have double benefits: ability to be replenished over a human lifespan and environmentally sustainable (carbon-free). So the enhancement of RE is healthy as environmentally concern to tackle climate change and global warming worldwide.

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CONSUMER BEHAVIOUR

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Preface

The book titled "CONSUMER BEHAVIOUR" contains the chapters related to Consumer Behavior and related areas in Consumer behavior. The chapters include the contributions of experts at their academic field. I am thankful to the contributors for their academic contents in edited book titled Consumer Behavior. I express my love and affection to my parents, wife, kids, colleagues and friends to makes my dream come true.

- Dr. Vinod A S

Tourism Marketing and Consumer Behaviour

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Abstract: *When go on summer vacation and burn up days shopping in traditional stores, hiking in a national park, ingestion local food and enthralling in a musical at the amphitheater, you are being a tourist. Tourism take place when you go away your distinctive surroundings where you live and work to go to a additional environment to fit into place in activities there, at a distance from of how close or how far it is. You are a visitor, and what you do while visiting is tourism. Individuals and organization at your justification give confidence to those activities from beginning to end advertising or other forms of marketing. Tourism marketing has far severed from characteristics from other marketing plans. Because tourists are provisional, they are open to the elements to an area's goods and services for shorter periods. But tourists are as well as on having a good time, so marketers should suppose policy that demand to the emotions, such as treat kids to an stupendous experience. Modern marketing is customer familiarize therefore, the study of customers behaviour is very momentous in surround product policies, price policies, decision in relation to sales promotion. The underlying principle of any business enterprise is to tender worth to its customer. Therefore the study of consumer behavior is of stable meaning for a marketing person to be able to bring value to consumer. This paper aimed to give a all-purpose idea of Tourism marketing and its consumer behaviour.*

Key Words: *Tourist Destination, Tourist-Based Economies, Economic Development, Disposable Income, Services, Handcrafted Objects and National Tourist Bodies.*

Introduction

Tourism and money-making development are concurrent by the collection of ways in which tourism can make a payment to the financial development of a tourist end. This relationship among tourism and economic development is the basis for the confidence of some tourist-based economies on the things of tourism for their economic development. For instance, tourism make accessible more jobs for local citizens, helps local citizens start businesses that offer to tourists and lead to the age bracket of revenue from tourist costs and fiscal policies, and aid in the development of infrastructure. One of the recompense or links linking tourism and economic development is the fact that jolly tourist regions offer employment for the citizens of that area. Tourism wants a lot of services in order to bring on the industry. Employment is macroeconomic factor that make expense to the distension of an economy by given those workers with casual income and as a result most important to an unnecessary in the Gross Domestic Product (GDP) of the region.

The store owners will make a payment to the take-home pay with the local artisans, or they may get hold of the objects from them outright. This helps the economy by afford that the poor members of the district with not reusable income. Tourists also like to visit places with a well-off cultural heritage. Most times, these places are to be originating in villages that would or else not get hold of much government concentration. Due to the inference of the villages, they will be

About the Author

Dr. Vinod A S received his MCom from University Of Kerala Trivandrum, Kerala , MBA from M S University Tirunelveli with second Rank in 2003 and started his career as Guest lecturer in Christian college Kattakada, Trivandrum and raised to the level of Assistant professor. He has switched over to Government aided college under NSS Management during 2009. He has served in various capacities from Guest lecturer, Lecturer, senior lecturer and assistant professor in Colleges such as Christian college Kattakada, ASIET Business School Kalady, ELIMS Business School Trissur, NSS College Nemmara, NSS college Pandalam and VTM NSS College Dhanuvachapuram. Presently he is working as an Assistant Professor of commerce Mahatma Gandhi College Trivandrum, Kerala. He has 5 Awarded thesis and 7 understanding research. He holds NET in both Commerce and Management, M.Phil in Commerce, M.F.M in finance, MA in Public Administration, M.L.M in Labour Management, MSc in Applied Psychology, MRS in Rural Studies, MTTM Tourism Management PGDBA in Business Administration, PGDTM in Tourism Management, PGDMM in marketing management, PGDPRIR in personal management and industrial relation, PGDAOR in Applied Operations Research PGDSBSA Software Based Statistical Analysis, SET in commerce and PhD in Commerce. He under gone Faculty Development programme (FDP) from leading institutes like IIM(B), IIM(K), TISS Mumbai, XIME Bangalore, FDPSDE Kerala University, FLAIR and IBS Business School. Presently he is guiding ten PhD Scholars of University of Kerala, among which one awarded and two submitted thesis. He has been a Assistant Professor of commerce since 2009 and Research Supervisor of PG Department of Commerce and Research Centre, Mahatma Gandhi College Trivandrum, Kerala. His major research areas are Finance, Tourism and Marketing. He has published couple of articles in leading national and international journals and authored chapters in books. He has presented papers in National International Conferences and chaired sessions in conferences. He has been serving as Board of Studies member of BBA in University of Calicut and in the editorial board of leading journals. He prepared question papers for various universities and Autonomous colleges. He is in charge of NCC care taker; NSS programme officer, Additional Chief supervisor of University examinations, and a member of college council for several times. He is an approved tax practioner certificate holder. He has been a life time member of IIA, ASDF etc. He has received gold medal for MBA second rank during the year 2003. He received faculty award from International Accreditation Association for Outstanding contribution to commerce edcuation in Kerela, ASDF - SIAA award finalist for Best familiar male faculty, South Asian Education award 2018 for the best faculty in Commerce and I2OR outstanding educator award. Winner 'India Book of record' - Maximum Number of Post Graduate Degree and Diplomas from single university. Winner 'Best of India record' -Assistant Professor Having Most number of qualifications from single university.

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