YASHWANTRAO CHAVAN COLLEGE OF SCIENCE, KARAD

CRITERION-III

RESEARCH, INNOVATIONS AND EXTENSION

3.2 RESEARCH PUBLICATIONS AND AWARDS

3.2.1 Number of research papers published per teacher in the Journals notified on UGC CARE list in 2018-2023

Index

Research papers published in 2022-2023

Sr. No	Title of paper	Name of the author/s	Department of the teacher	Name of Journal ISSN number
1	In-vitro anti-bacterial and cytotoxic activity of rubiadin.	Somade P. M., **Kirtane S. A.**, Jadhav P. D., P. P. Somade	Botany	Int. J. Biology, Pharmacy and Allied Science 2277-4998
2	A Comprehensive Review of Chromite, Ferrite and Aluminate Nano-Materials	**G. B. Dhake**, S. T. Dengle, R. S. Dhivare	Chemistry	Journal For Basic Sciences 1006-8341
3	SILAR synthesized dysprosium selenide (Dy2Se3) thin films for hybrid electrochemical capacitor	S. D. Khot, D. B. Malavekar, R. P. Nikam, **S. B. Ubale**, C. D. Lokhande	Physics	Synthetic Metal 0379-6779
4	Tetraphenylethene-Based Fluorescent Chemosensor with Mechanochromic and Aggregation-Induced Emission (AIE) Properties for the Selective and Sensitive Detection of Hg 2+ and Ag + Ions in Aqueous Media: Application to Environmental Analysis	**K. S. Jagadhane**, S.R. Bhosale, D.B. Gunjal, O.S. Nille, G.B. Kolekar, S.S. Kolekar, T.D. Dongale, P. V. Anbhule	Chemistry	ACS Omega 2470-1343
5	Multilocus Marker-based Delimitation of Salicornia persica and its Population Discrimination Assisted by Supervised Machine Learning Approach.	**Jamdade R.**, Al Shaer K., Al Sallani M., Al Harthi E., Mahmoud T., Gairola S., Shabana H.	Zoology	PLoS ONE 1932-6203

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Internal Quality Assurance Cell (IQAC),
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6	Spatial V ariations in the Geochemical Characteristics of Basalts from the Deccan Volcanic Province, India: Role of Mixing and Assimilation Fractional Crystallization	**L.B. More**, B. Nagaraju, K. Nagaraju, K. Vijaya Kuma	Geology	Journal of Earth System Science 2347-4327
7	In-vivo investigation of chronic inflammatory pain Modulating Potential of Niranthin	Gavekar P.S., Somade P.M., Chavan R.S., Pathak R. S., Chopade A.R., **Kengar S.B.**	Zoology	International Journal of Biology, Pharmacy and Allied Sciences 2277-4998
8	Formation of CuO nanostructures via chemical route for biomedical applications	S.R. Bhosale, S.A. Ghatage, P.N. Wahane, R.R. Bhosale, **Kishor S. Jagadhane**	Chemistry	Chemical Physics Letters 0009-2614
9	Xanthomonadin mediated synthesis of biocidal and photo-protective silver nanoparticles (XP-AgNPs)	Salunkhe N.S**., Koli S.H**., Mohite B.V., Patil V.S., Patil S.V.	Microbiology	Results in Chemistry 2211-7156
10	A Tetraphenylethene-Based Aggregation-Induced Emission Luminogen (AIEgen) With Mechanochromic Phenomena for Highly Selective Naked-Eye Detection of Mno4− Directly in Aqueous Media	**K.S. Jagadhane**, S.R. Bhosale, A.A. Moyo, G.B. Kolekar, K.K. Sharma, H.M. Yadav, P. V. Anbhule	Chemistry	ChemistrySelect 2365-6549
11	Effect of Electromagnetic radiations of a mobile phone on the growth of some pathogenic bacteria	**A. A. Raut**, A. H. Patil, K. A. Yadav, K. A. Sutar, J. U. Patil	Microbiology	Mukt Shabd Journal 2347-3150
12	Antibiotic sensitivity profile of Uro pathogenic Klebsiella pneumoniae	**S. B Jadhav**, M. M. Siddiqui, S. V. Mamdapure, H.J. Bhosale	Microbiology	Bulletin of Environment, Pharmacology and Life Sciences 2277-1808
13	Anti-Klebsiella pneumoniae Activity of Actinomycetes Isolated from Soil	M. M Siddiqui, **S. B Jadhav**, S. V. Mamdapure, R. N. Ghaleb, H.J. Bhosale	Microbiology	Bulletin of Environment, Pharmacology and Life Sciences 2277-1809

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14	Antimicrobial Activities of Actinomycetes Against Urease Producing Bacterial Pathogens	S. V Mamdapure, M. M Siddiqui, **S. B Jadhav,** H.J. Bhosale	Microbiology	Bulletin of Environment, Pharmacology and Life Sciences 2277-1810
15	Antibacterial Activity of Aegle marmelos on Uropathogenic Klebsiella pneumoniae	P. B Jadhav, S. V Mamdapure, **S. B Jadhav**, M. M Siddiqui, H.J. Bhosale	Microbiology	Bulletin of Environment, Pharmacology and Life Sciences 2277-1811
16	Antibacterial Activity of Biosurfactant Produced from Haloferax chudinovii HB1RANIA	R. N Ghaleb, S. V Mamdapure**, S.B Jadhav**, M. M Siddiqui, H.J. Bhosale	Microbiology	Bulletin of Environment, Pharmacology and Life Sciences 2277-1812
17	Symmetric supercapacitor based on biosynthesized nanosheets of reduced graphene oxide (rGO): Characterization and electrochemical behavior	A. A Survase, S. H Sutar, **S. B Ubale**, S. S Kanase	Physics	Journal of Electrochemical Chemistry 1873-2569
18	Isolation and biochemical characterization of phosphate solubilizing bacteria from soils of some regions of Satara district.	**Sutar K. A., Raut A. A., Shaikh N.R.**	Microbiology	Research Journal of Agricultural Sciences 2249-4538
19	Recent Trends in Synthetic Top-down Approach for Mesoporous Carbon: A Seminal Review	Bhosale S. R., Bhosale R.R., **K.S. Jagadhane**, Anbhule P. V	Chemistry	Journal of Materials NanoScience 2394-0867
20	Dielectric behavior and phase transition of $La_2Mo_2O_9$ films synthesized by spray pyrolysis technique	**G. A. Kadam** et. al.	Physics	Journal of Material Science: Material in Electronics 0957-4522
21	Synthesis and testing of polyacrylamide-grafted waste sand derived composite adsorbent for water purification	Harshada B. Garud, Sushilkumar A. Jadhav, Sayali P. Jadhav, **Shivaji H. Burungale**	Chemistry	Polymer Advanced Technologies 1099-1581
22	Surface Modifed Silicon Dioxide Based Functional Adsorbents Derived from Waste Sand for the Removal of Toxic Pollutants from Water	H. B. Garud, S. A. Jadhav, S. P. Jadhav, **S. H. Burungale**	Chemistry	Silicon 1876-9918

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23	Tetraphenylethene Carbothioamide-Based Organic Stimuli- Responsive Mechanochromic Memristive Devices with Non- Volatile Memory and Synaptic Learning Functionalities	**Jagadhane, K. S.**, Tukaram D. D., Ankita S. Nikam, N. B. T., R. K. Kamat, G. B. Kolekar, Anbule P. V.	Chemistry	Chemistry Select 2365-6549
24	Magnetic and structural characterization of Sn doped cobalt ferrites; A visible light-driven photocatalysts for degradation of rhodamine-B and modeling the process by artificial intelligence tools	S. D. Zimur, P. Gaikwad, **A.V. Mali**, A. P. Patil, **S. H. Burungale**, P.D. Kamble	Chemistry	Journal of Alloys and Compounds 0925-8388
25	Texture and major element geochemistry of channel sediments in the Orsang and Hiren River Basins, Gujarat, India: Implications for provenance and weathering	Keshwala N., Maurya S., Gurav C. A., **More L. B**	Geology	Journal Indian Association of Sedimentologists 2582 – 2020
26	Magnetic nanostructured adsorbents for water treatment: Structure-property relationships, chemistry of interactions, and lab-to-industry integration	S. M. Prabhu, N. R. Rane, X. Li, **S. V. Otari**, S. D. Girawale, A. R. Palake, K. M. Kodam, Y-K. Park, Y-H. Ha, K. Yadav, M. Ali Khan, B-H. Jeon	Microbiology	Chemical Engineering Journal 1385-8947
27	Multifunctional Fluorescent Tetraphenylethene-Based Reversible Mechanochromic for Highly Selective Detection of MnO4- in aqueous media and Green Organic Light Emitting Diode applications	**K. S. Jagadhane**, R. J. Buluminogenher T. D. Dongale, K. A. Nirmal, S. Salunke-Gawali, P. V. Anbhule	Chemistry	Crystal Growth & Design 1528-7505
28	Phytochemical Profiling, Antimicrobial, Antiproliferative and Apoptotic Effects of Stemodia viscosa Roxb. of Western Ghats Region, India, Chemistry & Biodiversity	A. A Moyo, **K. S. Jagadhane,** S. R. Bhosale, D. N Patil, V. B. Shimpale, P. V. Anbhule	Chemistry	Chemistry & Biodiversity 1612-1872

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29	One Pot Synthesis of CuO-CuFe2O4@rGO Nanostructure with Synergistic Effect for Efficient Electrochemical Sensing Application of Paracetamol	J. C. Bhangoji, S. S. Kahandal, **R. S. Patil**, T. L. Lambat, S. I. Khan, G. Wadhava, S. H. Mahmood, and S. S. Shendage	Chemistry	ECS Advances 2754-2734
30	Mesoporous carbon encapsulated zinc oxide nanorods derived from plant species 'Argyreia sharadchandrajii'for live cell imaging of drug delivery and multimodal bioactivities	S. R. Bhosale, **K. S. Jagadhane**, R. R. Bhosale, S. A. Vanalakar, V. B. Shimpale, G. B. Kolekar, P. V. Anbhule	Chemistry	New Journal of Chemistry 1369-9261
31	Evaluation Of The Groundwater Quality For Its Suitability For Drinking And Irrigation In The Indian State Of Maharashtra's Khanapur Taluka, Sangli.	**A. A. Lole**, D. B. Panaskar	Geology	International Journal of Novel Research and Development (IJNRD) 2456-4184
32	Histotoxicity of AIEgen Based on Triphenylamine for the Simultaneous and Discriminatory Sensing of Hg^{2+} and Ag^{+} Directly in Aqueous Media for Environmental Applications	**Jagadhane K. S.**, Birajdar N. B., Kolekar G. B., Anbhule P. V.	Chemistry	Chemical Research in Toxicology 1520-5010
33	Exploring Extracellular Hydrolytic Enzyme and Bio Flocculant-Producing Bacterial Isolates for Bioremediation of Vegetable Oil Refinery Effluent	**G.M. Shinde**, A. Jadhav	Microbiology	Journal of Chemical Health Risks 2251-6727
34	Anticancer and Apoptotic Effects of Hymenodictyon floribundum (Hochst. & Steud.) B. L. Rob. Stem Bark Hydroethanolic Extract	A.A. Moyo, **K.S. Jagadhane**, S.R. Bhosale, P. V. Anbhule	Chemistry	Chemistry Africa 2522-5758
35	Evaluation of antimicrobial, cytotoxicity effects and antioxidant potential of Stemodia verticillata (Mill.) Hassl extracts Journal of Applied Pharmaceutical Science	A. A Moyo, S. R Bhosale, **K. S. Jagadhane**, S. B. Shinde, V. B. Shimpale, P. V. Anbhule	Chemistry	Journal of Applied Pharmaceutical Science 2231-3354
36	Treatment of Textile Processing Effluent Using Bacterial Isolate and Activated Charcoal	**G. M. Shinde**, A. Jadhav	Microbiology	Journal of Chemical Health Risks 2251-6727

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37	Cultural and Morphological Characterization of Alternaria brassicicola Schwein. & Wiltshire. Associated with Leaf Spot Disease of Cabbage	S. S. Pawar, N. K. Khandare, **G. G. Potdar**	Botany	BIOINFOLET - A Quarterly Journal of Life Sciences 0976-4755
38	Symmetric supercapacitor based on biosynthesized nanosheets of reduced graphene oxide (rGO): Characterization and electrochemical behaviour	A. A Survase, S. H Sutar, **S. B Ubale**, S. S Kanase	Physics	Journal of Electrochemical Chemistry 1873-2569
39	Treatment of Textile Processing Effluent Using Bacterial Isolate and Activated Charcoal	**G. M. Shinde**, A. Jadhav	Microbiology	Journal of Chemical Health Risks 2251-6727

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IN-VITRO ANTI-BACTERIAL AND CYTOTOXIC ACTIVITY OF *RUBIADIN*

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ABSTRACT

Studies have confirmed the medicinal potential of the *Rubiadin*. While effects of Rubiadin on some bacteria and Brine shrimp lethality using their different concentrations has not been previously explored.

Present study shows that the Pure Rubiadin exhibited antibacterial and cytotoxic activity.

The findings of present work provide need for further exploration of Rubiadin to treat microbial infections and cancer.

Keywords: Rubiadin; Antibacterial activity; Brine shrimp lethality assay

INTRODUCTION

Rubiadin, 1,3- dihydroxy-2-methyl anthraquinone has been isolated from the *Rubia cordifolia* Linn (Rubiaceae). *Rubia cordifolia* is an important medicinal plant which is used for treatment of various ailments in Ayurvedic system of medicine **[1, 2]**. Rubiadin, isolated from the roots of *Rubia cordifolia* was found to have potent antioxidant property **[3]**. In addition, rubiadin also have been found to inhibit lipid peroxidation **[4]** and the plant *Rubia cordifolia* have been reported for anti-inflammatory **[5]**, immunomodulatory **[6]**, anticonvulsant and anxiolytic **[7]** and anti-tumor activities **[8]**. While the results of the study by Guntupalli *et al.*, **[9]** strongly

A COMPREHENSIVE REVIEW OF CHROMITE, FERRITE AND ALUMINATE NANO-MATERIALS

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Abstract: *Spinel oxides, which have the general formula AB_2O_4, are durable materials that may be used for a variety of processes, including catalysis. The distribution of various cations in the A and B sites is mostly influenced by the stabilization of respective crystal fields. This distribution's impact on the catalytic characteristics is not insignificant. Octahedral B sites are more exposed than tetrahedral A sites when the spinel structure is broken by a surface. However, with the comparison of chromite, ferrite, and aluminates oxides is exciting - this provides researchers an opportunity to really understand the differences between them and how they react under different circumstances! Chromite oxide has a high temperature coefficient of electrical resistance and provides electrical insulation up to 500°C. On the other hand, ferrite oxide demonstrates good magnetic properties including low power loss in various magnetic applications. Last but not least, aluminates are ideal for use in optoelectronics since they mostly consist of aluminium and numerous metal oxides. Aluminates have a lower thermal conductivity than the majority of metals, which makes them superior in this regard. Now with these three oxides at our study, the researchers are able to investigate a virtually infinite number of possibilities, each one of which may ultimately lead us to new discoveries that make life easier.*

Keywords: ***nano-materials, metal oxides, chromite, ferrites, aluminates***

1. INTRODUCTION

In recent years, the development of nano materials has garnered a significant amount of attention across various fields of study. In this essay, we will perform a full review of ferrite, chromite, and aluminate nano materials. A lot of research has been carried out on the synthesis and characterization of ferrite chromite and aluminate nano materials capable of being used in various fields of science and engineering. These materials exhibit remarkable magnetic, electrical, thermal, and catalytic properties. They are known to be efficient in many industrial applications, making them highly valuable substances to researchers and industries across the globe.

Ferrites are a class of ceramic materials that display magnetic properties, making them useful in various applications such as magnetic storage media, microwave devices, and sensors. Ferrite nano materials have been extensively studied due to their unique properties, including high magnetic anisotropy and improved magnetic responsiveness. Ferrite nano materials can be synthesized using various methods, including sol-gel processing, co-precipitation, and hydrothermal synthesis. The properties of ferrite nano materials can be easily tuned by controlling the synthesis parameters such as temperature, pH, and precursor concentration. Some of the current applications of ferrite nano materials include magnetic resonance imaging, drug delivery systems, and environmental remediation.

Chromite nano materials are another class of materials that have gained significant attention in recent years, mainly due to their unique properties, including high thermal stability, tuneable electrical and magnetic properties, and high refractive index. Chromite nano materials can be synthesized using various techniques, including sol-gel processing, hydrothermal synthesis, and co-precipitation, with the desired properties dependent on the synthesis method used. Chromite nano materials have applications in various fields, including energy conversion, catalysis, and biomedical imaging. For example, chromite nano materials are used as catalysts in the production of hydrogen fuel from water.

Aluminate nano materials are another class of ceramic materials that have unique properties, including thermal stability, high hardness, and high refractive index.

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Synthetic Metals

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SILAR synthesized dysprosium selenide (Dy_2Se_3) thin films for hybrid electrochemical capacitors

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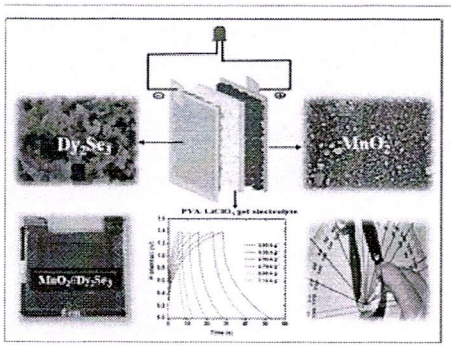
Abstract

As the necessity of energy storage is continuously increasing, new materials have been investigated for electrochemical energy storage, especially for electrochemical capacitors. These storage devices are rapidly convertible as well as air pollution free. Therefore, a number of materials have been explored as electrode materials for supercapacitors to fulfill different requirements of electrochemical energy storage. Herewith, dysprosium selenide (Dy_2Se_3) films were prepared using the simple successive ionic layer adsorption and reaction (SILAR) method and characterized using different physico-chemical techniques. The specific capacitance (C_s) of $92\,Fg^{-1}$ was obtained at the current density of $2.85\,Ag^{-1}$ in 1 M $LiClO_4$ electrolyte with a retention of 85% over 5000 galvanostatic charge-discharge (GCD) cycles performed at a current density of $4\,Ag^{-1}$. The flexible solid-state hybrid electrochemical capacitor of configuration $Dy_2Se_3/LiClO_4$-PVA/MnO_2 showed C_s of $83\,Fg^{-1}$ and specific energy of $18\,Whkg^{-1}$ at a specific power of $2.7\,kWkg^{-1}$. This hybrid device retained 92% of capacitance at a device bending angle of 160°. These results demonstrate the facile synthesis of Dy_2Se_3 and its possible use in electrochemical energy storage applications.

Graphical Abstract



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Introduction

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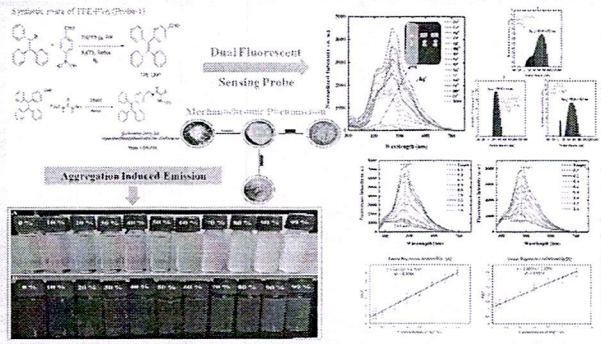
Article

Tetraphenylethene-Based Fluorescent Chemosensor with Mechanochromic and Aggregation-Induced Emission (AIE) Properties for the Selective and Sensitive Detection of Hg^{2+} and Ag^{+} Ions in Aqueous Media: Application to Environmental Analysis

Kishor S. Jagadhane, Sneha R. Bhosale, Datta B. Gunjal, Omkar S. Nille, Govind B. Kolekar, Sanjay S. Kolekar, Tukaram D. Dongale, and Prashant V. Anbhule*

Cite This: https://doi.org/10.1021/acsomega.2c03437

ABSTRACT: It is critical to design a novel and simple bifunctional sensor for the selective and sensitive detection of ions in an aqueous media in environmental samples. As a result, in this study, tetraphenylethene hydrazinecarbothioamide (TPE-PVA), known as probe 1, was successfully synthesized and characterized as having impressive photophysical phenomena such as aggregation-induced emission (AIE) and mechanochromic properties by applying mechanical force to the solid of probe 1. The emission of the solid of probe 1 changed from turquoise blue to lemon yellow after grinding, from lemon yellow to parakeet green after annealing at 160 °C, and to arctic blue after fuming with DCM. Such characteristics could lead to a variety of applications in several fields. The probe was implemented and demonstrated remarkable selectivity and sensitivity toward mercury(II) and silver(I) ions by substantially switching off emission over other cations. Following an extensive photophysical analysis, it was discovered that detection limits (LOD) as low as 0.18344 and 0.2384 $\mu g\ mL^{-1}$ for Hg^{2+} and Ag^{+}, respectively, are possible with a quantum yield (Φ) of 2.26. Probe 1 was also explored as a Hg^{2+} and Ag^{+} paper strip-based sensor and kit for practical use. The binding mechanisms of probe 1 (TPE-PVA) with Hg^{2+} and Ag^{+} were confirmed by ^{1}H NMR titration. These results could lead to the development of reliable onsite Hg^{2+} and Ag^{+} fluorescent probes in the future.



1. INTRODUCTION

Tetraphenylethylene (TPE)-based device materials have been of great interest in recent years for detecting metal ions in biological and environmental systems because of their aggregation-induced emission (AIE) properties,[1] high selectivity, sensitivity, and ease of evaluation. Tetraphenylethene is also a common building block for AIE photophysical phenomena. A carbothioamide derivative based on tetraphenylethene may exhibit AIE. Whenever illuminated with 365 nm ultraviolet (UV) light, dilute tetrahydrofuran (THF) solution of TPE-PVA emitted a modest yellowish color, whereas its solid emitted a strong yellowish color. Because of the hydrophobic nature of TPE, it is universally acknowledged that AIE-active sensors can be developed from TPE.[2] Aggregation-induced emission (AIE) compounds have a propeller-shaped structure, wherein $\pi-\pi$ stacking in aggregates and solids is avoided. Because of the hydrophobic characteristics of TPE, TPE-derived probes have long been recognized to be AIE-active.[3] Tetraphenylethylene has a propeller-shaped structure with rotating aromatic phenyl rings on the periphery. Recent research has discovered and proven that when in dilute solutions, free rotation of the peripheral aromatic rings is allowed. Nonradiative disintegration (decay) is induced by the excited state.[4] As a result of their "aggregation-induced emission" properties, tetraphenylethylene derivatives are the most commonly used chromophores to explain complexation with metal ions. The functionalization of the tetraphenylethylene-based molecular architecture with pendant coordinating sites for metal ions is a way of developing novel chemosensors for metal ion detection.[5] The AIE characteristics of tetraphenylethylene, which are based on the interaction of chromophore receptor sites with analytes, determine the detection capability of the compound.[6]

Recently, tetraphenylethylene and other aggregation-induced emission derivatives were successful in detecting Hg^{2+}

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RESEARCH ARTICLE

Multilocus marker-based delimitation of *Salicornia persica* and its population discrimination assisted by supervised machine learning approach

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Abstract

The *Salicornia* L. has been considered one of the most taxonomically challenging genera due to high morphological plasticity, intergradation between related species, and lack of diagnostic features in preserved herbarium specimens. In the United Arab Emirates (UAE), only one species of this genus, *Salicornia europaea*, has been reported, though investigating its identity at the molecular level has not yet been undertaken. Moreover, based on growth form and morphology variation between the Ras-Al-Khaimah (RAK) population and the Umm-Al-Quwain (UAQ) population, we suspect the presence of different species or morphotypes. The present study aimed to initially perform species identification using multilocus DNA barcode markers from chloroplast DNA (cpDNA) and nuclear ribosomal DNA (nrDNA), followed by the genetic divergence between two populations (RAK and UAQ) belonging to two different coastal localities in the UAE. The analysis resulted in high-quality multilocus barcode sequences subjected to species discrimination through the unsupervised OTU picking and supervised learning methods. The ETS sequence data from our study sites had high identity with the previously reported sequences of *Salicornia persica* using NCBI blast and was further confirmed using OTU picking methods viz., TaxonDNAs Species identifier and Assemble Species by Automatic Partitioning (ASAP). Moreover, matK sequence data showed a non-monophyletic relationship, and significant discrimination between the two populations through alignment-based unsupervised OTU picking, alignment-free Co-Phylog, and alignment & alignment-free supervised learning approaches. Other markers viz., rbcL, trnH-psbA, ITS2, and ETS could not distinguish the two populations individually, though their combination with matK (cpDNA & cpDNA+nrDNA) showed enough population discrimination. However, the ITS2+ETS (nrDNA) exhibited much higher genetic divergence, further splitting both the populations into four haplotypes. Based on the observed morphology, genetic divergence, and the number of haplotypes predicted using the matK marker, it can be suggested that two distinct populations (RAK and UAQ) do exist. Further extensive morpho-taxonomic studies are required to determine the inter-population variability of *Salicornia* in the UAE. Altogether, our results suggest that *S. persica* is the

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Spatial variations in the geochemical characteristics of basalts from the Deccan Volcanic Province, India: Role of mixing and assimilation fractional crystallisation

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In the present study, we have demarcated five zones within the Deccan Volcanic Province (DVP): (1) Kutch, (2) Western Ghats, (3) Central Son–Narmada, (4) Eastern Son–Narmada and (5) South-Eastern Deccan (SE DVP) to evaluate spatial geochemical variations within the DVP possibly controlled by different eruption loci. True OIB-type unmixed trace element and isotopic signatures are demonstrated by both alkali and tholeiitic basalts from Kutch and a small proportion from Western Ghats. However, large number of tholeiitic basaltic samples from both the zones and Central Son–Narmada zone illustrate sub-continental lithosphere mantle (SCLM) signatures. The Eastern Son–Narmada and SE DVP zones of the DVP show evolved compositions, but are dominantly derived from sub-lithospheric sources. The plume–lithosphere interaction is represented by mixing and/or assimilation and fractional crystallisation (AFC) of plume-derived melts with the sub-continental lithospheric mantle (SCLM)-derived melts, sediments preserved in the SCLM, lower crustal (TTG-type) and upper crustal (granitic) components. We argue that melts from the Archaean sediments preserved in the SCLM, *represented by calc-alkaline lamprophyres*, are the most suited components that interacted with the plume-derived as well as SCLM peridotite-derived melts. Few Kutch zone basalts require granitic components, while some proportion of Western Ghats zone basalts require TTG-type assimilate to explain their isotopic characteristics. Mixing and/or AFC between the plume-derived and sediment-derived melts and SCLM peridotite-derived and sediment-derived melts played fundamental roles in the observed geochemical heterogeneity of the Deccan basalts. We demonstrate that original sub-lithosphere melts may display apparent SCLM signatures by ~10% mixing and/or ~20% AFC of lamprophyre source melts and entire Deccan data considered in the present study can be explained by 20% mixing and/or 50% AFC of plume-derived melts with calc-alkaline lamprophyre as an assimilate.

Keywords. Deccan Volcanic Province; basalt; mixing; assimilation fractional crystallisation; plume; SCLM.

This article is part of the Topical Collection: Deccan Traps and other Flood Basalt Provinces – Recent Research Trends.
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IN-VIVO INVESTIGATIONS OF CHRONIC INFLAMMATORY PAIN MODULATING POTENTIAL OF NIRANTHIN

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ABSTRACT

Background: It has been well referred that lignan family of natural products has goodpharmacological potential. A lignan, Niranthin, 6-[(2*R*,3*R*)-3-[(3,4-dimethoxyphenyl)methyl]-4-methoxy-2-(methoxymethyl)butyl]-4-methoxy-1,3-benzodioxole] is a common phytoconstituents from various *Phyllanthus* species.

Objectives: This study aims to investigate chronic pain modulatory potential of Niranthin.

Materials and Methods: We have investigated the effects of Niranthin on chronic thermal and mechanical hypersensitivities in rats, which were injected with 3% carrageenan in the left gastrocnemius muscle and hyperalgesia to heat and mechanical stimuli was assessed before and at varying times after injection, till end of 22 days after muscle insult. Histological changes and the determination of prostaglandin E2 (PGE2) concentration were performed after the completion of drug treatment protocol.

Results: Our finding noted that Niranthin causes hypersensitivityactivity, when administered intraperitoneally. There was also reduction in prostaglandin E2 (PGE2) concentration observed during our analysis.

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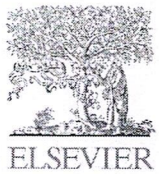

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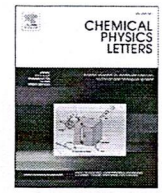

Research paper

Formation of CuO nanostructures via chemical route for biomedical applications

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ARTICLE INFO

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CuO nanostructure
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Particle size
Surface area
Antimicrobial study

ABSTRACT

In this report, we have successfully prepared the CuO nanostructure by simple and cost-effective co-precipitation method by varying the concentration of precursor's solution. The variation of concentration and its effect on the physico-chemical properties of the CuO nanostructure was investigated and discussed in detail. The structural, surface morphological, elemental composition, particle size with zeta potential, optical properties and surface area of the CuO nanostructures were characterized by X-ray diffraction (XRD), Fourier transform infrared analysis (FT-IR), Scanning electron microscopy (SEM), Energy dispersive X-ray analysis (EDAX), Dynamic light scattering (DLS), UV–Visible spectroscopy and BET analysis respectively. The XRD confirms the phase formation of the pure CuO and observed the monoclinic crystal structure of CuO nanostructure. Also, the surface morphology was studied by using SEM and it showed the petals like morphology and change in the aspect ratio of the nanostructure was observed when the concentration of precursors solution was altered. The surface area and porosity of the CuO nanostructures have been carried out and it reveals a more porous structure. Furthermore, the nanostructures are utilized for study of the antimicrobial properties. It is observed that CuO nanostructures shows enhanced antimicrobial properties towards *B. subtilis*, *E.coli* and *E. faecalis* and *S. aureus* bacteria. Also, we have studied the antifungal activity tested against *C. albicans*. Therefore, CuO nanostructures can be used as an ingredient for dermatological applications in creams, lotions, ointments, or other biomedical applications for human beings.

1. Introduction

In this era, nanostructures have enabled the homogenization of a wide range of specialties in the biological, pharmaceutical, and environmental fields. To name a few several nanomaterials are used in a variety of biomedical sectors, including drug delivery, diagnostics, medicine, antimicrobial, antifungal and therapies [1,2]. Because of their small dimensions and high biocompatibility, nanomaterials are beneficial in this area. As a consequence nanotechnology frequently employs nanomaterials in a variety of biomedical applications. One of the most significant basic investigations in nanoscience and technology is determining the antioxidant and antimicrobial activities of nanomaterials [3]. Improving antimicrobial activities and adaptability of materials is especially crucial to avoid hematolysis, allergic reaction, inflammation, and other unpleasant reactions whether prolonged or temporary, localized or universal [4,5].

In recent years, the preparation of metal oxide nanoparticles with tailored morphology has attracted much interest because of its unique features and applications [6]. Among the inorganic metals, copper is soft, bendable, and malleable with high electrical and thermal conductivities. CuO is a p-type semiconductor with band gap of 1.2 eV [7]. CuO is easily available with low cost as compared to equivalent metals such as platinum, gold, and silver nanoparticles [8,9]. Copper oxide nanoparticles show remarkable physico-chemical features as well as optical, magnetic properties,catalytic, high aspect ratio to volume ratio, and biocidal qualities [10–13]. CuO synthesis can be carried out by a variety of fabrication approaches including, sol–gel method, microemulsion, gas-phase oxidation, coprecipitation, hydrothermal and chemical bath deposition method [14–18]. Cu^{2+} ions produced from CuO nanoparticles exhibit antimicrobial potential. Cu was considered to be a great

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Xanthomonadin mediated synthesis of biocidal and photo-protective silver nanoparticles (XP-AgNPs)

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ARTICLE INFO

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Xanthomonadin
Pigments
Silver nanoparticles
SPF
Biocidal
Andtioxidant

ABSTRACT

Nanoparticles have drawn significant attention in recent years, owing to their unique electrical, optical, biocidal, and catalytic properties. The present study reports an environment friendly, green approach for silver nanoparticles (AgNPs) synthesis using bacterial yellow color pigment, xanthomonadin (XP) derived from *Xanthomonas* sp. After exposing the reaction mixture to sunlight, a visible colour shift and spectrophotometric measurement proved that nanosized silver particles (XP-AgNPs) were being synthesized by xanthomonadin. The size of XP–AgNPs was in the range between 30 and 100 nm, with the spherical shaped particles. The XP–AgNPs showed excellent biocidal activity against representative Gram positive and Gram negative organisms i.e. *Staphylococcus aureus*, *B. subtilis* and *Pseudomonas aeruginosa*, *Escherichia coli*. In addition, using standard assays, the photo-protecting/SPF enhancement of commercial sunscreens and DPPH radical scavenging activity of XP, and XP-AgNPs were evaluated. As a result, adding 4 % w/w xanthomonadin in commercial sunscreens have original SPFs 4 and 10 increases by 271 % and 85.2 %, respectively. XP and XP-AgNPs showed significant antioxidant activities with the IC_{50} values of 46.21 μg/mL and 21.62 μg/mL, respectively. In conclusion, xanthomonadin mediated silver nanomaterial with photo protecting, antioxidant and biocidal potential has been reported.

Introduction

In recent years, the nano sized particles of various metals have drawn significant attention owing to their unique properties over the bulk of metals. The characteristics, small size, shape, and structural distribution of metal particles improve the optical, electrical, and catalytic properties [1]. Therefore, nano sized metal particles are utilized mainly in electronics, medicine, and agriculture. As a result, around 3,862 nano based products are available within the market, with an estimated annual nanomaterial production rate of up to thousands of tons/year [2,3]. Still, the demand for nanomaterials continuously increases year and year basis.

Several methods were successfully used to produce nano-materials to meet market demand; chemical and physical methods. However, these are considered non eco friendly and potentially hazardous due to utilizing the toxic chemicals and high energy to reduce bulk metal into nano-formed. Besides, several carcinogenic and non-biodegradable chemicals use in a chemical method as reducing and stabilizing agents, which raise potential human and environmental concerns [4,5]. Due to the limitations of chemical and physical methods, in recent times, researchers have been focused on green approaches to develop simple, eco-friendly, non-hazardous procedures consisting of non-toxic chemicals as reducing and stabilizing agents [6].

Among the various nano sized metal particles, silver and gold nanoparticles have gained wide attention in both research and industrial platform due to their applications in diverse areas such as textiles, food packaging, biosensors, nano composites, nano electronics, nano diagnostics, cosmetics, bioremediation, and a biocidal agent [3,7,8]. The nano sized silver particles are preferred as an antimicrobial agent in biomedical use owing to their high biocidal potential against multi-drug resistant bacterial pathogens (Table 1).

The nano sized silver particles are also utilized in sunscreen preparations to enhance sun protection and provide better and longer protection against sunburn [17,18]. Besides these green synthesized nano silver was reported as good nano catalyst for oxygen evolving reactions and reduction of organic dye pollutant, as electrochemical sensor and

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A Tetraphenylethene-Based Aggregation-Induced Emission Luminogen (AIEgen) With Mechanochromic Phenomena for Highly Selective Naked-Eye Detection of MnO_4^- Directly in Aqueous Media

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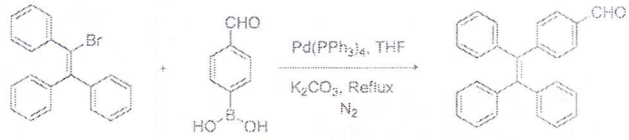
It is challenging to work on the detection of toxic anions and pollutants directly from aqueous media by using organic molecules. The ability to detect MnO_4^- selectively and sensitively is essential to improving human health and protecting the environment. As a result, a Tetraphenylethylene-based chemosensor was successfully synthesized and fully characterized with modern spectroscopic techniques and applied as a new rapid naked-eye detection for the MnO_4^- in a mixed aqueous media ACN: H_2O (v/v = 1/9) by significantly switching off an emission in a mixed aqueous media over another anion. Chemosensor has been thoroughly studied, which shows remarkable photophysical properties such as aggregation-induced emission (AIE) and mechanochromic phenomena. The linear regression (R^2) is ≈ 0.98 μgmL^{-1} and the LOD (the detection limit) as low as 0.150418 μgmL^{-1} is possible for MnO_4^-. This work demonstrates structure-property and application relationships of TPEgen scaffolds and connects topics such as AIE, mechanochromic phenomenon, and naked-eye fluorescence sensing. The current study's fundamental knowledge helps improvement in the fields of TPEgen, anion coordination triggered emission and naked eye fluorescence sensing. As a result, a chemosensor can be developed into a prospective luminescent sensor for detecting MnO_4^-, as well as onsite detection by using the paper-based sensor.

Introduction

Nowadays, tetraphenylethylene-based luminogens (TPEgen) have become very popular for detecting anions from biological and environmental sources because of their interesting photophysical phenomena, such as aggregation-induced emission and the mechanochromic phenomenon, for their high selectivity, sensitivity, and ease of evaluation.[1–4] Tetraphenylethene is one of the common building blocks that are responsible for such interesting photophysical phenomena as aggregation-induced emission and mechanochromic properties. The reported chemosensor (TPEgen) exhibited aggregation-induced emission with the illumination of a UV lamp (365 nm). The diluted solution of chemosensor in acetonitrile emits a modest while its solid state emits a strong yellowish color.[5,6]

Due to the hydrophobic nature of a chemosensor, it is universally acknowledged that the aggregation-induced emission of active sensors developed from tetraphenylethene.[7,8] It is very famous for having a propeller structural characteristic that is π-π stacking in aggregates and solids are avoided for aggregation-induced emission luminogens. TPEgens have long been recognized to be AIE-active because of the hydrophobic nature of tetraphenylethene.[8] Also, tetraphenylethene has a propeller-shaped structure with rotating aromatic phenyl rings on the periphery. In the research of recent years, it has been discovered and proved that when in dilute solutions the free rotation of the peripheral aromatic ring is allowed and there is nonradiative decay induced from the excited state.[9–11] TPEgens possess "aggregation-induced emission," for which the tetraphenylethene-based luminogens are mostly used to explain the complexation with the ions. For the detection of anions with chemosensors, the functionalization of TPEgens molecular architecture has overhanging coordinating sites, which is the better way to synthesize for the same.[8]

Recently, aggregation-induced emission and mechanochromic luminogens have been successful in detecting anions and harmful pollutants in aqueous media. So, the reported chemosensor having hydrazine carbothioamide sparked a lot of



Scheme 1. Synthetic route to TPE-CHO 4-(1, 2, 2-triphenylvinyl) benzaldehyde.

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Effect of Electromagnetic radiations of a mobile phone on the growth of some pathogenic bacteria

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Introduction:

Radiation is an emission of energy which ionizes the objects in their exposure. With the development of the technology in waves, radiation has affected the organism as well as human beings. Electromagnetic radiation is a form of energy travelling with the speed of light in space. The quantum radiation is a stream of energy called photon and each photon energy is considered to depend on radiation frequency (Douglas and Donald, **1981**). Exposure of electromagnetic radiation to bacteria reduces the viability of cells (Ewe *et al.*, **2013**).

Now-a-days technologies such as personal computers, pagers, mobile hand-held devices (wireless tablets, etc.) and mobile phones are used by individuals for ease of work (Soto *et al.* 2006). In 1983, in order to improve the communication system, the global system for mobile telecommunication was established in Europe. In India, the first use of mobile phone was in 1995 and today more than 287 million mobile phone users exist, which account for 85% of all the telecommunication users (Harish *et al.* **2011**).

In many countries, mobile phones outnumber landline telephones. Most adults and even many children now own mobile phones (Madhuri *et al.*, **2015**). Mobile phones increase the speed of communication and contact within healthcare institutions, making healthcare delivery more efficient. Mobile phones dispense laboratory and imaging results, patient data, and photographic images, which are being used by physicians during bedside rounds, in order to engage clinicians, residents, and students. HCWs access pharmaceutical knowledge and literature by mobile phone, which facilitates learning and clinical performance (Visvanathan *et al.*, **2011**). As the benefits of mobile phones and computers are many, their hazards to human health are often overlooked (Madhuri *et al.*, **2015**).

Potential risks of using mobile phones can lead to noise, distractions, loss of concentration, data safety and disturbance of patient privacy and transfer of micro-organisms

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ORIGINAL ARTICLE **OPEN ACCESS**

Antibiotic sensitivity Profile of Uropathogenic *Klebsiella pneumoniae*

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ABSTRACT

Klebsiella pneumoniae is an important cause of nosocomial and opportunistic infections associated with urinary tract infections, respiratory and bloodstream infections. The increasing drug resistance and emergence of virulent strains are posing major threat and challenges in clinical field. In the present study, one bacterial strain isolated from urine sample of urinary tract infected patient was characterized for its antimicrobial resistance using disk diffusion assay and 20 commonly used antibacterial agents belonging to different classes of antibiotics. The isolate was identified at molecular level as Klebsiella pneumoniae SJB-1. The varying degrees of resistance were found to different classes of antibiotics. Highest sensitivity (31mm) was observed in presence of Sulfonamide and (25-30mm) quinolone class of antibiotics followed by tetracycline (20-25mm), aminoglycosides (15-25mm) and macrolide (15-20mm), phenicol (20mm).The strain was less sensitive to selected cephalosporin (10-15mm) andpolymyxin(10-15mm) antibiotics and completely resistant to tested Beta-lactam antibiotics. The present work suggests the efficacy of Sulfonamide antibiotics in treatment of UTIs caused by Klebsiella pneumoniae.

Key words *– Uropathogens, Drug resistance, Klebsiella pneumoniae,Sulfonamides, Quinolones.*

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INTRODUCTION

The second most frequent microbial illness in humans is a urinary tract infection (UTI), which affects 150 million individuals annually worldwide(1).All age grouped people including young adults, small children's and elderly persons are susceptible to bacterial urinary tract infections. An estimated 40% of women have experienced a UTI at some point in their lives.*klebsiellapneumoniaeis the second most bacteria that cause UTI followed by E.coli.*The infections are more frequent in diabetic persons and they can happen anywhere along the urinary system. The changes in the kidney's host defense mechanism brought on by microvascular and diabetic illnesses may increase the occurrence of urinary tract infections (2). Several risk factors linked with UTI are cystitis, sexual activity, vaginal infection, diabetes, obesity and genetic susceptibility (3). Choosing the right antimicrobial treatment to treat bacterial illnesses depends on the identification of the bacteria and testing for their susceptibility.The incorrect use, improper prescription of antibiotics, excessive dosage, and long-term treatment in humans, agro farms, and veterinary, results in recurrent urinary tract infections (40–75%) (4). The problem is made worse by the development of antimicrobial resistance brought on by the over use of empiric broad-spectrum antibiotics for the treatment of simple UTIs. (5),(6). For instance, numerous investigations have documented the alarmingly high rates of antibiotic resistance for the *klebsiella pneumoniae* to ampicillin, amoxicillin, co-trimoxazole, and cefoxitin. The bacterial resistance to antibiotics poses a serious danger to the medical sector and a worldwide problem in the treatment of urinary tract infections (UTIs), making it a recurrent topic of conversation everywhere(7).Therefore, choosing the right medication for an effective course of therapy depends on making a correct diagnosis of UTI and identifying an antibiotic sensitivity pattern (8). This study investigates the sensitivity of *Klebsiella pneumoniae*isolated from urinary tract infected patient to different classes of antibiotics.

MATERIALS AND METHODS

Collection of sample

A 35-year-old female patient with an infection of the urinary tract was the source of the sample collection at the Uro care Hospital in Nanded. The urine sample was taken in a single-use, sterile bottle. Samples were taken from the hospital and transferred to the laboratory (9).

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Antimicrobial Activities of Actinomycetes Against Urease Producing Bacterial Pathogens

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ABSTRACT:

Ureolytic bacterial pathogens are clinically important group of organisms in which urease acts as an important biomarker and virulence factor during onset of infection. Multidrug resistant ureolytic bacteria are posing additional threat due to their involvement in potentially fatal conditions such as gastric and duodenal cancers. This induced the need to search novel bioactive molecules acting against ureolytic bacteria. In the present study48actinomycetes strains isolated from soil are screened against four ureolytic bacteria including Proteus mirabilis, Staphylococcus aureus, Klebsiella pneumoniae and Pseudomonas aeruginosa. The ethyl acetate extracts offiveactinomycetes inhibited growth of Proteus mirabilis, 13 extracts inhibited growth of Staphylococcus aureus,sixinhibited Pseudomonas aeruginosa growth and significant inhibition of Klebsiella pneumoniae growth was found in presence of 16extracts. Based on the results theCLA1strain was selected as potent ureolytic bacterial inhibitor and primarily identified at morphological level asStreptomyces species. The study highlights the inhibitory activity of different actinomycetes strain and can be useful to direct the development of novel bioactive molecules against ureolytic bacterial pathogens.

Keywords: *Urease, bioactive, actinomycetes, ureolytic.*
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INTRODUCTION:

Urease is a nickel ion dependent hydrolytic enzyme accelerating the rate of urea breakdown to ammonia and carbon dioxide (1). Ureases have been isolated from a range of organisms including bacteria, fungi and plants. Bacterial urinary tract infections (BUTI's) are most common infections affecting more than 150 million patients globally. Multidrug resistant uropathogens are gaining worldwide attention due to interference in treatment and increase in hospital stay. The complications also arise due to catheterization procedure and pregnancy (2). Urease dependent disease process is connected with BUTI's caused *Proteus* and *Klebsiella* species. The infections due to these urease positive bacteria may result in infection stone formation that offers protection to pathogens (4). In addition to this urease mediated pH changes causing host epithelial cells damage are considered important in promoting some bacterial infections. Ureolytic bacteria are also involved in formation of infectious kidney stones, gastroduodenal inflammation and pyelonephritis (5-7). Emergence of rapid drug resistance in ureolytic bacteria has been proved to make available line of treatment ineffective (8). The search for novel bioactive molecules from natural sources for modulating growth and activity of ureolytic bacteria can be helpful in overcoming the drawbacks associate with it. Actinomycetes are most important and dominant group of Gram-positive bacteria with a proven track record of producing a wide variety of bioactive metabolites (9, 10). Among the all known antimicrobial agents used in medicines and agriculture, 70 to 80% products have been isolated from actinomycetes. The present study aimed to screen some actinomycetes strains isolated from rhizosphere soil of *Ficus religiosa,Curcuma longa* and *Azadirachtaindica*for antibacterial activity against ureolytic bacterial pathogens.

MATERIALS AND METHODS:

Isolation of actinomycetes:

Rhizospheric soil samples associated with different medicinal plants viz,*Ficus religiosa,Curcuma longa* and*Azadirachta indica*cultivated in Vishnupuri region of Nanded, MS, India were collected from 15cm depth in sterile polythene bags, transferred to laboratory. The soil samples were air dried at room temperature (35°C) for 48 hrs and after removing recognizable stone and debris, crushed and sieved to

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ORIGINAL ARTICLE **OPEN ACCESS**

Antibacterial activity of Aegle marmelos On Uropathogenic *Klebsiella pneumonia*

Pallavi B Jadhav, S. V. Mamdapure, Sunil B Jadhav, Mujahed M Siddiqui, Rania N Ghaleb, Sanjana S Hallikar and H. J. Bhosale *

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ABSTRACT:

Urinary tract infections(UTIs) are common and frequently occuring diseases after respiratory and blood stream infections. The enteric bacterium Klebsiella pneumoniae causes the range of infections in humans including meningitis, blood stream infections, pneumonia and urinary tract infections. In the present study antibacterial activity of the methanol,ethanol and acetone extracts of the leaves and fruit pulp of Aegle marmelos was studied using agar well diffusion method against uropathogenic Klebsiella pneumoniae isolated from urinary tract infected patient. The acetone and methanol extracts of leaves showed significant inhibition of Klebsiella pneumoniae at 10mg/ml concentration. Based on the studies it can be concluded that Aegle marmelos leaves can be used as a potential source of natural bioactive products in drug screening programs against antibiotic resistant bacterial pathogens.

Keywords: *Antimicrobial activity, Aegle marmelos, Leaf,Pulp,Klebsiella pneumoniae.*
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INTRODUCTION:

Urinary tract infections(UTIs) are most common and leading type of bacterial infections affecting humans in all aged groups including neonates,young adults and elderly people(1) (2).The symptoms of infection may be mild to severe depending on part of urinary tract affected and may cover kidneys bladder and urethra.It is estimated that more than 8 to 10 million persons per year get infected with urinary tract and seeks healthcare providers to get treatment.Most frequent causes of UTI are *Escherichia coli,Klebsiella pneumoniae, Staphylococcus aureus, Candida albicans and Pseudomonas aeruginosa*(3). The increased incidence of infections are also found in diabetics and the people with abnormal urinary system.In case of recurrent urinary tract infections the onset of infection is repeatedly observed where low dose antibiotics are represcribed for treatment. In this case chances of gaining drug resistance are high and may cause complications in the treatment and led to greater use of broad-spectrum antibiotics.This intensifies the need to search an effective and potent bioactive agent against drug resistant bacterial pathogens. Medicinal plants are rich in pharmacologically active biomolecules since from ancient times they have proved their potential in treating various ailments and medical conditions.Medicinal plants are considered as best sources of bioactive molecules(WHO 2000) and needs through investigation to understand mechanism and nature of their target *molecules*(4) (5).*Aegle marmelos* an Indian sacred plant member of Rutaceae is known to have immense medicinal importance as antibacterial, anti-diarrheal, anti- diabetic, anti-dysentery and antiviral agent in addition to use in treating stomach pain, snake bite and food poisoning (6). Considering medicinal importance of *Aegle marmelos*in the present study leaf and fruit pulp extracts were evaluated to check their effect against uropathogenic*Klebsiella pneumoniae.*

MATERIALS AND METHODS:

Plant material and preparation of extracts: The fresh leaves and fruit of *Aegle marmelos* were collected from Shelgaon village in Latur District Maharashtra and the plant parts were identified and authenticated in School of Life Sciences,SRTMU, Nanded.Fresh leaves and fruits of *Aegle marmelos* were cleaned with water and the pulp was separated from fruit.The pulp and leaves were dried in shade for one week. After drying leaves and fruit pulp were pulverized separately into fine powder by using grinding machine and stored in airtight container.This powder was used to prepare methanol,ethanol and acetone extracts. To the 5gm of dried leaf and pulp powder 50ml of ethanol, methanol and acetone were

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ORIGINAL ARTICLE **OPEN ACCESS**

Antibacterial Activity of Biosurfactant Produced from *Haloferax chudinovii* HB1RANIA

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ABSTRACT

Multidrug resistant organisms (MDRO) raised as a big issue world-wide, and research are in progress to get a new alternative to the old drugs. Bioactivities of secondary metabolites from halophilic archaeon considered the least studied among extremophiles especially antibacterial activity. Biosurfactants (BS) were presented as the secondary metabolites promising bioactive molecule substitutes for several previous antibiotic and chemical ones.Haloferax is a halophilic archaeon thatcan grow, thrive in salinity ranges (0.5-25%), and produce some secondary metabolites to inhabit aharsh environment.In this work, we screened the ability of Haloferax chudinovii HB1RANIA isolated from the salt work saltern of Mulund to produce BS with antibacterial activity properties. BS production was determined in a modified mineral salt medium (MSM) supplemented with 5% waste engine oil, 5 % NaCl, and 1% glucose. BS derived from strain HB1RANIA emulsified 32.14% of soybean oil, has reduced surface tension of pure water to 57.24mN/m and showed good oil displacement and hemolysis (10mm) activities. Antibacterial activity of crude BS onthe growth of clinical pathogenic bacteria has carried out on 96 wells microtiter plateand showngrowth inhibition % on Proteus mirabilis (44.1%), Staphylococcus aureus (45.98%), Enterococcus sp (44.13%), and Escherichia coli (4.784%). The study highlighted the significance ofBSderived from strain HB1RANIAto be considered as an alternative for some inefficient antibacterial drugs.

Keywords: *biosurfactants; antibacterial; Haloferax, archaea*
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INTRODUCTION

Living microorganisms (bacteria, yeasts, and fungus) produce amphiphilic chemicals known as biosurfactants,to lower the surface and interfacial tension of immiscible phases [1],[2], [3]. It is preferred over synthetic surfactants due to less toxicity, lower critical micellar concentration, higher foaming capacity, more active at extreme temperatures, pH, and salinity, safe, and biodegradable[4], [5].Different industry fields including, food, agriculture, and pharmaceuticals, were widely usedBS[6],[7]. BS demonstrated a variety of bioactive characteristics, including antioxidant, anti-inflammatory, antibacterial, anti-adhesive, and anti-biofilm activities[17], [18].Antibiotic-resistant organisms are currently becoming more prevalent, especially in bacteria classified as MDRO[8].Since there is a daily and global need for novel antibiotics to combat MDRO, BS were promoted as bioactive molecules with antibacterial activity [9], [10].

The main classification criteria for BS are their molecular weight, chemical structure, microbial origin, and extracellular or cell wall attaching [11]. Glycolipids and lipopeptides areLow molecular weight BS, which are efficient in surface and interfacial tension reduction,andpolymeric compounds, such as proteins, polysaccharides, or mixed forms of lipoproteins or lipopolysaccharides are high molecular weight BS, which may adhere to a variety of surfaces and function as bioemulsifiers, are divided based on molecular weight[3], [12], [13]. Both aquatic ecosystem and terrestrial ecosystem, as well as ecosystems with severe pH, temperature, or salinity, are inhabited by microorganisms that produceBS[14].

The majority of microorganisms that produceBS are bacteria such as *Pseudomonas* sp., *Bacillus* sp., *Rhodococcus* sp., *Acinetobacter* sp., *Enterobacter* sp., *Halomonas* sp., and *Arthrobacter* sp. are some of the bacteria that have been studied the most in scientific investigations [15], [16]. Additionally, several probiotic bacteria, including some species of *Lactobacillus, Lactococcus lactis, Streptococcus thermophilus,* and *Propioni bacterium freudenreichii,* canproduce BS[16]. BS from lactic acid bacteria demonstrated dose-dependent antibacterial and antibiofilm effects against methicillin-resistant and sensitive staphylococcal isolates, with changes in cell surface integrity acting as evidence of cell death[19].Sophorolipids have antimicrobial properties between the exponential and stationary phases of

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ORIGINAL ARTICLE **OPEN ACCESS**

Anti-*Klebsiella pneumoniae* Activity of Actinomycetes Isolated from Soil

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ABSTRACT

Klebsiella pneumoniae is a gram negative bacteria belongs to Enterobacteriaceae family and a common cause of hospital acquired,blood borne,respiratory and urinary tract infections. The hyper-virulent strains of Klebsiella pneumoniae are emerging due to increased drug resistance and thus posing a serious threat and challenge in treatment of associated infections intensifying the need for novel bioactive molecules. In view of this, in present study 20 actinomycete isolates from rhizospheric soil were screened against clinical isolate of Klebsiella pneumoniae using agar well diffusion assay. The potential isolate AT15 showing highest zone of inhibition (14mm) was selected and identified at molecular level as Streptomyces ferralitis MMS8. The ethyl acetate extract of culture broth of Streptomyces ferralitis MM8 obtained after seven days of incubation at 30°C and 120 rpm showed considerable inhibition of Klebsiella pneumoniae,when compared with standard antibiotics available in the market . The study indicated the potential of bioactive extract of Streptomyces ferralitis MMS8 against Klebsiella pneumoniae after further purification and characterization studies.

Key words *– Bioactive molecules, blood –borne infections, UTI, Streptomyces.*

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INTRODUCTION

There are numerous Klebsiella species, and their infections are often recorded. Klebsiella pneumoniae has recently emerged as a significant pathogen in hospital-acquired infections [1]. In the 21st century, critical infections brought on by pathogenic bacteria resistant to widely used antibiotics in the market [2] becoming a severe healthcare issue. Antibiotic resistance has been created in many bacterial infections as a result of overuse and incorrect application of antibiotics, according to the World Health Organization. Today, drug-resistant pathogenic microorganisms appear more frequently than new antibiotics are discovered. Many scientists working in the pharmaceutical industry have been actively interested in isolating and screening actinomycetes from various uncharted habitats for the production of bioactive secondary metabolites in an effort to solve this issue [3]. Actinomycetes are significant category of microbes that colonise soil. Numerous bioactive secondary metabolites that are significant for industry are known to be produced by them. Actinomycetes are known to produce about 80% of all antibiotics, with the bulk coming from the genera Streptomyces and Micromonospora [4]. The majority of antibiotics in the market are derived from fungus and actinomycetes' natural compounds [5-6]. Actinomycetes have been isolated from both the sea environment and the soil. Only a limited fraction of the world's surface has been sampled due to the fact that many researchers in the pharmaceutical sector have screened soils, and very few actinomycetes species have been identified [8]. The major goal of the current investigation was to identify possible actinomycetes that could compete with drug-resistant Klebsiella pneumoniae in the rhizopheric soil sample. The World Health Organization recently issued a warning to the public stating that the global rise in bacterial antibiotic resistance poses a significant threat to healthcare. If we didn't move right once to address the issue of antimicrobial drug resistance, antibiotics might stop working as effective medicines to treat illness.

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Symmetric supercapacitor based on biosynthesized nanosheets of reduced graphene oxide (rGO): Characterization and electrochemical behavior

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Abstract

Reduced graphene oxide (rGO) nanosheets (NS) were synthesized via a simple, rapid, eco-friendly and cost effective biosynthesis approach using Lonar lake isolated bacterium strain *Bacillus cabrialesii RIRD-SK (MCC 4670)*. The biologically prepared rGO nanosheets were characterized via X-ray detection diffraction (XRD), Fourier transform infrared spectrum (FTIR), Raman spectroscopy, Field emission scanning electron microscopy (FE-SEM), Energy dispersive X-ray spectroscopy (EDX), and Brunauer-Emmett-Teller (BET) techniques, respectively. Electrochemical investigation was carried out using the cyclic voltammetry (CV), galvanostatic charge–discharge (GCD) and electrochemical impedance spectroscopy (EIS) tests. Most of the oxygen functional groups species in rGO were successfully eliminated resulting in little (0.39Ω) charge transfer resistance (R_{ct}). The rGO electrode exhibited 457 F/g specific capacitance at scan rate $5 mVs^{-1}$ in 1 M Na_2SO_4 aqueous electrolyte within the potential window of −1 to 0V. It showed a superior electrochemical cycle stability of 96% after 10,000 cyclic voltammetry cycles. The aqueous symmetric supercapacitor device was prepared in the configuration of rGO/Na_2SO_4/rGO. Device exhibited 165 F/g specific capacitance at scan rate $5 mVs^{-1}$ with cyclic retention of 94% for 10,000 cyclic voltammetry cycles.

Introduction

The ultracapacitor or supercapacitor is considered as a promising electrochemical energy storage device due to its numerous properties, such as ultrafast charging and discharging ability, environmental friendliness, long-term stability and high power density [1]. In general, ultracapacitors are classified into three categories based on their charge storage mechanism, and the electrode taxonomy is referred to as (i) pseudocapacitor, (ii) hybrid supercapacitor, and (iii) electric double layer capacitor (EDLC) [2], [3]. Supercapacitors have a longer cycle life compared to many other energy storage technologies, such as batteries and fuel cells [4]. However, the specific capacity of the EDLC is not significant since the electrolyte ions are stored by an adsorption/desorption reaction at the electrode/electrolyte interface or by a non-faradaic reaction [5]. To improve the performance of EDLC, several attempts have been made, including the new synthesis approach that uses liquid organic and aqueous electrolytes and manipulates the growth direction [6], [7]. However, the specific capacitance (Csp) obtained is still lower than that of the pseudocapacitors [8], [9]. Therefore, it is imperative to perform an alternative synthesis method to improve the Csp of carbon electrodes [10].

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Full Length Research Article

Isolation and Biochemical Characterization of Phosphate Solubilizing Bacteria from Soils of Some Regions of Satara District

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Abstract

The Phosphate Solubilization is very essential for recycling the nutrient in the nature. Phosphate is available in organic and inorganic form and its solubilization results into the availability to the plants. It is one of the plant growth promotion activities. The bacteria involved are species of *Pseudomonas*, *Mycobacterium*, *Bacillus*, *Flavobacterium*, Micrococcus etc., seven isolate of phosphate solubilizing were obtained by using Katzelson and Bose medium. Soil Samples were streaked on Katzelson and Bose medium incubated at room temperature for 48 – 72 hrs. and clear zone was observed and such colony was used for further morphological, cultural and biochemical characterization. From morphological, cultural and biochemical characters studies isolate no. 2,3,7 was tentatively identified as *Micrococcus lylae, Micrococcus sedentarius, Bacillus megaterium* and *Bacillus cereus* respectively and remaining isolate no. 1,4,5,6 they may be different strains of *Micrococcus* and *Bacillus.* The phosphate solubilization index of isolate 1 and 3 ranged between 2.4 to 2.6. Microbial Consortia of above isolates, we formulate the biofertilizer and it can be used for sustainable agriculture.

Key words: Katzelson and Bose medium, *Bacillus*, Phosphate solubilization index

Phosphorus (P) makes up about 0.2% - 0.8% of the plant dry weight, is the second major common limiting macronutrient after nitrogen that is required for plant growth and development as it is involved in the basic biological functions of the plants such as structures of DNA, RNA, Phosphoproteins, ADP, ATP etc. The Plant absorb phosphorus as phosphate anions from soil which are extremely reactive and can be immobilized through precipitation with cations such as Fe_3^-, Mg_2^+, Al_3^+, and Ca_2^+ and this proportional supply cause deficiency of phosphorus [1].

Phosphate solubilizing bacteria (PSB) such as *Bacillus, Pseudomonas, Azospirullum, Rhizobium, Azotobacter, Agrobacterium* etc., convert insoluble inorganic phosphate compounds into soluble forms. Phosphate solubilization takes place through the process of acidification, chelation and exchange reactions leading to the production of organic and inorganic acids which in turn lower the pH of the soil causing increase in solubility and release of phosphorus [2-3]. Occurrence of Phosphate solubilizing bacteria (PSB) in the soil are ubiquitous in different forms and an elevated Phosphate solubilizing bacteria (PSB) population are seen in agricultural soils [4]. The present study was designed and conducted with the objectives to isolate, characterize the Phosphate solubilization capabilities and used for plant growth promoting activities.

MATERIALS AND METHODS

Collection of samples

The soil samples selected as a source of phosphate solubilizing bacteria were from the rhizosphere of *Cajanus cajan* field of Patil Shivaji Ganapati from Marali near to Pal, Tal: - Karad. The soil samples were collected in polythene bag and after proper labeling, brought to the laboratory. The samples were kept in refrigerator till further use.

Isolation of phosphate solubilizing bacteria

One gram of each soil sample was mixed with 10 ml sterile distilled water and mixed vigorously and stood still for 10 min. to allow the soil to settle. Supernatant was further serially diluted and loopful of suspension was streaked on sterile Katznelson and Bose agar plates. The plates were incubated at room temperature (25 – 27 °C) for 48-72 hours. The colonies, which produced the clear zone around them, were selected. The isolates were then purified by repeated isolation of the bacteria from the obtained colonies on the same medium. The morphological characters of each colony were studied and recorded [5]. After proper labeling all the isolates were preserved at refrigeration temperature on Nutrient agar slants. Gram nature of the isolates was studied by Hucker and Cohn

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Recent trends in synthetic Top-down approach for Mesoporous Carbon: A seminal review

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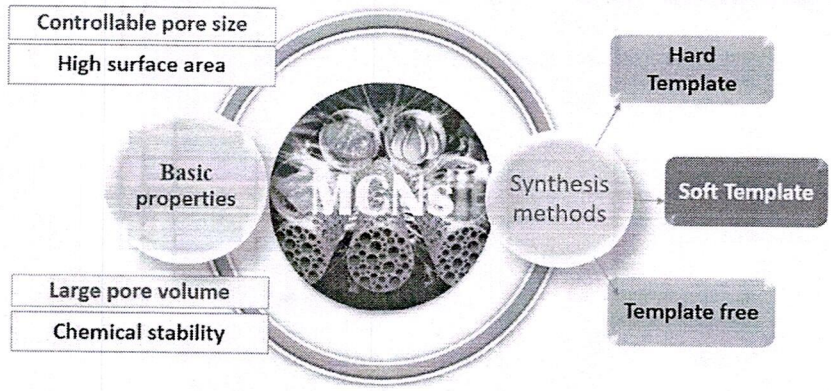
Review

ABSTRACT This review is focused on the different synthetic methods of mesoporous carbon for exotic applications. In the 21st century, doped carbon nanostructures and composites have cutting-edge applications in materials sciences due to their superior physicochemical properties. Porous carbon has enticed material scientists because of its excellent properties like ordered porous structure, tunable pore size, and high specific surface area. As a result, the extensive studies on the synthesis and modification of mesoporous carbon are being performed. The most enticing approaches for synthesis of ordered mesoporous carbon are hard template and soft template methods. On the other hand, non-templating pathways are equally important to synthesize mesoporous carbon as that are templating pathways. This report includes details of different synthetic methods for synthesis of mesoporous carbon materials by templating as well as non-templating methods.



Keywords: Synthetic methods; Carbon Nanomaterials; Mesoporous, template methods, non-template method.

INTRODUCTION

In recent times, the significance of nanomaterials has risen significantly due to their remarkable characteristics; as a result, researchers are concentrating on new approaches in the field of materials science to modify the physicochemical properties of nanomaterials by incorporating carbon nanomaterials. The carbon and synthesis of mesoporous carbon nanomaterials are of trending topics in the scientific community.[1,2] The designing of mesoporous carbon nanomaterials with unique properties and controllable porous structure.[3,4] high specific surface area, large pore volume,[5] and excessive stability has gained enormous curiosity from scientists around the globe. Porous carbon nanomaterials can be synthesized using a variety of techniques, including hard template synthesis, template-free method, hydrothermal carbonization, mechanochemical assembly, nano casting, and soft template.[6-16] These techniques provide several benefits. Carbonaceous solids can be produced from biomass without the need for an energy-intensive drying process attributable to an ordered mesoporous structure, a simple and adaptable approach, the ability to retain small particle sizes during carbonization, easy synthesis, and control, etc. Mesoporous carbon materials with their distinctive physicochemical characteristics, tunable pore size, and uniform structure frame it a perfect skeleton for various applications such as electrochemical energy storage, adsorption, catalysis, sensing, and biomedical applications.[17-24]

The term "mesoporous material" refer to a material containing a pore diameter between 2 to 50 nm. The method for the production of mesoporous ordered carbon was initially established by scientist Ryoo *et al.* Mesoporous material can be ordered or disordered in a mesostructure. And the ordered

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Dielectric behavior and phase transition of $La_2Mo_2O_9$ films synthesized by spray pyrolysis technique

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ABSTRACT

The novel fast oxide ion-conducting material $La_2Mo_2O_9$ (LAMOX) thin films were synthesized by using the cost-effective chemical spray pyrolysis technique. Thermal Gravimetric and differential thermal analysis show the phase transition of $La_2Mo_2O_9$ from α-monoclinic to β-cubic phase at 546.5 °C. Rietveld refinement confirms the stabilization of the β-cubic phase for $La_2Mo_2O_9$ thin films at high temperature. The porous morphology was observed after the annealing and the XPS study revealed elements La, Mo and O observed on the surface of thin films. The temperature and frequency-dependent dielectric constant were studied using an LCR-Q meter in the frequency range of 20 Hz–300 kHz. As the frequency increases, the dielectric constant and dielectric loss decreases for all $La_2Mo_2O_9$ thin films. The dielectric constant, dielectric loss and AC conductivity varied with increasing temperature, shows two relaxation peaks indicating the presence of oxide ion vacancies for ion conduction. The complex impedance shows the Cole–Cole plot for the LAMOX thin films.

1 Introduction

A fuel cell is an electrochemical device that converts chemical energy directly into electrical energy with the water as a by-product [1, 2]. The oxide ion-conducting materials are the interesting materials because of its application mainly in fields like oxygen sensors, oxygen pumps, oxygen separation membranes and solid oxide fuel cells [3–8]. In 2000, Lacorre [5] discovered the new fast oxide ion-conducting material and illustrated that the lanthanum molybdenum oxide ($La_2Mo_2O_9$) possesses greater ion conduction ability at 800 °C than the conventional oxide ion conductor Yttria Stabilized Zirconia (YSZ). The phase transition of $La_2Mo_2O_9$ takes place from low oxide ion conducting α-monoclinic to high oxide

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RESEARCH ARTICLE

polymers advanced technologies WILEY

Synthesis and testing of polyacrylamide-grafted waste sand derived composite adsorbent for water purification

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Abstract

In this work, waste sand derived polyacrylamide grafted sand particles (PAGSPs) were developed as an effective adsorbent for the adsorption of organic and inorganic pollutants from water. The composite particles were characterized using FESEM, EDX, ATR-FTIR, XRD, TGA, and BET analyses. The FESEM results revealed the sizes of composite particles were in the micrometer range and BET analysis showed specific surface area of 10 $m^2\ g^{-1}$ with average pore radius of 1.22 nm. The adsorption isotherm and kinetics of dyes namely Methyl Orange (MO) and Quinoline Yellow (QY) and Ni(II) and Cr(VI) metal ions were analyzed. The adsorption capacities for dyes MO and QY were 32.25 and 55.55 mg g^{-1} and for metal ions Ni(II) and Cr(VI) were 75.18 and 125 mg g^{-1} respectively, at experimental pH conditions. Because of the excellent regeneration capacity, the functional polymer based composite particles exhibit great potential for the removal of any organic and inorganic pollutants from wastewater.

KEYWORDS
adsorption, dyes, heavy metal ions, polymer grafting, waste foundry sand

1 | INTRODUCTION

Waste foundry sand (WFS) is a solid waste material originated from the ferrous and nonferrous metal casting industries.[1] WFS is suitable for casting and molding processes. Binders of various types are used to bind WFS fragments. The disposable molds are made from sand used for manufacturing sand castings. These sand castings are obtained from clay-bonded (green) sand, which constitutes silica sand (81%–94%), water (3%–6%), bentonite clay (5%–9%), and carbonaceous additions (3%–9%).[2] During the casting process, molding sands are recycled or mixed with fresh sand and reused. The reused sand decomposes to the point where it cannot be used in the casting process. After that, a major part of the sand is discarded, and fresh sand is added to the cycle. Conventionally, WFS has been effectively used as a landfilling material. However, because of expanded removal costs, landfilling has become a concern.[1] The United States has more than 3000 foundries that require huge quantity of sand each year for assembly, and approximately 6–10 million metric tons of WFS is wasted each year, which is disposed in landfills.[3] Therefore, the waste sand from the manufacturing process in foundries remain a concern.[4] The waste material generation can be limited by reusing it for different purposes.

The utilization of WFS as an adsorbent for removal of pollutants from wastewater can be notable alternative to deal with the problem. With rapid industrialization, industrial effluents are increasingly being dumped into the environment. Among the effluents, dyes are one of the most dangerous environmental pollutants.[5–7] Dyes are extremely stable, poisonous, and non-biodegradable and are widely used in an assortment of areas including drug, material, polymers, plastic, and leather.[8] Water pollution from poisonous dyes and metal ions negatively affects ecological systems, particularly aquatic bio systems in which symbiotic processes may be harmed.[9–12] Because of their long-term extensive industrial use of heavy metal ions and dyes, the discharge of these constituents into water sources poses risks to humans. Furthermore, the aromatic character of basic dyes (which are

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ORIGINAL PAPER

Surface Modified Silicon Dioxide Based Functional Adsorbents Derived From Waste Sand for the Removal of Toxic Pollutants From Water

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Abstract
Waste foundry sand (WFS), an industrial waste mainly comprising silicon dioxide was used to generate low-cost and efficient adsorbents for the expulsion of toxic pollutants from water through adsorption. The WFS was converted into particles by top–down approach followed by subsequent activation and functionalization. Activated sand particles (ASPs) with –OH groups and amino-functionalized sand particles (AFSPs) with $-NH_2$ groups were synthesized and fully characterized using FESEM, EDX, ATR-FTIR, XRD, TGA, and BET analyses. The adsorption capacities at experimental conditions for cationic dyes namely methylene blue(MB), malachite green(MG), methyl violet (MV), rhodamine B(Rh B) were 38.16, 26.31, 55.24 and 35.84 mg g^{-1} while for anionic dyes namely methyl orange (MO), patent blue VF(PB VF), quinoline yellow(QY), reactive Red 2(RR 2) were 7.28, 4.63, 7.84 and 6.91 mg g^{-1} as well as for metal ions namely Cd(II)), Ni(II)), Co(II)), and Cr(VI)were 23.81, 43.06, 17.03 and 3.47 mg g^{-1} respectively. The adsorption equilibrium isotherms optimally fit the Langmuir isotherm model, indicating homogeneous surfaces and monolayer adsorption. A pseudo-second-order model showed a strong agreement with the experimental data, thus identifying chemisorption as the rate-limiting step. Additionally, these particles were verified to be reusable for a minimum five adsorption–desorption cycles without loss of efficiency.

Keywords Waste foundry sand · Dyes · Heavy metal ions · Adsorption · Pollutant removal

1 Introduction

Metal casting foundry industries produce waste foundry sand (WFS) as a solid waste material. WFS is classified as a hazardous waste material that may cause critical health problems [1, 2]. Massive growth of the foundry industry makes it an alarming issue at the global level. Industries choose the most straightforward approach to tackle these potential problems by reducing waste sand and recovery at the source [3]. However, WFS cannot be completely nullified. The conversion of WFS into value-added products and its recycling can be important strategies to tackle the problem. The benefits of such approaches will save natural resources, energy and environment [4].

Water contamination has emerged as one of the critical global challenges in the twenty-first century [5, 6]. For removing contaminants from potable water, several techniques have been developed, namely, adsorption [7–12], flocculation [13], coagulation [14, 15], electrolysis [16],

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Tetraphenylethene Carbothioamide-Based Organic Stimuli-Responsive Mechanochromic Memristive Devices with Non-Volatile Memory and Synaptic Learning Functionalities

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A tetraphenylethene-based organic material (TC) was synthesized to demonstrate mechanochromic memristive properties. The synthesized material shows aggregation-induced emission and mechanochromic properties. The solvent optimization study reveals that the ethyl acetate-based TC switching layer shows good resistive switching (RS) properties. To get the mechanochromic memristive properties, different external stresses (ground, heat, and fume) were applied to the TC materials, and these materials were used for the fabrication of switching layers. The results asserted that ethyl acetate and grinding-based TC devices show good digital-type RS effects and non-volatile memory properties. On the other hand, heating and fuming-based TC devices show analog and quasi-digital type RS effects, respectively, and mimic various biological synaptic properties such as potentiation-depression, excitatory postsynaptic current, and paired-pulse facilitation index. The present investigation is important to fabricate stimuli-responsive memory and artificial synaptic devices for futuristic non-volatile memory and neuromorphic computing applications.

Introduction

Conventional silicon-based electronic devices are facing a serious bottleneck in terms of memory, processing, heat, and power consumption.[1] These bottlenecks can be resolved by either designing a new kind of computing architecture or utilizing the functional materials for the fabrication of novel memory and computing devices. The latter approach is convenient because of the availability of functional organic and inorganic nanomaterials. These functional nanomaterials can be engineered to meet the end demand of electronic devices. Owing to this fact, researchers are synthesizing high-performance materials for the fabrication of non-volatile memory and artificial synaptic devices.[2] Among different physical effects, resistive switching (RS) has gained popularity in industry and academia.

In recent years, the RS memory effect is utilized for the fabrication of both memory and brain-inspired computing devices.[3,4] In this effect, the device can show either digital or analog current-voltage (I-V) properties based on the intrinsic characteristics of the active switching layer, top electrode, and bottom electrode. The device with a digital RS effect is useful for non-volatile memory applications, whereas, biological synaptic properties can be mimicked by using the analog RS effect.[5] In recent years, a variety of materials such as organic, oxide, perovskite, 2D materials, biomaterials, etc. are being used to demonstrate the RS effect.[6–10] Among different materials, organic materials are a promising candidate to fabricate an active switching layer of non-volatile memory and artificial synaptic devices. Organic memory devices are low-cost, efficient, mechanically robust, and biocompatible as compared to traditional high-k dielectric-based devices.[11] Therefore, different organic materials have been synthesized and demonstrated their non-volatile memory and synaptic learning properties.

The tunable RS effect plays an important role when a single device can be used for both memory and neuromorphic computing applications. The tunable RS effect can be achieved by modulating the external bias, properly engineering the interface between electrodes and the switching layer,[12] utilizing different top electrodes,[13] controlling the thickness of the switching layer,[14] etc. The literature suggested that aggregation-induced emission and mechanochromic organic materials are not reported for RS applications. Typical mechanochromic organic materials change their color under the influence of external stresses such as grinding, heating, fuming,

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Magnetic and structural characterization of Sn doped cobalt ferrites; A visible light-driven photocatalysts for degradation of rhodamine-B and modeling the process by artificial intelligence tools

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ABSTRACT

Tin (Sn) substituted cobalt ferrites $Co_{1-x}Sn_xFe_2O_4$ with composition (x = 0.0, 0.1, 0.2, 0.3, 0.4 and 0.5) were synthesized utilizing sol-gel auto combustion method. All synthesized powders were characterized for their structural, magnetic and optical characterization after calcination. The single phase spinel with good crystallisation and a decreasing crystallite size with Sn substitution is confirmed by the powder X-ray diffraction (XRD) pattern. The magnetic measurements were carried out at room temperature where saturation magnetization values show sufficient magnetic nature of calcinated ferrites. The bandgap values for pure cobalt and Sn-substituted cobalt ferrites were closer to the experimental value. The visible light photocatalytic degradation of Rhodamine B was carried out in presence of Sn substituted cobalt ferrites that shows good catalytic activity up to 87% degradation for $Co_{0.5}Sn_{0.5}Fe_2O_4$ catalyst. Additionally, this study used Artificial Neural Network (ANN) and Adaptive Neuro-Fuzzy Interface System (ANFIS) models to simulate degradation efficiency with inputs including time, pH, and catalyst dosage. The results revealed that the 3–2–2–1 structure ANN4 model outperformed the other ANN and ANFIS models in the testing phase (RMSE = 6.90% and NSE = 0.92). According to the findings of this study, artificial intelligence models are capable of precisely predicting Rhodamine B degradation.

1. Introduction

Spinel ferrites garnered a lot of attention due to their inexpensive cost, excellent chemical stability, moderate saturation magnetization, high surface area, robust wear resistance, low density, low thermal expansion coefficient, and negligible toxicity to both human health and the environment [1,2]. Due to their distinctive magnetic characteristics and crystalline structure, which are caused by minute variations in the particle size, composition, presence of surface effects, they have attracted researcher's attention in a number of fields [3,4].

The modern era of ceramic research contains the synthesis and study of spinel ferrites with general formula $M^{2+}(Fe^{3+})_2O_4$ (where M^{2+}= Co, Mg, Zn and Ni) because of their exceptional chemical and physical properties [5]. Cobalt ferrite a kind of spinel ferrite is gaining popularity because it can be easily modified for use as an adsorbent [6,7]. In order to synthesize ultra-fine ferrite particles, a number of synthetic techniques have been developed, including chemical co-precipitation [8,9], solid state [10], sol-gel [11,12], micro-emulsion [13], hydrothermal [14], cetyl trimethyl ammonium (CTAB) assisted hydrothermal [15], and chemical reduction [16]. As a result, the sol-gel auto combustion method is regarded as a simple, approachable, perfectly composition-controlled, and remarkably reproducible procedure. Low processing time and very low external energy usage are requirements for this method [17]. The material can also be doped with various ions in a range of concentrations to modify its structural [18], optical [19], electrical [20], and magnetic [21] characteristics. Variations in the structure and crystallinity of ferrites are caused by the distribution of various elements between the tetrahedral (A) and octahedral (B) sites. Ferrites nanoparticles

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Texture and major element geochemistry of channel sediments in the Orsang and Hiren River Basins, Gujarat, India: Implications for provenance and weathering

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ABSTRACT

Size, shape, degree of sorting, and composition of sediments in the river channels are controlled by climate, lithology, weathering, sorting, and medium of transportation. The present investigation is focused on the grain-size and geochemical analysis of the channel sediments of the Orsang and Hiren river basins. Major outcrops in the study area are Archaean granites, granitic gneisses, Upper Cretaceous to lower Eocene Deccan Volcanic Basalts (DVB), Quaternary sediments and minor proportion of Proterozoic low grade metamorphic rocks. The sediments are poorly to moderately sorted, very finely skewed, suggesting its derivation from heterogenous sources, while the kurtosis value indicates a high-energy depositional environment. The sediments are with gravelly sand texture and the mean grain size is varying from 581.9µm to 1284.2µm. The DVB provenance of the Hiren river basin and granitic provenance of the Orsang river basin is clearly reflected in the texture and geochemical composition of sediments. The TiO_2 and Fe_2O_3 contents of sediments from the Hiren river basin are distinctly higher and are comparable to the basalts of the Saurashtra region of the Deccan Province. Sediments collected after Orsang and Hiren rivers confluence and from Narmada river show higher concentration of felsic sources, indicating that Orsang river's sediment supply significantly outweighs Hiren rivers. The arkosic-litharenite nature points towards less transportation and moderate chemical weathering for the Orsang river sediments. The low Chemical Index of Alteration (CIA) values (Avg. 48.45 and 56.99 for Orsang and Hiren rivers, respectively) and A-CN-K plot also suggest the supply of sediments from minimally weathered detritus under a semi-arid condition.

Keywords: Sediments, Grain Size, Orsang River, Provenance, Transportation, Weathering

INTRODUCTION

River sediments are unconsolidated fragments of pre-existing rocks that have undergone both mechanical and chemical weathering. Both weathering and erosion contribute to the degradation of the rocks, but this degradation has different impact on different types of rocks (Joshua and Oyebanjo, 2010). The size and shape of sand grains in the river provide ideal information about transportation media (Bui et al., 1989); they also provide clues on sediment discharge rates and the environment during deposition of sediments (Gray and Simões, 2008; Williams, 2012). The distribution of sand grains is largely influenced by three key processes: sediment movement, sediment aggregation, and depositional mechanism (Wai et al., 2004). Sediment textures and geochemistry have been extensively used to extract information on provenance, weathering conditions, tectonics, fluvial processes, and paleoclimate conditions (Nesbitt and Young, 1982; Bhatia, 1983; McLennan et al., 1983; Taylor and McLennan, 1985; Wronkiewicz and Condie, 1987; Cullers et al., 1988; Fedo et al., 1995; Sharma et al., 2013). In this context, grain-size data provide clues to sediment provenance, transport history, depositional conditions, and classifying sedimentary facies and environments, which are largely controlled by the nature of the source rock and the transport agent (e.g., Folk and Ward, 1957; Friedman, 1979; Singh and Rajamani, 2001; Bernabeu et al., 2002; Guti errez-Mas et al., 2003; Benavente et al., 2005; Garzanti et al., 2011) while geochemical characteristics reveal the provenance, nature and degree of weathering at the source region of sediments, which is controlled by lithology, climate, and tectonics (Taylor and McLennan, 1985; Singh, 2009; Mondal et al., 2012; Hernández-Hinojosa et al., 2018). In addition, reworking also affects the chemical composition of sediments (McLennan, 1982; Cox and Lowe, 1995). Several authors have investigated the fluvial sediments of Indian rivers to understand the source and process controls on the geochemistry of sediments (Jain and Tandon, 2003; Juyal et al., 2006; Sanyal and Sinha, 2010; Garçon and Chauvel, 2014; Maharana et al., 2018). However, textural and geochemical studies on the fluvial sediments from Orsang and Hiren river basins, which are part of west-flowing river system, are yet to be studied. Additionally, distinctly different spatio-temporal geologic domains are traversed by Orsang and Hiren rivers, making them strongly suitable for understanding provenance control. The data generated in the present study will

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Review

Magnetic nanostructured adsorbents for water treatment: Structure-property relationships, chemistry of interactions, and lab-to-industry integration

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ABSTRACT

Toxins released due to rapid industrialization and urbanization have significantly polluted the world's water resources. Current remediation technologies remain inadequate in terms of cost and effectiveness in removing low concentration pollutants. Nanomaterials have unique properties, such as precisely controllable surface areas, biocompatibility, and durability, and their surface properties can be easily modified to increase their specificity. Considering the variety of nanosorbent materials, creating economic and efficient adsorbents that could easily remove toxic pollutants from environmental water is one of the current challenges. Magnetic nanoparticles (MNPs) offer a low-maintenance and straightforward alternative to conventional adsorbents for the removal of contaminants from wastewater. This review critically evaluates recent advances in the use of magnetic materials for a variety of pollutants (anions, cations, organics, radioactive elements, and pathogens). Also, the technology developed using magnetic adsorbent for the treatment of large-scale wastewater treatment processes as magnetic separators have been reviewed in detail. The structure–property relationships between the MNPs and the pollutants were revealed based on the results of theoretical models. The challenges in developing highly stable MNPs and improvements in their practical use for the removal of toxic pollutants are also discussed in detail. Further, potential modeling for water pollutant removal, economic evaluations, toxicity and legality, and further research direction on MNPs for on-site remediation and pilot scale application are emphasized. The review bridges adsorption research and engineering science to facilitate efficient approaches for adsorption of various toxic pollutants on MNPs from wastewater.

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Article

Multifunctional Fluorescent Tetraphenylethene-Based Reversible Mechanochromism for Highly Selective Detection of MnO_4^- in Aqueous Media and Green Organic Light Emitting Diode Applications

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Kishor S. Jagadhane, Ray J. Butcher, Tukaram D. Dongale, Kiran A. Nirmal, Govind B. Kolekar, Mohaseen S. Tamboli, Tae Geun Kim, Sunita Salunke-Gawali, and Prashant V. Anbhule*

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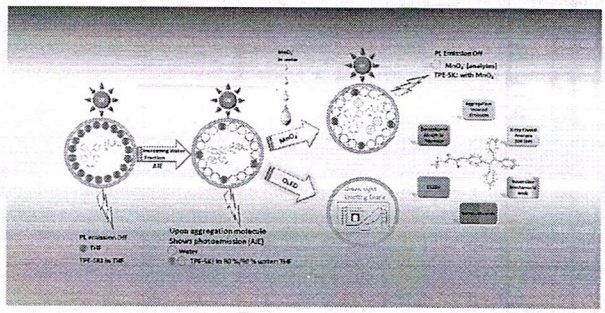
ABSTRACT: Ethyl 2-cyano-3-(4-(1,2,2-triphenylvinyl) phenyl) acrylate (TPE-SKJ), a newly synthesized luminogen based on tetraphenylethene, with single crystal analysis exhibits photophysical phenomena such as aggregation-induced emission (AIE); reversible mechanochromic, solvatochromic, organic light emitting diode; and chemical sensing in aqueous media with great selectivity and a low limit of detection. The synthesized material demonstrates high selectivity and sensitivity capacity for sensing MnO_4^- in mixed aqueous media (water/acetonitrile, v/v, 9/1). The detection limit for MnO_4^- was found to be 0.086009 μg mL^{-1} with a quantum yield (Φ) of 11%. Moreover, we employed TPE-SKJ material in an organic light-emitting diode (OLED) as an emissive layer. The device shows a maximum of 1.62% external quantum efficiency, higher than nondoped emitting layer-based green OLEDs. The present results will encourage ongoing research into the design of novel stimuli-responsive organic materials with switchable properties based on their supramolecular interactions for numerous applications.



1. INTRODUCTION

Aggregation-induced emission (AIE), a type of photophysical phenomenon connected to the aggregation of the chromophore moiety, was first proposed by Prof. B. Z. Tang and his team in 2001. In an aggregation-induced emission (AIE) mechanism, the water content in the mixture affects how quickly weak or nonemissive luminogens aggregate to become emissive; it means aggregation-induced emission means weak or nonemissive luminogens become emissive upon aggregation. Early research on AIE indicated that scientists were more interested in how a substance's molecular structure might affect it. As time went on, it was discovered that not all emission phenomena, particularly polymorphisms with various emissive features, could be described by molecular structure. In contrast, AIE exhibited a normal solid-state luminescence behavior, and the change in molecular packing from intense $\pi-\pi$ stacking to a suppressed one was the primary cause of the transition from ACQ to AIE. As a result, researchers started to concentrate more on molecule packing than molecular structure.[1−3] The tetraphenylethene-based luminogens show amazing photophysical phenomena such as aggregation-induced emission, solvatochromism, reversible mechanochromic, etc., which have very useful applications in diverse fields.[4]

Because of their use in optical information storage camouflage, mechanical sensors, memory chips, and security papers, luminogens with reversible stimulus-responsive switching in the solid state have drawn a great deal of attention.[5−8] Industry and academia have recently become enthusiastic about the successful applications of various aggregation-induced emission (AIE)-based reversible mechanochromic (MC) materials in cutting-edge nanotechnologies.[9−11] Contrary to conventional fluorophores, AIEgens have had the unique property of an emission strongly in the aggregated state (solid) despite being nonemissive in the solution state, due to restrictions on intramolecular rotations (RIR) or restrictions

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Phytochemical Profiling, Antimicrobial, Antiproliferative and Apoptotic Effects of *Stemodia viscosa* Roxb. of Western Ghats Region, India

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The present study shows the chemical profile, antimicrobial, antiproliferative, and apoptotic effects of *Stemodia viscosa* extracts. Thirteen bioactive compounds were identified in the 80% ethanolic extract by GC/MS analysis. The acetone extract exhibited a higher content of flavonoids and phenols of 805.10 μg QE/mg DW and 89.31 μg GAE/mg DW extracts, respectively. Furthermore, the acetone extract possessed the highest antioxidant activity (IC_{50} = 9.96 μg/mL). The 80% ethanolic extract exhibited significant antimicrobial activity; the highest activity was observed against *Staphylococcus aureus* with a zone of inhibition of 25 ± 0.51 mm, MIC value of 4 mg/mL, and MBC value of 8 mg/mL. The antiproliferative results revealed the presence of anticancer activity with an IC_{50} = 91.562 and 74.362 μg/mL against the B16F10 skin and COLO205 colon cancer cells, respectively. The flow cytometric analysis shows that the plant extracts cause cancer cell death through the induction of apoptosis. Our findings confirmed that *Stemodia viscosa* is a potential source of biologically active compounds.

Introduction

Medicinal plants have been used for centuries in different cultures and traditional healing systems around the world as a source of healing.[1,2,5,6] These plants contain natural chemical compounds such as alkaloids, flavonoids, terpenoids, and phenolic which possess pharmacological effects on the animal and human body.[3,4] The compounds can interact with physiological processes and help alleviate symptoms or treat various illnesses and diseases. The specific parts of the plant, such as leaves, flowers, roots, stems, or bark, are used for medicinal purposes.[7] They are often prepared and administered in various forms, including teas, infusions, decoctions, tinctures, poultices, powders, and extracts.[8] The use of medicinal plants as primary treatments has been incorporated into traditional medical systems such as Unani, Traditional Chinese Medicine (TCM), Ayurveda, and Indigenous healing practices.[9,10]

The importance of medicinal plants is multifaceted and can be examined from different perspectives. Medicinal plants have played a crucial role in human history and cultural practices, many ancient civilizations relied heavily on plants for their medicinal needs.[11] Traditional healing systems, which are still practiced today, have deep roots in the use of medicinal plants.[4] These plants have been passed down through generations, and their usage forms an essential part of cultural identity and heritage.[11] Medicinal plants have been a primary source of medicine for many people, especially in rural and developing regions where access to modern healthcare facilities may be limited or expensive.[12] According to the WHO, in developing countries, about 80% of the population still uses traditional drugs made of plant extracts for various purposes particularly for management of medical conditions.[2,13] In these areas, people rely on traditional plant-based remedies to treat common ailments and maintain their well-being.[8] Medicinal plants serve as a valuable resource for the discovery and development of new drugs, many modern pharmaceuticals have been derived from plant compounds or inspired by traditional remedies.[14,15] In recent times, the study of medicinal plants has gained significance in the field of chemistry of natural products and pharmacognosy which focuses on the discovery, characterization, and development of drugs from natural sources.[16] Researchers continue to explore medicinal plants to study their chemical composition, identify bioactive compounds, study their mechanisms of action, and develop effective and safe new drugs or herbal formulations based on this knowledge.[14]

Stemodia viscosa Roxb is a highly valued aromatic herb with a long history of traditional medicinal use in different regions of the Western Ghats in India. Local communities have utilized this herb for centuries to treat various infectious diseases and ailments. In Nasaki District, Maharashtra, India, the heated leaves of *S. viscosa* are specifically employed in the treatment of early stages of leprosy according to traditional practices.[17] Similarly, in Vodadora District, Gujarat, India, a rubbing medi-

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One Pot Synthesis of CuO-$CuFe_2O_4$@rGO Nanostructure with Synergistic Effect for Efficient Electrochemical Sensing Application of Paracetamol

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In the present study, the facile and synergistic approach for electrochemical sensing of paracetamol (PA) drug was demonstrated by hydrothermally synthesized copper oxide-copper ferrite nanohybrid composite supported on reduced graphene oxide (CuO-$CuFe_2O_4$@rGO) glassy carbon electrode. The surface texture and structural information of the electrode material were examined by FE-SEM, HR-TEM, and X-ray diffraction techniques, whereas the electrochemical sensing application of paracetamol oxidation was investigated by amperometric method. The average crystallite size of CuO-$CuFe_2O_4$ was calculated from XRD data and found to be 35.45 nm. The fabricated sensor exhibited a higher sensitivity of 970.26 $\mu A.mM^{-1}.cm^{-2}$ along with a lower limit of detection (LOD) and limit of quantification (LOQ) of 7.0 μM and 25 μM, respectively, with a linear dynamic range of 10–1200 μM. Furthermore, the CuO-$CuFe_2O_4$@rGO modified sensor showed excellent anti-interferents ability, long-term stability and reproducibility towards electro-oxidation of paracetamol drug. Moreover, it can be efficiently applied for the analysis of paracetamol in biological samples. Finally, the synthesized nanocomposite material was validated to be a competent electrocatalyst for electrochemical sensing application of paracetamol.
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Drugs like paracetamol (PA) are used as both antipyretics and painkillers. It is frequently used to treat a variety of ailments, including coughing, migraines, headaches, different types of bodily aches, and menstruation discomfort. Generally speaking, it is prescribed in many nations throughout the world as an aspirin substitute.[1–4] At lesser doses, paracetamol normally has no harmful side effects since it is quickly absorbed in the stomach and completely used by the body. However, a high dosage can have a number of negative consequences, including discomfort in the pancreas, kidney and liver problems, hepatic insufficiency, skin irritation, and skin rashes.[5,6] Thus, fast, sensitive and specific determination of paracetamol is essential for further investigation.

Different analytical techniques such as, chemiluminescence,[7,8] spectrophotometry,[9] capillary electrophoresis,[10] chromatography,[11] flow-injection analysis,[12] titrimetry,[13] electroanalytical[14,15] etc., have been employed for paracetamol analysis. However, different disadvantages including high cost, lengthy analysis and complex procedures render some techniques unfavourable.[16] Accordingly, the electroanalytical method is frequently used due to its simplicity, rapid response, cost effectiveness, high accuracy, selectivity and sensitivity.[17–19]

Unlike bulk materials, nanomaterials exhibit improved catalytic performance in various applications owing to their unique structural characteristics. Specifically, nanomaterials are widely used in applications including chemical sensors and bio-sensors.[20] In the last decade, a wide variety of nanocomposite materials were widely studied as catalytic materials for paracetamol oxidation reactions. These include polyimide-multi-walled carbon nanotube (polyimide-MWCNTs),[3] AuPd/GN-CNTs-IL (GN is Graphene nanotube, CNTs is Carbon Nanotubes, and IL is Ionic Liquid).[6] MWCNTs/CTS-Cu (CTS is chitosan),[21] GO/carbon black/chitosan (GO is Graphene Oxide),[22] GO-XDA-Mn_2O_3 (XDA is Xylenediamine),[23] GC/CNT/PEDOT/NF/Crown ether (where PEDOT is poly (3–4-Ethylenedioxy Thiophene).[24] Other hybrid materials such as mesoporous chitosan/silica hybrid material,[25] rGO/carbon black/chitosan,[26] chitosan - carbon paste,[27] and MWCNT/HSA-oppy were used as electrode materials.[28] Additionally, biomolecules and polymeric materials such as poly (L-leucine),[29] cellulose and starch polymers-Co NPs,[16] nano Molecularly Imprinted Polymers (MIP),[1] MIP/PB,[30] and MIP micelle were used.[31] Moreover, noble metal-based composites such as Pd/MnO_2 NRs/graphene,[32] Pd nanoclusters/polyfuran,[33] Pd graphene oxide,[34] Pd nanorods @hollow N, S-doped C were employed.[35] However, the high cost, complex synthetic procedure and instability of biomolecules and polymers limit their applications in paracetamol detection.

Hence, to overcome these shortcomings, different transition metal oxides were investigated, and revealed fascinating properties and merits for sensing purposes including low cost, high surface-volume ratio, non-toxicity, greater conductivity and semiconducting nature, sensitivity and rapid response.[36–39] Recently, many transition metal oxides like NiO,[4] CuO,[19] MnO_2,[32] TiO_2,[20,40] ZnO,[41] and Fe_2O_3[42] with different support materials have been extensively employed for electrochemical sensing of paracetamol. Among these, magnetite (Fe_2O_3) was widely used for different applications like sensors, catalysis, solar cells, and energy renovation owing to its non-toxicity, low cost, high stability, bio-compatibility, enzyme mimetic action (peroxidase enzyme) and *n*-type semiconducting nature with a band gap of 2.0–2.2 eV suitable for visible light absorption. Additionally, it

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Mesoporous carbon encapsulated zinc oxide nanorods derived from plant species '*Argyreia sharadchandrajii*' for live cell imaging of drug delivery and multimodal bioactivities†

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In this report, we develop a drug delivery system by binding *Argyreia sharadchandrajii* (A. S.) biomass-derived carbon encapsulated on the surface of zinc oxide (ZnO) nanorods by a two-step method. Firstly, we prepared mesoporous carbon (MC) by pyrolysis under an inert atmosphere at 800 °C for 3 h. Simultaneously, hydrothermal synthesis of ZnO nanorods was performed, followed by composite formation with surface modification of ZnO nanorods with carbon particles. The physicochemical properties of the mesoporous carbon encapsulated ZnO nanorods were studied by using X-ray diffraction, Fourier transform infrared spectroscopy, X-ray photoelectron spectroscopy, scanning electron microscopy, energy dispersive X-ray analysis, Brunauer–Emmett–Teller (BET) analysis, *etc.* The mesoporous carbon encapsulated ZnO nanorods revealed a wurtzite hexagonal crystal structure. The SEM image showed the mesoporous carbon covered on the surface of the ZnO nanorod-like morphology with an average diameter of 300–400 nm and an average length of 1.2 μm. Based on these characterizations, we have reported several bioactivities like antioxidant, antimicrobial, anticancer, and drug delivery. The carbon/ZnO composite (C@Z) loaded with doxorubicin (DOX) (C@Z-DOX) manifested sustained drug release to live cancer cells. Taking into consideration the ubiquitous availability of carbon sources and the facile synthetic strategy of composites for promising drug delivery studies and bioactivities, this approach could acquire remarkable results in biomedical research.

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Introduction

In conjunction with the rapid growth of the population, human health issues have increased prominently worldwide due to hybridization. Cancer is indeed one of the world's most dangerous diseases, killing thousands of people every year across the globe. The development of innovative materials and processes to promote sustainability is a universal challenge with regard to human health and the environment. As such, research on green and sustainable technology and its clinical implementation is a need in the present era.[1,2] The family of carbon nanomaterials is a rapidly growing branch of novel materials with enormous promise for expansion of the scientific community.[3] Nonetheless, the synthesis of carbon nanomaterials entails the use of harmful chemical reagents, the use of fossil fuels, and high energy consumption, all of which are in opposition to green principles. To achieve the peak performance of these materials, green synthetic procedures and the use of natural resources are prerequisites.[4] The advancement of nanocarriers for drug delivery based on bioderived carbon and its nanocomposites is now a potential platform for the biomedical field.[5,6] Various forms of carbon materials like graphene, fullerene, carbon nanotubes, and carbon dots have been developed to be exploited in sensing, bioimaging, drug delivery, tumor theranostics, *etc.*[7–10] Recently,

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EVALUATION OF THE GROUNDWATER QUALITY FOR ITS SUITABILITY FOR DRINKING AND IRRIGATION IN THE INDIAN STATE OF MAHARASHTRA'S KHANAPUR TALUKA, SANGLI.

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ABSTRACT

In order to evaluate the physicochemical properties of groundwater quality in Khanapur Taluka, Sangli District, representative groundwater samples from a total of 65 bore wells and 35 dug wells were collected in the pre-monsoon and post-monsoon seasons of 2014. The physico-chemical studies of water samples from dug wells and bore wells show that alkaline earths exceed alkalies ($Ca + Mg > Na + K$) hydrochemical facies are present in 100% of pre- and post-monsoon samples. Similarly, 100% dug well and bore well water samples belongs to weak acid exceed strong acid ($HCO_3 + CO_3 > Cl + SO_4$) hydrochemical facies in pre and post-monsoon seasons. Out of 35 samples of water taken from dug wells in the pre-monsoon season, 12 (34.29%) and 5 (14.29%) fell into the C2 - S2 and C2 - S1 categories, respectively, indicating good water quality for irrigation. 15 samples (42.86%) belong to C3 - S2, which indicates bad water quality for irrigation, while 3 samples (8.57%) belong to C3 - S1, which indicates medium water quality for irrigation. 18 samples (51.43%) from the post-monsoon season and 4 samples (11.43%) that belong to the C2 - S2 and C2 - S1 types, respectively, indicate good water quality for irrigation. Two samples (5.71%) fit the C3-S1 type, indicating that the water is of a medium quality for irrigation. 10 samples (28.57%) are of the C3 - S2 type, indicating bad irrigation water quality, and 1 sample (2.28%) is of the C3 - S3 type, indicating very bad irrigation water quality. Similar to this, out of 65 samples of pre-monsoon bore well water, 4 samples (6.15%) and 14 samples (21.54%) respectively belong to the C2 - S1 and C2 - S2 types, indicating good water quality for irrigation. 4 samples (6.15%) fall within the C2–S3 type, which indicates irrigation water of medium quality. 38 samples (58.46%) belong to the C3 - S2 type, indicating bad irrigation water quality, while 5 samples (7.69%) belong to the C3 - S3 type, indicating very bad irrigation water quality. 15 samples (23.08%) and 10 samples (15.38%) from the post-monsoon season are of the C2 - S1 and C2 - S2 types, respectively, indicating good water quality for irrigation. 15 samples (23.88%) fall within the C3-S1 class,

Chemical Research in Toxicology

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Article

Histotoxicity of AIEgen Based on Triphenylamine for the Simultaneous and Discriminatory Sensing of Hg^{2+} and Ag^{+} Directly in Aqueous Media for Environmental Applications

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Kishor S. Jagadhane, Nagesh B. Birajdar, Govind B. Kolekar, and Prashant V. Anbhule*

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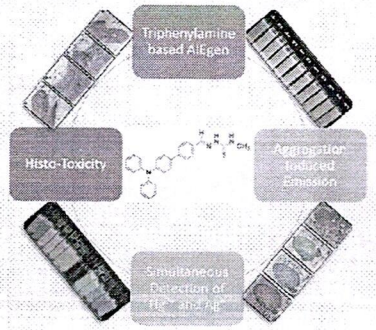
ABSTRACT: A newly synthesized AIEgen based on triphenylamine is fully characterized and coded as BRA for the simultaneous and discriminatory selective detection of Hg^{2+} and Ag^{+} ions directly in mixed aqueous media for the identification and purification of water with a low detection limit. Moreover, we employed BRA in histotoxicity in that when compared to the control group, fish exposed to the "novel synthesized luminogen (BRA)" that demonstrated photophysical phenomena during the "sensing of mercury and silver (heavy metals) in aqueous media" did not show any major distinguishing changes in the architecture of their gills, liver, muscle, brain, kidney, and heart tissues.



1. INTRODUCTION

Prof. B. Z. Tang and his team invented a new photophysical phenomenon known as aggregation-induced emission (AIE) in 2001, in which the mixture's water content affects how quickly weakened or nonemissive luminogens aggregate and become emissive. This conveys that aggregation-induced emission means that weak or nonemissive luminogens aggregate and become emissive.[1−3] AIE, on the other hand, exhibited normal solid-state luminescence behavior, and the fundamental cause of the transition from ACQ to AIE was a change in molecular packing from intense $\pi-\pi$ stacking to suppressed one. As a result, scientists began to focus on molecule packing rather than the chemical structure. Triphenylamine-based luminogens exhibit extraordinary photophysical phenomena such as aggregation-induced emission, solvatochromism, reversible mechanochromic, and so on, which have numerous uses.[4−6]

In recent years, potential applications of florescent organic luminogens having an aggregation-induced emission photophysical phenomenon in sensing have gained greater prominence due to their higher versatility and diversity in synthesis.[7] In context to this, a unique and novel organic compound with extraordinary photophysical phenomena was created via a straightforward Suzuki coupling reaction. The novel compound was observed to give promising results in sensing mercury and silver (heavy metals) in aqueous media. It also demonstrated aggregation-induced emissions and mechanochromic luminescence as its characteristic properties. The goal of the current experiment was to evaluate the toxicity of novel organic luminogen on the economically important Indian major carp *Catla catla*, by assessing how it affected the tissues of its critical organs, including the gills, liver, muscle, brain, kidney, and heart. Any major alterations observed in the normal architecture of vital tissues of fish in the "novel organic molecule"-treated groups were supposed to indicate the hazard susceptibility of that novel molecule.

Due to mining, oil refining, and the combustion of fossil fuels, mercury ions (Hg^{2+}) are extensively dispersed in the water, air, and soils. Organic mercury, such as methylmercury, can undergo microbial conversion to the inorganic mercury ions and elemental mercury ions in an environment, which enter the food chain and accumulate in the human body.[8,9] Hg^{2+} has a remarkable ability to interact with biological ligands in vivo, implying that an excess of Hg2+ in the body might cause major issues with the heart, stomach, kidneys, and brains, including the central nervous system, in a variety of irreversible disorders.[10,11] According to the WHO, Hg^{2+} levels in drinking

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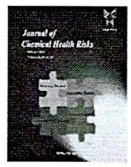

Exploring Extracellular Hydrolytic Enzyme and Bio Flocculant-Producing Bacterial Isolates for Bioremediation of Vegetable Oil Refinery Effluent.

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KEYWORDS
VORE,
BOD,
COD,
Toxicity,
Seed germination.

ABSTRACT:
The process of vegetable oil refining generates an enormous amount of wastewater. This study focused on characterization of vegetable oil refinery effluent (VORE) sample untreated and treated by bacteria for various physicochemical parameters. The sample has high COD and BOD; 12.32g/L and 1.7g/L respectively, this highlights the need for proper treatment. The VORE samples were treated by bacteria producing extracellular hydrolytic enzymes and bioflocculant, identified as *B. licheniformis, S. stutzeri, B. amiloliquificance* and, *S. mutabilis.* The bacterial treatment was performed in a separate 250ml flask containing 100ml effluent and inoculated with 2% of respective 24h grown culture. The bacterial treatment achieved a significant decrease in BOD and COD. The treated effluent showed significant increase in seed germination representing a reduction in toxicity in comparison to untreated effluent. This highlights the suitability of present study isolates for VORE treatment with high BOD and COD.

1. Introduction

The major source of vegetable oil is from seeds such as; soybean, sunflower, sesame, coconut, palm, rice bran, and groundnut. India is amongst the largest producers of oilseeds in the world, accounting for 36.56 MT production of nine different oilseeds in the year 2020-21 [1]. The oil production i.e., extraction of oil from seeds is done by physical or chemical extraction using a solvent. Crude oil extracted from seeds must process before human consumption [2]. This process includes degumming, alkali neutralization, bleaching, heating, and deodorization [3], which generates a higher amount of wastewater [4]. Generally, different processes involved in vegetable oil refining used a huge amount of water and generate an equal amount of wastewater, but chemical refining produces 20-30 times higher wastewater than water used in this process [5,6]. A substantial amount of waste is generated including wastewater, organic solid waste, and inorganic residues [7]. In the degumming step, some phosphoric acid is added to separate phospholipids, increasing the phosphorus level in the effluent. In the neutralization step sodium salt of free fatty acid ("soap stocks") were generated and split using H2SO4 in a stoichiometric amount which makes wastewater highly acidic [8]. A typical effluent from vegetable oil contains a higher amount of COD, BOD, TSS, TDS, nickel, oil & grease, fats, soap and sludges which cause deterioration of the environment and human health [6,9,10]. Wastewater generated both quantitatively and qualitatively has a profound impact on ecology, resulting in increased pollution load and concentration. Treatment of this type of effluent is more difficult because of its complex molecular structure [3].

There are numerous physicochemical (skimming of oil, flocculation, coagulation, air floatation) methods available to remove colloidal pollutants [11]. Chemical flocculating agents are the choice of many to remove the pollutant, but flocculating agents like inorganic and organic polymers may be toxic to the ecosystem. In comparison with this, bioflocculant produced by microorganisms are non-toxic, harmless, efficient, and biodegradable [12]. The biological methods are more suitable in terms of generation of secondary pollutant, partial treatment, investment costs. Further use of bacteria to remove pollutants is safe, eco-friendly and inexpensive, five to twenty times less costly than chemical treatments and more economical than physical-chemical treatment methods.

Bacteria are suitable for the degradation of pollutants because of their diverse carbon utilization ability [13]. The bioremediation process mainly depends on microorganisms that attack pollutants enzymatically and convert it to

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ORIGINAL ARTICLE

Anticancer and Apoptotic Effects of *Hymenodictyon floribundum* (Hochst. & Steud.) B.L.Rob. Stem Bark Hydroethanolic Extract

Alfredi A. Moyo[1,5] · Kishor S. Jagadhane[1,4] · Sneha R. Bhosale[1] · Sachin B. Shinde[1] · Alphonce I. Marealle[2] · Vinod B. Shimpale[3] · Prashant V. Anbhule[1]

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Abstract

Purpose The present study aimed to examine in vitro anticancer and apoptotic effects of the 80% ethanolic extract of *Hymenodictyon floribundum* and isolated compounds on A549 human lung cancer cell lines. Furthermore, isolated compounds and crude extract were investigated for their antimicrobial activity against *Aspergillus niger*, *Pseudomonas aeruginosa, Bacillus subtilis*, *Escherichia coli, Candida albicans*, and *Staphylococcus aureus*.

Methods The anticancer activity was examined by trypan blue exclusion and MTT assays. Flow cytometry was used to assess apoptosis using the Annexin V-FITC/PI technique, the antimicrobial activity was assessed by using Broth microdilution method against six pathogenic microbes. The GC–MS, ^{1}H NMR, ^{13}C NMR, and mass spectral data were used to elucidate the structure of isolated compounds.

Results The study resulted in the isolation of two compounds, 7-Hydroxy-6- methoxycoumarin (A) and 2,2,4-Trimethyl-3-(3,8,12,16-tetramethyl-heptadeca-3,7,11,15-tetraenyl)-cyclohexanol (K). The compound A and K inhibited the growth of A549 lung cancer cell lines with IC_{50} values of 77.56 µg/mL and 92.13 µg/mL, respectively. The anticancer effects of compounds A and K were due to early and late apoptotic cell death induction. Compounds A and K exhibited potential antimicrobial activity against all microbes tested. The highest antimicrobial activity was shown by compound A against *S. aureus* with a minimum inhibitory concentration (MIC) of 62.5 µg/mL.

Conclusion These findings provide evidence that the stem bark extract of *H. florubundum* contains compounds with both anticancer and antimicrobial activity. The isolated compounds were found to possess antimicrobial activity and inhibit the growth of A549-Human lung cancer cells by inducing apoptosis.

Keywords *Hymenodictyon floribundum* · Cancer · Apoptosis · Antimicrobial · Medicinal plant

Abbreviations

DCM	Dichloromethane
DMSO	Dimethyl sulphoxide
GC	Gas chromatography
GC–MS	Gas chromatography-mass spectrometer
ICCR	Indian council for cultural relations
MTT	3-(4, 5-Dimethylthiazol-2-yl)-2, 5-diphenyltetrazolium bromide
MIC	Minimum inhibitory concentration
MBC	Minimum bactericidal concentration
MFC	Minimum fungicidal concentration
NMR	Nuclear magnetic resonance
NCCS	National centre for cell science
O.D	Optic density
P.E	Petroleum ether
PI	Propidium iodide
PBS	Phosphate buffer solution

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Evaluation of antimicrobial, cytotoxicity effects and antioxidant potential of *Stemodia verticillata* (Mill.) Hassl extract

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Key words:
Phytochemicals, antimicrobial, verticillata, cytotoxicity, cancer.

ABSTRACT

The aim of this study was to evaluate the antimicrobial, cytotoxic, and antioxidant activities of *Stemodia verticillata* extract. Antimicrobial activity was assessed using agar well diffusion assay and Broth microdilution method, cytotoxicity effects using the 3-(4, 5-dimethylthiazol-2-yl) -2, 5-diphenyltetrazolium bromide assay, the 2,2-diphenylpicrylhydrazyl and ferric reducing antioxidant power assays were used to measure antioxidant. The various bioactive components were identified with the gas chromatography-mass spectrometer (GC-MS) technique. The highest antimicrobial activity was observed against *Staphylococcus aureus* with a minimum inhibitory concentration (MIC) of 4,000 µg/ml and a minimum bactericidal concentration of 16,000 µg/ml. In comparison, the least activity was observed for *Aspergillus niger* with a MIC of 16,000 µg/ml and minimum fungicidal concentration of 64,000 µg/ml. The cytotoxicity results revealed the presence of anticancer activity with an IC_{50} of 79.03 µg/ml against COLO205 colon cancer cell lines. The highest antioxidant activity was exhibited by acetone extract (IC_{50} = 29.112 µg/ml), followed by 80% ethanolic extract (IC_{50} = 34.72 µg/ml). The quantitative phytochemical analysis indicated that acetone and 80% ethanolic extracts contained higher amounts of flavonoids and phenolic compounds. Furthermore, five major bioactive compounds were identified by GC-MS. The Findings from the present investigation represent the high potency of *S. verticillata* extract as a source of more valuable bioactive compounds for developing future phytotherapeutic products.

INTRODUCTION

Infectious diseases are contagious illnesses or diseases brought on by pathogenic microorganisms, such as bacteria, fungi, viruses, protozoans, and helminthes (Shukla *et al*., 2014). In low-income societies, it is one of the primary causes of fatalities and morbidity (WHO, 2018a, 2018b). The diseases can cause suffering and death of the people but also have significant economic impacts that are not often recognized (Lindahl and Grace, 2015). The emergence and increasing rates of antimicrobial resistance to modern antibiotics are the main challenges to eradicating microbial infections, and the worst aspect is the development of antimicrobial resistance as a natural protective process among microorganisms; even rational use of antibiotics provides for antimicrobial resistance development (Review on Antimicrobial Resistance, 2016). The World Health Organization (WHO) has identified several priority pathogens against which newer antimicrobials should be developed to simplify the search for appropriate antimicrobials; these include *Mycobacterium tuberculosis*, *Escherichia coli*, *Candida albicans*, *Streptococcus pneumoniae*, *Enterobacter* spp., *Staphylococcus aureus*, and *Streptococcus pneumonia* and others (WHO, 2017). Most of these microorganisms have the capacity to produce biofilms, which are mostly made of DNA, proteins and polysaccharides. The biofilms created by these pathogenic bacteria and fungi are of serious concern because they give the underlying microbes a broad range of resistance (Bakkiyaraj *et al*., 2013). Novel agents are therefore required to combat these drug-resistant pathogens.

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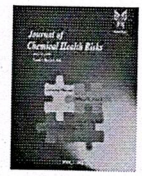

Treatment of Textile Processing Effluent Using Bacterial Isolate and Activated Charcoal

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KEYWORDS

Effluent, BOD, COD, bioremediation, B. *licheniformis*, seed germination

ABSTRACT:

Textile industries consume a huge quantity of water for their processes and generate an almost equal quantity of wastewater. Effluent Sample of textile processing industry was collected and physicochemical analysis was performed as per the standard protocol of APHA 2017. The high value of Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD) and adverse effect on wheat seeds, this highlights effluent is a highly toxic and hazardous effect to the ecosystem. Bacterial isolate identified as *Bacillus licheniformis* was screened for various hydrolytic enzymes and explored for effluent treatment, it showed a reduction in BOD by 50% and COD by 53%. The bacterial treatment followed by physical treatment by activated charcoal, resulted in 97% and 98% reduction in BOD and COD respectively. After treatment, the toxicity assessment by seed germination was performed and 90% germination of the wheat seed was increased in comparison with untreated effluent. Textile wastewater has very high amount of organic compound which makes this effluent very toxic and hazardous to environment. The combination of biological and physical treatment method shows significant reduction in terms of BOD, COD and toxicity which makes this combined treatment method more appropriate for such type of effluent.

1. Introduction

The textile industry is one of the rapidly emerging industrial sectors in India. It contributes 5% to the country's total GDP and India is the 6th largest exporter of textiles globally. It uses different raw materials like cotton, woollen, and synthetic fibers [1]. The problem of the textile industry is the massive consumption of water which transform into highly loaded by different chemicals of wastewater [2]; this wastewater contains chemicals like acids, alkalis, dyes, hydrogen peroxide, starch, surfactants dispersing agents, and soaps of metals, organic and inorganic chemicals [3,4]. The textile industry is estimated to use more water than any other industry and, almost all wastewater discharged is highly polluted and thus has a serious environmental impact. The level of dissolved oxygen decreases continuously and is a serious issue concerning the aquatic ecosystem. The dissolved oxygen should be at least 5 mg/l for survival of aquatic life [5]. Average-sized textiles mills consume water about 200 L per kg of fabric processed per day [6,7]. According to the World Bank estimation, textile dyeing and finishing treatment are given to a fabric that generates around 17 to 20 percent of industrial wastewater [7].These effluents contain high amounts of fatty acids, proteins, carbohydrates, and other plant materials. The effluents are diversified, and majorly possess higher amount of organic compounds of biodegradable nature [8], but their high amount results in a severe impact on environment [9,10, 11,12, 13, 14, 15].

Textile industrial effluent having dyes and other chemicals adversely affect to aquatic as well as agriculture land. Because of some industrial unwillingness and profit-making attitude their wastewater treatment plant not even working, and some are suffering due to shortage of material, time, infrastructure, land, manpower, and capital consumption [16]. Textile wastewater treatment is majorly done in effluent treatment plants (ETP). This treatment plant follows a series of treatment processes that mainly focus on different water quality parameters such as pH, temperature, color, electrical conductivity (EC), alkalinity, acidity, total dissolved solids (TDS),

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CULTURAL AND MORPHOLOGICAL CHARACTERISATION OF *ALTERNARIA BRASSICICOLA* SCHWEIN. & WILTSHIRE. ASSOCIATED WITH LEAF SPOT DISEASE OF CABBAGE

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ABSTRACT

Leaf spot disease of Cabbage is caused by *Alternaria brassicicola* Schwein. & Wiltshire. The present research work was conducted to find out the cultural and morphological characteristics of *Alternaria brassicicola* Schwein. & Wiltshire. For this purpose, field surveys were undertaken in three districts of Western Maharashtra viz. Kolhapur, Sangli and Satara during the years 2021 - 2022. Seven isolates of the pathogen were isolated from diseased samples collected during the survey. Those were purified and their pathogenicity was tested. Cultural and morphological characters of different isolates were studied, which showed variation in growth and conidial morphology.

Keywords: *Alternaria* leaf spot, Cabbage, Cultural characters, Morphological characters, Maharashtra.

Introduction

Cabbage (*Brassica oleracea* var. *Capitata* L.) is an important cole crop belonging to family Brassicaceae. The plant is grown for its fleshy leaves, which are used as vegetable, (Choudhary, 2006). It is a rich source of vitamin C and a moderate source of vitamin-K, Sulphur and an amino acid glutamine. Cabbage is mainly used to treat colon cancers and its juice helps in treating ulcers and intestinal problems. The crop is affected by many fungal pathogens among them, *Alternaria* leaf spot, caused by *Alternaria brassicicola* Schwein. & Wiltshire is the most common, causing considerable yield losses (Ellis, 1968; Narain, 1986). Present paper reports cultural and morphological characters of this pathogenic fungus.

Material and Methods

Cabbage leaves infected with Alternaria leaf spot were collected during the survey from three districts of western Maharashtra viz, Kolhapur, Sangli and Satara during the year 2021-2022.

The diseased leaf material of cabbage was collected during the survey and the symptomology of *Alternaria* leaf spot disease was studied. As a result of infection by the pathogen, brown to black lesions surrounded by a yellow halo appeared initially on the lower leaves of cabbage. Later on, these lesions enlarged in size and developed concentric zonations (Agrios, 2008). As the disease progressed the number of lesions increases and these lesions coalesced together forming patches which leads to the blighting of the leaf (Ansari, 1988; Kucharek, 2000).

Results and Discussion:

The cultural characteristics of the seven isolates were studied and observed that they differ in average growth rate, growth pattern and colony colour (Table 1). The maximum growth rate (0.66 cm/day) was recorded in isolate Ab-2 followed by isolate Ab-7 (0.63 cm/day). The days taken by the Ab-1, Ab-2, Ab-4, Ab-7 isolates to cover the entire petri plate (9 cm) were 14 days. The colony

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Symmetric supercapacitor based on biosynthesized nanosheets of reduced graphene oxide (rGO): Characterization and electrochemical behavior

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ABSTRACT

Reduced graphene oxide (rGO) nanosheets (NS) were synthesized via a simple, rapid, eco-friendly and cost effective biosynthesis approach using Lonar lake isolated bacterium strain *Bacillus cabrialesii RIRD-SK (MCC 4670)*. The biologically prepared rGO nanosheets were characterized via X-ray detection diffraction (XRD), Fourier transform infrared spectrum (FTIR), Raman spectroscopy, Field emission scanning electron microscopy (FE-SEM), Energy dispersive X-ray spectroscopy (EDX), and Brunauer-Emmett-Teller (BET) techniques, respectively. Electrochemical investigation was carried out using the cyclic voltammetry (CV), galvanostatic charge–discharge (GCD) and electrochemical impedance spectroscopy (EIS) tests. Most of the oxygen functional groups species in rGO were successfully eliminated resulting in little (0.39 Ω) charge transfer resistance (R_{ct}). The rGO electrode exhibited 457 F/g specific capacitance at scan rate 5 mV s^{-1} in 1 M Na_2SO_4 aqueous electrolyte within the potential window of −1 to 0 V. It showed a superior electrochemical cycle stability of 96 % after 10,000 cyclic voltammetry cycles. The aqueous symmetric supercapacitor device was prepared in the configuration of rGO/Na_2SO_4/rGO. Device exhibited 165 F/g specific capacitance at scan rate 5 mV s^{-1} with cyclic retention of 94 % for 10,000 cyclic voltammetry cycles.

1. Introduction

The ultracapacitor or supercapacitor is considered as a promising electrochemical energy storage device due to its numerous properties, such as ultrafast charging and discharging ability, environmental friendliness, long-term stability and high power density [1]. In general, ultracapacitors are classified into three categories based on their charge storage mechanism, and the electrode taxonomy is referred to as (i) pseudocapacitor, (ii) hybrid supercapacitor, and (iii) electric double layer capacitor (EDLC) [2,3]. Supercapacitors have a longer cycle life compared to many other energy storage technologies, such as batteries and fuel cells [4]. However, the specific capacity of the EDLC is not significant since the electrolyte ions are stored by an adsorption/desorption reaction at the electrode/electrolyte interface or by a non-faradaic reaction [5]. To improve the performance of EDLC, several attempts have been made, including the new synthesis approach that uses liquid organic and aqueous electrolytes and manipulates the growth direction [6,7]. However, the specific capacitance (Csp) obtained is still lower than that of the pseudocapacitors [8,9]. Therefore, it is imperative to perform an alternative synthesis method to improve the Csp of carbon electrodes [10].

Graphene is a two-dimensional, sp^2-hybridized, one atom thick, with a close-packed honeycomb like hexagonal structure carbon material, extensively used for multifunctional applications [11]. It has been synthesized by chemical vapor deposition [12], thermal exfoliation [13], sonochemical synthesis, liquid phase exfoliation, electrochemical reduction and hydrothermal synthesis [14]. However, large-scale production of graphene is not feasible due to the stacking problem. The strong van der Waals force can be the origin of graphene stacking, which reduces the electrical properties significantly [15]. In general, without considering this stacking, graphene is one of the promising materials. In this study, reduced graphene oxide (rGO) is synthesized via a biological protocol because it has many advantages over other processes, including one-step green reduction and properties tunable by different reaction

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Treatment of Textile Processing Effluent Using Bacterial Isolate and Activated Charcoal

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KEYWORDS

Effluent, BOD, COD, bioremediation, B. *licheniformis*, seed germination

ABSTRACT:

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