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One pot synthesis of CuO-NiO nanoparticles using *Aegle marmelos* fruit extract and their antimicrobial activity

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ABSTRACT

In this study, bimetallic Copper oxide and nickel oxide nanoparticles (CuO-NiO NPs) were synthesized using a green approach that utilized Aegle marmelos fruit extract as fuel. The solution-combustion technique was found to be effective in the synthesis of CuO-NiO NPs. Phytochemical screening of the aqueous extract revealed the presence of terpenoids, alkaloids, glycosides, flavonoids, reducing sugar, and phlobatannin. X-ray diffraction analysis confirmed that the bimetallic CuO-NiO NPs had a face-centered cubic structure with a crystallite length of 15 nm. The surface morphology of the CuO-NiO NPs was analyzed using SEM, revealing that the particles were agglomerated, and the size of the NPs was estimated to range from 50 nm to 100 nm. EDX analysis showed the presence of elemental copper oxide and nickel oxide nanoparticles, with the weight percentage of Ni being comparatively higher than Cu. Elemental mapping indicated the distribution of copper, Nickel and oxygen. The synthesized CuO-NiO NPs were tested for their antimicrobial activity against Escherichia coli and Bacillus subtilis using an agar well diffusion approach, and they demonstrated a potent antimicrobial effect against bacterial pathogens. These findings confirm that green-synthesized nanoparticles have potential antimicrobial activity.

Selection and peer-review under responsibility of the scientific committee of the International Conference on Applied Research in Engineering Sciences.

1. Introduction

Recently, many efforts have been made to reduce the side effects of drugs and vaccines. Infections caused by microbes and bacteria pose a serious problem to human health. Metal oxide nanoparticles such as NiO [1,2], CuO [3], ZrP_2O_7 [4], ZrO_2 [5], MgO, $BiVO_4$ [6], $Mn_2V_2O_7$ [7], Bi_2WO_6 [8], BiOCl [9], and ZnO [10–12] have exhibited significant antibacterial activity. Compared to conventional organic materials, nanoparticles have gained wide popularity because of their physical and chemical properties. They have received a lot of attention from both technological and scientific points of view due to their therapeutic, optical, and electronic properties [13].

Bacterial infections cause severe health problems and remain a major health concern. Although antibiotics have saved many lives, bacteria have gained resistance against them. This has led to a search for new antibacterial agents. Based on their surface to volume ratio, metal oxide nanoparticles show different antimicrobial properties. Among gram-positive and gram-negative bacteria, gram-positive bacteria are resistant, which can be related to their cell wall structure.

Analyses of NiO nanoparticles' antimicrobial activity were carried out by Wang *et al.* In the aqueous system, both the nanoparticles and stressed bacteria tended to aggregate, and the toxicities of the nanoparticles were mainly assigned to the dissolved metal ions [14]. However, NiO nanoparticles demonstrated much higher

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Facile synthesis of multifunctional bismuth oxychloride nanoparticles for photocatalysis and antimicrobial test

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ABSTRACT

Nanotechnology provides a good opportunity to investigate and develop multifunctional nanoscale materials. Due to increased surface area and smaller size, nanomaterials are used as promising tools for many biological applications. Herein, a green approach is used to prepare bismuth oxychloride (BiOCl) nanoparticles using a hydrothermal method and tender jackfruit extract is used as a natural reducing agent. The synthesized nanoparticles were subjected to different spectroscopic techniques to characterize them. The crystallinity and phase composition were investigated by X-ray diffraction studies and confirmed the tetragonal structure of BiOCl. The surface morphology and elemental composition were studied using a scanning electron microscope (SEM) and energy dispersive spectra (EDS) analysis, and functional groups were identified by Fourier transform infrared spectroscopy (FTIR) analysis. The as-synthesized BiOCl nanoparticles showed superior catalytic activity toward the detection of methylene blue dye with high degree of recyclability.

1. Introduction

In recent years, contamination of water sources with heavy metals and organic dyes has become a severe threat to the ecosystem and leads to serious problems for humans [1–6]. The release of industrial effluents containing organic dyes such as methyl orange, eriochrome black T, Thymol blue, Rhodamine blue, and malachite green can adversely affect human life and aquatic ecosystem because of their poor biodegradable property [7,8]. Among the different dye removal techniques reported so far, photodegradation of organic dyes by suitable photocatalysis can be beneficial. As an effective approach, the fabrication of nanomaterials with controlled morphology and dimensions has attracted considerable interest due to their unique chemical and physical properties. Based on the properties of the materials, scientists have been attempting to prepare new nanomaterials with high photocatalytic activity to solve the problem of disposing of organic dyes [9]. Semiconductor nanomaterials are taken as environmentally friendly, sustainable and cost effective to solve a series of environmental problems. Lots of functional nanomaterials of metals and metal oxide and their composites have been fabricated [10,11]. Among all semiconductor-based photocatalysts, bismuth-based nanomaterials have attracted more attention for their excellent properties, shapes-sizes and extensive applications in removing organic pollutants and heavy metals from water sources. Bismuth oxychloride is a representative bismuth-based material, which has drawn much attention for excellent photocatalytic activity, and a member of V, VI and VIII ternary layered compounds and used as a pigment in the pharmaceutical, cosmetic industries, energy storage devices like light emitting diodes and battery cathodes [12].

In addition, changing the morphology of BiOCl mainly depends on the method of preparation, such as flower, film, nanowire and facet-controlled BiOCl [13]. So far, several researchers have employed different methods to fabricate BiOCl nanoparticles, including precipitation [14], solution combustion [15], hydrothermal [16] and green synthesis [17–21]. The synthesis of nanomaterials by nontoxic methods utilizing plant extracts is environmentally helpful [12,22,23]. To synthesis nanostructured materials green approach have drawn to great

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RESEARCH ARTICLE

BENTHAM SCIENCE

Improved Bioavailablity of Curcumin by Derivatisation with Isoleucine in Plasma and Reproductive Tissues of Female Rats is Mainly Due to Altered Affinity for P-gp Transporter

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Abstract: ***Aim*:** The present study aimed to investigate the bioavailability of curcumin conjugated with isoleucine.

***Background*:** Curcumin has various health beneficiary properties; however, it is poorly bioavailable because of its insolubility in water, poor absorption and quick systemic elimination. Hence, any approach that could improve bioavailability is necessary.

***Objective*:** The objective of the present study is to examine whether the bioavailability and biodistribution of curcumin is improved upon derivatisation with isoleucine than that of native curcumin.

***Methods*:** About 0.1 g/kg bw of curcumin and its isoleucine-derivative were administered to fasting rats. Then the blood and tissue samples were collected at different time intervals (0, 1800, 3600, 7200, 14400, 28800, 43200, 86400, and 172800 seconds) and processed for the extraction of curcumin and its derivative with methanol. The processed samples were subjected to HPLC analysis and compared with the standard curcumin and its derivative. The results were analysed using the software, PKSolver, for determining the bioavailability and biodistribution. Further, the docking studies were carried out to better understand the results obtained.

***Results*:** We found that isoleucine-curcumin conjugates have better bioavailable in plasma, ovary and uterus in the experimental rats. The curcumin and its isoleucine-derivative was detected to be maximum at 14400 seconds. However, the concentration of isoleucine-derivative of curcumin was significantly high at T_{max} compared to native curcumin. Further, curcumin and its derivative were found in the reproductive organs only at 28800 seconds, 43200 seconds and 86400 seconds. The binding energy of isoleucine-derivative of curcumin with p-glycoprotein transporter was found to be more compared to the native form. This may be the reason for the increased bioavailability of isoleucine-derivative of curcumin.

***Conclusion*:** The isoleucine-curcumin conjugate has better bioavailability compared to curcumin both in plasma and reproductive organs.

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1. INTRODUCTION

Curcumin is a yellow color compound used extensively as an ingredient/food colorant in India, especially south India [1]. It is the major component of the perennial herb *Curcuma longa* of the family Zingiberaceae [2]. It is generally known as the golden spice of India because of its immense medicinal values [3]. It is used in the Ayurveda system of medicine as one of the major ingredients. It is also used as a household remedy for various ailments, such as wound healing, cough, skin problems, *etc.* [4]. Although it has been used since time immemorial, in the last 50 years, the scientific research on different aspects of curcumin has been reported extensively. To cite a few, curcumin has anti-inflammatory [5], antimicrobial [6], hypoglycemic [7], anti-oxidant [8], anti-angiogenesis [9] anti-atherosclerotic [10], and anti-cancer [11] properties. It also acts against Alzheimer's disease [12]. In addition, it is reported that curcumin is also potent enough for the treatment of cancer, even at the metastasis stage, as well as for autoimmune conditions, arthritis, cardiovascular

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Synthesis, crystal structure, Hirshfeld surface analysis and DFT calculations of 1,2-bis(1-phenylethylidene)hydrazine

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ABSTRACT

The compound 1,2-bis(1-phenylethylidene)hydrazine was synthesized by refluxing acetophenone and hydrazine hydrate in the presence of ethanol. The 1,2-bis(1-phenylethylidene)hydrazine was characterized by various spectroscopic techniques and the 3D molecular structure was confirmed by single crystal X-ray diffraction experiment. The single crystal XRD studies show that the molecule crystallizes in the monoclinc crystal system with the space group $P2_1/n$. The intermolecular interactions in the crystal were visualized using Hirshfeld surface analysis. The interaction energies, 3D energy frameworks were computed to visualize the packing modes of the molecules. The density functional theory calculations were performed to optimize the structure using B3LYP/6–31 G(d,p) functional. The energy levels of the frontier molecular orbitals were studied to estimate the kinetic stability, and chemical reactivity of the molecule. MEP surface was generated to investigate the charge distribution over the molecule and to find possible chemical reactive sites in the molecule.

1. Introduction

The significance of azines compounds stems from their numerous pharmacological actions, which include antibacterial, antifungal [1,2], anticonvulsant, depressive, anti-inflammatory, antiviral, anticancer agents [3,4], antimalarial, and therapeutic agents [5]. Azines have drawn attention due to their NLO characteristics. Schiff bases are used as good chelating agents due to their relative ease of synthesis, synthetic flexibility, and the specific property of the C = N group. Due to the broad spectrum of applications, Schiff bases have been employed in organic dyes catalysts, liquid crystals and also used as intermediates for several bioactive compounds. Due to the presence of delocalized electron clouds between donor and acceptor groups, Schiff bases demonstrate unique hyperpolarizabilities as characteristics of interest [6]. A macroscopic dipole moment created on the azine with proper donor or acceptor substituents may make it acceptable for NLO materials [7,8]. Other physical implications include the use of liquid crystal (LC) compounds [9–12] in twisted-nematic displays, optical sensors [13,14], conducting materials [15], dye lasers, image recording materials [16], and supramolecular chemistry [17,18].

Azines are utilized as starting materials in organic synthesis [19], such as heterocyclic compounds [20], purines, pyrazoles, and pyrimidines [21–24], and they are also used in the synthesis of substituted hydrazones [25]. Azines are becoming increasingly popular due to their uses in the generation of liquid crystals, biological qualities, bond formation processes and other material applications [26].

Symmetrical azines are chemicals formed by the interaction of two molecules of identical carbonyl compounds with hydrazine, depending on whether the carbonyl compound is an aldehyde or a ketone. The compounds are known as aldazines or ketazines, respectively [27–29]. These are N—N-linked diimines and 2,3 diaza analogs of 1,3 butadiene. Several methods for the synthesis of symmetrical and unsymmetrical azines employing an excess of aldehyde or ketone with hydrazine and catalytic glacial acetic acid have been reported [30–33]. Furthermore, azines are synthesized from (E)−2-benzylidenehydrazinecarboxamide using an autoclave [34], iodoalkylzinc iodide [35], thermolysis of aryl semicarbazones [36], decomposition of diazo compounds catalyzed by platinum(0) complexes [37], and imines using copper as a catalyst [38]. The ketone employed in this study is acetophenone in 2 equivalent moles relative to hydrazine hydrate with a catalytic quantity of glacial acetic acid.

In view of these applications, the title compound is synthesized. The

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Full length article

Large optical anisotropy in quasi-one-dimensional tantalum thallium chalcogenides $TaTlX_3$ (X = S, Se): A first-principles investigation

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HIGHLIGHTS

- Large optical anisotropy is reported for quasi 1D $TaTlX_3$ (X = S, Se) materials
- The optical properties are investigated through the DFT method using HSE06 functional
- $TaTlX_3$ exhibit large birefringence values in the energy range 1–6 eV
- $TaTlX_3$ exhibit large absorption coefficient in the visible and UV regions
- Optical parameters of $TaTlX_3$ are suitable for optoelectronic applications

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ABSTRACT

Anisotropy of optical parameters of $TaTlS_3$ and $TaTlSe_3$ is investigated through first principles calculations. Indirect bandgap quasi-one-dimensional semiconductors $TaTlS_3$ and $TaTlSe_3$ have bandgaps of 1.15 eV and 0.84 eV, respectively. Important optical parameters are found to be strongly influenced by the radiation direction of the incident beam, as indicated by large birefringence and dichroism. Large optical anisotropy suggests promising nonlinear and linear optoelectronic applications for these materials, including wave plates, polarizers and phase-matching devices.

1. Introduction

Quasi-one-dimensional materials possess extraordinary structural, optical and electronic properties [1–3]. Many of these compounds have significant electronic and optical anisotropy as a result of their quasi-one-dimensional structure, which is suggestive of their potential use in high performance compact optical devices [4–6]. Belonging to the generic class of ternary metal chalcogenides ABX_3 (where A is a non-transition metal, B is a transition metal, and X is a chalcogen element), both $TaTlS_3$ and $TaTlSe_3$ are quasi-one-dimensional compounds having the orthorhombic structure with space group Pnma. The absolute birefringence values (> 1) of $TaTlS_3$ and $TaTlSe_3$ indicate a large anisotropy in comparison with many of the currently used high performance optical materials such as liquid crystals and inorganic solids, which possess birefringence values typically less than 0.4 [7–10]. Further, the birefringence of $TaTlX_3$ are greater than that reported for other large birefringent materials such as layered h-BN and $BaTiS_3$ [11–13] and comparable to the large birefringence ($\Delta n \sim 1.5$ for infrared and $\Delta n \sim 3$ for visible regions) reported for the transition metal dichalcogenide MoS_2 [14]. Even though artificially designed metamaterials and metasurfaces have been reported to offer huge birefringence [15,16], the optical losses and fabrication challenges limit their widespread usage [17] leading to a high demand for the naturally existing large anisotropic ($\Delta n > 1$) materials. This large optical anisotropy of $TaTlX_3$ is associated with their quasi-one-dimensional structure and the tendency to maximize the polarizability difference between different crystal directions [12]. Due to their appreciable charge mobility and light absorption ability, $TaTlX_3$ are interesting candidates for solar energy conversion applications [18,19].

Teske et al. reported the Pnma structure of $TaTlS_3$ for the first time, with the lattice parameters of 9.228 Å, 3.503 Å, and 14.209 Å along the a, b, and c directions and an optical bandgap of 0.78 eV obtained from diffuse UV/Vis reflectance spectra [20]. Later Teske et al. [21], after the synthesis and structural analysis of $TaTlSe_3$, reported that the material exhibits dimorphism, with one type crystallizing in the space

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A first principles characterization of electronic and optical anisotropy of quasi-one-dimensional transition metal lead sulfides $PbMS_3$ (M = Hf, Zr)

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ABSTRACT

$PbMS_3$ (M = Hf, Zr) are ternary sulfides with the general structure ABX_3, where A is a metal, B is a transition metal and X is a chalcogen or halogen element. This work investigates the anisotropy of the optical and electronic properties of $PbMS_3$, and their applicability in optoelectronic devices using first principles DFT calculations. $PbHfS_3$ is an indirect bandgap semiconductor (1.2 eV), whereas $PbZrS_3$ has direct bandgap (1.1 eV). The effective masses of electrons and holes exhibit strong anisotropy along the various high symmetry directions of the Brillouin zone. Important optical parameters are found to be strongly dependent on the direction of the incident radiation, best indicated by the large birefringence value. Considerable optical anisotropy suggests their promising linear and nonlinear optoelectronic applications such as polarizers, wave plates, and phase-matching elements. Small carrier effective masses, large charge recombination rates and suitable bandgap indicate the possibility of solar and photovoltaic applications.

1. Introduction

Many one-dimensional van der Waals (1D vdW) materials, in which the bulk crystal is formed through vdW bonds between atomic chains or ribbons [1], exhibit strong anisotropy in their optical properties [2,3]. For instance, significant optical anisotropy has been reported in quasi-one-dimensional materials like barium zinc chalcogenides Ba_2ZnX_3 [4], barium titanium chalcogenides $BaTiX_3$ [5–7], barium cadmium chalcogenides Ba_2CdX_3 [7], Sb_2Se_3 [8], $TaTlX_3$ [9], $ZrTe_5$ [10], $CrSbX_3$ [11] and lead iodine perovskite $C_4N_2H_{14}PbI_4$ [12], to name a few. These optically anisotropic materials are expected to have extensive applications in optical communication, laser industry [5,6,13], polarization sensitive photodetectors, polarization controllers, polarization resolved imaging, linear polarization light source [14,15] etc.

$PbHfS_3$ and $PbZrS_3$ are quasi-one-dimensional ternary transition metal chalcogenides having the orthorhombic Pnma structure [16,17]. In 1970, Sterzel and Horn reported their synthesis for the first time, by reaction of PbS with the sulphides of zirconium and hafnium and suggested that they are isotypic with each other and have probably orthorhombic structure [18]. Later, in 1978, Lelieveld and Ijdo prepared $PbZrS_3$ and $PbHfS_3$ by firing stoichiometric proportions of the binary sulphides at 800 °C, and after analysing the neutron diffraction powder data, reported the orthorhombic Pnma structure, which is isostructural with the NH_4CdCl_3, containing columns of double edge-sharing octahedra connected by Pb ions in tricapped trigonal-prismatic coordination [19]. In 1988, Wiegers et al. [17] succeeded in obtaining single crystals of $PbHfS_3$ as bundles of red needles through vapour transport with chlorine as transport agent. Through single crystal X-ray diffraction, they confirmed its orthorhombic Pnma structure and also confirmed that $PbHfS_3$ is isostructural with $PbZrS_3$.

Though the structural features of $PbMS_3$ (M = Hf, Zr) have been well established through the earlier experimental works [17,19], the anisotropy of their electronic and optical properties have not been explored yet. This study intends to investigate the optical and electronic anisotropy of them through DFT studies involving GGA-PBE functional, and hence to assess their prospective optoelectronic applications.

The orthorhombic Pnma (62) structure was confirmed in the present study, and the results agreed well with the previously reported experimental data [17,19]. $PbMS_3$ possess quasi-one-dimensional structure with chains of edge-sharing MS_6 double octahedra along the crystallographic b direction. $PbHfS_3$ is an indirect bandgap semiconductor with bandgap of 1.2 eV, and $PbZrS_3$ is a direct bandgap semiconductor with bandgap of 1.1 eV. They exhibit pronounced optical anisotropy in the

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The quest for optimal photovoltaics: A theoretical exploration of quasi-one-dimensional tin based chalcogenides $XSnS_3$ (X=Ba, Sr)

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ABSTRACT

Structural, mechanical, electronic, and optical properties of alkaline metals (Ba, Sr) tin chalcogenide were investigated by the first principles method based on density functional theory (DFT) implemented in the WEIN2K program. The study found that both materials exhibit a quasi-one-dimensional nature along the *b*-axis, and the optimized structure agrees with the available experimental data. Mechanical properties revealed that both materials are mechanically stable, exhibit ductility, and have significant anisotropy. $BaSnS_3$ and $SrSnS_3$ exhibit an indirect band gap with the values of 1.55 eV and 1.39 eV, respectively. Which is favorable for photovoltaic solar cell absorber materials. Like many ternary metal chalcogenides, $XSnS_3$ compounds show significant anisotropy in the optical properties due to their quasi-one-dimensional structure. This work determined the degree of optical anisotropy of $XSnS_3$ in terms of the dielectric function, refractive index, optical absorption, reflectivity, optical extinction, birefringence, and energy loss function. The results indicate that $BaSnS_3$ and $SrSnS_3$ materials possess notable optical anisotropy and a high absorption coefficient ($\alpha \approx 10^6$ cm^{-1}), low reflectivity and energy loss function within the visible and ultraviolet energy range. It indicates their potential for use in a range of applications, such as sensors, optoelectronics, and photovoltaic solar cell absorber materials.

1. Introduction

Mixed organic–inorganic halide perovskites represent a notable breakthrough in photovoltaic (PV) materials. Within a decade, their utilization in PV devices has dramatically improved the power conversion efficiency (PCE) from 3.8% to an impressive 24.2% [1,2]. However, these materials suffer from instability and toxicity issues due to lead (Pb) [3]. To overcome these challenges, exploring alternative semiconductor compounds that possess the desired characteristics for PV applications is intriguing, including an optimal band gap within the range of 0.5 to 2.5 eV, high carrier mobility, and a stable crystal structure [1]. Metal halide perovskites have indeed received significant attention from the scientific community [4]. A recent study by S. Idrissi et al. [5] indicated that $CsXCl_3$ (X = Ge, Sn, and Pb) halide perovskites have good photovoltaic properties due to their desirable band gaps. Furthermore, Cs-based fluoro-perovskites such as $CsMF_3$ (M = Ge, Sn, and Pb) have demonstrated promising thermoelectric and optoelectronic properties [6]. The photovoltaic community has been looking for lead-free perovskites [7] and organic–inorganic materials for photovoltaic applications for several years. Recent studies revealed that Sn substitution in methyl ammonium lead halide decreases toxicity and is suitable for optimum solar cell efficiency [8].

$BaSnS_3$ and $SrSnS_3$ materials are ternary chalcogenide materials that crystallize in an orthorhombic D_{2h}^{16}- Pnma space group, forming a needle-like structure isostructural to NH_4CdCl_3. The quasi-one-dimensional nature of these materials is observed along the *b*-axis of the unit cell, which indicates strong anisotropy of the structural and physical properties of the materials [9,10]. Sujith et al. [11] observed anisotropy in $HfSnS_3$ and $ZrSnS_3$ ternary chalcogenide materials. They found that both materials display substantial birefringence with quite sizeable optical anisotropy and can potentially be employed as photovoltaic absorber materials. Yang Lu et al. [12] recently synthesized $HfSnS_3$ and confirmed that it forms a one-dimensional Van der Walls P-type semiconducting material. This material exhibits giant anisotropy and substantial photo response in a broadband range from UV to near-infrared (NIR) with short response times of 0.355 ms, high responsivity of 11.5 AW^{-1}, detectivity of 8.2×10^{11} Jones, and environmental stability, making it suitable for photodetector and opto-electronic applications.

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Green, nonchemical route for the synthesis of $MnWO_4$ nanostructures, evaluation of their photocatalytic and electrochemical performance

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ABSTRACT

This research article presents the synthesis of $MnWO_4$ nanoparticles using a combination of $MnCl_2$ and $Na_2WO_4{\cdot}2H_2O$ as precursors, with water as the sole solvent for dissolution, eliminating the need for additional solvents. The synthesized materials underwent comprehensive characterization employing various analytical techniques, including X-ray diffraction, scanning electron microscopy, UV–visible spectrophotometry, and Fourier Transform Infrared Spectrometry. The photocatalytic activity of $MnWO_4$ nanoparticles for degrading the organic contaminant methylene blue in water was also investigated under visible light irradiation. Notably, a significant degradation of methylene blue was observed, with 98% degradation achieved within a 120-min irradiation period. Additionally, the material was subjected to electrochemical studies to assess its sensing capabilities and exhibited strong sensing activity by detecting nano-molar concentrations of nitrite solution.

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Biogenic synthesis of orthorhombic α-MoO_3 nanoparticles for photocatalytic degradation and electrochemical sensing

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ABSTRACT

One-step solution combustion method was used to synthesize α-MoO_3 nanoparticles using ammonium molybdate tetrahydrate as the molybdenum source and rain tree pod extract as the green fuel. Spectroscopic techniques such as powder X-ray diffraction (PXRD), scanning electron microscopy (SEM), and transmission electron microscopy with selected area electron diffraction patterns were used to describe the morphological and structural properties of the as-synthesized molybdenum oxide nanoparticles. Furthermore, an assessment of the synthesized α-MoO_3 nanoparticles encompassed their performance in degrading methylene blue dye under visible irradiation, revealing an impressive dye removal efficiency of 98% upon exposure with high degree of recyclability. Additionally, these α-MoO_3 nanoparticles were explored for their sensing capabilities with regard to dopamine. This current synthetic endeavor holds the promise of offering fresh insights into the development of nanomaterials tailored for multifaceted, enduring applications in environmental remediation and biomedical contexts.

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Facile green synthesis of cerium oxide nanoparticles using *Jacaranda mimosifolia* leaf extract and evaluation of their antibacterial and photodegradation activity

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ABSTRACT

In the present work cerium oxide nanoparticles were synthesized by solution-combustion method using Jacaranda mimosifolia leaf extract as a fuel. The phytochemical screening of leaf extract was carried out, revealing the presence of alkaloids, phenolics, flavonoids, steroids and reducing sugar. The synthesized nanoparticles were characterized by XRD, SEM, EDAX and Elemental mapping. The XRD and SEM analysis revealed that they are highly homogenous and symmetrical in morphology with almost spherical in shape. EDAX depicted the purity of nanoparticles and elemental mapping showed the spatial arrangement of atoms. The present report aims at the application of Cerium oxide nanoparticles as antibacterial agents against Escherichia coli and Bacillus subtilis. Further the photocatalytic activity of methylene blue was evaluated under visible light irradiation. 95% of dye removal was achieved within 60 min. This study shows that synthesized Cerium oxide nanoparticles act as antibacterial agents and potential photocatalysts for degradation of organic pollutants present in water bodies.

Selection and peer-review under responsibility of the scientific committee of the International Conference on Applied Research in Engineering Sciences.

1. Introduction

The discovery of nanoscale matter has created a phenomenal change in the field of material science and provided scientists and researchers with numerous ways to develop solutions for the contemporary problems impacting the society. The idea of nanotechnology was added by the American physicist and Nobel Prize laureate Richard Feynman in 1959 [4]. In 1974 the 'Nanotechnology' was coined with the aid of Prof. Norio Taniguchi, Tokyo Science University to describe the precision manufacture with nanometers tolerances, which was accidently referred to through K. Eric Drexler, who published the primary e-book on nanotechnology "Engines of Creation: The Coming Era of Nanotechnology", which brought about the principle of "molecular engineering" [19]. The NPs can be synthesized through numerous ways, but there are two general methods (1) Top-down approach and (2) Bottom-up approach [20]. The significant application of nanoparticles in modern science has increased rapid growth of nanoparticle synthesis [21]. The concept of green technology is considered as the best alternative to resolve the concerns of the traditional methods [22]. Synthesis of nanoparticles using plants and microorganisms can be termed as green nanobiotechnology [18]. Cerium oxide nanoparticles can be used as catalysts, fuel cells and antioxidants in biological systems, thus used widely in nanotechnology. Cerium is the most abundant rare metal. [9]. Cerium oxide NPs are used extensively when compared to other NPs as it has good

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Molecular mechanism of anti-obesity effect of total lutein oxidized products (LOPs) in diet-induced obese mice

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ABSTRACT

The present study explores the molecular mechanism of anti-obesity effect of total lutein oxidized products (LOPs) in high-fat diet-induced obese C57BL/6 mice. Total LOPs (50, 100, 200 mg/kg b.wt.) were intubated for 22 weeks. Lipid profile, peroxides, AST, ALT, GST activities, lipid metabolizing enzymes/molecules, 3T3-L1 cell differentiation, TGF-β1 and p38 MAPK expressions were studied. Total LOPs at 100 mg/kg b.wt. reduced plasma and hepatic cholesterol, triglycerides, phospholipids, ALT and AST activities. FAS and CPT activities were inhibited in the liver homogenate, and epididymal WAT (eWAT). Total LOPs at 200 mg/kg b.wt. reduced HMGCoA:Mevalonate in eWAT, lipid peroxides in eWAT and liver. GST activity was high in the liver and eWAT. Total LOPs (100μg/ml) suppressed adipogenesis and decreased the accumulation of lipid droplets from two to eight days. Adiponectin was upregulated, PPARγ, lipoprotein lipase, TGF-β1, and p38 MAPK were down-regulated. The results have shown that total LOPs are potent anti-obese molecules.

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Lutein oxidized products; C57BL/6 mice; lipid metabolizing enzymes; 3T3-L1 cells; adiponectin; p38 MAPK; pre-adipocytes

ABBREVIATIONS: AIN 93G: American institute of nutrition 93 for growth; ALT: alanine transaminase; AST: aspartate transaminase; CEBPα: ccaat/enhancer binding protein α; C-DNA: complementary deoxyribonucleic acid; CPT: carnitine palmitoyl transferase; GST: glutathione-S-transferase; ELISA: enzyme-linked immune sorbent assay; FAS: fatty acid synthase; HDL: high-density lipoprotein; HFD: high-fat diet; HMG CoA: β-Hydroxy β-methylglutaryl-Coenzyme A; LDL: low-density lipoprotein; LOPs: total lutein oxidized products; LPL: lipoprotein lipase; MDA-Malonaldehyde; MTT: 3-(4,5-dimethylthiazol-2-yl)−2,5-diphenyl tetrazolium bromide; MVA: mevalonate; p38MAPK: p38 mitogen-activated protein kinases; RNA: ribonucleic acid; RTq-PCR: quantitative reverse transcription polymerase chain reaction; PPAR-γ: peroxisome proliferator-activated receptor-gamma; TGF-β1: transforming growth factor beta 1; WAT: white adipose tissue.

1. Introduction

Obesity is a growing health condition globally with excessive fat accumulation giving a negative impact on human health. People who are obese are prone to various risk factors like high blood sugar levels/type 2 diabetes, High blood pressure resulting in hypertension, cardiovascular diseases leading to heart failure and stroke, stiffness in bones and joints causing joint pain/osteoarthritis, sleep apnea, and some cancers [1]. Clinical trials and animal experiments suggest that obesity is directly linked with dyslipidemia resulting in elevated blood and hepatic cholesterol, phospholipids, triglycerides, impaired lipid functions, nonalcoholic fatty liver disease (NAFLD), inflammation, and oxidative stress [2].

At the molecular level, obesity is linked to the dysregulation of various signalling molecules, transcription factors, enzymes, and hormones involved in the process of fat accumulation. Obesity imbalances adipogenesis *i.e.* the process of formation of mature adipocytes from the proliferation and differentiation of adipocyte precursor cells, and results in adipose hypertrophy, hyperplasia, and hypoxia [3]. The peroxisome proliferator-activated receptor γ (PPARγ) and CCAAT/enhancer-binding protein α (CEBPα) are the principal regulators of adipogenesis. Activation of PPARγ and CEBPα, in turn, transcribes various lipid metabolizing enzymes/molecules involved at different stages of lipid metabolism like Lipoprotein lipase (LPL), Fatty acid synthase (FAS), Carnitine palmitoyltransferase (CPT), Fatty acid-binding protein 4 (FABP4), Adiponectin, Hormone-sensitive lipase (HSL), Glucose transporter 4 (GLUT4), and Stearyl-CoA-desaturase(SCD) [4]. Hence regulators/modulators of adipogenesis play a vital role in controlling the progression of obesity.

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Anti-corrosive and anti-microbial activity of MTMI on CRCA metal

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ABSTRACT

The present study was intended to demonstrate the synthesis, and characterization of 1-(3-methoxyphenyl)-N-(4H-1,2,4-triazol-4-yl)methan-imine(MTMI) as an inhibitor for the corrosion on CRCA in 1 M HCl. In addition to this, molecular docking, and biological activity was carried out. MTMI formation was confirmed by FTIR and NMR spectroscopic studies. The corrosion inhibition effect was studied by weight loss, potentiodynamic polarization (PDP) measurements, and electrochemical impedance spectroscopy (EIS) techniques. The conditions for optimum inhibition efficiency were established by varying the concentration of the inhibitor and temperature by weight loss method. Kinetic and thermodynamic parameters were calculated and discussed. Results were fitted into various adsorption isotherm models. The adsorption of MTMI on CRCA was confirmed by scanning electron microscopy (SEM). Adsorption obeyed the Langmuir isotherm model and followed physical adsorption. Increasing inhibitor concentration led to a significant reduction in the corrosion rate of mild steel, with an inhibitor efficiency value above 93%. A molecular docking study showed the binding capacity of the protein endo-polygalacturonase (1HG8) and the activity of polygalacturonase enzyme on MTMI was measured.

1. Introduction

Corrosion is the deterioration of the metal when exposed to the environment. Here, metal basically undergoes electrochemical oxidation by reacting with different components present in the environment. Corrosion study is of academic, economic, aesthetic, and environmental importance. Corrosion may lead to several consequences like financial loss, loss of natural resources, and injuries to human and living entities. At the industrial level corrosion may lead to the wastage of valuable resources and leads to a reduction in efficiency. The plant shutdown, expensive design, and various health hazards.

In today's fast-paced commercial world, CRCA steel finds its importance in the market as they are commonly used as structural parts in automobiles and other industries due to its improved mechanical and physical properties [1]. The low cost and ease of fabrication of CRCA steels make them readily accepted for many applications. The CRCA metal is composed primarily of iron (99.9%), carbon (0.15%), manganese (6.8%), sulphur (0.055%), and phosphorus (0.055%). The metal is not corrosion-resistant at low and high temperatures, challenging various applications in acidic environments. The degradation of steel/-alloys in the course of industrial processes, such as pickling, itching, descaling, oxidation, etc., occurs when the metal reverts easily to its ionic state from its metallic state [2].

Furthermore, the use of inhibitors is critical in achieving some phenomenally effective corrosion control techniques. An inhibitor minimizes the impact of corrosion on the metal surface in a rigid environment by forming a protective film or coatings. The effectiveness of inhibitors is determined by their structure, reactivity, and other physical properties. Organic inhibitors [3,4], green inhibitors, and carbon dots [5] have attained importance among all the different classes of inhibitors, owing to their easy synthesis, low cost, and high inhibition ability.

It has also been found that organic compounds with heteroatoms like sulphur, nitrogen, oxygen, and phosphorus atoms have been effective inhibitors in acidic mediums with varying pH levels [6]. Due to their high polarizability and electronegativity, atoms with large pits are likely

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Rhizobial elicitor molecule signaling muskmelon defense against gummy stem blight disease involving innate immune response

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ARTICLE INFO

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Growth promotion

ABSTRACT

The crude oligosaccharide (CO) from plant growth-promoting fungus, *Talaromyces verruculosum* (AB2 strain) was isolated from the muskmelon rhizospheric soil in this study. Various concentrations of CO elicitor was utilized for seed treatment to muskmelon at varying time intervals to evaluate its plant growth promotion and disease protection ability against gummy stem blight disease, which is caused by *Stagonosporopsis cucurbitacearum* (DBTNP-2 strain). A maximum of 92% of germination and seedling vigor of 2439.76 was recorded at 6 h under *in vitro* conditions, after CO-pre-treated plants with 4 $mgml^{-1}$. Similarly, when compared to the control, the CO-treated seed (4 $mgml^{-1}$) exhibited increased vegetative growth parameters under greenhouse conditions after 6 h. In the studies of disease protection, a significant 80.88% protection from disease was noticed in plants pre-treated with CO (4 $mgml^{-1}$) after 6 h. The protection thus obtained was systemic and needed a minimal of five days to achieve maximum resistance and thereafter, this protection remained stable at all time periods. An early elevated hypersensitive reaction and the defense related cellular components such as lignin, callose, H_2O_2 and phenol deposition, were noticed in comparison with the unprocessed control plants. Furthermore, when compared to pathogen or water control, a significant up-regulation of defense-related PAL, POX, PPO and LOX enzymes was found in the plants, which were pre-treated with CO, either with or without pathogen infection. The present research directly evidences that when confronted with the pathogen infection, the CO-treated muskmelon plants promote plant growth and trigger the resistance through the morphological, histological and biochemical defense mechanisms.

1. Introduction

Gummy Stem Blight (GSB) is one of the major illnesses of muskmelon (*Cucumis melo*) caused by an ascomycetous fungus *Didymella bryoniae* (Fuckel) Rehm. (*Stagonosporopsis cucurbitacearum*) (Fr.) [1] and its [anamorph *Phoma cucurbitacearum* (Fr.) Sacc.], cucurbit crops are constantly affected by pathogens which lead to calamitous disease epidemics; seeds are mainly susceptible to many diseases of cucurbits, which makes disease management difficult [2,3]. In India the disease was first noticed on the young muskmelon seedlings and reported about 21% of incidence during the field survey in Karnataka [4]. The present control measures followed by the farmers are mainly chemical control by the application of fungicides which is not that successful in controlling the disease due to development of resistance to some systemic fungicides by pathogen [5,6]. The disease control is also being difficult due to the complexity of pathogen cell wall that contains highly crystalline chitin and β- 1, 3 glucan as well as unavailability of resistant varieties of cucurbit crops for this disease [7].

Plant Growth-Promoting Fungi (PGPF) is highly efficient in promoting growth as well as inducing systemic resistance against various

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Certain classes of analytic Functions involving multiplier transformations by using q-calculus operators

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Abstract: In this paper we define the classes $T_q^{\lambda}(m,l,A,B)$ using Janowski class, multiplier transformations and q-calculus. The results investigated for these classes of functions include the co-efficient estimates, inclusion relations, distortion bounds. Extreme points and many more properties.

Keywords: Univalent functions, Janowski class, multiplier transformation.
MSC 2010 Classifications: 30C45,30C50.

1. Introduction

Let A denote the class of all analytic functions of the form

$$f(z)=z+\sum_{k=2}^{\infty}a_k z^k \tag{1.1}$$

defined in the unit disc U = {z:|z|<1}.

Let T denote the subclass of A and U, consisting of analytic functions whose non-zero coefficients from the second onwards are negative. That is, an analytic function $f \in T$ if it has a Taylor expression of the form

$$f(z)=z-\sum_{k=2}^{\infty}a_k z^k \ (a_k \geq 0) \tag{1.2}$$

Which is analytic in the open disc U

The q-shifted factorial is defined for $a, q \in \mathbb{C}$ as a product of n factors by

$$(a,q)_n=\begin{cases}1, & n=0;\\ (1-a)(1-aq)\ldots(1-aq^{n-1}), & n\in\mathbb{N}.\end{cases} \tag{1.3}$$

And in terms of the basic analogue of the gamma function

$$(q^a;q)_n=\frac{\Gamma_q(a+n)(1-q)^n}{\Gamma_q(a)},(n>0), \tag{1.4}$$

Where the q-gamma functions [2,3] is defined by

$$\Gamma_q(x)=\frac{(q;q)_{\infty}(1-q)^{1-x}}{(q^x;q)_{\infty}}(0<q<1) \tag{1.5}$$

Note that, if |q|<1, the shifted factorial (1,3) remains meaningful for n = ∞ as a convergent infinity product

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CERTAIN SUBCLASSES OF BI-UNIVALENT FUNCTIONS DEFINED BY LINEAR MULTIPLIER FRACTIONAL q-DIFFERENTIAL OPERATOR

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ABSTRACT. This paper introduces a novel subclass of analytic and bi-univalent functions that are linked to a linear multiplier fractional q-differential operator, defined in the open unit disk $\mathbb{D}$. The authors establish the upper bounds for the coefficients $|a_2|$ and $|a_3|$ for the functions that belong to this new subclass and its subclasses.

1. INTRODUCTION AND PRELIMINARIES

Let the class of functions $\mathcal{A}$ be of the form:

$$\eta(z) = z + \sum_{k=2}^{+\infty} a_k z^k, \tag{1.1}$$

which are analytic on the open unit disk $\mathbb{D} = \{z \in \mathbb{C} : |z| < 1\}$. Also let S indicates the functions of all subclasses in $\mathcal{A}$, which are univalent in $\mathbb{D}$. Since univalent functions are one-to-one, they are invertible. Although the inverse functions of single-valued functions are inverse functions, they do not need to be defined for the entire unit disk $\mathbb{D}$. Certainly, according to Koebe's quarter theorem [1], the disk with radius $\frac{1}{4}$ is in the image $\mathbb{D}$. Thus, every univalent function η has an inverse η^{-1} that satisfies $\eta^{-1}(\eta(z)) = z$, $z \in \mathbb{D}$, and $\zeta(w) = \eta^{-1}(\eta(w)) = w$, $|w| < r_0(\eta)$, $r_0(\eta) \geq \frac{1}{4}$, where

$$\eta^{-1}(w) = w - a_2 w^2 + (2a_2^2 - a_3)w^3 - (5a_2^3 - 5a_2 a_3 + a_4)w^4 + \cdots. \tag{1.2}$$

Key words and phrases. Analytic function, univalent function, bi-univalent function, starlike function, convex function, q-derivative operator.

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Certain New Subclassess of Analytic and Bi-univalent Functions

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Abstract. The paper presents two novel subclasses of the function class Σ, which consists of bi-univalent functions defined in the open unit disk $\mathcal{D} = \{\zeta : |\zeta| < 1\}$. The authors investigate the properties of these new subclasses and provide estimates for the absolute values of the second, third, and fourth Taylor-Maclaurin coefficients r_2, r_3, and r_4 for functions in these subclasses.

1. Introduction

Let $\mathcal{A}$ be the class of functions with the following form:

$$\chi(\zeta) = \zeta + \sum_{k=2}^{\infty} r_k \zeta^k \tag{1.1}$$

which are analytic in the open unit disc $\mathcal{D} = \{\zeta : |\zeta| < 1\}$.

Let $J_\chi(\gamma, b, c)$ where $\chi \in \mathcal{A}$ with $\dfrac{\chi(\zeta)\chi'(\zeta)}{\zeta} \neq 0$ denote the class of convex function in $\mathcal{D}$ defined as fallows [8]

$$J_\chi(\gamma, b, c) = (1-\gamma)\left[1 - \frac{1}{c} + \frac{\zeta}{c}\frac{\chi'(\zeta)}{\chi(\zeta)}\right] + \gamma\left[1 + \frac{\zeta}{b}\frac{\chi''(\zeta)}{\chi'(\zeta)}\right]$$

where $\gamma, b \neq 0$ and $c \neq 0$ are complex numbers. Further, by $\mathcal{S}$ we shall denote the class of all functions in $\mathcal{A}$ which are univalent in $\mathcal{D}$. It is well known that every function $\chi \in \mathcal{S}$ has an inverse χ^{-1}, defined

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Probing the hydrogen bond network in the crystal structure of a sulfonamide derivative: A quantum chemical approach

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ABSTRACT

A novel sulfonamide derivative, N-[2-[(5-bromo-2-chloro-4-pyrimidinyl)thio]-4-methoxyphenyl] benzene sulfonamide, was synthesized and characterized using spectroscopic techniques. Single crystal X-ray diffraction analysis determined that the compound crystallizes in the monoclinic crystal system with the space group P21/c with $Z = 8$. The crystal packing of the compound was found to be largely influenced by N-H···O intermolecular interactions. Hirshfeld surface analysis with fingerprint plots was performed to visualize the intermolecular interactions present in the crystal structure. Density functional theory (DFT) studies were employed to obtain the electronic structure of the compound, including frontier molecular orbitals and their energy gap, molecular electron densities, and electrostatic potential maps. The stability of the molecule, resulting from hyperconjugative interactions and charge delocalization, was analyzed using Natural Bond Orbital (NBO) analysis. Quantum theory of atoms in molecules (QTAIM) and reduced density gradient (RDG) analysis were conducted to explore the weak interactions present in the molecule. Overall, this study provides insight into the hydrogen bonding interactions and crystal packing of sulfonamide derivatives, which have important implications for their properties in various fields such as medicinal chemistry, agrochemicals, and material science.

1. Introduction

The hydrogen bond, a crucial intermolecular force, plays a vital role in diverse chemical and biological processes. Understanding the hydrogen bonding network in molecular crystal structures is essential for advancing materials, drugs, and catalysts [1]. Researchers have long been intrigued by the study of hydrogen bonding in these structures, as it provides valuable insights into molecular organization and properties. For instance, Liu et al. demonstrated the influence of hydrogen bonding networks on the mechanical properties of organic crystal structures [2]. Additionally, Dey and Bhattacharyya highlighted the significance of hydrogen bonding in the crystal structures of pharmaceutical compounds [3]. Sulfonamide derivatives, widely employed in medicinal chemistry, agrochemicals, and material science, exhibit a range of biological and physicochemical properties [4–6]. The crystal packing of sulfonamide derivatives is predominantly governed by hydrogen bonding interactions, impacting their stability, solubility, and bioavailability [7,8]. Consequently, the hydrogen bonding network in sulfonamide derivative crystal structures holds sway over their properties. A notable study by Grujicic et al. investigated the impact of hydrogen bonding on the stability and mechanical properties of sulfonamide crystals, revealing a significant influence on their mechanical behavior. The presence of hydrogen bonding in sulfonamide derivatives has been shown to play a critical role in their biological activity, as it can affect their binding affinity and selectivity for specific targets [9].

Quantum chemical calculations have become invaluable for exploring hydrogen bonding networks in crystal structures, enabling a deeper understanding of their nature and strength [10–13]. Notably, Vargas-Baca et al. utilized these calculations to examine the hydrogen bonding interactions in a guanine derivative crystal, revealing their significant contribution to the crystal's structural stability. Similarly, Ishida et al. investigated the hydrogen bonding network in a

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ARTICLE

Infrared and Electronic Spectroscopy for Assay of Dosulepin in Pharmaceuticals: *Stability Indicating Study and Quantification Approach*

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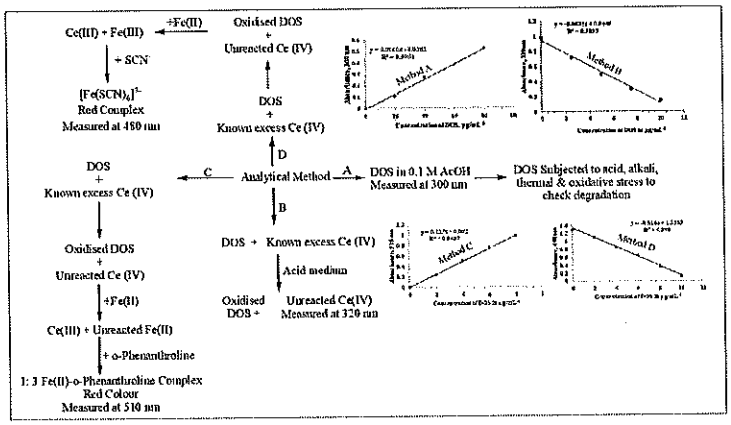

Four simple, precise, and cost-effective spectrophotometric methods were designed and validated to assess Dosulepin hydrochloride (DOS) in pure and dosage form. Two of them are direct UV (Methods A and B), and the other two are indirect visible spectrophotometric methods (Methods C and D). Method A is based on the measurement of the chromophoric activity of DOS in 0.1 M acetic acid (AcOH) at 300 nm. Method B involves the measurement of absorbance due to cerium (IV) left in excess after oxidizing DOS at 320 nm. The unreacted cerium (IV) was treated with a large excess of iron (II), which results in iron (III) and cerium (III). The surplus iron (II) forms a red colored complex with o-phenanthroline at a slightly higher pH was measured at 510 nm in Method C. In Method D the iron (III) formed in the redox reaction between unreacted cerium (IV) and iron (II) was made to form a red colour complex with thiocyanate and measured at 480 nm. The methods are applicable over good linear ranges of 1.0-80.0, 0.25-10.0, 0.5-8.0 and 0.50-10.0 μg mL^{-1} with actual molar absorptivity values of 2.07×10^3, 3.11×10^4, 4.08×10^4 and 3.7×10^4 L $mol^{-1}cm^{-1}$ for Method A, B, C and D, respectively. The validating parameters like limit of detection (LOD), quantification (LOQ), Sandell sensitivity and others have been reported. The methods proposed were successfully applied to quantify DOS in pharmaceuticals. The Fourier Transform Infrared (FT-IR) spectra of the post degradation DOS were studied, compared with that of pure drug and reached to the possible effect of degradation to stress by stability indicating property of Method A.

Keywords: Dosulepin hydrochloride, cerium (IV), spectrophotometry, chromophore, pharmaceuticals

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Environmentally benign silver bio-nanomaterials as potent antioxidant, antibacterial, and antidiabetic agents: Green synthesis using *Salacia oblonga* root extract

Guru Kumar Dugganaboyana[1], Chethan Kumar Mukunda[2], Anisha Jain[3], Raghavendra Mandya Kantharaju[2], Rani R. Nithya[1], Divya Ninganna[2], Rathi Muthaiyan Ahalliya[4], Ali A. Shati[5], Mohammad Y. Alfaifi[5], Serag Eldin I. Elbehairi[5,6], Ekaterina Silina[7], Victor Stupin[8], Gopalakrishnan Velliyur Kanniappan[9]*, Raghu Ram Achar[1]*, Chandan Shivamallu[10]* and Shiva Prasad Kollur[11]*

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Introduction: The use of plant extracts in the green synthesis of metallic nanoparticles is one of the simplest, most practical, economical, and ecologically friendly methods for avoiding the use of toxic chemicals.

Method: Silver nanoparticles (AgNPs) were synthesized, employing a high-efficiency, non- toxic, cost-effective, green, and simple technique that included the use of *Salacia oblonga* root extract (SOR) as a capping agent compared to synthetic nanoparticles. The use of *S. oblonga* can be seen in traditional medicines for treating diabetes, obesity, rheumatism, gonorrhea, asthma, and hyperglycemia. The objectives of the current study were to green synthesize *S. oblonga* root extract silver nanoparticles (SOR-AgNPs), characterize them, and study their antioxidant, antibacterial, and antidiabetic activities.

Result: The shape of SOR-AgNPs was spherical, at less than 99.8 nm in size, and exhibited a crystalline peak at XRD. The green synthesized SOR-AgNPs showed significant antioxidant properties like DPPH (80.64 µg/mL), reducing power capacity (81.09 ± SEM µg/mL), nitric oxide (96.58 µg/mL), and hydroxyl (58.38 µg/mL) radical scavenging activities. The MIC of SOR-AgNPs was lower in gram-positive bacteria. The SOR-AgNPs have displayed efficient inhibitory activity against α-amylase, with an EC50 of 58.38 µg/mL. Analysis of capping protein around the SOR-AgNPs showed a molecular weight of 30 kDa.

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ORIGINAL PAPER

An alkali-extracted polysaccharide from *Pleurotus eous* and exploration of its antioxidant and immunomodulatory activities

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Abstract
The *Pleurotus eous* fruiting body was used to prepare an alkali-extracted polysaccharide (PEAP). The goal was to characterize PEAP's physicochemical characteristics, structural characteristics, antioxidant capabilities, and immunological functions. PEAP had an average molecular weight of 156 kDa and was composed of glucose, galactose, rhamnose, xylose, and mannose. Both the FTIR and NMR spectra of PEAP showed distinctive polysaccharide bands. In addition to demonstrating significant scavenging activity against 2,2-azino-bis-3-ethylbenzothiazoline-6-sulfonic acid (ABTS) (EC_{50} = 16.06 mg/mL), superoxide radicals (EC_{50} = 9.77 mg/mL), and 1,1-diphenyl-2-picrylhydrazyl radicals (DPPH) (EC_{50} = 16.21 mg/mL), PEAP also exhibited reducing power (EC_{50} = 9.71 mg/mL), chelating ability (EC_{50} = 7.89 mg/mL), and inhibition of β-carotene bleaching (EC_{50} = 2.06 mg/mL). PEAP was revealed to have an immunomodulatory effect as it increased the proliferative and phagocytic activity of RAW264.7 cells and caused concentration-dependent releases of nitric oxide (NO), interleukin 4 (IL-4), interleukin 12 (IL-12), interleukin 17 (IL-17), tumor necrosis factor (TNF-α), and interferon-gamma (IFN-γ) by macrophages. The results showed that PEAP might be a natural immunostimulant and antioxidant in functional foods or medicine.

Keywords *Pleurotus eous* · Mushroom polysaccharide · Alkali extraction · Structural characterization · Antioxidant activity · Immunomodulatory activity

Introduction

Polysaccharides, long-chain polymeric carbohydrates made of monosaccharide units linked together by glycosidic connections, have recently acquired popularity. Due to their harmless side effects, fungal polysaccharides have remarkable biological effects, particularly antitumor [1], immunomodulatory [2], antioxidant [3], and hypoglycemic activities [4]. The yeast polysaccharide demonstrated biological activity and is employed as an antioxidant, natural immunomodulatory, cholesterol-lowering agent, anti-microbial, anti-viral, anti-cancer and antimutagenic properties [5, 6]. Developing polysaccharides as active compounds to regulate macrophage activation, cytokine production, and immune system regulation has attracted growing interest recently. Macrophages, which are key players in the immune response, can kill pathogens directly via phagocytosis or indirectly by secreting cytokines, including nitric oxide (NO), interleukins-6 (IL-6), and other cytokines when activated [7]. Overall, polysaccharides are ideal candidates for evaluating immune enhancers from natural products since

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Short Review Paper

Importance of disaster risk reduction and management of vulnerable communities in the context of Atmanirbhar bharat

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Abstract

In compliance with the Disaster Management Act of 2005, the National Policy on Disaster Management, 2009, is a national-level policy. The policy outlines a framework or road map for responding to disasters in a thorough and all-encompassing way. Accordingly, the state government bears the main responsibility for handling a crisis. The Disaster Management Authority is also set up at the national, state, and district levels. The unveiling of a new government programme is something that the people of India have learned to anticipate. With Make in India, "Swachh Bharat Abhiyaan," and Demonetisation or Less Cash in the last seven years, "Aatmanirbhar Bharat" now refers to a self-sufficient nation.The paper aims to understand the Importance of Community Awareness and Preparedness in Disaster Risk Reduction and to know the Aatmanirbhar Bharat Abhiyan for Disaster Risk Reduction and its management in communities. The paper's objectives have been met, and the paper has been constructed based on those results. It relied on secondary sources such as magazines, books, and websites, among other things. The descriptive method was used throughout this paper.Every facet of disaster management involves the community in a significant way. The planning for disaster management would not be accomplished without their input and involvement. Assessing community engagement and awareness in rural and urban regions.

Keywords: Disaster Risk Reduction, management of vulnerable communities, Atmanirbharbharat.

Introduction

Communities and residents' participation in disaster risk reduction strategies can benefit the community and the administration not just in times of catastrophe, such as during both a disaster (the emergency stage) and subsequent stages of disaster management, such as preparation and risk reduction (the pre-disaster stage) and recovery and reconstruction (the post-disaster stage). Community Participation promotes independence and a sense of responsibility while reducing reliance on external resources. Communities must know about disaster management procedures to participate in such activities. More than 4.03 billion people were impacted by 7348 disaster occurrences registered globally in the 20 years from 2000 to 2019 that claimed 12 million lives. Because of its vastness, topography, and high human density, Asia saw the greatest number of disasters of any continent. Among the nations affected globally, India ranked third in economic damage and fatalities with 321 occurrences[1].

The term "vulnerability" refers to the degree to which a community, structure, service, or geographic area is likely to be harmed or disrupted by the effect of a specific hazard, given its nature, composition, and location near hazardous terrain or a disaster-prone area. A society, system, or asset is vulnerable if it possesses the traits and conditions necessary to make it sensitive to the negative impacts of a hazard. There are three main ways to look at vulnerability, even though the size of a disaster brought on by a natural hazard depends on how vulnerable a person is. Consider vulnerability first as a natural occurrence before applying a technical bias to the ways and means of mitigating it. The second viewpoint continues to be based on the idea that humans have become the primary cause of many of these catastrophes by forcibly stealing nature via technology. The third perspective, which appears to be an extension of the second, highlights how different countries' social structures vary and how their human geography is arranged concerning their socioeconomic space affects the size and severity of disasters[2].

The objectives of the paper: i. To understand the Importance of Community Awareness and Preparedness in Disaster Risk Reduction, ii. To know the Aatmanirbhar Bharat Abhiyan for Disaster Risk Reduction and its management in communities.

Methodology

The paper's objectives have been met, and the paper has been constructed based on those results. It relied on secondary sources such as magazines, books, and websites, among other things. The descriptive method was used throughout this paper.