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Sankaranarayanan-Ramasamy (SR) technique L- threonine lithium chloride single crystal: Unidirectional growth, optical and mechanical studies

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ABSTRACT

L-Threonine Lithium Chloride (LTLC), an effective semi-organic NLO material, was successfully produced as a bulk single crystal using the Sankaranarayanan Ramasamy (SR) process. According to a study of a single crystal's X-ray diffraction, LTLC crystallises in an orthorhombic system with space group P212121. From the powder XRD method, unidirectional development along the plane (1 1 0) was established. The optical absorption spectra reveals that LTLC has a broad bandgap of 3.75 eV and is very transparent over the whole visible region. On the magnified crystal, photoconductivity measurements show positive photoconductivity. According to the photoluminescence investigation, LTLC emits green light with a wavelength of 535 nm. Vickers microhardness testing was done to determine the crystal's mechanical strength. At different temperatures and frequencies, the dielectric constant and dielectric loss were calculated. In addition to the density functional theory (DFT) calculations such as frontier molecular orbital's (FMOs), analysis was carried out. Utilizing Kurtz's Nd:YAG Laser, powder testing is another method used to assess the produced crystal's SHG activity.

1. Introduction

Higher values of the original frequency can be produced by nonlinear optical materials, which have uses in optoelectronics, fibre optic communication, and optical modulation [1,2]. Numerous researchers have looked for various NLO crystal types for laser applications recently [3]. Due to their high degree of chemical inertness, inorganic crystals were also commonly employed in optoelectronics applications due to their high melting point and outstanding mechanical stability.

Inorganic crystals' optical nonlinearity is typically less than the need for optical devices [4]. Vander Wall and hydrogen bonds that are weak and have a significant degree of delocalization frequently produce organic molecules. Significant drawbacks of organic NLO crystals include their higher optical quality, increased mechanical stability, and difficulty in making crystals at large sizes. [5]. Semi possesses NLO features because of its advantages in both organic and inorganic crystals. [6–7].The potential for employing new semi-organic materials in a lot of interest has been shown recently in a variety of devices. Amino acids are currently the focus of significant research regarding the hunt for newer nonlinear optical materials since they may have a wide range of possible applications. Many amino acids exhibit outstanding optical second harmonic generation and are optically active. SHG, which makes them the best option for uses such coherence of blue-green laser generation and frequency doubling [8–10]. Amino acid complexes with inorganic salts frequently combine the benefits of an organic amino acid and an inorganic salt, making them suitable building blocks for SHG properties.. As a result, different inorganic acids were utilised to examine the production of salt utilising L-arginine, L-histidine, L-threonium, L-alanine, and L-valine. The result is superb semi-organic compounds have been investigated as prospective NLO application materials, including L-valine picrate [11], L-histidine hydrochloride [12], L-valine hydrochloride [13], L-analine zinc chloride [14], L-threonine cadmium chloride, and L-threonine lithium chloride. However, there is little information available regarding bulk LTLC growth for devices of the second harmonic generation. The SR method is unique for directional solution growth and also having many advantages such as defect-free, high transparency, good healthy bulk crystals in different orientations. Solute to crystal conversion efficiency 100% was achieved in SR method. The unidirectional crystal with a cylindrical shape is more important to avoid the post-growth machining process. The external morphology facets may induce strain through the lattices, it could be avoided in the single interface growth [15,16]. Therefore, higher qual-

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Article

Terminalia chebula-Assisted Silver Nanoparticles: Biological Potential, Synthesis, Characterization, and Ecotoxicity

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Abstract: In the current research, an aqueous extract of *Terminalia chebula* fruit was used to produce silver nanoparticles (Ag NPs) in a sustainable manner. UV-visible spectrophotometry, transmission electron microscopy (TEM), and scanning electron microscopy (SEM) were used to characterize the synthesized nanoparticles. Synthesized Ag NPs were detected since their greatest absorption peak was seen at 460 nm. The synthesized Ag NPs were spherical and had an average size of about 50 nm, with agglomerated structures, as shown via SEM and TEM analyses. The biological activities of the synthesized Ag NPs were evaluated in terms of their antibacterial and antioxidant properties, as well as protein leakage and time-kill kinetics assays. The results suggest that the green synthesized Ag NPs possess significant antibacterial and antioxidant activities, making them a promising candidate for therapeutic applications. Furthermore, the study also evaluated the potential toxicological effects of the Ag NPs using zebrafish embryos as a model organism. The findings indicate that the synthesized Ag NPs did not induce any significant toxic effects on zebrafish embryos, further supporting their potential as therapeutic agents. In conclusion, the environmentally friendly production of Ag NPs using the extract from *T. chebula* is a promising strategy for discovering novel therapeutic agents with prospective uses in biomedicine.

Keywords: *Terminalia chebula*; silver nanoparticles; mechanism; embryonic toxicology; antibacterial; antioxidant agent

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1. Introduction

The distinct characteristics of nanomaterials have garnered increased interest from scientists, thereby facilitating diverse biomedical implementations [1]. The fabrication of nanoparticles with diverse structures can be accomplished through physical, biological, and chemical methodologies. However, physical and chemical methods often result in low yields, high costs, high energy consumption, and environmental damage. Biological synthesis, which employs plants and microbes as reducing agents, is one of the three synthesis approaches [2,3]. Because of their superior thermal, strong optoelectronic, catalytic, and surface volume ratio properties, metal nanoparticles play an essential role in the healthcare sectors. This is due to the fact that they have great physicochemical features. Silver, gold, and platinum are characterized as the "noble metal nanoparticles" among all of the other metal nanoparticle types [4,5]. Silver nanoparticles have been paid special

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Data-driven multi-valley dark solitons of multi-component Manakov Model using Physics-Informed Neural Networks

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ABSTRACT

In this paper, we employ a Deep Learning technique, namely Physics-Informed Neural Network for solving multi-component Manakov models. In particular, we consider three and four-coupled nonlinear Schrödinger equations. We show that in the former case, one of the components and two others can carry, respectively, a double valley dark soliton and asymmetric bright solitons. In the four-component Manakov model, all four components are predicted by PINN with high accuracy in which the first component is shown to be a triple-valley dark soliton. We compare the results with the exact solutions and bring out the ability of Deep Learning in solving coupled systems of nonlinear partial differential equations with high accuracy. The performance of the PINN in approximating the solutions is estimated by taking the squared difference between the exact and predicted squared magnitude of the solutions. We have also computed the $\mathbb{L}^2$-norm errors for real, imaginary and absolute-value components of the solutions to emphasize the accuracy of PINN.

1. Introduction

Most of the dynamical systems in nature are inherently nonlinear being described by nonlinear differential equations, either continuous or discrete. Finding their exact or approximate solutions is crucial to the understanding of most of the natural phenomena around us. They can be broadly classified into integrable and nonintegrable systems. While integrable systems can be analytically solved using celebrated techniques like Inverse Scattering Transform [1], Hirota method [2], Darboux transformation method [3] etc., nonintegrable systems can only be investigated in the general case by means of numerical simulations [4,5]. With the rapid advancement in computing power combined with the vast availability of data, the use of Machine Learning (ML) and Deep Learning (DL) techniques to investigate relevant problems in physics [6] has skyrocketed in recent times. In fact, the vast availability of data in the domain of both integrable and nonintegrable nonlinear dynamical systems has helped us to experiment with ML and DL methods to penetrate deep into the dynamics of natural phenomena. In particular, the chimera states are predicted using ML [7] while recurrent neural networks are used to predict chaotic attractors [8–10]. Further, ML and DL algorithms have been used in the study of extreme events [11–14] as well as in the identification of ground states of Bose–Einstein Condensates (BECs) [15,16]. ML and DL methods have also been used to solve diverse systems of ordinary and partial differential equations (ODEs and PDEs) [17]. Raissi et al. [18] introduced a DL method called Physics-Informed Neural Networks (PINN) for solving problems involving linear and nonlinear PDEs by incorporating the physical information about the system into the Artificial Neural Network (ANN). The PINN model and its variants have been used in various fields, including bio-engineering [19–21], fluid dynamics [22,23], stochastic differential equations [24], nano-optics and metamaterials [25,26], design of photonic devices [27] and also in disease spreading dynamics [28–30].

In particular, PINNs have been widely used for solving nonlinear PDEs namely, Nonlinear Schrödinger (NLS) equation. For example, the

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ANTI-CORROSIVE STUDY OF ADATHODA VASICA EXTRACT IN 1M HCL ON THE CORROSION OF MILD STEEL

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Abstract

In the current era, natural products extracts are used for corrosion inhibition activity. This method is an ecovative and non-toxic technique. Many researchers do their research on inhibition of corrosion on this green method. The efficiency of corrosion inhibition carried out by weight loss method. In the present study, the leaves extract of *Adathoda vasica* was studied as corrosion inhibitors by weight loss method. The variation of corrosion rate, percentage inhibition efficiency and surface coverage with increasing concentration were measure in this work.

Keywords: Keywords: Adathoda vasica; corrosion inhibitor; weight-loss method; Anti-corrosive study

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1. Introduction

Corrosion is an inevitable natural process of deterioration of metals/materials by chemical or electrochemical process with their environment. It is one of the sources of waste [1]. Corrosion is called a billion-dollar thief because every year several billion loss occur due to this corrosion. As per International Zinc Association at 2021, India loses 5-7% [2] of Gross Domestic Product (GDP),

Corrosion is a natural, spontaneous and it is thermodynamically stable process favoured by nature. So, nobody prevents or stop corrosion. But, the rate of corrosion can be controlled (i.e) just like postponing the death of material. There are many methods to control corrosion and an usage of inhibitors in small quantities is a common process. Suppose chromates were used as corrosion inhibitors, environmental scientists pointed out the health hazards caused by chromium (VI) ions. Hence corrosion research scientists go for eco-friendly, innovative, non-toxic natural products extracts as corrosion inhibitors.

2. Experimental procedure:

2.1 Materials:

For the weight loss measurements, a mild steel rod (C 0.2% by wt) with approximate size of 2.5×2.5×0.1cm were used. Before that a pre surface treatment of dipped in pickling solution for the removal of rust and then it is polished on emery paper. After that the rod was washed and degreased by using alcohol and acetone.

Research Article

Mahendrakumar Mani, Aruna Sharmili Sundararaj, Khalid A. Al-Ghanim, Shiny Punalur John, Kuppusamy Elumalai*, Marcello Nicoletti, and Marimuthu Govindarajan*

Rapid synthesis of copper nanoparticles using *Nepeta cataria* leaves: An eco-friendly management of disease-causing vectors and bacterial pathogens

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Abstract: Insecticides kill mosquitoes but damage other animals including humans. Eco-friendly metal nanoparticles may be a plant-based pesticide for vector control. Here, the copper nanoparticles (Cu NPs) synthesized from *Nepeta cataria*leaves have been investigated for their antibacterial and larvicidal properties. Fourier transforms infrared spectroscopy demonstrated that biochemicals reduced and stabilized nanoparticles by shifting peaks from 1,049 to 1,492 cm^{-1}, and ultraviolet–visible spectrometry proved that produced Cu NPs had a peak at 550 nm. Transmission electron microscopic and scanning electron microscope showed that the particles are spherical and 23–29 nm in size. X-ray diffraction analysis shows that Cu NPs are crystalline. At a 100 $\mu g \cdot mL^{-1}$ concentration, Cu NPs exhibited a higher percentage of inhibition in the order of *Escherichia coli* ≫ *Enterococcus faecalis* ≫ *Staphylococcus aureus*. The lethal concentration (LC_{50}) of the Cu NPs against the larvae of *Aedes aegypti*, *Anopheles stephensi*, and *Culex quinquefasciatus* was determined to be 60.63, 56.58, and 54.32 $\mu g \cdot mL^{-1}$, respectively. This ground-breaking study describes the biological production of Cu NPs utilizing *N. cataria* leaf extract for the first time. Based on these findings, the bio-synthesized Cu NPs and the aqueous extract of *N. cataria* may provide a potential alternative method for managing these vector populations.

Keywords: biosynthesis, copper nanoparticles, larvicidal efficacy, microbial pathogens, vector control

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1 Introduction

Nanotechnology deals with controlling and manipulating matter at the molecular level between 1 and 100 nm. This field leads to the development of discrete properties collated with those related to atoms or molecules or bulk behaviour [1]. In the expanding field of nanotechnology, physical, chemical, and even ecologically friendly biological processes might all be employed to create nanomaterials. Chemical methods of generating nanoparticles (NPs) need the unrestricted use of harmful compounds, polluting the environment [2]. The biologically mediated processes can be conceded using bacteria, fungi, yeast, actinomycetes, and viruses [3–5]. Green synthesis based on the extraction of plant extracts has been reported in the literature [6–8]. Plant-based approaches are one of the most cost-effective, safe, and environmentally friendly ways to produce NPs [9]. The plant-mediated biosynthesized NPs are also steadier and can be synthesized faster than other synthesis methods [10].

fermentation

MDPI

Article

Probiotic-Bacteria (*Lactobacillus fermentum*)-Wrapped Zinc Oxide Nanoparticles: Biosynthesis, Characterization, and Antibacterial Activity

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Abstract: Recently, fabricated nanoparticles (NPs), which can efficiently penetrate biological systems, have found increased usage in the health and hygiene industries. Microbial enzymes and proteins have recently shown their potential to act as reducing agents for the production of NPs, thereby providing an alternative to physical and chemical methods. Not only is this approach efficient and cost-effective, but it also produces a minimal ecological footprint. In this study, zinc oxide nanoparticles (ZnO NPs) were synthesized using probiotic bacteria (*Lactobacillus fermentum*) as the reducing and capping agent. Several analytical methods, including Fourier transform infrared spectroscopy (FT-IR), scanning electron microscopy (SEM), X-ray diffraction analysis (XRD), ultraviolet–visible spectroscopy (UV–Vis), and atomic force microscopy (AFM), were used to analyze the produced ZnO NPs. The SEM analysis confirmed the spherical form of the nanoparticles and estimated their average size to be between 100 and 120 nm. FT-IR analysis verified that the ZnO NPs' surfaces contained many functional groups. X-ray diffraction examination evidenced that the biogenically produced nanoparticles were crystalline. AFM analysis revealed that the nanoparticles' size was about 90–100 nm. The maximum absorption peak, determined via a UV–visible spectrophotometer, was 510 nm. The synthesized ZnO NPs' antimicrobial activity against various bacterial strains was tested, and the highest level of antimicrobial activity was noted against a *Vibrio harveyi* strain. The maximum concentration, namely, 20 mM of ZnO NPs, showed the highest antimicrobial activity. These observations indicate that the synthesized ZnO NPs possess remarkable antimicrobial potency. This method is an efficient, environmentally friendly, cost-effective approach for producing ZnO NPs that are useful for various biomedical applications.

Keywords: green synthesis; nanoparticles; fish pathogen; bio-medicinal application; *Vibrio harvey*; *Lactobacillus fermentum*

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RESEARCH

Thermal quantum correlations and teleportation in a graphene sheet

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Abstract
The characterization of quantum resources in dynamical systems is one of the most important problems to be addressed in quantum information theory. In this article, we investigate the behaviors of quantum correlations and teleportation technique in a graphene sheet comprising of disordered electrons in a two-dimensional honeycomb lattice. We use three different measures of quantum correlations such as entanglement, measurement-induced nonlocality and uncertainty-induced nonlocality. We study the ground state properties of the graphene sheet from the perspective of quantum correlations. At thermal equilibrium, we show that the band parameter strengthens the quantum correlations whereas the scattering strength weakens the correlations. Finally, the impact of the system's parameters on the teleportation technique is also expounded.

1 Introduction

Nonlocality is a fundamental feature of quantum systems which is known to be at the heart of the development of modern quantum technologies. Since the entanglement resources are crucial for various quantum information processing tasks such as dense coding, teleportation, remote state preparation and key generation [1], their characterization and quantification have attracted considerable attention ever since the inception of EPR paradox [2, 3] and Bell nonlocality [4, 5]. Further, the entanglement also quantifies correlations of nonlocal distributions between spatially separated particles. In the context of quantum information science, the characterization of any quantum system from the perspective of nonlocality is a fundamental and formidable task. The quantification of the nonlocal aspects present in pure states is more straightforward and entanglement provides the complete spectrum of the nonlocality. On the other hand, there are certain open challenges in the understanding of nonlocality of mixed states and multiqubit systems. In the realm of Bell nonlocality, it is widely accepted that the entanglement captures only a portion of nonlocal character of the system. To support this, certain tasks were demonstrated in the environment of zero entanglement i.e., other quantum correlations were also detected in some naturally unentangled bipartite systems [6, 7]. To bring out the complete spectrum of nonlocality, researchers have identified various measures from the perspective of the measurements. Nonclassical signatures of quantum systems can be quantified by correlation measures such as quantum discord [8, 9], measurement-induced nonlocality (MIN) [10], measurement-induced disturbance (MID) [11] and uncertainty-induced nonlocality (UIN) [12]. The correlation measures with different notions have unique advantages in the context of information processing task. In particular, MIN and UIN are considered to be useful resources for quantum communication [13, 14] and quantum metrology [15–17] respectively.

The rapid developments which has taken place in the domain of quantum information processing has virtually shifted the attention of the semiconductor industry towards the fabrication of nanomaterials which work in the realm of quantum regime. The graphene is one of the most important nanomaterials with a relatively high decoherence time [18]. In view of the implementation of QIP, the behaviors of quantum resources in the graphene system are worthy of investigation. Graphene is a two-dimensional novel nanomaterial with carbon atoms hexagonally positioned on a honeycomb lattice and is predicted to show interesting magnetic phenomena like intrinsic ferromagnetism [19, 20], nontrivial electronic properties [21] etc. The electronic excitations in graphene arise due to chiral and massless Dirac fermions

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agriculture

Article

Insecticidal Potential of *Matricaria chamomilla*'s Essential Oil and Its Components (E)-β-Farnesene, Germacrene D, and α-Bisabolol Oxide A against Agricultural Pests, Malaria, and Zika Virus Vectors

Khalid A. Al-Ghanim [1,*], Kaliyamoorthy Krishnappa [2], Jeganathan Pandiyan [2], Marcello Nicoletti [3], Baskar Gurunathan [4] and Marimuthu Govindarajan [5,6,*]

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Abstract: Agricultural and medical insect pests are damaging edible crops, spreading diseases, and harming non-target fauna and flora. Prominent polyphagous insect pests harass farmers in the agronomy sector, causing uncountable revenue corrosion. Ecofriendly phytopesticides can avoid the consequences of the bulk usage of synthetic chemicals. In this study, the toxic effect on third-instar larvae of four different insect species (*Spodoptera litura*, *Helicoverpa armigera*, *Aedes vittatus*, and *Anopheles subpictus*) and the bio-toxicity on non-target fauna (NTF) (*Stegodyphus sarasinorum* and *Gambusia affinis*) were evaluated using *Matricaria chamomilla* (*Mc*) essential oil (EO) and its major phytoconstituents (*Mc*-MPCs). GC–MS analysis of the studied *M. chamomilla* EO gathered 39 constituents, with (E)-β-Farnesene (24.3%), Germacrene D (9.4%), and α-Bisabolol oxide A (10.2%) accounting for the major constituents. Remarkable larval death was seen in *H. armigera* and *Ae. vittatus*. In addition, (E)-β-Farnesene, Germacrene D, and α-Bisabolol oxide A exhibited a relevant maximum toxic effect on the target pest's third-instar larvae. The bio-toxicity of *M. chamomilla* EO and *Mc*-MPCs was tested on terrestrial and aquatic NTF. The LC_{50} values for *S. sarasinorum* and *G. affinis* ranged from 922.65 to 1750.49 µg/mL. *M. chamomilla* EO and its MPCs evidenced prospective phytopesticidal efficiency on selected agricultural and medical insect pests.

Keywords: phytoconstituents; pesticide; insecticide; larvae; non-target fauna; ecofriendly

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1. Introduction

Globally, agri-pests play a pivotal role in the deterioration of several high-value agri-products. Due to human activities, vector proliferation in tropical and subtropical environments has dramatically increased [1,2]. Among arthropods, mosquitoes are massive blood-sucking vectors that cause several public health problems. The effects of blood-sucking vectors on the human population have increased yearly [3–6] in terms of death and morbidity. Vectors are a major cause of significant, worrying economic problems in many parts of the world, as well as are responsible for transmitting a wide variety of infectious illnesses to humans and other species that rely on humans for their vascular system [7]. *Spodoptera litura* (Fab.) (*Cotton leafworm*) and *Helicoverpa armigera* Hubner (*Cotton bollworm*)

fermentation

MDPI

Article

Green Synthesis of Copper Oxide Nanoparticles Using *Sesbania grandiflora* Leaf Extract and Their Evaluation of Anti-Diabetic, Cytotoxic, Anti-Microbial, and Anti-Inflammatory Properties in an In-Vitro Approach

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check for updates

Citation: Ramasubbu, K.; Padmanabhan, S.; Al-Ghanim, K.A.; Nicoletti, M.; Govindarajan, M.; Sachivkina, N.; Rajeswari, V.D. Green Synthesis of Copper Oxide Nanoparticles Using *Sesbania grandiflora* Leaf Extract and Their Evaluation of Anti-Diabetic, Cytotoxic, Anti-Microbial, and Anti-Inflammatory Properties in an In-Vitro Approach. *Fermentation* **2023**, *9*, 332. https://doi.org/10.3390/fermentation9040332

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Abstract: Green methods of synthesizing nanoparticles are safer than chemical and physical methods, as well as being eco-friendly and cost-efficient. In this study, we use copper oxide nanoparticles (CuO NPs) fabricated with *Sesbania grandiflora* (Sg) (Hummingbird tree) leaves to test the effectiveness of green synthesizing methods. The attained *Sg*-CuO NPs physical and optical nature is characterized by UV-Vis spectroscopy Differential Reflectance Spectroscopy (UV-Vis DRS), Fourier Transform Infra-Red spectroscopy (FTIR), X-ray Diffraction spectroscopy (XRD), Scanning Electron Microscope (SEM), and Energy Dispersive X-ray Analysis (EDAX). UV-Vis spectrum for *Sg*-CuO NPs revealed a peak at 410 nm. SEM images showed the aggregation of needle-shaped particles, at a size of 33 nm. The amylase and glucosidase enzymes were inhibited by the *Sg*-CuO NPs up to 76.7% and 72.1%, respectively, indicating a possible antihyperglycemic effect. Fabricated *Sg*-CuO NPs disclosed the excellent inhibition of DPPH-free radicle formation (89.7%) and repressed protein degradation (81.3%). The results showed that *Sg*-CuO NPs display good anti-bacterial activity against the gram-negative (*Escherichia coli* and *Pseudomonas aeruginosa*) and gram-positive (*Staphylococcus aureus*). Cytotoxicity of the *Sg*-CuO NPs was determined using anIC_{50} of 37 µg/mL. *Sg*-CuO NPs have shown promising anti-diabetic, anti-oxidant, protein degradation-inhibiting, and anti-microbial properties. Our findings have shown that synthesized *Sg*-CuO NPs have biological activities that may be utilized to treat bacterial infections linked to hyperglycemia.

Keywords: nanotechnology; green synthesis; medicinal plant; antihyperglycemic; bioactivity; anticancer

1. Introduction

Nanotechnology focuses on synthesizing nanomaterial, and has diverse application, such as biomedicine, delivery of nutrients and drugs, imaging techniques, etc. Multiple methods are available for nanoparticle synthesizing, including chemical processes, sol-gel, laser ablation, electro biosynthesis, biological, and green synthesis. In the green synthesis method of nanoparticles, instead of chemicals, plant-mediated products are likely to play the role of reducing agents; green reducing agents lessen the toxic effects of chemicals in the

toxics

MDPI

Article

Exopolysaccharides-Mediated ZnO Nanoparticles for the Treatment of Aquatic Diseases in Freshwater Fish *Oreochromis mossambicus*

Muthukumar Abinaya [1], Sathappan Shanthi [1], Jesudasan Palmy [2], Khalid A. Al-Ghanim [3], Marimuthu Govindarajan [4,5] and Baskaralingam Vaseeharan [1,*]

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Abstract: Bacterial fish disease outbreaks are a key concern for aquaculture. Complementary feed additives such as immunostimulants can serve as an ideal solution for disease prevention. Herein, we scrutinized the efficacy of exopolysaccharides (EPSs) from probiotic *Bacillus licheniformis* and EPS-mediated zinc oxide nanoparticles (EPS-ZnO NPs) for a diet to evaluate growth parameters, antioxidant enzyme activities, and immune stimulation together with disease resistance against *Aeromonas hydrophila* and *Vibrio parahaemolyticus* in Mozambique tilapia *Oreochromis mossambicus*. Fish were separated into seven groups, with six experimental groups fed with EPS and EPS-ZnO NPs at 2, 5, and 10 mg/g and a control fed a basal diet. The fish ingesting feed supplemented with EPS and EPS-ZnO NPs at 10 mg/g showed improved growth performance. Cellular and humoral-immunological parameters were tested in serum and mucus after 15 and 30 days of feeding. These parameters were substantially enriched with a 10 mg/g diet ($p < 0.05$) of EPS and EPS-ZnO NPs in comparison with the control. Furthermore, the EPS and EPS-ZnO NP supplemental diet actively enhanced the antioxidant response (glutathione peroxidase, superoxide dismutase, and catalase). In addition, the supplemental diet of EPS and EPS-ZnO NPs lowered the death rate and improved the disease resistance of *O. mossambicus* following assessment with *A. hydrophila* and *V. parahaemolyticus* at 50 µL. Hence, the overall results suggest that the supplemental diet of EPS and EPS-ZnO NPs might be used to ensure aquaculture feed additives.

Keywords: *Bacillus licheniformis*; zinc nanoparticle; immune parameters; antioxidant response; growth performance; aquatic pathogens

Citation: Abinaya, M.; Shanthi, S.; Palmy, J.; Al-Ghanim, K.A.; Govindarajan, M.; Vaseeharan, B. Exopolysaccharides-Mediated ZnO Nanoparticles for the Treatment of Aquatic Diseases in Freshwater Fish *Oreochromis mossambicus*. *Toxics* **2023**, *11*, 313. https://doi.org/10.3390/toxics11040313

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1. Introduction

Aquaculture is the most important agriculture industry, and it has grown far faster than other food sectors to satisfy fish market requirements. Around 15% of the protein ingested by three billion people comes from fish. In emerging nations such as South Asia, Southeast Asia, China, and Japan, fish is considered a primary nutrition source, creating a massive demand for intensive farming. With the expansion of industry and increased yields, intensive culture practices have been adopted that lead to environmental stress and disease prevalence, which are considered essential challenges for the sector [1–4]. Bacterial

molecules

MDPI

Article

Green Synthesis, Characterization and Bioactivity of *Mangifera indica* Seed-Wrapped Zinc Oxide Nanoparticles

Shanmugam Rajeshkumar [1,*], Royapuram Parthasarathy Parameswari [1], Dayalan Sandhiya [2], Khalid A. Al-Ghanim [3], Marcello Nicoletti [4] and Marimuthu Govindarajan [5,6,*]

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Abstract: In the realm of nanoparticles, metal-based nanoparticles have traditionally been regarded as the pioneering category. Compared to other nanoparticles, zinc oxide nanoparticles have several advantages, including optical and biological properties, which provide them a significant competitive advantage in clinical and biological applications. In the current investigation, we used an aqueous *Mangifera indica* seed extract to synthesize nanoparticles of zinc oxide (ZnO NPs). UV-Vis spectroscopy, Fourier transform infrared spectroscopy analysis, atomic force spectroscopy, X-ray diffraction, scanning electron microscopy, and transmission electron microscopy were used to characterize the synthesized ZnO NPs. The nanoparticles were assessed for their potential to inhibit bacterial growth and protect cells from free radical damage. According to the current study's findings, zinc oxide nanoparticles that had been modified with the aid of mango seeds were very efficient in preventing the development of the tested bacteria and were also powerful antioxidants.

Keywords: nanotechnology; ZnO NPs; biofabrication; antioxidant; antibacterial activity

Citation: Rajeshkumar, S.; Parameswari, R.P.; Sandhiya, D.; Al-Ghanim, K.A.; Nicoletti, M.; Govindarajan, M. Green Synthesis, Characterization and Bioactivity of *Mangifera indica* Seed-Wrapped Zinc Oxide Nanoparticles. *Molecules* **2023**, *28*, 2818. https://doi.org/10.3390/molecules28062818

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1. Introduction

Nanotechnology has been gaining attention recently as a potential platform for future growth in several fields. Nanotechnology has drawn significant attention in the healthcare, engineering and food industries by offering novel prospects in the respective fields. In particular, theranostics, a cutting-edge combination system of therapeutics and diagnostics, utilize nanotechnology principles for target-specific drug delivery and enhanced bioavailability of active pharmaceutical ingredients [1,2]. The field of nanotechnology deals with various synthesis methods, particle size reformations and structural variations of nanoparticles. Nanoparticles are nanosized materials ranging in size <100 nm with high thermal stability, high surface-to-volume ratio, high electrical, mechanical, optical as well as magnetic properties [3].

In the last decade, the use of nanoparticles has been the most significant archetype advancement in engineering, medicine and technology [4]. Nanoparticles may be classified as organic and inorganic nanoparticles. While metals and metal-derived oxide nanoparticles come under the inorganic nanoparticles classification, organic nanoparticles include solid lipid nanoparticles, polymeric nanoparticles, lipid-based nanocarriers, liposomes and carbon-based nanomaterials [5]. Metal nanoparticles are promise for site-specific drug administration, clinical diagnostics, bio-imaging, dental implants, and biomedicine due

toxics

MDPI

Article

Fishing Cat Scats as a Biomonitoring Tool for Toxic Heavy Metal Contamination in Aquatic Ecosystems

Thirupati Lakshmi Harika [1], Khalid A. Al-Ghanim [2], Mian Nadeem Riaz [3], Kaliyamoorthy Krishnappa [1], Jeganathan Pandiyan [1] and Marimuthu Govindarajan [4,5,*]

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Abstract: Mangrove forest is one of the productive ecosystems that provide essential habitats for various fauna as breeding and feeding drives. However, heavy metal pollution in the mangrove forest has led to severe health problems for several aquatic species. Biomonitoring of metals using a nondestructive method is an emerging technique. Scats of the fishing cat (*Prionailurus viverrinus*) were collected from five locations in the Godavari estuary mangrove habitats, Coringa Wildlife Sanctuary, Andhra Pradesh, India, to determine the level of various metals. An opportunistic method was applied to collect scats in the mangrove forest. Six scat samples were collected from each of the sampling sites. The following prey species, such as crabs, fishes, birds, rodents, plants, plastics, and unidentifiable prey matters, were found in the scats. Select metals, such as chromium (Cr), copper (Cu), and lead (Pb) were analyzed from the scats of the fishing cat since they intensively influence the physiology and behavior of top predators. The concentration of Cu in fishing cat scats was higher than the other two metals assessed. Metals showed statistically substantial variation across locations ($p < 0.05$). According to the current study, heavy metals may significantly threaten the fishing cat in the Coringa Wildlife Sanctuary. The fishing cat is a vulnerable species in accordance with the ICUN categories. Due to pollution and other human pressures, the fishing cat may soon be categorized as a threatened or endangered species; the research advises that authorities should prioritize the protection of the vulnerable species of the fishing cat from the Coringa Wildlife Sanctuary, Andhra Pradesh, India.

Keywords: heavy metal; toxicity; scats; prey species; mangrove forests; carnivores; conservation

Citation: Harika, T.L.; Al-Ghanim, K.A.; Riaz, M.N.; Krishnappa, K.; Pandiyan, J.; Govindarajan, M. Fishing Cat Scats as a Biomonitoring Tool for Toxic Heavy Metal Contamination in Aquatic Ecosystems. *Toxics* **2023**, *11*, 173. https://doi.org/10.3390/toxics11020173

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1. Introduction

Metals are a class of non-biodegradable contaminants that cause extensive ecological damage by accumulating in aquatic ecosystems and posing substantial health risks to various organisms [1]. Evaluating heavy metals in the aquatic environment is crucial to comprehend the toxicity of metals and their effect on aquatic life. Countless animal species rely on mangrove forests for sustenance and shelter, making them an essential aquatic environment. Mangrove forests have been shown to play an important role in the lives of many animal species [2]. The eastern coast of southern India is home to one of India's biggest mangrove forests, the Godavari forest. The Godavari mangrove forest has major ecological and biological functions in its estuary locations [3]. Due to its importance as a marine ecosystem, the Godavari mangroves have been declared as a "Coringa Wildlife Sanctuary."

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Contents lists available at ScienceDirect

Bioresource Technology

journal homepage: www.elsevier.com/locate/biortech

Dual strategy for bioconversion of elephant grass biomass into fermentable sugars using *Trichoderma reesei* towards bioethanol production

Jayaraj Iyyappan [a], Ravichandran Pravin [b], Khalid A. Al-Ghanim [c], Marimuthu Govindarajan [d,e], Marcello Nicoletti [f], Gurunathan Baskar [b,*]

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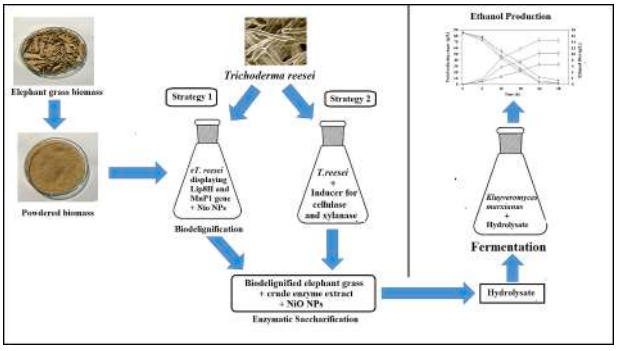
HIGHLIGHTS

- Lignolytic enzymes were produced by recombinant *Trichoderma reesei.*
- Biodelignification assisted with NiO nanoparticles has removed 54% of lignin.
- Hydrolytic enzymes were produced by *Trichoderma reesei* with enhancer.
- Dual strategy has supported bioconversion of elephant grass into ethanol.

GRAPHICAL ABSTRACT



ARTICLE INFO

Keywords:
Bioethanol
Elephant grass
Biodelignifcation
Hydrolytic activity
Nanoparticle

ABSTRACT

In this study, biodelignification and enzymatic hydrolysis of elephant grass were performed by recombinant and native strain of *Trichoderma reesei,* respectively. Initially, r*T. reesei* displaying Lip8H and MnP1 gene was used for biodelignification with NiO nanoparticles. Saccharification was performed by combining hydrolytic enzyme produced with NiO nanoparticles. Elephant grass hydrolysate was used for bioethanol production using *Kluyveromyces marxianus*. Maximum lignolytic enzyme production was obtained with 15 μg/L of NiO nanoparticles and initial pH of 5 at 32 °C. Subsequently, about 54% of lignin degradation was achieved after 192 h. Hydrolytic enzymes showed elevated enzyme activity and resulted in 84.52 ± 3.5 g/L of total reducing sugar at 15 μg/mL NiO NPs. About 14.65 ± 1.75 g/L of ethanol was produced using *K. marxianus* after 24 h. Thus, dual strategy employed for conversion of elephant grass biomass into fermentable sugar and subsequent biofuel production could become potential platform for commercialization.

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Investigations on evaluation of marine macroalgae *Dictyota bartayresiana* oil for industrial scale production of biodiesel through technoeconomic analysis

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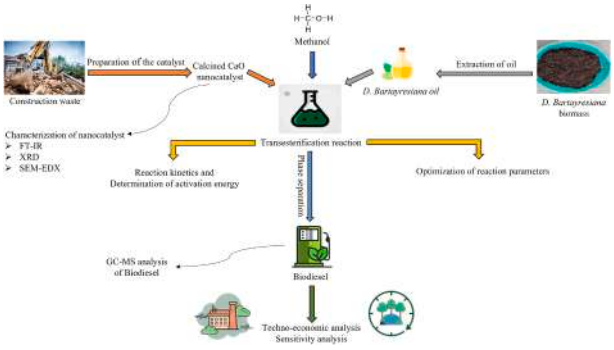
HIGHLIGHTS

- Biodiesel production from marine macroalgae *Dictyota bartayresiana* oil was studied.
- CaO nanocatalyst was synthesized using waste collected from building demolition site.
- The reaction parameters for efficient production of biodiesel was optimized.
- Investigation on techno-economic aspects was studied for biodiesel production.
- Sensitivity analysis was used to study the uncertainty of biodiesel production process.

GRAPHICAL ABSTRACT



ARTICLE INFO

Keywords:
Dictyota bartayresiana
Marine macroalgae
Biodiesel
Response surface methodology
Process optimization
Techno-economic analysis

ABSTRACT

The investigation on utilizing macroalgae for industrial scale biodiesel production is an imperative action needed for commercialization. In the present research work, the biooil from marine macroalgae *Dictyota bartayresiana* was used for biodiesel production using calcium oxide nanocatalyst synthesized using waste collected from building demolition site. The optimization results obtained were the calcination temperature 573 °C, concentration of catalyst 5.62%, methanol to oil molar ratio 14.36:1, temperature 55.7 °C and time 67.57 min for the transesterification with the biodiesel yield of 89.6%. The techno-economic aspects of biodiesel production were investigated for 20 MT/batch. The return on investment and internal rate of return from the biodiesel production plant was found to be 25.39% and 31.13% respectively. The plant payback period was about 3.94 years with a positive NPV value of about 14,053,000 $/yr. Thus, *Dictyota bartayresiana* biomass can be efficiently used for the sustainable production of biodiesel.

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Preparation and characterization of a novel cobalt-substitution cadmium aluminate spinel for the photodegradation of azo dye pollutants

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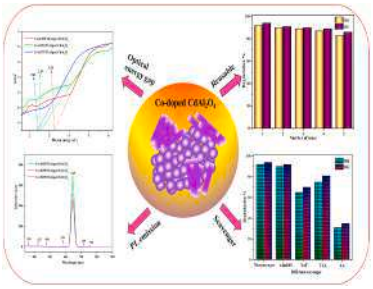
HIGHLIGHTS

- A novel Co (0.025–0.075 M) doped $CdAl_2O_4$ was fabricated by chemical co-precipitation approach.
- The ESR and PL confirms the existence of a substantial number of V_O or defects state in the spinal product.
- The active species h^+ and $\cdot OH^-$ acted the predominant role in the photo-degradation process.
- The novel photocatalyst shows outstanding performance in degrading pollutants in water.

GRAPHICAL ABSTRACT



ARTICLE INFO

Handling Editor: Kuan Shiong Khoo

Keywords:
Co-doped $CdAl_2O_4$
Scavenger species
ESR
Photodegradation
COD

ABSTRACT

Modern-year organic contaminants have been highly observed in ecosystems since they are not removed entirely and remain dangerous. Semiconductor binary oxide photocatalysts have been well accredited as capable technology for ecological contaminants degradation in the existence of visible irradiation. In this research, novel Co ions doped $CdAl_2O_4$ materials were fabricated by a facile co-precipitation approach. The fabricated pure and Co-doped $CdAl_2O_4$ exhibited the typical peaks of $CdAl_2O_4$ with the E_g of 3.66, 3.24, 2.57, and 2.41 eV respectively. The HR-TEM microstructures revealed that the Co (0.075 M) doped $CdAl_2O_4$ has rod-like morphology, and some places are spherical with particle sizes reaching 21 nm. The PL peaks of the Co (0.075 M)-$CdAl_2O_4$ are much lesser than that of the other dopant and pure $CdAl_2O_4$, representing much more effectual separation of generated e^- and h^+ at the interface which in fact outcomes in superior expected photodegradation behaviours. The Co (0.075 M)-$CdAl_2O_4$ catalyst demonstrated the highest performances of 92 and 94% toward the degradation of both dyes, respectively, owing to the lowest e^- and h^+ recombination rate. The Co (0.075 M) doped $CdAl_2O_4$ photocatalyst revealed outstanding reusability and stability under visible irradiation, retaining the performance of about 83 and 86% after the fifth consecutive run of BB and BG elimination. A probable photodegradation

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Fabrication of an effectual, stable and reusable Mg-doped $CdAl_2O_4$ nanoparticles for photodegradation of toxic pollutants under visible light illumination

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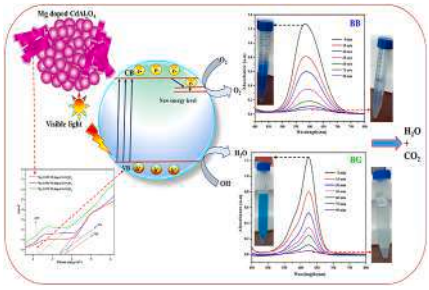
HIGHLIGHTS

- Preparation of a novel $CdAl_2O_4$ and Mg-doped $CdAl_2O_4$ nanoparticles under a co-precipitation approach.
- Mg-doped $CdAl_2O_4$ products slightly increase and reduce the energy gap compared to pure.
- The PL emission spectra of the pure $CdAl_2O_4$ and Mg-doped $CdAl_2O_4$ nanoparticles exhibited some defect or oxygen vacancies.
- ESR and Reactive species tests suggested that h^+ and $^{\cdot}OH^-$ played significant roles in the BB and BG photocatalytic process.
- The Mg (0.075 M) doped $CdAl_2O_4$ catalyst exhibit substantially high photocatalytic capability.

GRAPHICAL ABSTRACT



ARTICLE INFO

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Keywords:
Mg-doped $CdAl_2O_4$,
Photoluminescence
ESR
Scavenger
Photodegradation

ABSTRACT

The water contamination caused by discharging extensive organic dyes stuff into water bodies is one of the utmost significant concerns disturbing the environment and human life. $CdAl_2O_4$ spinel materials have been excellent in the elimination of emerging pollutants by the photocatalysis route. These materials, when altered through methods namely doping with Mg ions, have benefits over $CdAl_2O_4$, especially reduced energy gap and light absorbed in the visible region. The XRD established the creation of space group R $\overline{3}$ with no other phase step being found. The photoluminescence outcomes indicated that Mg-doped $CdAl_2O_4$ nanoparticles had the preventing e^--h^+ recombination possibility, which was favorable for the photocatalytic process. The Mg (0.075 M)-doped $CdAl_2O_4$ catalyst had higher photocatalytic performance with 94 and 96% removal of two azo (BB and BG)

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toxics

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Article

Biochemical, Genotoxic and Histological Implications of Polypropylene Microplastics on Freshwater Fish *Oreochromis mossambicus*: An Aquatic Eco-Toxicological Assessment

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Abstract: In recent years, polypropylene microplastic has persisted in freshwater ecosystems and biota, forming ever-growing threats. This research aimed to prepare polypropylene microplastics and evaluate their toxicity to the filter feeder *Oreochromis mossambicus*. In this research, fish were given a dietary supplement of polypropylene microplastics at 100, 500, and 1000 mg/kg for acute (96 h) and sub-acute (14 days) durations to assess toxic effects on liver tissues. FTIR results revealed the presence of polypropylene microplastic in their digestion matter. The ingestion of microplastics in *O. mossambicus* led to fluctuations in homeostasis, an upsurge in reactive oxygen species (ROS) levels, an alteration in antioxidant parameters, including superoxide dismutase (SOD), catalase (CAT), glutathione-S–transferase (GST), and glutathione peroxidase (GPx); a promotion in the oxidation of lipid molecules; and a denaturation in the neurotransmitter enzyme acetylcholinesterase (AChE). Our data indicated that sustained exposure to microplastics (14 days) produced a more severe threat than acute exposure (96 h). In addition, higher apoptosis, DNA damage (genotoxicity), and histological changes were found in the liver tissues of the sub-acute (14 days) microplastics-treated groups. This research indicated that the constant ingestion of polypropylene microplastics is detrimental to freshwater environments and leads to ecological threats.

Keywords: polypropylene microplastics; freshwater ecosystem; ever-growing threats; liver tissues; food; genotoxicity

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1. Introduction

Microplastics may pose a hazard to a variety of ecosystems, making them a potential contaminant. Due to their diminutive size, they are readily diffused and carried throughout all aquatic environments, including sediment, the surface, and other zones such as the littoral, limnetic, profundal, euphotic, and benthic [1–3], and even in aquatic creatures [4]. In general, biota accidentally ingests microplastics, via oral, and gill, which cause obstruction or irritation of the digestive system due to their accumulation. Accumulated microplastics were transported into different internal organs via circulatory body fluids. Which triggers the dysfunction or alteration in endocrine and metabolic pathways, leads to oxidative stress, cell necrosis, finally inducing cell apoptosis, and aids the organism's death [5,6]. Microplastics and their impacts were reported in algae, zooplankton, fish, marine reptiles, sea birds, and aquatic mammals [7–11]. Among these, fish is a crucial predator and is

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Response of hepatic biochemical parameters and neurotoxicity to carbamazepine and ibuprofen in *Oreochromis mossambicus*

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Abstract Globally, the prevalence and pollution of pharmaceutical drugs in aquatic environments have been steadily increasing. This study sought to evaluate the effects of 14 days of exposure to environmental-relevant doses (ibuprofen 0.5, 5, and 50 µg/L, and carbamazepine 0.005, 1, and 10 µg/L) of the non-steroidal anti-inflammatory drugs ibuprofen and carbamazepine in the freshwater fish *Oreochromis mossambicus*. The results showed a significant ($P < 0.05$) decrease in *O. mossambicus* superoxide dismutase, catalase, biotransformation enzymes, glutathione-s-transferase, glutathione peroxidase, oxidative stress lipid peroxidation, protein carbonyl activity, cellular damage metallothionine, reduced glutathione, immunological activities, and respiratory burst activity. Consequently, the acquired data revealed that *O. mossambicus* treated with ibuprofen and carbamazepine shows more significant alterations in metabolic depression, biochemical parameters, and oxidative stress. In addition, increased neurotoxic effects were observed in ibuprofen and carbamazepine treated *O. mossambicus*.

Keywords Drugs · *Oreochromis mossambicus* · Oxidative stress · Neurotoxicity

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Introduction

Human, veterinary, agricultural, and aquaculture sectors, as well as human health as a whole, have benefited from the pharmaceutical industry's creation of a vast array of drugs. (Saravanan et al. 2012). The aquatic environment is regularly exposed to a range of medications (parental compounds) and their by-products (metabolites) because of the widespread usage and large-scale manufacture of pharmaceuticals (parental compounds) (metabolites). These drugs may enter the local aquatic environment through pharmaceutical companies, hospital effluent, and domestic

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A synergistic consequence of catalyst dosage, pH solution and reactive species of Fe-doped $CdAl_2O_4$ nanoparticles on the degradation of toxic environmental pollutants

G. Rajesh [a,b], P. Senthil Kumar [a,b,**], S. Akilandeswari [c], Gayathri Rangasamy [d,f,*], Aindrila Mandal [a,b], V. Uma Shankar [a,b], M. Ramya [a,b], K. Nirmala [a,b], K. Thirumalai [e]

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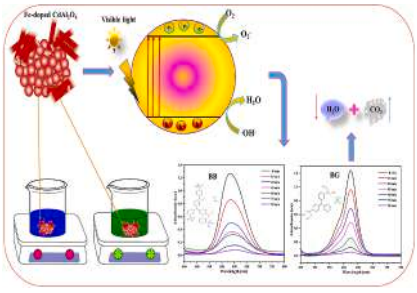
HIGHLIGHTS

- A novel pure and Fe-doped $CdAl_2O_4$ nanoparticles fabricated by chemical co-precipitation approach.
- Fe (0.075 M) doped $CdAl_2O_4$ catalyst removed 94 and 96% for BB and BG dyes under visible illumination.
- $\cdot OH^-$ and h^+ radicals were the major scavenging species in the degradation of the two Azo dyes.
- Fe (0.075 M) doped $CdAl_2O_4$ catalyst showed 78 and 84% degradation efficiencies in six consecutive runs.

GRAPHICAL ABSTRACT



ARTICLE INFO

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Keywords:
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ABSTRACT

Industrial wastewater treatment techniques are one of the biggest challenges of the scientific community that necessitate an increased consciousness to address water scarcity worldwide. Herein, an eco-friendly and cost-effective process was demonstrated to cope with tannery, textile and pharmaceutical dye wastes through the co-precipitation of highly reusable Fe-doped $CdAl_2O_4$ samples. The XRD studies exposed the space group R $\bar{3}$ with no secondary phase step being found for all samples. The outcomes of optical absorbance spectra demonstrate that Fe doping diminished the energy gap from 3.66 to 1.67 eV. HR-TEM images of existing spherical particles and some of the particles' rod-like structures with little agglomeration were found for Fe (0.075 M) doped $CdAl_2O_4$ nanoparticles. The PL emission outcomes show that Fe doping effectively prevented the charge carrier's recombination in $CdAl_2O_4$ during photocatalysis. All Fe-doped $CdAl_2O_4$ samples demonstrated higher photodegradation behaviors towards the effectual degradation of both dye solutions as compared to pure $CdAl_2O_4$ samples. Particularly, Fe (0.075 M)-doped $CdAl_2O_4$ samples exhibited improved

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Process and technoeconomic analysis of bioethanol production from residual biomass of marine macroalgae *Ulva lactuca*

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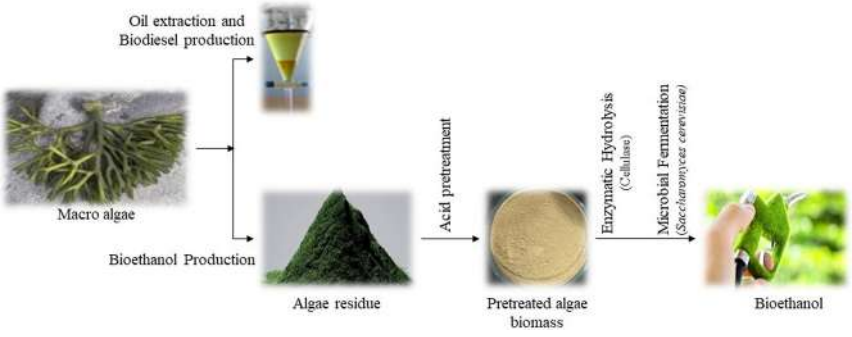
HIGHLIGHTS

- Pretreatment of algal residue was optimized to improve the availability of carbohydrates.
- Enzymatic hydrolysis and fermentation of algal biomass were optimized.
- Bioethanol produced under optimized conditions was characterized using GC–MS
- Techno-economic analysis of bioethanol production was studied.
- The minimum selling price of bioethanol was 0.47 $/kg.

GRAPHICAL ABSTRACT



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ABSTRACT

In the present work, the residual biomass of the green seaweed *Ulva lactuca* was chosen as feedstock to undergo separate hydrolysis and fermentation process to produce bioethanol. The hydrolysis process was optimized for cellulase, biomass, temperature, and time conditions. The maximum yield of fermentable sugars was 13.48 mg/mL. The recovered hydrolysate was subjected to fermentation using *Saccharomyces cerevisiae*. The bioethanol produced was subjected to gas chromatography coupled mass spectrometry analysis to determine the presence of ethanol. The technical performance and economic feasibility of the bioethanol production from *U. lactuca* were evaluated using the lab-scale data obtained for optimized conditions. The plant capacity was 10 MT/day of bioethanol production. The plant's capital investment and annual operating cost were 3.18 M$ and 0.86 M$ respectively. The total annual revenue of the plant was 1.41 M$. The minimum selling price of bioethanol was 0.47 $/kg. The ROI, payback period, IRR and NPV of the plant were 16.99 %, 5.89 years, 11.57 % and 291,000 $ respectively. The utilization of residual biomass for biofuels helps to develop an economic and environmentally sustainable plant.

1. Introduction

The economic development of many countries depends on fossil fuels consumption in transportation sector, industrial industries, and many other uses. In addition to the limited availability of resources, these fuels

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Article

Synthesis of Tungsten Oxide Nanoflakes and Their Antibacterial and Photocatalytic Properties

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Abstract: This current work revealed a single-step fabrication of tungsten oxide nanoflakes (WO_3 NFs) with the help of *Terminalia arjuna* bark extract. Bioactive phytoconstituents of *T. arjuna* bark extract were involved in the nucleation process and promoted the material crystalline growth in a particular direction. The as-prepared sample thermal decomposition was analyzed by TG/DTG. The as-prepared sample was annealed at 300 °C for 2 h, and the annealed sample was characterized by UV-Vis-DRS, FTIR, Raman, XRD, SEM, EDX, and TEM. Synthesized WO_3 samples showed a monoclinic phase of the flake-like structure with lengths of 25~230 nm and diameters of 25~120 nm. The WO_3 NFs were evaluated against *S. aureus* and *E. coli*. Over 3 mg concentrations of WO_3 NFs outperform the positive control in antibacterial activity. The pseudo-first-order kinetics of the WO_3 NFs enhanced the photocatalytic performance of methylene blue (MB). These results prove that WO_3 NFs have sustainable performance in antibacterial and MB degradation applications.

Keywords: *Terminalia arjuna*; bark extract; nano-flakes; reactive oxygen species; photodegradation

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1. Introduction

Bacterial infections have recently been identified as a major global health threat [1]. For the most part, organic antibiotics have been utilized to treat human bacterial diseases, resulting in bacterial pathogens becoming resistant to antibiotics. However, novel classes of antibiotics slow their further development [2]. On the other hand, the prime source of all living organisms for sustainable development needs is water. The discharges of industrial effluents, especially from the textile industry, such as azo dye, phenyl matter, and toxic organic substances resistant to degradation and decomposition by biological treatment, cause severe water pollution. Chemical markers and biological staining procedures employ methylene blue (MB), a cationic dye. Due to the high chromatic nature and poor biodegradability, it has been complicated to process degradability. More importantly, it causes various harmful effects on human health care, such as diarrhea, vomiting, severe headache, and methemoglobinemia-like syndrome. In addition, it significantly affects the waterbody phytoplankton photosynthesis and microorganism metabolic activity in the water environment [3–6]. Photocatalyst is one of the novel methods to prevent water pollution. Two-dimensional (2D) nanomaterials are efficient catalysts for solving bacterial pathogens, mosquito vectors, and environmental remediation problems. Nowadays,

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Unburned Carbon from Bagasse Fly Ash to Produce Activated Carbon in a Single-Stage Chemical Process

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ABSTRACT: Bagasse ash waste is generated in sugar mills from the use of bagasse as a fuel. This waste frequently noticed, its way to landfilled places where it is disposed. The dumping of biomass wastes caused in numerous agricultural processes is usually an environmental problem as odour and pollutes the soil. Recycling these leftovers for the manufacturing of activated carbon, an adsorbent with numerous uses, including the removal of pollutants, was one option for such a problem. In this work, activated carbon was made from Bagasse ash using a chemical activation process at 800 °C. Fourier Transform-Infrared (FT-IR) spectroscopy, Scanning Electron Microscopy (SEM) and X-ray diffraction (XRD) were used to characterize the sample. The functional groups are confirmed by FT-IR and the existence of hydrocarbons. The SEM and XRD studies show that the generated activated carbon has a low amount of inorganic elements when compared to the precursor. These experimental results suggested that Bagasse ash might be used as a starter in the activated carbon manufacturing method, making it a cost effective resource.

KEYWORDS: Activated carbon, Bagasse fly ash, FT-IR, SEM, XRD.

1. INTRODUCTION

Bagasse is the non-homogeneous fibre residue that remains while crushing sugarcane stalks to get juice. Sugarcane bagasse has become one of the most prolific agricultural wastes, with a yearly output of more than 540 million metric tons [1]. It is estimated that sugar factory produces 3 tons of wet bagasse for 10 tons of sugarcane crushed, which indicates each sugar manufacturing country produces significant amount of bagasse. Even though, it is a byproduct, it has many applications like fuel and paper production. The bagasse is made up of pith fiber, an attempt has been made to produce and understand characteristic of activated carbon from bagasse. As number of raw material may be used to produce activated carbon, bagasse is chosen for the current study because over the recent years production of activated carbon in low cost has prompted a growing interest since it play a vital role in both waste management and pollution control [2-5]. Activated carbon has a long history of usage in the removal of chemical species from aqueous medium generated by the medicinal, agriculture, food and industrial applications [6]. The absorption properties of activated carbon mainly depend on pore volume, porosity and the functional groups presence [2]. The current study, the surface characteristics and the internal pore structure was studied using scanning electron microscope. The presence of functional group and crystalline formation during activation process is analyzed using FT-IR and XRD respectively.

2. MATERIALS AND METHODS

Sugarcane bagasse ash (SBA) used in this work collected after electric power generation in EDI parry sugarcane industry, Nellikuppam, Cuddalore disirct, Tamil Nadu, India. All of the chemicals utilized in this investigation were of analytical reagent (AR) quality. Bagasse ash was dried in a 110 °C oven for 6 hours. Subsequent, it was crushed with a micro hammer blade grinder and mesh sieve to a grain size of 10 or 32 meshes (2.0 mm or 500μm). For the characterization and synthesis of activated carbons, bagasse ash with only a particle size of 500 μm was utilized.

2.1. Single-stage chemical activation and carbonization process

In a glass beaker, 10 g raw material was combined with the chemical reagent at 1:4 ratios. Distilled water was included in an amount equal to ten times the total weight of the combination. The liquid was then mixed and heated to homogenise before being infused at 85 °C until a thick homogeneous powder was formed.

fishes

MDPI

Article

Effects of Dietary Blend of Algae Extract Supplementation on Growth, Biochemical, Haemato-Immunological Response, and Immune Gene Expression in *Labeo rohita* with *Aeromonas hydrophila* Post-Challenges

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Abstract: In this study, the effects of a mixed algal blend (*Chlorella vulgaris*, *Euglena viridis*, and *Spirulina platensis*) at different levels were evaluated on growth, hematological immune responses, and expression of immune genes in *Labeo rohita* against post-challenges of *Aeromonas hydrophila*. Fish samples were fed a diet containing different levels of mixed blend algal (0, 0.01, 0.02, 0.04 and 0.08% of basal diet). At the end of the feeding period, the fish were challenged with *A. hydrophila* and fish mortality was recorded over a 14-days period. To evaluate the serum biochemical (albumin, globulin), hematological parameters (Hb, RBC and WBC) and immune parameters (neutrophil activity, lysozyme activity, myeloperoxidase activity, antiprotease activity, ceruloplasmin activity, and bactericidal activity), as well as the expression of immune genes (NKEF-B, Lysozyme C and G, TNF α, TLR22, β2M, and β-actin), fish were sampled on Day 7, 14, 21 and 28. Fish were challenged with virulent *A. hydrophila* 30 days post-feeding and mortalities were recorded over 30 days post-infection. Results demonstrate that fish fed with a mixed algal blend showed that total body weight gain, specific growth rate, total serum protein, globulin, total hemoglobin content, white blood cells, neutrophil, lysozyme, bactericidal, myeloperoxidase, and antiprotease activity in dietary algae blended application was higher than in the control ($p < 0.05$). According to the results, relative expression of target genes showed significant increases of 0.02 to 0.04% in the treatment group compared to the control group ($p < 0.05$). At the end of the 30-day exposure to *A. hydrophila*, the fish that received the mixed algal blend had a significantly higher rate of survival than the control group, with the highest survival rate recorded in the 0.02% mixed algal blend ($p < 0.05$). According to the effective results of the mixed algal blend on stimulating the immune system and increasing fish resistance to *A. hydrophila*, it is recommended to use 0.02 to 0.04% of this mixed algal blend in rohu, *L. rohita* diets.

Keywords: mixed algae; rohu; *Aeromonas hydrophila*; immune gene expression

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Fabrication of a novel Ni-doped $CdAl_2O_4$ nanoparticles and applications in photo-oxidation processes under visible light illumination

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Ni-doped $CdAl_2O_4$
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Photoluminescence
Photodegradation

ABSTRACT

The existence of azo dyes (BB and BG) in textile wastewater is a major problem owing to their possible effect on human health and the environment. In this work, we examine the photodegradation performance under the visible sources of BB and BG are Azo dyes extensively applied in the food and textile industries. An initial screening of dissimilar Ni-doped $CdAl_2O_4$ nanoparticles was determined to classify the most outstanding candidate for BB and BG removal. The Ni (0.075 M) doped $CdAl_2O_4$ nanoparticles after 90 min illuminations, 95 and 96% of BB and BG removal were noticed in pH =5 (acidic) and 5 mg catalyst dosage conditions. The recyclability of the Ni (0.075 M) doped $CdAl_2O_4$ catalyst was tested under optimized circumstances. The outcomes demonstrate that Ni (0.075 M) doped $CdAl_2O_4$ products exhibit substantially high stability with above 85 and 90% removal after the sixth catalytic run. The scavenging (free radicals) experiments revealed that $^{\cdot}OH^{-}$ and h^{+} radicals play a central role in BB and BG degradation. Overall, the outcomes obtained propose that the suggested route may denote an appropriate technique for the elimination of BB and BG from textile wastes. This work shows the new pathway to improve more efficient materials for the elimination of industrial effluents.

1. Introduction

Water contamination has become a significant issue in the current era of climate change, industrialization, and urbanization. The primary ecological contaminants commonly encountered are pesticides, metal ions, aromatic compounds, pharmaceuticals, and organic/inorganic dyes [1]. Among them, inorganic/organic dye solutions are extensively applied in various industries like plastics, paint, tanneries, textile, and paper, which causes an everyday release of vast quantities of coloured wastes [2]. Organic/inorganic dyestuffs have lower biodegradability and are resistant to chemical reagents and heat. Furthermore, a maximum of them are regarded as carcinogenic components and mutagenic.

Their existence in water bodies can also disturb the aquatic ecosystem [3,4], so the elimination of these contaminants from water bodies with sustainable and effective green approaches has become an essential task for researchers [5,6]. Dissimilar methods have been applied for dye elimination from water effluents, such as membrane filtration [7], reverse osmosis [8], adsorption [9], coagulation [10], ozone treatment [11], and photocatalytic degradation [12]. The Photocatalysis route is significantly probable in the remediation of the removal of inorganic/organic dyestuffs as it can completely mineralize inorganic/organic dyestuffs molecules into CO_2 and H_2O [13,14].

For this intent, dissimilar oxides materials like $MnAl_2O_4$ [15], $CoAl_2O_4$ [16], $ZnAl_2O_4$ [17], $CaAl_2O_4$ [18], $MgAl_2O_4$ [19], $SrAl_2O_4$ [20] and so are frequently applied. Generally, these mixed metal oxides materials have fascinated much attention owing to their numerous properties like, photocatalytic [16], magnetic [21], gas sensing [15], antibacterial activity [22], electrochemical performance [23], or applied in Li-ion batteries [24]. Tangcharoen et al., [25] reported the

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Acaricidal efficacy of silver nanoformulations of *Commiphora molmol* and *Zingiber officinale* against the camel Tick, *Hyalomma dromedarii* (Ixodida: Ixodidae)

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ABSTRACT

Ticks are blood- feeding ectoparasites transmitting many dangerous pathogens to humans and animals, leading to great economic losses. Emerging acaricide resistance has urged the use of eco-friendly acaricides. The novel *In vitro* application of the aqueous extracts of myrrh, *Commiphora molmol* (AME) and ginger, *Zingiber officinale* (AGE) and their corresponding silver nanoparticles (AgNPs), synthesized by subjecting myrrh and ginger extracts to laser ablation (NME and NGE, respectively), was evaluated against the camel tick, *Hyalomma dromedarii* by adult immersion bioassays. Moreover, spot- on treatments of infested cattle was done. AgNPs were characterized by Transmission Electron Microscopy and UV–visible spectrophotometry. The phytochemical profile showed that the used extracts contained phenols, gallic acid, flavonoids, and tannins. Fifteen days post- treatment (PT), 96 and 84.01% mortalities were observed PT with AME and AGE, respectively; 100% mortality was reached 7 and 9 days PT with 12% of NME and NGE, respectively. Three days PT, the LC_{50} values of AME, AGE, NME, and NGE were 10.37, 12.81, 2.38, and 4.12%, respectively. The corresponding LT_{50} values PT with 4% were 5.6 and 6.73, 2.25, and 3.56 days, respectively. Three days PT, AME, AGE, NME, and NGE reduced cattle- tick infestations by 54.45, 45.73, 100, and 100%, respectively. Ticks showed resistance against Deltamethrin (Butox®). This study demonstrated the novel acaricidal effect of myrrh and ginger and their silver nanoformulations through laser ablation, which increased the speed and efficacy of the aqueous extracts against *H. dromedarii*. Consequently, they could be produced as efficient eco-friendly pesticides after revealing their ecotoxocological profile.

1. Introduction

Ticks are important ectoparasites that transmit pathogens of medical and veterinary importance, which cause serious health issues to humans and domestic animals [1,2] leading to great economic losses [3]. Ticks are vectors of severe viral, bacterial, and parasitic diseases [4–9]. In addition to spreading diseases, ticks have direct effects on the health of livestock through their bites, which can be painful, cause blood loss, damage the skin, and make animals lose their appetite, which slows their growth [10,11]. Therefore, it is necessary to fight these pests to reduce the damage caused by them and limit their spread through the application or use of the appropriate control strategies. Using of chemical pesticides in the control of ticks led contaminated meat and dairy products, polluted environment, and development of acaricide- resistant strains of ticks. Consequently, using eco-friendly acaricides is a potential solution to the resistance problem, which is what we seek in this current work [12,13].

Biorational pesticides are safe, cost-effective, and biodegradable [12–14]. Besides their antiparasitic effect [15,16], botanicals have ovicidal, adulticidal [17]; larvicidal [18,19], repellent, and deterrent effects [20]. Pesticidal activity of *Commiphora molmol* and *Araucaria heterophylla* methanol and hexane extracts against ectoparasites

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Synthesis of zinc oxide nanoparticles using *Vigna mungo* seed husk extract: An enhanced antibacterial, anticancer activity and eco-friendly bio-toxicity assessment on algae and zooplankton

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ABSTRACT

An ecological synthesis of zinc oxide nanoparticles (ZnONPs) from plant extracts has several applications in contemporary research owing to its enhanced pharmacological efficacy, lower toxicity, and cost-effectiveness. This study synthesized ZnONPs using the seed husk extracts of *Vigna mungo* (*Vm*) (Black gram). UV, XRD, FTIR, SEM, and TEM were used to analyze well-dispersed *Vm*-ZnONPs. Moreover, we examined the bactericidal efficacy of *Vm*-ZnONPs against aquatic Gram-negative pathogens. In addition, the breast cancer cell line MDA-MB-231 was utilized to conduct conventional apoptosis tests, fluorescent dye assays, and cytotoxicity of cancer cell line data, which revealed that *Vm*-ZnONPs had good anticancer activity against MDA-MB-231. Furthermore, the growth rate and biotoxicity of *Vm*-ZnONPs were investigated on three marine microalgae: *Chaetoceros calcitrans, Isochrysis galbana*, and *Nannochloropsis oculata*. The concentration of *Vm*-ZnONPs significantly improved the growth rate of three algae species. At 96 h, *I. galbana* grew at a faster rate than *N. oculata* and *C. calcitrans* in response to *Vm*-ZnONPs. Also, the effects of biotoxicity on *Vm*-ZnONPs were validated using two animal models, including zooplankton rotifers and copepods. *Brachionus plicatilis* and *Parvocalanus crassirostris* treated with *Vm*-ZnONPs exhibited low toxicity, with LC_{50} values of 62.87 and 71.73 μg/mL, respectively. The *Vm*-ZnONPs were highly identified by zooplankton rotifers (*B. plicatilis*), copepods (*P. craniirostris*), and no morphological or anatomical alterations verified their safety to the variety of fauna. This is the first research to examine the impact of *Vm*-ZnONPs on the marine ecosystem biotoxicity of three phytoplanktons and two zooplanktons.

1. Introduction

Biowaste materials have been recognized as a global ecological problem, and they have prompted the development of innovative pathways to create renewable, low-cost, and extensive therapeutic and aesthetic uses. *Vigna mungo* (Black gram) is the most important pulse crop in India; 25% of by-products (agro waste) are derived by grinding black gram into dhal [1]. This seed husk is one of these agro-industrial by-products, and it is utilized as livestock feed; it has no economic value. It was discovered that the seed husk of *V. mungo* contains flavonoids, glycoflavones, flavonol glycosides, and compounds such as vitexin, leucodelphinidin, and delphindin 3-glucoside [2]. In addition, the seed husk contains saponins, namely acetylsoyasaponin and soyasaponin [3].

ZnONps have recently attracted much interest because of their

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Original article

Synthesis and antimicrobial activity of silver nanoparticles: Incorporated *couroupita guianensis* flower petal extract for biomedical applications

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ABSTRACT

Recently, numerous plant-based synthesis techniques have been used to develop metal nanoparticles. The current study uses the medicinal plant extract of *couroupita guianensis* (CG) petals to create biogenic silver nanoparticles in an environmentally friendly manner. Different techniques, including ultraviolet–visible spectroscopy (UV–vis), Fourier Transformation Infrared spectroscopy (FTIR), X-ray diffraction (XRD), and Dynamic Light Scattering (DLS) analysis, are used to evaluate synthesized silver nanoparticles. From the XRD results confirm the emergence of nanosilver crystalline arrangement with the characteristic peaks at the glancing angles of 38.04°, 44.22°, 64.40°, and 77.37°. UV–vis spectroscopy displays the spectral absorption at λ^{max} = 282 nm and shows the formation of silver nanoparticles. Images of produced Ag NPs taken with a scanning electron microscope (SEM) show the creation of flower-shaped particles. The functional behavior of flavones, triterpenoids, and polyphenols belonging to *couroupita guianensis* has been observed by ensuring their selective absorptions in FTIR spectral analysis silver nanoparticles had a substantial antibacterial effect on Gram-positive (*B. subtilis*) and Gram-negative (*Escherichia coli)* bacteria in general. It is found to become effective when symbiotic with the extract of *couroupita guianensis* flower petals for enhancing their antibacterial properties. This composite product gives a new and cost-effective formulation with more therapeutic possibilities. The observed results wide open the avenues of research possibilities with a lot of future scopes. The photocatalytic degradation efficiency of CG-Ag NPs on methylene blue (MB) dye was evaluated under visible light irradiation and produced indications of the synthesized material for photocatalytic applications.

1. Introduction

Medicinal plants are special elements known for their therapeutical scope and render long-time remedies for several human diseases. It is mainly because of the healing value of their components used as a raw material in modern medicine. The *couroupita guianensis* (CG) is a tree and its parts are familiar components used for medicinal purposes. Particularly, its chemical ingredients are responsible for various pharmacological and therapeutic properties. The study used to explore the characteristic

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Synthesis and characterization of *Vitis vinifera* exocarp-mediated ZnO nanoparticles: An evaluation of biological potential and ecotoxicity

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ABSTRACT

The popularity of plant-based nanoparticle synthesis has increased over the years due to the quantity of bioactive compounds. It is economical and environmentally friendly, which is an added feature. In the present study, the polyphenol-rich exocarp extract of *Vitis vinifera* was used to synthesize zinc oxide nanoparticles (*Vv*-ZnO NPs) and evaluate their potential usage in various biological applications. UV–Vis spectrophotometer observations of *Vv*-ZnO NPs revealed an SPR peak at 355 nm. FTIR analysis confirmed the presence of *V. vinifera* phytochemicals in the produced ZnO NPs. The electron microscope (SEM, TEM) revealed that the *Vv*-ZnO NPs had a conical shape and varied in size between 30 and 73.5 nm. The current investigation indicated that *Vv*-ZnO NPs are a more effective antioxidant than grape peel extract when exposed to DPPH solution, with an 87% inhibition rate at 100 μg/ml. At 200 μg/ml concentration, *Vv*-ZnO NPs demonstrated good antibacterial activity against *Staphylococcus aureus* (6 mm) and *Pseudomonas aeruginosa* (4 mm). The total destruction of biofilm architecture by *Vv*-ZnO NPs at high concentrations (100 μg/ml) was clearly seen in light microscopic images. The IC_{50} value for its anticancer activity against the MDA-MB-231 breast cancer cell line was 12.90 μg/ml. The nanoparticles demonstrated acceptable larvicidal effectiveness against the Zika virus vector *Aedes aegypti* (LC_{50}-80.27-LC_{90}-136.39 μg/ml). *Vv*-ZnO NPs exhibited decreased ecotoxicity against non-target bioindicators such as *Daphnia similis, Artemia salina*, and *Perionyx excavatus*. Overall our studies revealed the eco-friendly synthesis of ecologically sound *Vv*-ZnO nanoparticles for diverse biological applications.

1. Introduction

The increasing urgency of developing eco-friendly technologies has helped the emerging science of nanotechnology gain ground in recent years. Nanomaterials are often manufactured via physical, chemical, and mechanical processes that need significant amounts of energy. These techniques are often risky since they call for high pressure, varying temperatures, and toxic mediators [1–4]. The detrimental impacts of such procedures on the environment and living organisms have prompted researchers to develop more cost-effective, biocompatible, and eco-conscious strategies [5]. Applications like semiconductors, catalysts, surfactants, and so on have been documented using individual nanoparticles, bimetallic nanoparticles, and polymer-based nanocomposites [6–11].

Biopolymers produced from different types of life are used as capping agents in the environmentally friendly production of nanoparticles. Researchers have successfully created metal and metal oxide nanoparticles using plant-based biopolymers [12–14]. The plants are readily available and pose no health risks to those working with them. Zinc oxide nanoparticles (ZnO NPs) are a kind of metal oxide that has been shown to be both eco-friendly and biocompatible [15,16]. It has been found that biosynthesized ZnO NPs treat cancer and wounds and have antibacterial, antifungal, anti-inflammatory, and antidiabetic properties [17–20]. ZnO NPs are also employed as a packaging material for the

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RESEARCH ARTICLE

Ingestion and impacts of water-borne polypropylene microplastics on *Daphnia similis*

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Abstract

Polypropylene microplastics are the leading contaminant in aquatic environments, although research on their toxicity remains scarce. The proposed research focuses on the harmful consequences of acute exposure to polypropylene microplastics in *Daphnia similis*. This work converts widely available polypropylene bags into microplastics using xylene. FTIR findings demonstrated the lack of xylene residue in the produced polypropylene microplastic particles, which were spherical and ranged in size from 11.86 to 44.62 µm (FE-SEM). The results indicate that acute exposure to polypropylene microplastics causes immobility in *D. similis*. Ingestion of microplastics enhances the generation of reactive oxygen species (ROS), as shown by biochemical studies. Due to the production of free radicals in *D. similis*, the antioxidant enzymes superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPx) and glutathione-S-transferase (GST) and a non-antioxidant enzyme of reduced glutathione (GSH) and also oxidative stress effects in lipid (lipid peroxidation — LPO), protein (carbonyl protein — CP) were increased. Additionally, the amount of the neurotransmitter enzyme acetylcholinesterase (AChE) activity was decreased. These findings indicate that the accumulation of polypropylene microplastics in the bodies of filter-feeding organisms should aggravate toxicity in the freshwater environment.

Keywords Polypropylene microplastics · *Daphnia similis* · Acute exposure · Aquatic environments · Biochemical parameters

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Introduction

In the middle of the nineteenth century, the manufacturing and usage of plastic were raised annually owing to its durability, adaptability, strength and insulating properties. For instance, in 2018, the global plastic manufacturing rate climbed to 359 million tonnes (Plastic Europe 2019). According to Bilal and Iqbal (2020), plastics were divided into micro (100–5 mm) and nano-sized (100 nm) particles by the action of physical (photo radiation, weathering conditions), chemical and natural abrasion. Eighty per cent of microplastics were ultimately derived from the terrestrial environment (Jambeck et al. 2015; Dusi and Coors 2016), while 20% was derived from ocean-based sources (Wright et al. 2013; Karbalaei et al. 2018). However, its ineffective disposal methods persist in the environment, such as landfilling, incineration, recycling and pyrolysis (Panda et al. 2010).

In general, freshwater is a critical impact on the transfer of microplastic debris from land to the ocean, which

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Citrullus lanatus-encased zinc oxide nanoparticles as potential anti-diabetic, anti-inflammatory and antibacterial agents: A new strategy towards biocompatible nano-drugs

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ABSTRACT

This research aimed to develop a rapid, cheap, and environmentally friendly method for synthesizing zinc oxide nanoparticles (ZnONPs) from *Citrullus lanatus* (*Cl*) seed extract and the *Cl*-ZnONPs were analyzed using several techniques to determine their properties. These included UV–vis spectroscopy, XRD, FTIR, SEM, and TEM. *Cl*-ZnONPs have sizes between 10 and 50 nm and are spherical in form. Compared to *Cl* seed extract, *Cl*-ZnONPs displayed significantly higher levels of antioxidant activity. Comparatively to α-amylase, *Cl*-ZnONPs showed much stronger inhibition of β-glucosidase and DPPIV (anti-diabetic activity). *Cl*-ZnONPs and *Cl*-seed extract were tested for their ability to reduce inflammation, demonstrating potent in vitro anti-inflammatory properties (membrane stabilization, proteinase inhibitory, and lipoxygenase). In addition, the *Cl*-ZnONPs' antibacterial activity revealed that they had a significantly greater effect on inhibiting the growth of Gram-negative bacteria such as *Escherichia coli* and *Pseudomonas aeruginosa*. Synthesized *Cl*- ZnONPs are promising solutions for treating inflammatory and diabetic concerns, as suggested by the outcomes. In conclusion, the biosynthesized *Cl*-ZnONPs shown in this study provide a synthetic substance replacement that is safe and effective in various biomedical and pharmaceutical applications, including those requiring antioxidant, antibacterial, and anti-inflammatory properties.

1. Introduction

Biomedical nanomaterials have recently received much interest because of their well-known biological and biomedical uses. A decade ago, more than 30,000 t of ZnO NPs were produced annually, and it is the most prominent metal oxide nanoparticle. It is widely used in various sectors because of its unique physical and chemical characteristics [1,2] and extra effortlessly immersed through the body when the particle size is tiny. As a consequence, nano-ZnO is widely applied in food. Furthermore, the US Food and Drug Administration (FDA) has categorized ZnO as a "GRAS" (generally recognized as safe) material [3]. ZnO NPs are relatively affordable and less toxic than other metal oxide NPs, and have a broad spectrum of application uses, including in medical and pharmaceutical fields [4–6].

Diabetes is a metabolic disorder distinguished through lack of secretion or action of endogenous insulin resulting in the elevation of blood glucose and several other problems and it is one of the most significant public troubles. According to World Health Organization (WHO) estimates, diabetes will reach 300 million or more by 2025 [7]. Moreover, after an injury or infection, inflammation is a multifactorial phenomenon that restores cellular homeostasis and the tissue microenvironment. Nonsteroidal anti-inflammatory drugs have various side effects like stomach ulcers, bleeding, and cardiovascular strokes, limiting their use in treating chronic inflammation diseases [8,9]. This emphasizes the importance of activity-based phytopharmacological evaluation of herbal medications. More awareness has been paying attention to

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Research Article

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Green synthesis of silver nanoparticles using *Atalantia monophylla*: A potential eco-friendly agent for controlling blood-sucking vectors

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Abstract: Developing floral-based replacement molecules might manage blood-sucking vectors in an eco-friendly way. *Atalantia monophylla* (*Am*) aqueous leaf extract (ALE) and silver nanoparticles (AgNPs) were evaluated against mosquitoes (*Aedes vittatus*, *Anopheles subpictus*, and *Culex vishnui*) and ticks (*Haemaphysalis bispinosa*, *Rhipicephalus microplus*, and *R. sanguineus*) at different concentrations. Phytochemical screening and AgNPs' synthesis were performed on ALE of *A. monophylla*. UV-visible spectroscopy, Fourier-transform infrared (FTIR) spectroscopy, scanning electron microscope, and transmission electron microscope were used to examine the synthesized *Am*-AgNPs. *A. monophylla's* ALE included alkaloids, flavonoids, saponins, tannins, triterpenes, coumarins, anthraquinones, and phenolics. *Am*-AgNPs had a higher LC_{50} (22.19, 23.92, 26.09, 40.25, 51.87, and 60.53 $\mu g \cdot mL^{-1}$, respectively) than leaf aqueous extract (LAE) against *Ae. vittatus*, *An. subpictus*, *Cx. vishnui*, *H. bispinosa*, *R. microplus*, and *R. sanguineus* larvae. *A. monophylla* ALE and *Am*-AgNPs' bio-toxicity was investigated against aquatic and terrestrial non-target species (*Acilius sulcatus*, *Anisops bouvieri*, *Araneus mitificus*, and *Cyrtophora moluccensis*) with LC_{50} values ranging from 2,094.5 to 10,532.8 $\mu g \cdot mL^{-1}$, respectively. *A. monophylla* ALE and *Am*-AgNPs had little negative impacts on the chosen non-target fauna. Environmental protection is important nowadays. Green AgNPs are low-cost, readily accessible, environmentally safe, and effective pesticides. Am-AgNPs are effective alternative insecticides, requiring a considerable study on this plant to control blood-sucking vectors for worldwide human/animal health importance.

Keywords: greener nanoparticles, blood-sucking vectors, larval toxicity, environmental safety, non-target fauna

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1 Introduction

Blood-sucking vectors (BSVs) generating an abundance of newly developing illnesses substantially affect live-stock and public health [1]. As a vector, ticks disperse pathogens responsible for causing cardinal diseases among cattle and human beings [2]. Around 900 tick species were recently identified [3]. The life-threatening pathogenic viruses are conveyed to animals by infected ticks' bites, especially in the family Ixodidae [4]. Ticks are notorious vectors for around 38 pathogenic viral species transmitted in the animal kingdom [5]. Worldwide, US$ 7 billion is lost annually, and nearly 80% of farm animals are in high-risk because of ticks and tick-borne diseases (TTBDs). They are very serious BSVs that spread several arboviruses above 80% in lives-stock and have a positive infection of

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CRITERION III - RESEARCH, INNOVATIONS AND EXTENSION

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Comparative toxicity of silver nanoparticles and silver nitrate in freshwater fish *Oreochromis mossambicus*: A multi-biomarker approach

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ABSTRACT

Silver nanoparticles (AgNPs) in the aquatic environment affect ecological repercussions and have fatal impacts on aquatic animals. The current study examined and correlated the toxicity of silver nitrate ($AgNO_3$) and silver nanoparticles (AgNPs) to the Mozambique tilapia, *Oreochromis mossambicus*. The comparative toxicity studies were done by exposing *O. mossambicus* to various doses of $AgNO_3$ and AgNPs (0, 25, 50, 75, and 100 μg/L) over a 7-day subacute exposure period. AAS analysis was used to detect Ag accumulation, while the histological examination established gill tissue damage. Oxidative stress affects lipid peroxidation (LPO) and protein carbonyl activity (PCA) in the gill tissue. Antioxidant parameters such as glutathione-S-transferase (GST), glutathione peroxidase (GPx), superoxide dismutase (SOD), catalase activity (CAT), and non-enzymatic antioxidants such as metallothionein (MT) and reduced glutathione. The serum in the blood was used to determine non-specific immunological characteristics such as lysozyme (LYZ), myeloperoxidase (MPO), and respiratory burst activity (RBA). The neurotoxic impact of acetylcholine esterase activity (AChE) was investigated in brain tissues. The findings demonstrated that larger concentrations of $AgNO_3$ than AgNPs improved enzymatic antioxidant activities in the gill tissue. Histological examination of fish gills demonstrated that both AgNPs and $AgNO_3$ induced telangiectasia and epithelial cell hyperplasia. By increasing the concentration of AgNPs and $AgNO_3$, the present research demonstrated that silver accumulation leads to inefficient oxidative stress and altered enzymatic and non-enzymatic parameters, leading to cellular damage.

1. Introduction

Engineered nanomaterials are increasing due to their many uses in biology and biomedicine, health care technology, home appliances, pharmaceutical, textile, cosmetic, and electronics sectors (Hana et al., 2020; Fabrega et al., 2011; Benelli and Govindarajan, 2017; Ishwarya et al., 2017). The buildup of nanomaterials in freshwater habitats due to human activities leads to the contamination of freshwater ecosystems with nanomaterials (Shah and Mraz, 2019; Jeyavani et al., 2022; Paulpandian et al., 2022; Rashidian et al., 2021; Sibiya et al., 2022). Because of the heavy usage of the above-said materials, the impact of the nanomaterial contamination on the aquatic organism is of great alarm as they are highly toxic, tenacious, non-decomposable and vastly bioaccumulative (Jafarabadi et al., 2020).

The hazardous nature of nanoparticles (NPs) in the aquatic ecosystem can be well evaluated by considering their bioavailability and toxic nature to the aquatic organisms (Nowack and Bucheli, 2007). NPs and their ionic forms may interact at an elevated concentration which possibly causes antagonistic effects on aquatic organisms (Griffitt et al., 2007; Xiang et al., 2020). Nevertheless, the ecological consequences of

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Biomimetically synthesized *Physalis minima* fruit extract-based zinc oxide nanoparticles as eco-friendly biomaterials for biological applications

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Physalis minima
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ABSTRACT

In the present study, the fruit extract of *Physalis minima* was used to synthesize zinc oxide nanoparticles (*Pm*-ZnO NPs). The first validation of the *Pm*-ZnO NPs production was obtained using a UV–Vis spectrophotometer at 327 nm. *Pm*-ZnO NPs crystalline nature was determined as hexagonal, relating to a joint corporation of powder diffraction standards (JCPDS) 75-1526 examined in XRD analysis. FTIR spectroscopy was used to identify functional groups associated with *Pm*-ZnO NPs, i.e., O–H and C=N. *Pm*-ZnO NPs were measured to be 50-150 nm in size and spherical in form using a TEM. Arrested augmentation of Gram-positive (*Enterococci faecalis*) and Gram-negative bacteria (*Pseudomonas aeruginosa*) populations was recorded at a 50 μg mL^{-1} concentration of *Pm*-ZnO NPs, where the zones of inhibition were measured as 31.4 ± 2.8 mm & 33.5 ± 0.8 mm, respectively. *Pm*-ZnO NPs inhibited the growth of bacteria *E. faecalis* and *P. aeruginosa* at a minimum concentration of 30 μg mL^{-1}. Inverted microscopic images revealed that *Pm*-ZnO NPs diminished bacterial biofilm thickness at 50 and 100 μg mL^{-1}. The biocompatibility of *Pm*-ZnO NPs was examined by potential antioxidant properties (DPPH assay). Biotoxicity values of *Pm*-ZnO NPs were determined as LC_{50} – 76.5 (68.7–86.4) μg mL^{-1} and LC_{90} – 153.4 (132.4–189.6) μg mL^{-1} on 48 h treatment with *Artemia salina* nauplii and damages in the mid-gut region were examined under a stereomicroscope. *Pm*-ZnO NPs exhibited photocatalytic activity at 48 h duration against methylene blue (MB) dye. Concludingly, all the reported findings suggest the utilization of these generated nanoparticles as nanomedicine against microbial infection.

1. Introduction

Human health is at risk, due to emerging of new alerts involving infectious microbial diseases [1]. Among several microbial infections, the disease caused by multi-drug resistant (MDR) bacteria is considered the most challenging task by medical practitioners and researchers focused on finding a permanent solution to cure those infections. Resistance is the consequence of the overuse of various antibiotics in clinical medicines that provoked the generation of MDR strains of bacterial pathogens [2]. *Enterococcus faecalis* is a Gram-positive facultative anaerobic bacterium that colonises the human mouth cavity and gastrointestinal system [3]. *E. faecalis* resistant to vancomycin is commonly a urinary tract infectious pathogen that infects the endocardium, bloodstream, biliary tract, abdomen and burns wounds [4–6]. Similarly, *Pseudomonas aeruginosa*, a Gram-negative bacterium, is an opportunistic infectious disease in immunocompromised people and causes nosocomial infections that are resistant to various medications, such as cephalosporins and penicillin carbapenems, cephamycins and cefepime [7–10]. Hence, an urge to design a bactericide against these two dangerous MDR pathogens is essential.

The interdisciplinary field “Nanopharmacology” incorporates nanotechnology and medicine to assist disease diagnosis, drug delivery,

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Swift synthesis of zinc oxide nanoparticles using unripe fruit extract of *Pergularia daemia*: An enhanced and eco-friendly control agent against Zika virus vector *Aedes aegypti*

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ARTICLE INFO

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Green synthesis
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ABSTRACT

In this study *Pergularia daemia* unripe fruits were used to synthesize zinc oxide nanoparticles (*Pd*-ZnONPs). UV-vis Spectroscopy detected the production of ZnONPs. XRD, FTIR, SEM, and TEM studies were used to characterize the synthesized *Pd*-ZnONPs. *Aedes aegypti* (*Ae. aegypti*) third instar larvae were analyzed to diverse concentrations of *Pd*-unripe fruit extract and *Pd*-ZnONPs for 24 hours to assess the larvicidal effect. Mortality was also detected in *Ae. aegypti* larvae under laboratory conditions, with corresponding LC_{50} and LC_{90} values of 11.11 and 21.20 μg/ml respectively. As a result of this study, the levels of total proteins, esterases, acetylcholine esterase, and phosphatase enzymes in the third instar larvae of *Ae. aegypti* were significantly lower than the control. These findings suggest that *Pd*-ZnONPs could be used to suppress mosquito larval populations.

1. Introduction

Along with its ecological and physiological flexibility, the *Ae. aegypti* mosquito is now acknowledged as the world's most common invasive mosquito, spreading its range through consignments of bamboos, wet shrubbery and water containers, the worldwide commerce of used tires (Benelli and Govindarajan, 2017; Govindarajan, 2017; Fahimmunisha et al., 2020). Dengue control requires a reduction in *Ae. aegypti* populations (WHO, 2012). Dengue fever is the majority universal mosquito-borne viral disease, disturbing nearly a quarter of the world population and spreading rapidly (WHO, 2016). Mosquito populations have developed resistance to synthetic chemical pesticides, which can have unintended consequences for beneficial non-target creatures (Melo-Santos et al., 2010; Govindarajan, 2011a,b; Govindarajan and Benelli, 2016, 2017).

Due to their cheap cost and limited cross-resistance, natural insecticides have been studied for their larvicidal effects on *Ae. aegypti* resistant lines (Govindarajan et al., 2005; Braga and Valle, 2007; Sim et al., 2007). Insects' acetylcholinesterase and detoxifying enzymes have been tested for inhibitory effects on green plants' larvicidal function to find synergists for commonly used pesticides (Larson et al., 2010; Maheswaran and Ignacimuthu, 2012). Due to their eco-friendly qualities and great biodegradability they have recently become a viable alternative for vector control via plant secondary metabolites (Mathivanan et al., 2010; Govindarajan and Sivakumar, 2012; Benelli, 2015; Govindarajan et al., 2016a). *Pergularia daemia* (*P. daemia*) (Forssk.) Chiov. is a milky plant of the Asclepiadaceae family (Pankaj, 2003). *P. daemia*, also called as "Veliparuthi" in Tamil, is used to cure infantile diarrhea and malarial intermittent fevers (Kirtikar and Basu, 1999; Nadkarani, 1976). Phytochemicals like cardenolides, alkaloids, and saponins have been

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Azadirachta indica-wrapped copper oxide nanoparticles as a novel functional material in cardiomyocyte cells: An ecotoxicity assessment on the embryonic development of *Danio rerio*

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ABSTRACT

This research reports on the production of copper oxide nanoparticles (CuO NPs) through the green synthesis method using *Azadirachta indica* (*Ai*) flower extract. Synthesized *Ai*-CuO NPs are characterized by Zeta Potential, TGA, SEM and TEM analysis. The *Ai*-CuO NPs gave a maximum peak at 270 nm. As per XRD studies, the *Ai*-CuO NPs obtained were crystalline. FTIR spectrum *Ai*-CuO NPs showed the presence of functional groups like the O–H group, aromatic group, etc. TEM and SEM assist in investigating the size and morphology of the *Ai*-CuO NPs, which were spherical and varied in size between 10.11 nm and 17.54 nm. EDAX showed that *Ai*-CuO NPs were pure with no impurities. The synthesized *Ai*-CuO NPs were then analyzed for their cytotoxicity at various concentrations (5, 10, 20, 30, 40 and 50 μg/mL) against H9c2 cardiomyocyte cells using MTT assay. DOX-induced H9c2 cell damage of apoptosis and ROS. The nanoparticle formed by *Ai*-CuO was cured with different concentrations (5, 10 and 20 μg/mL). In zebrafish, 48 hpf and 72 hpf were measured at 75 μM to reduce dysfunction and mortality during organ development. These results can have a beneficial impact on eco-toxicological effects.

1. Introduction

Nanoparticles are ultra-fine inorganic particles existing in the natural world surrounding an interfacial layer created by human activities (Batista et al., 2015; Benelli and Govindarajan, 2017; Balalakshmi et al., 2017). They are defined as solid particles with a size in the range of 10–100 nm that shows particulate dispersions (Mohanraj and Chen., 2006; Govindarajan and Benelli, 2017; Ishwarya et al., 2017; Fahimmunisha et al., 2020). Biotechnology scientists have shown proven biology and material science (De et al., 2008; Suganya et al., 2017; Thaya et al., 2018; Vinotha et al., 2019). The applications of nanoparticles, mainly in medical nanotechnology, provide enormous opportunities (Gao et al., 2009). This may eventually include protein and peptide delivery, drug delivery, nanoparticle targeting, medical surgeries and endo visualizations, whereas the similar term biomedical nanotechnology is used in the biomedical sector (Ahmed et al., 2012). Since these nanoparticles provide a large surface area to the volume ratio, they also exemplify magnetic and optic roles in biology and sensing and catalysts. Compared to any other bulk materials, they can be considered as potentials regarding in antimicrobial and anticancer drugs (Prakash et al., 2018). Some applications include semiconductor doping such as antimicrobial agents, chemical sensors and anticancer (Karthika

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Original Article

Synthesis of Cu-MOF/CeO_2 nanocomposite and their evaluation of hydrogen production and cytotoxic activity

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ABSTRACT

In this investigation, new composites of cerium oxide were incorporated in the copper-based metal–organic framework using trimesic acid by the precipitation method. Synthesized Cu-MOF/CeO_2 nanocomposite is characterized by numerous analytical methods to interpret their structure, morphology, and thermal behaviour. Surface micrograph analysis revealed that spherical particles and cerium oxide nanoparticles are embedded in the Cu-MOF matrix. The prepared nanocomposite shows a lesser onset potential and overpotential with a high current density (18.6 mA cm^{-2}). The Cu-MOF/CeO_2 composite exhibits a small Tafel slope of 54.6 mV dec^{-1} and suggests that the hydrogen evolution reaction follows the Heyrovsky mechanism. On the other hand, five different MOF/CeO_2 nanocomposite concentrations were tested on a human osteosarcoma cell line (MG63). The 50% cell mortality was observed at 97.9 μg/ml and it proved less cytotoxicity effect with better biocompatibility. Thus, overall results showed that the nanocomposite as an

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SURVEY OF MARINE TOURISM AND AROUND NAGAPATTINAM DISTRICT – A STATISTICAL ANALYSIS

Abstract

The Marine tourism industry has different characteristics and it has a hospitality business. This study examines the various components of socio-economic and coastal tourism in Nagapattinam, Tamil Nadu and the perception of tourism people about the ecological status of tourism. The researcher concluded that the primary data from the 150 respondents in the study area were obtained through interview methods, as well as using statistical tools such as SPSS techniques and frequency and communication. The findings of the study suggest that it is necessary to make the contribution and growth of residents more sustainable.

Keywords- Coastal Tourism, Socio-Economic, Environment, Development.

1. Introduction

Tourism is one of the largest industries in the world. The coastline of Tamil Nadu is about 1076 kms, which is 15% of the total coastline of India, stretching along the Bay of Bengal, the Indian Ocean and the Arabian Sea. It is one of the longest coastlines of 187.9 kms and the second longest coastline. One of the most common types of tourism is coastal tourism. It is strongly dependent on natural and cultural aspects. Coastal tourism has become the main face of modern life. Coastal tourism is a process that attracts tourists, especially coastal ecosystems. Most coastal tourism takes place on the coast and in the immediate vicinity of the coast. The growth of tourism in general and in coastal areas in particular is related to three main factors: increased personal incomes, leisure time and improvements in transportation system and greater public awareness of world destinations due to improved communications (EEA, 2001). We can examine the interdependent relationships between tourism and the environment in terms of the interaction of the visitor, the place and the host community (UNWTO, 2004). Sustainability principles refer to the environmental, economic and socio-economic aspects of tourism development and a suitable balance must be established between these three dimensions to guarantee its long-term sustainability (UNEP & UNWTO, 2005). This growth, which has reached it is peak in recent decades exert pressures on the environmental and cultural resources of coastal areas patterns of tourist destinations (Marina & Alessio, 2009).

2. Study area

The present study area is located in the eastern part of Tamil Nadu and Nagapattinam is one of the coastal districts of the state. It is a peninsular delta district, bordered on the east by the Bay of Bengal, on the south by the Balk Strait and coastal plain land on the west and north. The district is geographically located between 10° 10' and 11° 50' North latitude and between 79° 30' and 79° 50' East longitude. The total

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Synthesis and physicochemical characteristics of Ag-doped hydroxyapatite nanoparticles, and their potential biomedical applications

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ABSTRACT

In this present scenario, hydroxyapatite (HAp) nanostructures were synthesized through green routes for biomedical applications, particularly remediation towards human pathogens and cancer cells. The present study aims at forming non-toxic and eco-friendly silver (Ag^{+}) doped HAp using Polyethylene glycol (PEG), Cetyl Trimethyl ammonium bromide (CTAB) and curcumin. Ag^{+} doped HAp nanoparticles (NPs) were prepared by the sol-gel method with a cube and rod-like morphology. Ag-HApNPs showed a sharp and well-defined diffraction peak, which possesses the hexagonal crystalline structure with space group $P6_3/m$. The Fourier-transform infrared spectroscopy and Raman spectra confirmed the formation of Ag-HApNPs, and the bandgap values were obtained using UV-DRS analysis. The Ag-HApNPs with PEG, CTAB and curcumin might be fabricated materials were examined against antibacterial, antifungal, antioxidant, and cytotoxic activities, which provided exemplary biomedical applications. Overall, Ag-HApNPs can be used as potential drug delivery and perspectives to control multidrug-resistant pathogens.

1. Introduction

Recently, the application of nanomaterials in biomedical aspects (Govindarajan et al., 2016; Govindarajan and Benelli, 2017; Ishwarya et al., 2017; Chi et al., 2022; Das et al., 2022) considerably increased by their novelty of physicochemical properties and it has been intensively analyzed due to their peculiar properties and high human osseous tissue similarity (Turkoz et al., 2013; Suganya et al., 2017; Shen et al., 2017; Balalakshmi et al., 2017). A revolution has arisen in using bioceramics to enhance human life quality during the last fifty years. The biocompatibility of calcium phosphate-based bioceramics, such as hydroxyapatite (HAp), is the key factor for dental and orthopedic applications (Fakharzadeh et al., 2017). Hydroxyapatite is a significant biocompatible and osteoconductive substance with finite antibacterial resistance (Khalili et al., 2017). Properties of HAp can be enhanced by substituting some cations, including Ag^{+}, Sr^{2+}, Mg^{2+}, Zn^{2+}, Ce^{3+}, La^{3+}, Y^{3+} and Gd^{3+} into hydroxyapatite lattice (Kalita et al., 2004; Pietak et al., 2007; Bang et al., 2011; Suganthi et al., 2011; Webster et al., 2004; Ahymah Joshy et al., 2011; Yasukawa et al., 2012a,b; Yang et al., 2008) which leads to enhance the biological properties. Many techniques were adopted for the synthesis of monovalent and divalent doped HAp, which includes co-precipitation (Paluszkiewicz et al., 2010; Dubnika et al.,

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Toxicity evaluation of polypropylene microplastic on marine microcrustacean *Artemia salina*: An analysis of implications and vulnerability

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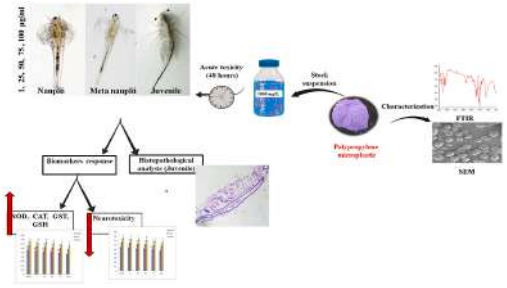
HIGHLIGHTS

- Various life stages of *Artemia* easily intake polypropylene microplastics (11–44 μm).
- Microplastics were accumulated in their track, triggering the redox-hemostasis.
- Microplastic consumption disturbs the antioxidant biomarkers and neurotransmitter activity.
- Mortality was observed in nauplii & *meta*-naupili; in juveniles, only behaviour changes.
- Morphological analysis of the juvenile intestinal epithelial layer was damaged.

GRAPHICAL ABSTRACT



ARTICLE INFO

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Keywords:
Microplastics
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Biomarkers
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ABSTRACT

Polypropylene microplastic particles are one of the predominant pollutants in marine ecosystems and their toxic effects are unknown in aquatic biota. The study aims to prepare the spherical shaped polypropylene microplastics (size range 11.86 μm–44.62 μm) and assess their toxic effects (1, 25, 50, 75 and 100 μg/mL) in various life stages (nauplii, metanauplii and juvenile) of marine microcrustacean *Artemia salina* within 48 h. In addition, microplastics ingestion by *Artemia* nauplii was proved by FTIR analysis. The results revealed, microplastics accumulation in their tract leads to change in their homeostasis, as followed increase in the oxidative burst causes mortality in nauplii (LC_{50} 40.947 μg/mL) and meta nauplii (LC_{50} 51.954 μg/mL). In juvenile, swimming behaviour was changed. Moreover, microplastic consumption disturbs the antioxidant biomarkers such as superoxide dismutase (SOD), catalase (CAT), reduced glutathione (GSH), glutathione –S- Transferase (GST) and

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Research Article

Facile synthesis of silver nanoparticles using the *Simarouba glauca* leaf extract and their impact on biological outcomes: A novel perspective for nano-drug development

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Keywords:
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ABSTRACT

Nowadays, novel green metal-based nanoparticles are receiving global research interest for their potential utilization in several fields, including the formation of nanoparticles for medical treatment. This work reports a synthesis of silver nanoparticles (AgNPs) using *Simarouba glauca* (*Sg*). The obtained *Sg*-AgNPs were characterized by UV–visible, FTIR, XRD and SEM. Furthermore, the biological properties of synthesized *Sg*-AgNPs were investigated for reverse mutation, antimicrobial properties, biofilm analysis, hemolytic activities, DNA fragmentation and MTT assay on HeLa cells. The results revealed a biological efficacy of *Sg*-AgNPs between 25 and 400 μg/mL concentrations. They showed excellent permeability and a promising drug delivery medium.

1. Introduction

As evidenced by the new vaccine against malaria containing a saponin derived from the bark of *Quillaja saponaria*, plants are a fundamental source of new medical drugs, including treatments for HIV and cancer [1,2]. Besides the activity, the form and the adequate size are key aspects in the delivery and possibility of interacting at the molecular level [3,4]. Due to their size-based properties, nanomaterials have been proposed in different applications [5]. *Simarouba glauca* DC. (*Sg*), commonly known as the Paradise tree, has shown a potential aid in the treatment of different types of cancer [6–8]. Previously, the *Sg* chemical constituents were determined and their biological activities investigated [9–12]. In particular, *Sg* leaf extract contains active cytotoxic polyphenols, such as tannins, gallic acid, protocatechuic acid and caffeic acid dimethyl ether [13]. The *Sg* extracts were tested for various biological applications in cancer and microbial inhibition [14]. This study reports the utilization of *Sg* for bio-catalytic reduction reaction of silver nitrate to silver nanoparticles, whose properties were investigated.

Due to their reduced size, novel metal nanoparticles (NPs) expose suitable biological properties [15–18], such as anti-viral, anti-cancer, antibacterial, antifungal and larvicidal applications [19–23]. The facile preparation of *Sg* mediated green-synthesized (*Sg*-AgNPs) is described. The obtained nanoparticles were tested against different microorganisms, biofilm analysis, hemolytic activity, DNA fragmentation, and MTT assay on HeLa cells as part of the thorough screening.

Sg-AgNPs were obtained using microwave energy in the presence of

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Article

Interplay between Binary and Three-Body Interactions and Enhancement of Stability in Trapless Dipolar Bose–Einstein Condensates

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Abstract: We investigate the nonlocal Gross–Pitaevskii (GP) equation with long-range dipole-dipole and contact interactions (including binary and three-body collisions). We address the impact of the three-body interaction on stabilizing trapless dipolar Bose–Einstein condensates (BECs). It is found that the dipolar BECs exhibit stability not only for the usual combination of attractive binary and repulsive three-body interactions, but also for the case when these terms have opposite signs. The trapless stability of the dipolar BECs may be further enhanced by time-periodic modulation of the three-body interaction imposed by means of Feshbach resonance. The results are produced analytically using the variational approach and confirmed by numerical simulations.

Keywords: Bose–Einstein condensates; Gross–Pitaevskii equation; dipole-dipole interaction; variational method; Runge–Kutta method; Crank–Nicolson method

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1. Introduction

The advent of Bose–Einstein condensates (BECs) in ^{52}Cr [1,2], ^{164}Dy [3,4] and ^{168}Er [5] accompanied by long-range dipole-dipole (DD) interactions superimposed on the contact inter-atomic collisions has impacted the investigation of ultracold quantum gases [6]. The anisotropic character and long-range nature of DD interactions endows the dipolar BECs (DBECs) with several distinct features such as the subordination of stability on the trap geometry [1,2], roton-maxon character of the excitation spectrum [7,8], new dispersion relations for elementary excitations [9,10], novel quantum phases [11,12], explicit [13,14] and hidden vortices [15], specific vortex-antivortex pairs [16], anisotropic multidimensional solitons [17,18], quantum droplets stabilized by beyond-mean-field effects [19–21], etc. The above phenomena arise due to the interplay between the contact *s*-wave interactions and the dipolar attraction or repulsion [22]. Tuning contact interactions by means of the Feshbach resonance is an important tool in analyzing the properties of DBECs [7,8]. In particular, DBECs with pure long-range interactions can be made by tuning the contact interactions to zero.

The theoretical description of a dilute weakly interacting DBEC is based on the Gross–Pitaevskii (GP) equation with the nonlocal DD-interaction term [1,2,23–25]. In particular, the combination of local and nonlocal terms in the GP equation can support various species of bright and dark matter-wave solitons. In the alkali BECs, bright solitons exist when the negative (attractive) contact interaction exactly balances the dispersion (kinetic-energy) term [26,27]. In DBEC, the nonlocal DD interaction term may reinforce local ones originating from the *s*-wave contact interaction. DD interactions are strongest in the atomic condensates

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Analysis of Socio, Economic Impact on Tourism Development in Nagapattinam District using in SPSS

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ABSTRACT

The present paper analyze about the tourism of Nagapattinam district with various dimensions. "Coastal and marine tourism includes those recreational activities which involve travel away from one's place of residence which have as their host or focus the marine environment and/or the coastal zone." ICMTS.The present study analyzed using the Simple statistical methods, Chi square Test, ANOVA Test and SPSS Factor analysis. Nagapattinam is a developing district and it also a major pilgrimage centre for Hindu, Christians and Muslim. So the district has the religious values. It also having the coastal tourist spots of Kodiyakkarai, Tharangambadi, Poombuhar and Velankanni. From the findings there is significant development in economy of Nagapattinam district due to tourism. In general, Nagappatiinam district has enormous the potential to attract tourists which will generate employment opportunities economic status of the people.

Key words: *Tourism, Development, Determining factors, social impact.*

INTRODUCTION:

Tourism is a Major industry and it plays a essential role in the economic progress of a country. It gives immense pleasure to the people. So people desire to seen various places and have interest to see different places. The number of Foreign Tourist Arrivals (FTAs) in India during 2018 increased to 10.56 million as compared to 10.04 million in 2017. The growth rate in FTAs during 2018 over 2017 was 5.2% as compared to 14.0% during 2017 over 2016 (India Tourism Statistics 2019. According to India Tourism Statistics 2019,"Tourism continues to play an important role as a foreign exchange earner for the country. In 2018, foreign exchange earnings (FEE) from tourism were US$ 28.59 billion as compared to US$ 27.31 billion in 2017, registering a growth of 4.7%." According to United Nations World Tourism Organization (2020, "Travel as the activity of moving between different locations offense for any purpose but more so for

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Molecular interaction analysis of β-1, 3 glucan binding protein with *Bacillus licheniformis* and evaluation of its immunostimulant property in *Oreochromis mossambicus*

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ABSTRACT

Analyzing the health benefits of any two immunostimulants (synbiotics) in combined form and information on their interactions gain more visibility in the usage of synbiotics in aquafarms. With this intention, the current work explores the immunostimulant effect and structural interaction of synbiotic (β-1, 3 glucan binding protein from marine crab, *Portunus pelagicus* (*Pp*β-GBP) and *Bacillus licheniformis*) on *Oreochromis mossambicus*. The experimental diet was prepared with *Pp*β-GBP and *B. licheniformis*, and nourished to the fingerlings of *O. mossambicus* for 30 days. After the experimental trial, a higher growth rate and immune reactions (lysozyme, protease, myeloperoxidase and alkaline phosphatase activity) were noticed in the fish nourished with synbiotic (*B. licheniformis* and *Pp*β-GBP) enriched diet. Moreover, the synbiotic enriched diet elevated the antioxidant responses like glutathione peroxidase (GSH-Px) and catalase (CAT) activity in the experimental diet-nurtured fish. At the end of the feed trial, synbiotic diet nourished fish shows an increased survival rate during *Aeromonas hydrophila* infection, reflecting the disease resistance potential of experimental fish. Also, the interaction between *Pp*β-GBP and *Bacillus licheniformis* was analyzed through computational approaches. The results evidenced that, *Pp*β-GBP interacts with the *B. licheniformis* through sugar-based ligand, β-glucan through a hydrogen bond with a good docking score. Thus, the synbiotic diet would be an effective immunostimulant to strengthen the fish immune system for better productivity.

1. Introduction

Currently, disease appearance in aquaculture and the development of antibiotic-resistant genes in pathogenic microorganisms become a significant hindrance towards aquaculture production. Fish culture under a restricted environment (intensive farming) creates stress conditions that weaken the immune system and makes the animal more prone to infectious disease-causing microbes. An innovative feeding method is one of the left practices employed in aqua farming by feed manufacturers and farmers to attain better growth in cultured fish [1]. Immunostimulants are harmless and beneficial bio-agents administered to farming animals (intensive or extensive) to prevent the entry of infectious microbes and improve the growth rate of the cultured organisms. Supplementation of immunostimulants such as probiotics,

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Research Article

Balachandran Kartha, Kalaivani Thanikachalam, Natesan Vijayakumar*, Naiyf S. Alharbi, Shine Kadaikunnan, Jamal M. Khaled, Kasi Gopinath, and Marimuthu Govindarajan*

Synthesis and characterization of Ce-doped TiO_2 nanoparticles and their enhanced anticancer activity in Y79 retinoblastoma cancer cells

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Abstract: Rare earth metal cerium-doped titania nanoparticles (titanium dioxide [TiO_2]) were produced utilizing a low-cost and straightforward sol–gel technique, and its enhanced photodynamic anticancer activity was tested on Y79 retinoblastoma cancer cells. The structural, optical, morphological, anticancer activity, and cytotoxicity of pure and cerium-doped TiO_2 (Ce-doped TiO_2) were investigated. In X-ray diffraction (XRD) measurements, apparent doping of cerium in TiO_2 was detected, with reported anatase patterns shifting toward a lower angle in the anatase structure. Raman spectra verify the presence of cerium doping in TiO_2 by revealing greater wave number shifting. The scanning electron microscope (SEM) and transmission electron microscope (TEM) analysis showed that the synthesized TiO_2 and Ce-doped TiO_2 nearly spherical. TiO_2 and Ce-doped TiO_2 were studied for their photodynamic anticancer activities, and the results suggest that cerium doping in TiO_2 improves anticancer activity.

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Keywords: cerium, nanocomposites, TiO_2, TEM, cytotoxicity

1 Introduction

Due to their innovative biological applications, semiconductor nanostructures with diameters smaller than 100 nm have emerged as nanobiomaterials [1,2]. In recent years, a wide range of nanocomposite semiconductor materials has been created to increase the photocatalytic activity efficiency [3,4]. By covering metal or semiconductors nanoclusters with some other layer of appropriate materials, the functional characteristics of such materials can be substantially enhanced [5,6].

Titanium dioxide (TiO_2) has been extensively used and demonstrated as a critical perspective photosensitizer [7–9], photostability, low cost, and nontoxicity. According to a recent study, the particle size of TiO_2 has a significant impact on its photocatalytic activity [10]. The reduction in particle size suggests an increase in surface area and a high redox potential, resulting in a strong photocatalytic activity.

Several methods, including doping, surface modification with metal particles, and particle size reduction to the nanoscale, have been proposed to increase the effectiveness of photocatalytic reactions utilizing TiO_2 when exposed to visible light [11]. Chemically modified TiO_2 nanoparticles are used in several environmental applications due to their self-cleaning properties [12,13]. Because of their nontoxicity, excellent optical absorption, cheap cost, and good chemical stability, metal and metal oxide nanoparticles have been widely investigated [14–19]. Among them, the medical applications of TiO_2 are undeniably promising, with the potential to significantly enhance health care, notably cancer therapy. Doping of Ce in TiO_2 enhances the photocatalysis and photodegradation of TiO_2 [20].

Sol–gel, direct aqueous solution depositions, ultrasonic spray pyrolysis, and sputtering are some of the

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β-1,3-Glucan binding protein-based silver nanoparticles enhance the wound healing potential and disease resistance in *Oreochromis mossambicus* against *Aeromonas hydrophilla*

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ARTICLE INFO

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ABSTRACT

Here we attempted to synthesize β-1,3-glucan binding protein-based silver nanoparticles (*Ph*β-GBP-AgNPs) and evaluate its wound healing and disease resistance prompting ability in *Oreochromis mossambicus*. Using a column chromatography technique, an immune molecule, *Ph*β-GBP was purified from the haemolymph of rice field crab, *Paratelphusa hydrodromus*. *Ph*β-GBP-AgNPs were synthesized and described through SDS-PAGE, UV–vis spectroscopy, HR-TEM, XRD and FTIR analysis. HR-TEM revealed that the synthesized *Ph*β-GBP-AgNPs were spherical with a 20–40 nm size range and the particles were not aggregated. Wound and infection were experimentally generated in *O. mossambicus* and treated with *Ph*β-GBP, chem-AgNPs and *Ph*β-GBP-AgNPs for 20 days. The immune parameters (peroxidase, lysozyme and protease) and antioxidant enzymes (SOD and catalase) were examined in the serum of experimental fish. *Ph*β-GBP-AgNPs elevated the immune and antioxidant enzymes during the healing process and enhanced the wound healing percentage in fish than *Ph*β-GBP and chem-AgNPs. The immune parameters and antioxidant enzymes were declined in the serum of fish (treated with *Ph*β-GBP-AgNPs) after the mid-period of wound healing. Compared to others, relative percentage survival was increased in experimentally wounded and infected fish treated with Phβ-GBP-AgNPs against *Aeromonas hydrophila*. Moreover, *Ph*β-GBP-AgNPs exhibited less toxicity towards *Artemia salina* than chem-AgNPs during 24 h exposure period. As a result, *Ph*β-GBP-AgNPs may act as an alternative to commercial antibiotics and be considered an effective immunostimulant in treating skin lesions in intensive farming.

1. Introduction

Aquaculture is the fastest expanding food sector that supplies protein-rich food to meet the protein requirement for the growing population. Increased demand for protein leads to overfishing from wild sources results in unbalanced fish species [1]. Aquaculture introduces extensive and intensive fish farming to maintain the fish diversity in the wild from underbalanced conditions and meet the protein demand. Intensive fish farming is highly practiced to increase fish production in a controlled area with regular aeration, water and food supply [2]. However, stress, disease, skin lesions are more prevalent in an intensive type of fish farming due to many fish populations [3]. Fish farmed in the intensive culture was more prone to skin damage, which may cause due to handling, transportation and infections [4,5]. Skin acts as a primary barrier against pathogens and its damage results in secondary infections caused by microorganisms. Infected or injured fish affect the wealth of

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Changes in the contour of karyology and histoarchitecture of the primary respiratory organ in the fish *Oreochromis mossambicus* (Peters, 1852) inhabiting the polluted estuarine ecosystem

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ABSTRACT

The wetland ecosystem (WE) is subject to pollution by many anthropogenic activities, including domestic and industrial effluents. These effluents may contain toxic heavy metals that can interact within the aquatic ecosystem and have a capacity to disturb the metabolic activities, histological profile, and genetic structure and functions in aquatic species inhabiting the environment. The present study observed the karyological and histological alterations in gills of the freshwater fish, Mozambique tilapia, *Oreochromis mossambicus* in two different sublethal concentrations (1% and 3%) of heavy metals in 7, 15, and 30 days of experimental periods. The heavy metals induced various structural damages such as ring chromosome, sister chromatid exchange, acrocentric association region, condensed chromosomal morphology, heterochromatin region, and nucleolar organizer region in the chromosomes of *O. mossambicus* treated with 1% and 3% sublethal concentrations of water sample collected from Pallikaranai wetland ecosystem. Gills exposed to 1% and 3% effluent exhibited several variations in the respiratory surfaces of gill arches or lamellae in the light and scanning microscopical study. The gills exposed to 1% concentration for 30 days showed marked necrosis, and the secondary lamellae showed the lamellar membrane's dissolution. Exposure of gills to raw effluent in the field condition was observed in the presence of Cd, Pb, Cr, Cu, and Zn. Thus, this present study shows the environmental deterioration by heavy metal pollution on the structure of the gills in tilapia.

1. Introduction

The aquatic and terrestrial regions are highly polluted by various anthropogenic activities, including domestic and industrial effluents, untreated dangerous chemicals, agricultural runoffs, and others (Maurya et al., 2019; Rezania et al., 2021). Major cities in India produce thousands of tons of effluents daily that get dumped in ecologically sensitive areas like streams, ponds, lakes, riverbanks, wetlands, and seashores (Jayaprakash et al., 2010). During the past five decades, ninety percent of Pallikaranai wetland was lost due to dumping, inhabiting, and city development (Vencatesan et al., 2014). Chennai city produces 3500 tons of waste materials every day, and about 55–60% of waste is dumped around the Pallikaranai wetland ecosystem. These waste materials contain exceedingly toxic heavy metals like Chromium (Cr), Cadmium (Cd), Copper (Cu), Zink (Zn), Arsenic (As), Mercury (Hg), Nickel (Ni), lead (Pb) (Punitha et al., 2018), that can interact with aquatics residents of the region and disturb their metabolic activities, histology and genetic structure and function in aquatic animals. As heavy metals cannot degrade or be destroyed, they severely damage the ecosystem due to the toxicity persistence, accumulation ability, and bio-magnification in the food chain (Georgieva et al., 2016).

Different fish species are widely used for different toxicity studies for

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Original article

DNA barcoding of waterbirds: A novel technique in environmental conservation biology

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ABSTRACT

Cytochrome *c* oxidase I (COI) is one of the mitochondrial genes, an excellent marker used for the DNA barcoding of various organisms. The COI was isolated from twelve different species of waterbirds using the Gene Elute DNA miniprep Kit. The relationship among the waterbirds was assessed by making a phylogenetic tree with the software MEGA-X. The phylogenetic tree's dendrogram showed two main branches in which seven species of water birds aligned one group with four subgroups and the remaining five species aligned with two subgroups based on their similar COI sequences. The Little egret showed 96% similarity with the Cattle egret, Purple heron and Oriental Darter produced 94% similarity with the Grey heron, pond heron shared 90% similarity with the Black-crowned night heron, Asian openbill shared 89% with Pheasant-tailed Jacana and the Common coot 94% similarity with White-breasted waterhen. The pond heron and the Black-crowned night heron showed zero % pairwise distance, but the Cattle egret, Little egret, Oriental Darter, Purple heron and Grey heron showed < 0.29%. However, the other seven species of water birds showed > 12% of the pairwise distance. Twenty-one conserved haplotypes have been shown in their COI sequences based on the multiple sequences alignment. DNA barcoding identifies the species with their genetic property rather than based on their ecology and behvaviour.

1. Introduction

Generally, the taxonomists identify the avian species based on their field characters and behavior, in which several masked and similar morphological species have shown distinct species, based on the DNA barcoding techniques (Hebert et al., 2004). Nevertheless, millions of species are yet to be described and identified because expertise in avian taxonomy amongst zoologists is dwindling globally. DNA barcoding is a practical and modern tool for taxonomists who are endowed with preparing inventory and management recommendations of the vast and altering earth biodiversity.

Indeed Hebert et al. (2004) published an article on the barcoding of birds in Central American birds using the COI gene. He has made a breakthrough in taxonomy, wherein mitochondrial DNA, rather than nuclear DNA, formed another most attractive and remarkable protocol in the molecular taxonomy of species by using a novel gene called Cytochrome *c* Oxidase I (COI). Globally, after Hebert's publication in 2004, several studies have been made and documented the species diversity based on COI, for example, Eurasian birds (Zink et al., 2008), Korean birds (Yoo et al., 2006), Kingfishers (Moyle et al., 2007), Palearctic birds (Kerr et al., 2009a), Scandinavian birds (Johnsen et al., 2010), Marine biodiversity

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Original article

Green synthesis of zinc oxide nanoparticles using *Anoectochilus elatus*, and their biomedical applications

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ABSTRACT

Zinc and its derivatives requirement increased to enhance human immunity against the different pandemics, including covid-19. Green synthesis is an emerging field of research. Zinc oxide (ZnO) nanoparticles have been prepared from *Anoectochilus elatus* and characterized using absorption, vibrational and electron microscope analysis. They were carried for antibacterial, inflammatory control tendency, and potential antioxidant activities. The brine shrimp lethal assay tested the biologically derived nanomaterial toxicity and the lethal concentration (LC_{50}) is 599.79 μg/ml. The inhibition against the important disease-causing pathogens was measured against four-gram negative, gram-positive bacteria and two fungus pathogens. The nanomaterial exposed inhibition zone for gram-positive bacteria between 17 mm and 25 mm. The inhibition zone against gram-negative bacteria exists between 19 mm and 24 mm. The anti-inflammatory activity was assessed by inhibition of protein denaturation and protease inhibitory activity using nanomaterial. The antioxidant activity was examined using four assays for the therapeutic activities. The average size range of 60–80 nm nanoparticles has prepared and exposed the good biological activity between 50 μg/ml and 100 μg/ml. The comparative results of anti-inflammatory and antioxidant assay results with standards such as Aspirin and vitamin C exposed that two to three times higher concentrations are required for the fifty percent of inhibitions. The prepared low-cost nanoparticle has exhibited excellent biological activity without any side effects and may enhance immunity.

1. Introduction

Green synthesis has received more attention for various applications because of the low-cost, eco-friendly, safe nanoparticles (NPs) preparation (Govindarajan et al., 2016a,b; Govindarajan and Benelli, 2017; Balalakshmi et al., 2017; Suganya et al., 2017; Balasooriya et al., 2017). Due to the size and shape of the nanomaterials, they have shown various applications in medicinal fields (Narayanan and Sakthivel, 2011). Synthesis of new molecules using the biosynthetic technique is a growing field and the method using bio-extracts has expected more responsiveness than chemical and physical methods for the nanomaterial preparation (Iravani, 2011).

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Molecular docking and network pharmacology-based approaches to explore the potential of terpenoids for Mycobacterium tuberculosis

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ABSTRACT

Objective: Mycobacterium tuberculosis (Mtb) infection is quickly countered by the host immune system; but, the pathogen is never eradicated. In this infection, 10% of infections are considered as open tuberculosis, while the remaining 90% are becoming latent, a state that can persist in the host for decades until immune control is lost. To date, more than 350 plant species have been studied in mycobacterial research.

Methods: In this research, we used a mixture of software and database explorations to find the anti-mycobacterial possibilities of phytoconstituents. Maestro v12.7 and Cytoscape v3.8.0 were applied as software. In addition, the String v11.0, KEGG, Reactome and Pass Server databases assisted us in understanding TB cellular processes and phytoconstituent drug possibilities.

Results: The racemosol and pacharin have registered higher docking scores of 7.823 and -7.715 respectively. Furthermore, these compounds have substantial binding affinities in the active pocket of Mtb, and their docking metrics have consisted close to that of an approved drug (Rifampin). The network pharmacological exploration is also revealed possible connections with all of the TB-associated genes and other important signaling pathways.

Conclusions: This computational study found that racemosol and pacharin were the safest anti-mycobacterial drugs for tuberculosis. Following comprehensive research of the pharmacological properties of racemosol and pacharin, we decided that this would be the first study to focus on anti-mycobacterial activity utilizing those compounds. Also, we believe that racemsosol and pacharin compounds will reveal potential actions when used in mycobacterial research. Furthermore, the derivatives of these compounds will be acted as possible drugs for tuberculosis and associated diseases. More pharmacological and toxicological explorations are required to have a better understanding of these compounds.

1. Introduction

Mycobacterium tuberculosis (Mtb) is the bacteria that cause Tuberculosis (TB). It is considered to be the world's lethal infectious disease agent and leads to cause high fatality rate in developing countries including South-East Asia, India, Africa, Western Pacific, Indonesia, China, Eastern Mediterranean, Philippines, Pakistan, Nigeria, Bangladesh, South Africa, America and Europe [1]. This bacterium spreads extremely faster when there are a huge number of people present, as well as in situations of starvation and poverty [2]. It primarily infects the respiratory system of people. In the case of respiratory tract infections, it reveals the signs such as persistent cough, chest discomfort, hemoptysis, weakness or weariness, weight loss, fever, and night sweats [3].

Since1996, the World Health Organization has issued a global TB prevalence report every year [1]. In 2020, data from 198 countries and territories represented more than 99% of the world's population and

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Green synthesis, characterization and biological activity of *Solanum trilobatum*-mediated silver nanoparticles

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ABSTRACT

Biologically inspired synthesis of nanoparticles was found to be more attractive in metal nanoparticle synthesis. The present study reported an *in-situ* biogenic synthesis of silver nanoparticles (AgNPs) using *Solanum trilobatum* aqueous leaf extract. On this basis, the aqueous leaf extract of *S. trilobatum* acted as a reducing agent and stabilizing agent to synthesize highly stable AgNPs at ambient temperature. Eventually, the synthesized and stabilized AgNPs surface plasmon resonance was near 430 nm through a UV–visible (UV–vis) spectrophotometer. Here, the stability of the silver colloids monitored through zeta potential and mean particle size was evaluated through diffraction light scattering (DLF). Further, the average particle size was found to be 27.6 nm and spherical, confirmed with transmission electron microscopy (TEM). Also, colloidal AgNPs and aqueous extract are found to be rich sources of antioxidants and exhibit higher free radical scavenging ability. Thus, efficient inhibition with COX1 and COX2 enzymes and the protective effect with human red blood cell (HRBC) membrane stability showed significant results. These features are promising, suggesting the possibility of the AgNPs to be useful to disease-modifying for treating inflammatory disorders and associated complications.

1. Introduction

Regulation of oxidative stress manifests potential therapeutic targets in various cancers and neurological disorders (Barnham et al., 2004). Oxidative stress is correlated with reactive oxygen species (ROS) fluctuations in macromolecules, like lipids, proteins, carbohydrates, and nucleic acids (Rahal et al., 2014). The peroxisomal oxidation in mitochondrial fatty acids can generate ROS, which consumes excessive oxygen. Among the consequences, the accumulation of free radicals and oxidative phosphorylation found in the mitochondrial respiratory chain down-regulates oxygen metabolism (Ježek and Hlavatá, 2005). Nowadays, the field of neurobiology includes neurogenesis neurotrophins, corticosteroids, inflammatory cytokines, mitochondrial energy generation, and oxidative stress to explain the concepts of bipolar disorder (Berk et al., 2011). Additionally, ROS provokes the mitochondrial permeability abnormalities and induces signal catalyzing to prognoses autophagy, apoptosis, and necrosis (Montaigne et al., 2012). In addition, dysregulation of apoptosis results in inflammations and associated neurodegenerative disorders, arthritis, and types of cancer (Hwang and Kim, 2015). The traditional herbs are polyphenols rich and influential in regulating inflammation and associated symptoms (Singh et al., 2011). Conventionally, these phytochemicals had profound regulation with transcription factors, nuclear factor kappa-light-chain-enhancer of activated B cells, Tumour Necrosis Factor-alpha, Interleukin -1β, c-Jun N-terminal kinase, Interleukin -6, Mitogen-activated protein kinase 1, Interleukin 1 beta, Mitogen-activated protein kinases and COX-2, which

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Characterization of secondary metabolites from Lamiaceae plant leaf essential oil: A novel perspective to combat medical and agricultural pests

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ABSTRACT

The insecticidal bio-efficacy of Lamiaceae essential oils (LEOs) and its major compounds (MCs) were tested against mosquitoes (*Aedes vittatus* and *Anopheles maculates*) and agricultural pests (*Spodoptera litura* and *Helicoverpa armigera*). The naturally gained LEOs were confirmed through GC-MS analysis. The larval and pupal toxicity of LEOs and their major compounds LC_{50}/LC_{90} value was calculated by standard protocol. A total of 54, 47 and 31 compounds were identified from *M. officinalis*, *L. latifolia* and *O. majorana,* respectively. The MCs of LEOs: (*M. officinalis*) 2,6-Octadienal, 3,7-dimethyl-, (Z)- (29.4354%) and Caryophyllene (20.2749%); (*L. latifolia*) 1,6-Octadien-3-ol, 3,7-dimethyl- (34.4992%) and 1-Cyclohexyl-2-buten-1-ol (c,t) (38.0339%); (*O. majorana*) Eucalyptol (57.1278%) and p-menth-1-en-8-ol (17.9683%). The LEOs and their MCs were tested individually against larvae and pupae of *Ae. vittatus*, *An. maculates, S. litura* and *H. armigera,* which produced maximum toxic effects. Predominantly, the MCs were safer to the non-target organisms and target-specific insecticidal properties against selected insect pests. On the whole, our findings highlight that LEOs and their MCs represent promising eco-friendly and target specific insecticidal activities.

1. Introduction

The nuisance of growing agricultural and medical insect pest populations is exceedingly threatening to the human community in different ways. Globally, above 30% of economic losses in many cultivated crops are severely damaged by agricultural insect pests [1]. Human vector mosquitoes are well-known for transmitting plenty of frightful human diseases and creating negative impacts on human health, therefore which have been declared as “Public Enemy” [2]. Mosquito biting not only transmits the disease, consequently causing itching, irritation, and allergic skin response [3]. Mainly, tropical and subtropical zones are preferable hotspots for the occurrence of high levels of illness [4]. In addition, globally *Aedes* species are the predominant vector of many diseases as a shred of single evidence. Around 390 million people are highly ripped by dengue infection in all continents [5]. In order to control the mosquitoes, people frequently use plenty of unadvisable synthetic insecticides, which are non-selective and cause drastic negative impacts on the environment/diverse eco-system [6]. According to the WHO [7], worldwide, nearly 3 million deaths and around 500 million infections are mainly raised by the only key vector of *Anopheles* species that remains endemic in above 100 developing tropical zones.

Spodoptera litura is a leading polyphagous Lepidopteron pest that drastically consumes all kinds of green flora and causes active infestation, consequently declining yield and significant profitable losses [8]. It exploits above 200 host flora and belongs to nearly 30 economically substantial vegetations families [9]. It has a wide range of hosts and almost 40 species are known from India only. Recently in southern India, it was noticed on brinjal, which is not an actual host plant of this pest

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GENERAL LAND USE PATTERN IN THANJAVUR DISTRICT, TAMIL NADU: A GEOGRAPHICAL ANALYSIS

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Abstract

Thanjavur District is geographically located in the Cauvery delta area, and it is known as the "rice bowl" of Tamil Nadu State. Fruitful terrain was equally fertile ground for the creation of art, architecture, and culture. The study of the general land use pattern in Thanjavur District, Tamil Nadu, is an essential part of agricultural geography since it offers a solid foundation for the planning and development of the farming sector in the district. The agricultural industry is the most important source of revenue for the people of the Thanjavur District. Finally, this research discovers that the Thanjavur districts land use classifications have been determined taluk-by-taluk utilising the Geographic Information System (GIS). As a result, the current paper covers the overall land use pattern in Thanjavur District, Tamil Nadu: A Geographical Analysis.

Keywords: Land use/land cover, Geographic Information System (GIS), Thanjavur district.

Introduction

Agriculture is the science and art of producing plant life from the soil to benefit humans and other living things. It includes all the productive efforts he put into raising different products by increasing with other natural recourses to satisfy his needs and wants. Agriculture is the backbone of the Indian economy. In India, nearly 70 % of the total population and 90 % of the rural population is engaged in agriculture. Land use can be considered an important aspect of the land-man relationship, and it has been studied particularly relevant to agricultural geography (Yuvaraj et al., 2020; Gumma, 2015; Sujatha et al., 2011).

Numerous foreign and Indian geographers have interpreted the idea of land use differently. For, the land must be exploited to meet the legitimate wants and aspirations of the people as feasible (NRSA, 2006, 2007). Essentially self-explanatory, the phrase land use refers to the real and precise usage of an earth's surface in terms of natural main land use, such as the land beneath the forest, grassland, farming, or other similar land uses, as opposed to other land uses. The term "land usage" refers to all industrialised and developing areas on their surface, for a specific point at a given time and space (Arulbalaji, 2019; Gumma et al., 2015; Freeman, 1968). Land use is any permanent or cyclic human intervention on the environment to satisfy human needs (Ganeshmoorthi, 2018; Prabu and Dar, 2018; Sangeetha and Baskaran, 2011). Land use appropriateness is a tract's potential to accommodate various land use patterns under specific cultural and socio-economic circumstances (Lenin Sundar et al., 2019; Vink, 1975). Symons (1978) states that land-use maps are crucial instruments for regional development and planning. (Krishnan, 2014).

Thanjavur district has been known for its agricultural activity from ancient times. The Granary of Tamil Nadu is in the deltaic area of the famed river Cauvery and is criss-crossed by a vast network of irrigation systems and irrigation systems. Tropical vegetation abounds in this coastal area. An important part of agricultural geography is the study of general land-use patterns in the Thanjavur District.

The Study Area

Located in southern India, Thanjavur is a significant centre of art and architecture. The city of Thanjavur is home to the majority of the magnificent living Chola temples, which are all designated as UNESCO World Heritage Sites. On the eastern coast of the Indian state of Tamil Nadu, Thanjavur district is situated. Its latitude ranges from 90° 50' to 11° 25' north, while its longitude ranges from 78° 45' to 70° 25' east. It has a total area of 3,411 square kilometres (Fig.1). The Coloroon River separates the district from the Perampalure and Thiruchirappalli districts to the north. It is bordered on the east by the Thiruvarur and Nagapattinam districts, on the south by the Palk Strait and Pudhukottai district, and on the west Pudukkottai and Thiruchirappalli districts. It is also bordered on the east by the Thiruvarur and Nagapattinam districts. Thanjavur district is divided into three revenue divisions with eight taluks with fourteen blocks and three municipalities.

Research Article

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Antibacterial greener silver nanoparticles synthesized using *Marsilea quadrifolia* extract and their eco-friendly evaluation against Zika virus vector, *Aedes aegypti*

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Abstract: Fabrication and use of nanoparticles have progressively enlarged within the last decade. Herein the silver nanoparticles (AgNps) were synthesized via the extract from *Marsilea quadrifolia* (*Mq*) as a decreasing and steadying mediator. The *Mq*-AgNPs demonstrated superior toxicity on Zika virus vector, *Aedes aegypti* with the LC_{50} value of 10.69 $\mu g \cdot mL^{-1}$. The *Mq*-AgNPs were established securely to non-target organisms *Artemia nauplii* and *Ceriodaphnia cornuta,* and no structural or anatomical alterations confirm its security to the surroundings. The antibacterial activity exposed that *Mq*-AgNPs showed superior growth inhibition effect against the tested bacteria. Furthermore, the *Mq*-AgNPs showed strong antioxidant activities when compared to *Mq* leaf extract. Overall, our results highlight that *Mq*-AgNPs are hopeful and biodegradable devices against mosquito vectors of therapeutic significance, with moderate toxicity against non-target aquatic animals.

Keywords: *Marsilea quadrifolia*, Zika virus, *Artemia nauplii*, *Ceriodaphnia cornuta*, antioxidant assay

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1 Introduction

Mosquito vectors are exclusively liable for spreading pathogens and parasites of different infections like dengue, malaria, chikungunya, encephalitis, Zika virus infection, filariasis, and yellow fever [1–3]. World Health Organization (WHO) approximates that dengue is passed on from 50 to 400 million citizens yearly on the earth. The appearance of dengue-resistant strains is a significant challenge to hold; it has extended and impacted human health [4]. Since commercial vaccines for most diseases spread by *Aedes aegypti* do not exist, mosquito control remains a critical component of all prevention and control campaigns, which typically rely on pesticide spraying, biological control agents, and environmental management, among other things. As a result, developing novel, environmentally acceptable, and effective mosquito control techniques are critical to ensuring our future ability to prevent and manage diseases spread by these insects. Mosquito management is being improved in numerous regions; however, essential confronts and the rising mosquito resistances to insecticides require other

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Facile synthesis and characterization of ZnO nanoparticles using *Abutilon indicum* leaf extract: An eco-friendly nano-drug on human microbial pathogens

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ARTICLE INFO

Keywords:
Plant extract
Phytocompounds
Hexagonal wurtzite structure
ROS generation
Nano-drug carriers

ABSTRACT

The green synthesis of zinc oxide nanoparticles (ZnO NPs) using the leaf extract of *Abutilon indicum* and its characterization have been investigated. UV–vis, FT-IR, Micro- Raman, XRD, and SEM investigations were used to study the optical, structural, and morphological properties of produced ZnO NPs. The antimicrobial affectivity of ZnO NPs tested by well diffusion method counter to bacteria; *S. aureus, E. coli* and one fungal strain; *C. albicans*. The absorption peak of UV–vis spectrum was observed at 377 nm. FT-IR function vibration groups had proved the existence of ZnO NPs. The Micro-Raman analysis showed low and high-intensity bands of 330 and 436 cm^{-1} concerning ZnO NPs. The XRD configuration indicated the pure crystalline nature ZnO NPs formation with an approximate crystalline size at 27.89 nm. SEM images showed the structure of NPs to be a spherical shape with 10–30 nm. The ZnO NPs interact with bacterial cells by electrostatic interaction. It has enhanced the surface tension and generates reactive oxygen species (ROS), leading to bacterial lysis. Conveniently, synthesized ZnO NPs can be used against $Gram^{-ve}$ bacteria causing infectious disease in the medical field.

1. Introduction

The rapid emergence of bacterial and fungal infections has become a significant cause of mortalities all over the globe. The availability of multiple resistance drugs for different bacteria and fungi has further made the condition more problematic. Worldwide annually, 50% of hospitalized patients are infected by multiple drug-resistant bacteria [1]. The development of new alternatives for combat drug-resistant bacteria became necessary. Various therapeutic values have been practiced since ancient times and contribute to essential tasks in traditional medicine. Plants will always be an alternative for the enhancement of novel drugs.

Abutilon indicum is a domineering herb with potent biological activities that belong to the Malvaceae family. In the ancient Ayurvedic system, *A. indicum* was reported with inflammatory and antimicrobial activity and used to treat various diseases, including cough, gonorrhea, piles etc., [2,3]. Besides, essential biologically active constituents such as carbohydrates, alkaloids, starch, glycosides, flavonoids, and phenol are also accessible [4]. It has been commonly used as a stimulant purgative, moisturizing cream, pain-relieving, anti-diabetic, anti-inflammatory, and anti-dot medication as well as to cure leprosy, urinary infection, jaundice, masses, thirst relief, injury and ulcer cleansing, menstrual infections, rheumatism, mumps, respiratory illness, bronchitis, allergies, bloody dysentery, and ear disorders in conventional medicine [5,6]. The antioxidative, antimicrobial, anti-inflammatory, hepatoprotective, anticancer, immunomodulatory

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The dietary supplementation of zinc oxide and selenium nanoparticles enhance the immune response in freshwater fish *Oreochromis mossambicus* against aquatic pathogen *Aeromonas hydrophila*

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ARTICLE INFO

Keywords:
Immunostimulant
M. koenigii berry
Nanoparticles
Supplemented diet
A. hydrophila
O. mossambicus

ABSTRACT

Background: Green nanoparticles are subjected as an immunostimulant against bacterial pathogens.
Methods: Murraya koenigii berry extract-based synthesized zinc oxide nanoparticles (Mb-ZnO NPs) and selenium nanoparticles (Mb-Se NPs) were relatively analyzed for immunostimulation in serum and mucus fish *Oreochromis mossambicus* against *Aeromonas hydrophila* infections. Initial minimum inhibitory concentration (MIC) was determined for both Mb-ZnO NPs and Mb-Se NPs followed by specific growth rate (SGR), antioxidant level (Superoxide dismutase activity (SOD), Catalase activity (CA), and Glutathione peroxidase activity (GPx)), and immune parameters Myeloperoxidase activity (MPO), Respiratory burst activity (RBA), Lysozyme activity (LYZ), Alkaline phosphatase activity (ALP), Serum antiprotease activity and Natural complement activity (NAC).
Results: The potential bacterial inhibition property of Mb-ZnO NPs and Mb-Se NPs exhibited the most negligible concentration of 25 and 15 μg mL^{-1}, respectively, against *A. hydrophila*. In addition, Mb-ZnO NPs and Mb-Se NPs exhibited 70–80 % and 90–95 % diminished biofilm activity at 50 μg mL^{-1} that was viewed under an inverted research microscope and confocal laser scanning microscopy (CLSM). Protein leakage and nucleic acid leakage assay quantified oozed out protein and nucleic acid from *A. hydrophila* that confirms Mb-Se NPs exhibited vigorous antibacterial activity than Mb-ZnO NPs at tested concentrations. *Oreochromis mossambicus* fed with Mb-ZnO NPs and Mb-Se NPs supplemented diet at different concentrations (0.5 mg/kg, 1 mg/kg and 2 mg/kg) improved SGR along with a rise in the immune response of those fishes against *A. hydrophila* infection. Serum and mucus of fish fed with Mb-Se NPs supplemented diet exhibited a significant rise in antioxidant level SOD, CA and GPx at a dosage of 2 mg/kg. Likewise, lipid peroxidation assay detected significantly diminished oxidative stress in the serum and mucus of fish fed with Mb-Se NPs supplemented diet (2 mg/kg). Enhanced immune parameters in serum and mucus of fish fed with Mb-Se NPs supplemented diet determined by MPO, RBA, LYZ, ALP, Serum antiprotease activity and NAC.
Conclusion: Thus *O. mossambicus* fed with Mb-Se NPs supplemented diet was less prone to become infected by aquatic pathogen *A. hydrophila* established by challenge study. On the whole, Mb-Se NPs supplemented diet ensured the rise in antioxidant response that boosts the immune responses and reduces the chance of getting infected against *A. hydrophila* infections.

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CUSTOMER ACHIEVEMENT ALONG WITH LIFE INSURANCE CORPORATION

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ABSTRACT:

This study investigates achievement level of clients towards Life Insurance Corporation in Chennai city. Because of expanding mindfulness among individuals about their vulnerability of life and expanding rivalry in Insurance area, it is critical for Insurance Companies to comprehend the essential of their clients. The primary point of this investigation is to know the purchaser achievement towards LIC. This investigation depends on essential information which is gathered through survey among 160 policyholders in Chennai and information were broke down with factual device like rate is utilized to recognize the components in charge of buyer achievement towards LIC.

Keywords: LIC; Consumer Achievement; Consumer Awareness.

1. INTRODUCTION:

Protection business wad quickly developed in eighteenth century. Individuals are shaky towards dangers and vulnerabilities. Time of death of an individual isn't sure. Each judicious man is progressively wary about keeping them from hazard or limiting or giving impact against it. Protection segment have made conceivable to cover the hazard which is inconceivable. Insurance agencies began to move the hazard and hazardous to the interpretation of who are happy to acknowledge the weight for monetary thought. The principle goal of protection organization is to dispense with the hazard on the substitution conviction for dubious and in this manner it makes collaboration among the policyholders for spreading their hazard. Because of expanding rivalry in Insurance division and expanding desire for policyholder's prompts measure the mindfulness and achievement level of the clients. LIC began to give more administrations so as to fulfill the necessity of the client and for their prosperity and survival in the Insurance Sectors. Because of progress in taste and inclination of the policyholder it is getting to be hard for the insurance agency to comprehend and quantify the administration viably.

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Financial Performance Of Oriental Insurance Company Ltd

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Abstract

Insurance is been an vital part of the Indian Financial system, after 17 years of Liberalization of Insurance Industry in India, it has taken a new trajectory as many life insurers have managed to list themselves in the Indian bourses. The Indian Insurance is growing faster since 2000, as it has been liberalized after more than 50 years, where private life insurers have entered the insurance sector with innovative practices leading to more business as it clearly needs a lot of finance that can now be mobilized through the cleaner equity capital from a longer perspective. The Oriental Insurance Company actions adds to transparency, governance, accountability after liberalization of sector and also to improve the focus towards profitability of the Indian Insurance Industry. This study attempts to measure the financial performance of oriental insurance company ltd.

Keywords: Life Insurers, Financial system, Profit after tax, Net premium, Net Claim, Investment Income, financial performance

Introduction

Insurance is the backbone in managing the risk of the country. The insurance providers offer diversity of products to business, providing protection from risk thereby ensuring financial security. It helps individual and organization to minimize the consequences of risk which impart significant cause on the growth and development of insurance industry. Indian insurance industry is facing major challenges in reaching out willing customers, providing them services, acquiring and retaining players, product and distribution innovation etc. Apart from addressing the challenges of customers, improving the performance to achieve profitable growth is another big challenge faced by Indian life insurers. To sustain the profitable growth, private companies are struggling in spreading awareness about need of insurance, developing brand strength, meeting regulatory demands, establishing wide network of distribution channels and setting infrastructure. Oriental insurance sector anticipate different segments of customers with different needs thereby raising the importance of new and competitive dynamics.

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Evaluation of Budget Analysis of Kumbakonam Municipality

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Abstract:
The financial structure of Urban Local Bodies in India is mainly comprises of tax and non-tax revenues as major source of revenues and these local bodies also receive grants-in aid and other concessions from the Government. The expenditure of the municipalities are classified as establishment expenditures, administration expenditures, operating, repairs & maintenance expenditures finance expenses and depreciation. Therefore this study is focussed on the evaluation of budget analysis of Kumbakonam Municipality using trend analysis using actual and estimated values. For further study Chi-square test is used.
Key words: Urban Local Bodies, Source of revenues, Grants-in aid.

Introduction

Financial Management is used in each and every organisation, whether it is trading or non-trading organisation. Finance is needed to promote or establish business, acquire fixed assets, make investigations such as market survey, develop product, keep men and machine at work It is necessary as it guides in

- Financial planning and successful promotion of an enterprise,
- In acquisition of funds at a minimum cost,
- In efficient usage and allocation of funds,
- In taking sound financial decisions and
- In promoting and mobilising individual and corporate savings.

Urban Local Government(ULG):

Research Article

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Synthesis of greener silver nanoparticle-based chitosan nanocomposites and their potential antimicrobial activity against oral pathogens

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Abstract: In the present investigation, silver nanoparticles (AgNPs) and silver nanoparticle-based chitosan nanocomposite were synthesized using *Cissus arnottiana* leaf extract. The biosynthesized nanoparticles and nanocomposites were characterized using SEM, TEM, and AFM to uncover the morphological characteristics such as size and shape. The SEM image depicts the size of the nanocomposite to be 30–40 nm and shape as spherical. The TEM results reveal the shape of the nanocomposite to be spherical and size around 10–60 nm. The XRD results show the crystalline nature of the AgNPs-based chitosan nanocomposite. The SAED analysis pattern seems to be concordant with the XRD results. The AFM image ensured the precise surface morphology of the synthesized silver nanocomposite in the 3-dimensional pattern. The antimicrobial efficacy of the biosynthesized AgNPs, AgNP nanocomposite, and chitosan nanoparticles was tested against oral pathogens. The results revealed a potential antimicrobial effect, which states that it must be converted into nanomedicine to meet future biomedical needs.

Keywords: green synthesis, silver nanoparticles, chitosan nanocomposite, *Cissus arnottiana*

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1 Introduction

Recently, the field of nanotechnology arised to a greater extent due to its ablazing applications in biomedical field [1]. This attracts huge number of researchers to create different nanomaterials with specific functions to cure a disease or to enhance and perform in equipments or products such as health care products, cosmetics, household products, etc. The nanolevel requirement of these nanomaterials in living cells plays a significant role in outraging the disease-causing pathogens and organisms [2].

Nowadays, the disease-causing pathogens become more resistant to upcoming antibiotic drugs. To combat this issue, metallic nanoparticles like silver nanoparticles (AgNPs) have been reported in several studies by researchers as an effective antimicrobial agent [3–5]. The AgNPs are majorly used in treating burn and open injuries to avoid contamination from wound pathogens and other nosocomial pathogens [6]. AgNPs assume a significant part in science and medication due to their desirable physicochemical properties. AgNPs are known to have antifungal, anti-inflammatory, antiviral, antibacterial, antiangiogenesis, and antiplatelet properties [7–9].

In several studies, chitosan, a natural biopolymer, has been reported to enhance the antibacterial efficacy of the metallic nanoparticles [10–12]. In this present study, chitosan was added to *Cissus arnottiana* leaf

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Ulvan loaded graphene oxide nanoparticle fabricated with chitosan and D-mannose for targeted anticancer drug delivery

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ARTICLE INFO

Keywords:
Graphene oxide
Chitosan
D-mannose
Ulva lactua
Biocompatibility
Glioblastoma

ABSTRACT

Cancer growth is a developing significant public health threat, and notwithstanding the advances in biomedical research and innovation, a pressing need is felt for the progress of new anticancer drugs. Sulfated polysaccharides, such as ulvan from green macroalgae, exhibit a diverse range of biological applications. In this study, a novel D-mannose-mediated targeted drug delivery system (GO–CH–Ma) for targeting glioblastoma cancer was developed by loading *Ulvan lactua* as the anticancer model drug onto functionalized graphene oxide. Ultraviolet spectroscopy, Fourier-transform infrared spectroscopy (FT-IR), X-ray diffraction (XRD) and Zeta potential were used to describe the main physicochemical properties of the chitosan-functionalized graphene oxide (GO-CH). Similarly, scanning electron microscopy (SEM) and transmission electron microscopy (TEM) enabled the study of surface morphology. The entrapment of ulvan on GO–CH–Ma has been observed to be 88%. The biocompatibility of the nanocarrier and drug-loaded nanocarrier was studied via hemolysis and anti-inflammatory assay. The *in vitro* drug release profile of ulvan revealed a pH-dependent-controlled release system observed by UV–Visible analysis. Moreover, a human glioblastoma cell line (U87) was used to examine the preliminary *in vitro* cytotoxicity. Finally, a mannose-decorated GO-CH carrier loaded with ulvan demonstrated a promising targeted drug delivery system to treat *in vitro* glioblastoma.

1. Introduction

Nanotechnology has made a meaningful contribution to nanomedicine's advancement, thereby demonstrating extraordinary guarantees to improve restorative methodologies against various diseases. Nanomedicine speaks to a chance of focusing on procedures and multifunctionality. Despite the significant advancement in medicine, the majority of tumors are still incurable, and malignant gliomas being the most concerning. Additionally, glioblastoma (GBM) is the most malignant and exceptionally vigorous, having a place to evaluate IV gliomas as per the WHO [1,2].

Marine polysaccharides are a vital source of compounds with therapeutic applications because they are stable, inexpensive, biocompatible, non-toxic, safe, and biodegradable. Many researchers have studied polysaccharide-based nanomaterials for biomedical applications such as drug delivery, gene delivery, cancer therapy, wound dressing, and antimicrobial activity in recent years [3–5]. Green algae (Chlorophyceae), red algae (Rhodophyceae), and brown algae (Phaeophyceae) are the three major types of macroalgae. In particular, macroalgae are an excellent candidate for sulfated polysaccharides and have piqued the interest of cosmetics, nutraceuticals and pharmaceutics [6].

Ulvan (UL) is a naturally occurring anionic sulfated polysaccharide

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Factors determine the population characteristics of migratory shorebirds and their prey species in the coastal saltpans

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ARTICLE INFO

Keywords:
Coastal habitats
Man-made saltpans
Shorebirds
Prey
Conservation

ABSTRACT

Naturally-occurring seasonal saltpans serve as a major foraging ground for migratory shorebirds. Nevertheless, little is known about the role of various environmental factors in determining the density, diversity and species richness of shorebirds and their prey in India. This study was designed to collect quantitative data for the first time on the role of season, salinity, water depth, and prey availability in influencing the density, diversity, and species richness of migratory shorebirds in the eastern coastal saltpans of Tamilnadu, India. Selected sites were classified as seasonal saltpans and hypersaline saltpans based on the concentration of salinity in water. Shorebirds were counted systematically from (August) 2012 to (May) 2015 using the total count method. The measurement of salinity level and water depths of each sighting was also collected. The density, diversity and species richness of shorebirds showed highest in the seasonal saltpans than the hypersaline saltpans. The monsoon season attracted more shorebird density, diversity species richness when compared to other seasons. *Calidris alpine* was only the migratory shorebird species recorded in both types of saltpans and across seasons. The micro and macro-invertebrate prey species showed the highest in the seasonal saltpans. The Chironomid larva showed the highest turnover than other species recorded in the studied saltpans. The multiple regression models showed that the year, season, salinity, and water depth influence the shorebird density, diversity, species richness, and prey species' density with a more significant percentage. The study results found that saltpans are also an ideal habitat for migratory shorebirds and their diverse prey species seasonally.

1. Introduction

Shorebirds are fascinating creatures (Richards, 1998). They undertake phenomenal migration in a north-south direction each year propelled by natural selection to circumvent extremer cold weather. About two million shorebirds, most weighing <50 g undertake a monumental roundtrip from Alaska to Australia, covering 25,000 km. They surprisingly live long; the Eurasian oystercatchers, for example, are known to live beyond 40 years (Colwell, 2010). Therefore, a single shorebird has the potential to migrate over 200,000 km with a lifespan of just 10 years. The shorebirds embark on one of the longest-distance migrations compared to all other species in the animal kingdom. A female shorebird, for instance, was recorded to have flown 11,500 km from Alaska to New Zealand and even without taking a break to feed and rest, which puzzled the scientific community (Hansford, 2007). Similarly, shorebirds caught and ringed by ornithologists at the Arctic Russian tundra, Kazakhstan and Uzbekistan were recaptured at the eastern coastal areas of Tamil Nadu, India, by our colleagues at the Bombay Natural History Society (Balachandran, 2012). Throughout their migratory routes, the shorebirds are naturally wedded to few stopover sites that face enormous threats due to various manmade disturbances.

India's coastal wetlands support thousands of migratory shorebirds

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CRITERION III - RESEARCH, INNOVATIONS AND EXTENSION

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Review

Microbial degradation of plastics: Sustainable approach to tackling environmental threats facing big cities of the future

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ABSTRACT

Most microorganisms are used as a foundation of bioplastic production and also used for the decomposition of plastics. Although bioplastics production is considered expensive than artificial plastic, it has many advantages over them. Some bio-polymers have also gained public acceptance and are now being produced. The useful breakdown of plastic bags takes more than a thousand years. For the decomposition of plastics, microorganisms should be calculated extensively so that solid wastes can be decomposed. Thus, microbes have been played an important role in decompose as well as the production of plastics.

Contents

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1. Introduction

Plastic usage has transformed our life in various ways. The production and utilization of plastics are always increasing due to the rising demand. They are inexpensive, strong, lightweight, corrosion-resistant, duration and electrical insulation properties and have high thermal (Aruna and Shanthi, 2015). Five hundred

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Review

A review on microbial degradation of drinks and infectious diseases: A perspective of human well-being and capabilities

Vijayalakshmi Shankar [a], Shahid Mahboob [b,*], Khalid A. Al-Ghanim [b], Zubair Ahmed [b], Norah Al-Mulhm [b], Marimuthu Govindarajan [c,d]

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ABSTRACT

Various microorganisms present in beverages as contaminants, yet few can develop in the presence of acidic and low oxygen conditions. Notably, yeast is the dominant microbe group present in the fruit juices and drinks in the fruit juices and drinks. Due to the microbe development and secondary metabolite production, such as polluting compounds, carbon dioxide, and spoilage, the beverages were identified. Yeast and molds are considered to be a vital microbe that causes deterioration. The primary reason for the deterioration in fruits and fruit juices is because of the contamination caused by fungi and yeast, and sometimes damage may cause by insects. Sugars and sugar concentrates are generally polluted with osmophilic yeasts, for instance, *Z. rouxii*. This review mainly focuses on the types of spoilages in soft drinks and beverages and their control measures.

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Original article

Green synthesis of ZnO nanoparticles for antimicrobial and vegetative growth applications: A novel approach for advancing efficient high quality health care to human wellbeing

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ABSTRACT

The present work aims to synthesize zinc oxide (ZnO) nanoparticles via green approaches using leaf extract of *Parthenium hysterophorus*. UV–vis and FT-IR tests confirmed the existence of biomolecules, active materials, and metal oxides. The X-ray diffraction structural study exposes the ZnO nanoparticles formation with hexagonal phase structures. SEM and TEM analysis reveal surface morphologies of ZnO nanoparticles and most of them are spherical with a size range of 10 nm. ZnO nanoparticles were revealed strong antimicrobial activity against both bacterial and fungal strains. The germination of seeds and vegetative growth of *Sesamum indicum* has been greatly improved.

1. Introduction

Nanotechnology is a multidisciplinary scientific domain and has been used in various science fields, including chemical, physical, biological, pharmaceutical and material science (Porter and Youtie, 2009; Govindarajan et al., 2016a,b; Govindarajan, M. and Benelli, 2016, 2017; Balalakshmi et al., 2017; Divya et al., 2018; Fahimmunisha et al., 2020). The promising application of nanotechnology unlocked up a new scope and perspective in agriculture. The relatively small size, high surface to volume ratio and characteristics optical properties of nanomaterials find the application from plant protection to nutrition and management practices in the farm (Shang et al., 2019). The perceptive of nanotechnology provides a new precision to agriculture with particular reference to fertilizer. The effects and efficiency of nanoparticle uptake on growth and metabolic activities may vary between the plants (Rastogi et al., 2017). The uptake concentration of nanoparticle influences the germination process and plant growth. Deficiency of zinc (Zn) is one of the major micronutrient problems affecting crop production, mostly calcium carbonate-rich alkaline soils (Takkar and Walker, 1993). The calcium carbonate abundant soils and alkaline pH may reduce both the obtainability and solubility of Zinc to the crops (Alloway, 2009; Rashid and Ryan, 2004). The Zn fertilizers such as zinc oxide (ZnO) and zinc sulphate were used to compensate the Zn deficiency in soils (Mortvedt, 1992) but were limited to their applications due to Zn non-availability to the plants. Apart, the application of chemical fertilizer leads to adverse effects on livestock, beneficial soil microorganisms and finally reduces soil fertility. In order to combat this problem, more effective and non-persistent fertilizer such as controlled release formulation is therefore required. ZnO nanoparticles

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Facile synthesis of gold and platinum doped titanium oxide nanoparticles for antibacterial and photocatalytic activity: A photodynamic approach

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ABSTRACT

A simple method has been needed to synthesize nanoparticles (NPs) to avoid environmental pollution, an alternative chemical and physical method. This current study deals with phytosynthesis of gold (Au) and platinum (Pt) metal doped with titanium oxide (TiO_2) NPs using *Enterolobium saman* bark extract. This extract plays a vital role in reducing and stabilizing Au and Pt doped into the TiO_2 NPs lattices. Phytosynthesized samples were characterized by XRD, SEM, ED-XRF, TEM, FTIR, Raman, and UV–vis-DRS analyses. The metal doping effect has decreased bandgap energy and particle size, whereas increased conductivity for TiO_2/M-Au and TiO_2/M-Pt NPs compared to pristine TiO_2 NPs. Phytosynthesized NPs were fabricated for dye-sensitized solar cell (DSSC) and photocatalytic behaviour against methylene blue (MB) dye was studied. An obtained result demonstrates that TiO_2/M-Au NPs have excellent feasibility for applying DSSC and photocatalytic application due to particle size, crystallite size, absorption ability, and bandgap energy. Besides, synthesized samples were measured with cyclic voltammetry and impedance spectroscopy found that the metal doping is drifted the dielectric and increases that the metal doping is drifted the dielectric increases electro-catalytic of the TiO_2. Different concentrations of all NPs were tested against *Escherichia coli* MTCC 40 and *S. aureus* ATCC 6633 bacteria by a well-diffusion method. The 10 mg concentration of all NPs showed better antibacterial activity. However, we believe that the proposed simple phytosynthesized method provides an efficient way to overcome the chemical and physical methods.

1. Introduction

Apparently, due to the lightweight, easy accessibility, high performance, and non-toxicity, biologically derived titanium dioxide (TiO_2) based nanomaterials have recently been very desirable in the field of energy harvesting and environmental remediation [1]. The Food and Drug Administration (FDA) and Environmental Protection Agency (EPA) regulations have reported that 50 μg/kg body weight/day of TiO_2 nanoparticles (NPs) is a safe dose for humans. In contrast, the toxicity of TiO_2 NPs in cellular function depending on the size, shape, surface defect, coating, adsorbed groups, solubility, and surface charge [2]. TiO_2-based nanomaterial has considerable potential for dye-sensitized solar cells (DSSCs) applications. DSSC promises third-generation solar cells for research and development in the area of renewable energy harvesting. High power conversion efficiency (PCE) and stable solar cells because of their cost-effectiveness. Due to the optical band gap and effective charge isolation separation, the TiO_2 nanostructure has also been used in photocatalytic dye degradation applications [3]. A traditional DSSC consists of four components: dye as a primary sun-absorbing part to generate photoelectron, nanocrystalline semiconducting material to anchor dyes, and develop the electron-hole pair, an effective electro-catalytic counter-electrode to transmit the produced electron-holes pair to complete the circuit [4]. Compared to other metal oxides such as SnO_2 and ZnO [5], regular nanocrystalline TiO_2 layers are used as photoanodes. Dyes based on ruthenium are more effective and are used conventionally in different dyes tested for better absorption [6].

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Review

A review on biological carbon sequestration: A sustainable solution for a cleaner air environment, less pollution and lower health risks

R. Gayathri [a], Shahid Mahboob [b,*], Marimuthu Govindarajan [c,d,*], Khalid A. Al-Ghanim [b], Zubair Ahmed [b], Norah Al-Mulhm [b], Masa Vodovnik [e], Shankar Vijayalakshmi [f,*]

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ABSTRACT

Carbon dioxide gas is the key element of the carbon cycle and a major source for photosynthesis, but for the past 150 years, the atmospheric CO_2 has been increased drastically from 250 to 418 ppm due to the extreme utilization of fossil fuels. This accelerated release of CO_2 acts as a major source for climatic change due to the greenhouse gas effect resulting in global warming and melting of polar ice caps, alteration in biogeochemical cycles, altered rainfall, ocean acidification, eutrophication of lakes, imbalance in the ecological communities and extinction of some species, effects on soil fertility, changes in the metabolism and at the molecular level. Reduce, reuse and recycle strategy can be applied to control elevated CO_2 levels by preventing deforestation, using renewable energy as an alternative for fossil fuels and reusing the atmospheric CO_2. Carbon capture and storage (CCS), Carbon capture and utilization (CCU) are the two technologies adapted to capture the atmospheric CO_2, utilize it, and focus on permanent storage in the geological sites. Captured CO_2 is used to produce many value added products such as polymers, biofuels, reactants etc. Plants and microorganisms act as a natural CO_2 filter. Several biomolecules such as carbohydrates, proteins, and lipids are produced due to the biological carbon fixation process using photosynthesis. Six different photosynthetic pathways and some non-photosynthetic pathways to fix atmospheric CO_2 have been reported in diverse species of plants and microbes such as bacteria, fungi, yeast, algae etc. Algae are the most potent microbe in CO_2 utilization and biological carbon fixation compared to other microbes and used widely on a large industrial scale for biofuel production. Algal biofuel production using captured CO_2 is the best productive method to recycle and reduce atmospheric CO_2.

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Original article

An assessment of level of heavy metals pollution in the water, sediment and aquatic organisms: A perspective of tackling environmental threats for food security

Jeganathan Pandiyan [a], Shahid Mahboob [b,*], Marimuthu Govindarajan [c,d], Khalid A. Al-Ghanim [b], Zubair Ahmed [b], Norah Al-Mulhm [b], Rajendran Jagadheesan [a], Kaliyamoorthy Krishnappa [a]

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ABSTRACT

Pollution is severely threatening the wetland habitats. Heavy metals are one among of the major pollutants in wetland habitats. The cadmium (Cd), copper (Cu), chromium (Cr), cobalt (Co), lead (Pb), mercury (Hg), nickel (Ni) and zinc (Zn), were assessed in the water, sediment, benthic species (polychaetes, mollusc and crustaceans), prawn and fishes. The assessment of heavy metals was done by using double-beam Atomic Absorption Spectrophotometer (AAS). The Hg, Cr and Co were greater in sediment, Ni and Cd were higher in polychaetes and molluscs respectively. However, the Cu and Pb greater in crabs and the Zinc was greater in fishes. The concentration of metals showed significant differences among the various sources examined ($P < 0.05$) except Cr ($P > 0.05$). The inter-correlational analysis among the metals assessed from the various sources showed that the Cr and Pb not correlated among the eight metals examined. However, the Cu and Co were correlated with Hg ($r = 0.307$) and ($r = 0.788$) respectively. The nickel was correlated with Hg ($r = 0.367$), Cu ($r = 0.362$) and Co ($r = 0.432$). The Zinc was correlated with the Cd ($r = 0.331$) and Hg ($r = 0.737$). However, correlation of metals among the different sources shown that the metals of polychaetes correlated with sediment $r = 0.637$, the metals of crabs correlated with the sediment and polychaetes $r = 0.630$ and $r = 842$ respectively, the metals of molluscs was also correlated with sediment ($r = 0.636$), polychaetes ($r = 0.889$) and crabs ($r = 0.894$). In addition to that the metals of prawns was correlated with the polychaetes ($r = 839$), crabs ($r = 0.628$) and molluscs ($r = 0.634$). The metals of fishes correlated with polychaetes ($r = 0.529$), crabs ($r = 0.710$), molluscs ($r = 0.493$) and prawns ($r = 0.593$). Indeed the multiple regression model explained that the metals of sediments influence the accumulation of metals in biotic species such as polychaetes, molluscs, crustaceans, prawns and fishes with 84% ($F = 21.079$; $p < 0.001$).The order of the heavy metals in the water, sediment and biotic species was Hg > Pb > Ni > Cr > Zn > Co > Cu > Cd. The study found that the level of heavy metals at various sources in the sanctuary is showing considerable warning and the sanctuary is required intensive assessment on various aspects of pollution since the Point Calimere Wildlife Sanctuary is supporting several species of migratory and endangered shorebirds seasonally.

1. Introduction

The wetlands habitats are most productive ecosystem in the world, providing suitable habitats for various species of aquatic organisms which are depends on it. Nevertheless the coastal wetland habitats including intertidal mudflats are functioning as a proper shelter, feeding and breeding grounds for various species (Balachandran, 2012; Sivaperuman and Venkatraman, 2014). But recently several wetlands are under severe threats due to various

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Original article

Optimization strategies for improved biogas production by recycling of waste through response surface methodology and artificial neural network: Sustainable energy perspective research

Lakshmi C. Gopal [a], Marimuthu Govindarajan [b,c,*], M.R. Kavipriya [d], Shahid Mahboob [e,*], Khalid A. Al-Ghanim [e], P. Virik [e], Zubair Ahmed [e], Norah Al-Mulhm [e], Venkatesh Senthilkumaran [f], Vijayalakshmi Shankar [f,*]

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ABSTRACT

Objective: The primary aim of the study is to augment the biogas production from flower waste through optimization and pretreatment techniques.
Methods: Enhancement of biogas production by using response surface methodology (RSM) and artificial neural network (ANN) was done. The time for agitation, the concentration of the substrate, temperature and pH were considered as model variables to develop the predictive models. Pretreatment of withered flowers was studied by using physical, chemical, hydrothermal and biological methods.
Results: The linear model terms of concentration of substrate, temperature, pH, and time for agitation had effects of interaction ($p < 0.05$) significantly. From the ANN model, the optimal parameters for the biogas production process increased when equaled to the model of RSM. It indicates that the artificial neural network model is predicting the yield of biogas efficiently and accurately than the RSM model. Chemical pre-treatments were found to enhance the biogas production from flower waste with higher biomethane kinetics and cumulative yield.
Conclusion: Biogas production was significantly improved with statistical optimization and pretreatment techniques.

1. Introduction

In recent times, about 85% of the world's universal energy demands will be obtained from fossil fuels (Edenhofer et al., 2010), these are contributing to a lot of global warming and natural damages (Nigam and Singh, 2011; Rahman et al., 2011). Present approaches deliver the utilization of alternative energy, which is renewable, such as biomass, geothermal, solar and wind, to decrease the GHG. There is an immense possibility for the generation of biofuels from biomass (Naik et al., 2010).

Liquid biofuels or gaseous fuels that are chiefly made by using biomass will be classified as three generations (1st, 2nd and 3rd generations) (Dragone et al., 2010). From the edible portion of plants, such as seeds, grains and sugars, are considered to be

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Original article

Cellulase immobilized magnetic nanoparticles for green energy production from *Allamanda schottii* L: Sustainability research in waste recycling

Shankar Vijayalakshmi [a], Marimuthu Govindarajan [b,c], Norah Al-Mulahim [d], Zubair Ahmed [d], Shahid Mahboob [d,*]

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Allamanda schottii

ABSTRACT

This study presents ethanol's fabrication by fermenting the golden trumpet flower (*Allamanda schottii L*) with the yeast strain *Saccharomyces cerevisiae*. The changes in different parameters during fermentation were studied and optimized while producing the ethanol and the end product was subjected to emission test study by blending petrol and ethanol. The *Allamanda* floral substrate contains 65% polysaccharides. The strain *S. cerevisiae* was obtained in the form of baker's yeast from a domestic shop. For 100 ml of slurry, the highest bioethanol yield recorded was about 18.75 ml via optimization of different culture conditions, including a 1:8 ratio for slurry preparation, maintained under 35 ^{0}C, 5.5 pH, 72 h. old inoculum with a quantity of 3.75 g 100 ml^{-1}, fermented for120 h. The highest yield of bioethanol was acquired under the addition of urea. This technique & design is capable of industrial-scale fabrication of bioethanol by using *A. schottii* floral substrates. This research was conducted to fabricate ethanol by fermentation (*A. schottii* L*)* floral substrate with *S. cerevisiae.* The optimum physiochemical parameters required to obtain the highest yield of bioethanol from *A. schottii* flower by fermentation was studied. The immobilization strategy with a cheap agricultural substrate and magnetic nanoparticles were also studied. The engine performance and emission studies were done with different blends of petrol and bio-ethanol.

1. Introduction

Biomass energy reduces GHG emissions on a large scale. The CO_2 released on burning biomass is equal to fossil fuels (Kongkiattikajorn and Sornvoraweat, 2011). However, during photosynthesis, the CO_2 is captured for the growth of biomass and hence a balance exists. The biomass can be grown on underutilized farmland (Rankovic et al., 2009). Biofuels are the only renewable liquid transportation fuels that can reduce dependence on foreign oil. Huge biomass potential is available in our country to produce biodiesel and bioethanol, so investing in this sector proves to be economical (Raita et al., 2016). When burnt, the biomass can pollute the air, but at low levels than fossil fuels' burning. The Sulphur content, which causes acid rain, are not produced while burning the biomass. The burnt biomass releases CO_2, contributing to GHG emission but compensated by the photosynthesis process during biomass growth (Liu et al., 2018).

The first-generation biofuels are obtained from sugary, starchy and fatty food crops. Molasses, the byproduct of the sugar industry, are used to produce ethanol (Talebnia et al., 2010). The 2nd generation biofuels are mainly from lignocellulosic materials. The raw materials like wood, straw, agricultural, horticultural residues and forest waste are available in large quantities (Mittal, 1992). Various methods are available to convert these residues into biofuels. This type of biomass focuses mainly on avoiding food crop resources, which pose a threat to food security (Abdel Ghany et al., 2014). The second-generation processes mainly aim to

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Green synthesis of magnetic nanoparticles via Cinnamomum verum bark extract for biological application

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ABSTRACT

The green synthesis of magnetic Fe nanoparticles (NPs) was prepared via Cinnamomum Verum bark extract. The UV–vis analysis explained the formation of Fe NPs with SPR band at 288 nm. The powder X-ray diffraction analysis (XRD) explicated the mean crystallite size was at 36 nm. The Fourier Transform Infra-Red analysis (FTIR) revealed the functional groups in the prepared Fe NPs. The Scanning Electron Microscope (SEM) and High-Resolution Transmission Electron Microscope (HR-TEM) analyses notified the circular and spherical shaped Fe NPs with the size at 20–50 nm. The Energy dispersive X-ray spectroscopy (EDS) and mapping analyses validated the formation of Fe NPs with purity. The Vibrating Sample Magnetometer (VSM) revealed the paramagnetic behavior of prepared Fe NPs. The phytochemical analysis described the phytochemicals compounds which present in Cinnamomum Verum bark extract. The Antibacterial assay described the much higher inhibition zone of prepared Fe NPs upon human pathogenic bacteria. The Antioxidant (DPPH) assay described the efficient scavenging behavior of Fe NPs with 89 % at 80 μg/mL concentration. The Anti-inflammatory assay explicated the potential protein denaturation behavior of Fe NPs with 87 % at 500 μg/mL concentration. The Anti-diabetic assay reported the much higher potential efficiency of prepared Fe NPs with 84 % at 500 μg/mL concentration.

1. Introduction

In recent decades, nanotechnology has gained more recognition due to its unique properties associated with the size distribution and morphology of nanoparticles. Nanotechnology was an umbrella term that covers many research areas dealing with objects that are covered in nanometers such as chemistry, physics, biology, engineering and other scientific aspects of nanotechnology [1,2]. Nanoparticles having 1–100 nm possess great impact in the field of chemistry, optics, batteries, physics, environmental remediation, drug delivery and medicine. Nanoparticles exhibit enormous structures which create a different approach in catalytic, physical, chemical and medicinal properties of materials than bulk [3–5].

Nowadays, the researchers concentrate on the metal nanoparticles due to the large surface area, low melting point, and good optical, catalytic, electrical and thermal properties. These distinctive properties of metal nanoparticles create exploitation in the industrial area such as food, agriculture, space, cosmetics, medical and chemical aspects of use in day-to-day life [6–9].

Recent research in the synthesis of nanoparticles opened a new era in the fast-growing method for the production of nanoparticles. Physical and chemical methods were usually used for the synthesis of nanoparticles, however, based on the toxicity of these methods; the objective of the research has latterly moved towards the biosynthetic method [10–12].

Nanoparticles of magnetic materials have attracted much consideration due to their properties deviate from those of bulk materials and they can be used to make materials and devices with new properties [1]. Magnetic Nanoparticles have important applications in magnetic storage devices, in ferrofluids, i.e. stable suspensions of magnetic nanoparticles, in magnetic beads that are applied in biotechnology, for contrast enhancement in magnetic resonance imaging (MRI), and targeted drug delivery, bioelectrochemical sensing, environmental remediation and as an electrode for supercapacitors and lithium-ion batteries [2]. The magnetic nanoparticles received from the green synthesis method using plants applied in many fields such as semiconductors [13], catalysts [14], optics, chemistry [15] and medicine [16].

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Original article

Phytochemical analysis and fabrication of silver nanoparticles using *Acacia catechu*: An efficacious and ecofriendly control tool against selected polyphagous insect pests

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ABSTRACT

Globally, the farmers are struggling with polyphagous insect pest, and it is the number one enemy of agri-products, which made plenty of economic deterioration. *Spodoptera litura* and *Helicoverpa armigera* are the agronomically important polyphagous pests. Most of the farmers are predominately dependent on synthetic chemical insecticides (SCIs) for battle against polyphagous pets. As a result, the broad spectrum usage of SCIs led a lot of detrimental outcomes only inconsequently the researchers search the former-friendly phyto-pesticidal approach. In the present investigation, leaf ethanol extract (LEE) and silver nanoparticles (AgNPs) of *A. catechu* (*Ac*) were subjected to various spectral (TLC, CC, UV, FTIR, XRD and SEM) analyses. Larval and pupal toxicity of *A. catechu Ac*-LEE and *Ac*-AgNPs were tested against selected polyphagous insect pests. The significant larval and pupal toxicity were experimentally proven, and the highest toxicity noticed in AgNPs than *Ac*-LEE. The larval and pupal toxicity of *Ac*-AgNPs tested against *S. litura* and *H. armigera* LC_{50}/LC_{90} values were 71.04/ 74.78, 85.33/ 88.91 μg/mL and 92.57/ 96.21 and 124.43/ 129.95 μg/mL respectively. *Ac*-AgNPs could be potential phyto-pesticidal effectiveness against selected polyphagous insect pests. In globally, it is significantly sufficient ratification giving towards the prevention of many unauthorized SCPs.

1. Introduction

Most of the quality and quantity of the agricultural product is directly/ indirectly deteriorated by insect pests in many countries (Elumalai et al., 2010; Kamaraj et al., 2008; Krishnappa et al., 2010; Krishnappa and Elumalai, 2012; Misra, 2014). *Spodoptera litura* is a predominant polyphagous pest occupied a wide range of hosting around 200 floral species globally, in which 74 floral host species noticed from India (Elumalai et al., 2014; Paulraj et al., 2017). *S. litura* larvae consumed the different parts of host flora, including rhizome and causing severe damage, which gives above 60% of revenue loss in India (Elumalai et al., 2014; Krishnappa et al., 2010a, 2010b). India is a tropical country, polyphagous pest (*S. litura*) surviving and high abundance in that particular climate; therefore, recently, agriculture is facing severe economic losses (Paulraj et al., 2017). *Helicoverpa armigera* is a multivoltine, agronomically predominant polyphagous pest and it consumed a wide range of hosts estimated above 300 floras communities globally (Backiyaraj et al., 2014; Namin et al., 2014). The initial larval stage feeds only soft floral structures then turned to later stages feed on every part of flora (Gokulakrishnan et al., 2012).

Globally, most of the farmers are predominantly depending on synthetic chemical insecticides (SCIs) for battle against polyphagous insect fauna (Elumalai et al., 2010; Krishnappa and Elumalai, 2012). As the results of broad-spectrum usage of SCIs

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Original article

A novel approach to assess the heavy metal content in the feathers of shorebirds: A perspective of environmental research

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ABSTRACT

Metals are major toxic elements and cause various diseases and damage shorebirds. The study envisaged the heavy metals content in the feathers of shorebirds, prey, water, and sediment from Pichavaram Mangrove Forest (PMF). Primary feathers of shorebirds species such as Curlew Sandpiper, Eurasian Curlew, and Painted Stork were collected and analyzed the following metals viz., Cd, Cu, Cr, Co, Pb, Hg, Ni, and Zn. The levels of Hg, Cr, Pb and Ni varied significantly among the metals studied ($p < 0.05$). The metal contamination pattern of shorebirds followed in the following order: Painted stork > Eurasian Curlew > Curlew sandpiper. However, in the habitat, Cd, Co, Pb, Hg, Ni and Zi varied significantly between water and sediment ($p < 0.05$) and Cd, Cu, Hg, Pb, Ni, and Zi differed significantly among the prey species ($p < 0.05$). Overall, except for Cd, whereas, other seven metals showed significant differences between the feathers of shorebirds and the environment such as water, sediment, polychaetes, mollusc, crabs, prawns and fishes ($p < 0.05$). Nevertheless, the resident bird (Painted stork) had a higher level of metal accumulation than migratory species, showing that PMF is under threat and requires proper monitoring, management and conservation strategies to sustain organisms that depend on it.

1. Introduction

Heavy metals are major toxic elements and cause various diseases and damage wildlife when their load exceeds normal levels. Higher content of Cd in feathers of birds can wreck their flying mechanism and lead to poor development of bones (Spahn and Sherry, 1999). Pb mainly deposits in the tissues of feathers of birds (Jayakumar and Muralidharan, 2011), and a higher content of it could destroy their thermoregulation, growth of nestlings, and recognition of their siblings (Burger and Gochfeld, 2000). The toxicity of Cr had several impacts on birds, such as the development of embryo and hatching success of eggs in Mallard (Kertész and Fáncsi, 2003). Even in lower concentrations, Ni can affect pigment colouring of feathers during moulting (Honda et al., 1990). Zn at higher concentrations can affect reproduction and increase kidney toxicity (Carpenter et al., 2004). Rising Hg levels in birds can affect their breeding success (Gochfeld, 1997), and above 5 ppm adversely affects reproduction (Evers et al., 2007). Co is considered as a significant element necessary for metabolism but can negatively affect it in excessive concentrations (Roginski and Mertz, 1977). The role of metals in benthic organisms is also significant since they are involved in littoral trophic mechanisms and benthic organisms, including fishes, are essential prey for the majority of shorebirds (Wilson, 1989).

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INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

GEOMATIC BASED SOIL AND GEOMORPHOLOGICAL CLASSIFICATION OF KUMBAKONAM TOWN, THANJAVUR DISTRICT, TAMILNADU

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ABSTRACT

In the present study, an attempt has been made to classify the different soil and geomorphic units of Kumbakonam town Thanjavur district, Tamilnadu. The drainage, contour and delineated geological units have been overlaid on IRS-ID LISS III satellite imagery (bands 2, 3 and 4) the system to delineate and characterize different geomorphological units and analysis of their processes based on the field observations. The study area is basically of sedimentary in origin with different geomorphological formations and is influenced by the various processes. Based on the satellite data analysis, the distinct geomorphological units viz., alluvial plain and deltaic plain fills have been delineated and characterized. The information generated from satellite data in the form of vector layers has been used in GIS to generate soil and geomorphological maps of the study area. The present study demonstrates that IRS-ID LISS-III data in conjunction with geomorphology, soil, river and drainage and parameters to enable detailed evaluation of different geomorphological units and analysis of their processes based on the field observations. The delineated geomorphological units can be utilized for evaluation and management of natural resources and geo-environment on sustainable basis at river catchment level.

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INTRODUCTION

The soil and geomorphological pattern using Remote Sensing has been attempted in a number of previous investigations. Roy and Raina (1973) studied hydrogeomorphology of Kotepalli Catchment area of Hyderabad. Chatarjee et al., (1978) studied the geomorphology of central Luni Basin of Western Rajasthan. Raju and Vaidyanadhan (1984) also used Remote Sensing techniques in the study of Sarada River Basin. Similar investigations were also attempted by some more workers (Raviprakash and Mishra 1993, Mangrukar et al., 1993; Thomas et al., 1995, Saini and Nathawat, 1996). Recently Jaisankar et al., (2001) have under taken hydromorphogeological and Remote Sensing studies for groundwater exploration in Agnigundala area, Andhra Pradesh. In this investigation, geomorphology and land use pattern of Visakhapatnam urban industrial area has been taken up using IRS-IB and SPOT imageries with subsequent field checks.

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Study Area: Kumbakonam is a special grade Municipal Town and second biggest town in terms of administrative status to Thanjavur District. It is situated 10°57' North Latitudes and 79°23' East Longitude Kumbakonam is located 313 km away from Chennai on the South, 90 km away from Trichy on the East and 40 Km away from Thanjavur on the North- East. The town is bound by River "Cauvery" on the North and "Aresalar" on the South with a gentle slope from north to south. Civil Administration was looked by a town level committee (Municipal Committee) which was formed in 1866 with an extent of 7.68 Sq.km. At present, the Kumbakoardnam town extends over an area of 12.58 Sq.km and the local planning area extends over an area of 64.02 Sq.Km.

Soil; The town is not having any commercially exploitable minerals. The Alluvium and Regur are the major type of soils found in the region. More than 65% of the areas are covered by alluvium soil due to the presence of Cauvery delta. This is fertile and suited for agricultural purpose. Rice is the principle crop: Coconut, Mango and Tamarind are the major types of trees found in the region. The Adanur soil type mostly found in the western part and the Alattur soil type found in the eastern part of the study area. The Padugai soil type mostly found in the northern part along the edges.

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Phytochemical analysis and Biological activities of fruit extract of *Naringi crenulata* (Roxb) Nocols.

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ABSTRACT

This study was carried out with an objective to investigate the phytochemical analysis, antimicrobial, antidermatophyte and antihelminthic activity potentials of fruit of Naringi crenulata (Roxb).The phytochemical screening and antimicrobial activites with different solvent aqueous, methanol, chloroform and benzene extract and antidermatophytes, antihelminthic activity aqueous and methanol fruit extract treated against microbes and earthworms. The results showed antibacterial activity of maximum zone of inhibition of Enterococcus aeromonas with aqueous extract and antifungal activity maximum zone of inhibition Penicillium sp in aqueous fruit extract respectively. The antidermatophyte activity maximum zone of inhibition of T. rubrum activity fruits extract and dose dependent activity was observed in aqueous and methanol leaf extracts exhibitive, respectively dose-dependent action and death mortality (%) compared to others. The present study qualitative and quantitative phytocompound confirm the presence of alkaloid, carbohydrate, flavonoids, glycosides, phlobatannins, protein, saponin, steroid, tannin, terpenoids and teriterpenoids compound in fruit extract. The presence of phytocompounds, may be of use for developing plant based drugs for various ailments.

Keywords: antifungal activity, secondary metabolites, *Naringi crenulata*, antibacterial activity.

PHYTOCHEMICAL CHARACTERIZATIONOF *Naringi crenulata* (Roxb) LEAF EXTRACT BY GC-MS method

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ABSTRACT

The bioactive compounds of *Naringi crenulata* (Roxb) leaves have been evaluated using GC-MS. The active chemical compounds were identified by using Gas Chromatography-Mass Spectrometry. The phytochemical compounds found in the *N. crenulata* leaves with methanolic extract were matched with NIST library. GC-MS analysis of leaves extract *Naringi crenulata* in characterization of photochemical sixteen components were identified Phytochemical compounds of *N. crenulata* leaves with methanolic extract was 16 specified compounds identified including hexadecocenoic acid performed.

Keywords: Methanol extract, *Naringi crenulata*, GC-MS analysis andphotochemical.

INTRODUCTION

Herbal medicine is one of the most remarkable uses of plant based diversity. As many as 75 to 90% of the world's rural people rely on herbal medicine. The success of any health care system depends on the availability of suitable drugs on a sustainable basis. Natural medicine improves strength of the body. The knowledge medicinal plant has been accumulated in the course of many centuries based on different medicinal systems such as Ayurveda, Unani and Siddha. In india, it is reported that traditional healers uses 2500 plants species 100 species

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OPTICAL PHYSICS

Interplay of three-body and higher-order interactions on the modulational instability of Bose–Einstein condensate

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We investigate the modulational instability (MI) of trapped Bose–Einstein condensates with three-body and higher-order interactions employing both semi-analytical and numerical methods. Using the time-dependent variational approach, we derive variational equations for the time evolution of the amplitude, phase of modulational perturbation, and effective potential of the system. By means of an effective potential, we retrieve the corresponding MI condition of the dynamical system under consideration. The interplay between three-body interaction and higher-order interaction is discussed in detail. The semi-analytical predictions are confirmed through numerical simulations.

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1. INTRODUCTION

In the ultracold regime where the temperature is much lower than the critical temperature for condensation, a Bose gas may obey the $T = 0$ formalism. Most experiments in Bose–Einstein condensates (BECs) are reproduced and described by the theoretical model based on the nonlinear mean-field Gross–Pitaevskii (GP) equation with two-body interaction. The effect of the interatomic interaction leads to a nonlinear term in the GP equation, which is proportional to the s-wave scattering length a_s and the condensate density [1]. One can change the sign and strength of the scattering length by using the Feshbach resonance technique [2]. This indicates that the strength of the interaction can be restrained by using diverse experimental devices. In the one-dimensional (1D) homogeneous limit, the GP equation takes the form of a nonlinear Schrödinger equation that supports a spectrum of exact soliton solutions. Experimentalists approach this mathematically ideal scenario by confining the condensate in an elongated and prolate trap, typically with tight radial confinement. However, this quasi-1D geometry is usually accompanied by the presence of weak axial harmonic trapping, which removes the integrability of the system [3].

It is understood that at low densities, where the interatomic distances are significantly greater than the distance scale of atom–atom interactions, the two-body interaction can be described by a scattering length where the effects of the higher-order interactions are negligible [1,4]. But in certain experiments, the density of the BECs is considerably high. In particular, the evolution of BECs on the surface of atomic chips and in atomic waveguides involves a strong compression of the traps, and this results in the enhancement of densities in BECs [5–8]. Consequently, the simple GP equation (with two-body interaction alone) becomes inadequate. Hence, the dynamics of the BEC needs a better description of atom–atom interaction. Such a system comprises three-body interactions due to higher densities and shape-dependent potential due to strong confinement. Higher-order terms in the expansion of the phase shifts at low momenta, determined by the effective range, the shape parameter, etc., give corrections to the simple GP equation. It has been shown that the critical number of condensed atoms needed for stability, the chemical potential, the condensate

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Original article

Seed dispersal by ungulates in the point calimere wildlife sanctuary: A scientific and perspective analysis

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ABSTRACT

Exotic woody weed plants are a very serious threat to seed dispersed by ungulate in the tropical forest of Asia. The ungulates in Point Calimere Wildlife Sanctuary (PCWS) are a significant role in native indigenous seed dispersal. The exotic woody weed tree *Prosopis juliflora* prevalence distributed in the PCWS and they might potentially alter the native medicinal plant species. In the present investigation, we have assessed the seed dispersal by ungulates in PCWS from January to March 2017. Four different ungulate species were selected to understand their seed dispersal rate of different plant species in selected sanctuary. This investigation was planned to confirm the seed dispersal by ungulates of blackbuck, spotted deer, wild boar and feral horse. Among the four different ungulates tested, the maximum numbers of pellets collected from blackbuck and no seed found in their pellets. The low quantities of pellets were collected from wild boar and this study has recorded medium-sized ungulates which dispersed variety of plant. However, the dispersal of the seed of medicinal plants were not considerably high and relatively moderate percentage of seeds dispersal occurred in medium-sized ungulates like wild boar and spotted deer. *P. juliflora* had 100% seed germination rate were observed from the faecal samples of wild boar and feral horse. The control seed achieved maximum seedling rate than the ungulates seeds.

1. Introduction

Plants are very less mobility in consequently their diverse of seeds dispersal are highly influencing through variety of biotic vectors. The majority of seeds are dispersing through animals by their digestive system, excreted seeds which fall on the ground and growing it naturally. Usually, that excreted seeds are getting higher potential chances to form new plants which could be far away from the mother plant (Jordano et al., 2010; Chapman et al., 2017; Susan Harrison, 2017; Chaves et al., 2018). Many birds are likely to eat diverse of fruits varieties which help to dispersing seeds to different locality by their dropping. The animals are doing seed dispersal and play a major role towards, success and wealth of environmental (Ingle, 2003; Lozada et al., 2007; Pejchar et al., 2008; Patrick David et al., 2015). The avian fauna are doing long-distance distribution of seed dispersal and accidentally these seeds are dispersed in uneven and critically important flora filling wild and epizoochoary (Gonzales et al., 2009; Chimera et al., 2010; Balasubramanian et al., 2011). Globally, the past three decades forest fire becomes major threat to wild ecosystem in various parts of the continents. As a result of forest fire, most of the indigenous/endemic flora species will become extinct as possible (Satendra and Kaushik, 2014). These problems are recently highlighted in many

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Urban Population Growth Using GIS in Kumbakonam Municipality, Tamilnadu,India

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Abstract

Urbanization is the processes by which villages turn into towns and towns develop into cities. It is a process and can be interpreted that there is an increasing economic specialization and advancing technology which results in the accumulation of people. Kumbakonam Municipality, located in South India has experienced rapid urbanization in the past two decades. Urban population growth occurs in the study area with major processes led to a slow by slow transformation of agricultural land into urban land-uses leading to increase in more built-up area. This study attempt to measure and analyze urban growth in the study area using temporal data changes for years 2000 and 2015 using ARC GIS.

Keywords: Urban Population Growth,Built-up area Mapping, Buffer Analysis and GIS

1.0 Introduction

Urbanization is the processes by which villages turn into towns and towns develop into cities. Two major causes are responsible for the growth of urbanization and its rapid spread from the beginning of the 21th century. The first is development of technology and rapid industrialization, and the second is unplanned migration to large cities from the rural areas. Urbanization is two way processes because it involves not only movement from village to cities and change from agricultural activities to commercial and service activities but it also involves change in the attitudes and behavior patterns of migrant peoples. Man has always tried to improve his lifestyle everybody, because the new invention of instruments helps to reduce the working time which in turn brought changes in human lifestyle change.Change detection analysis is an important key to understanding changes took place over time.Towns and cities have acted as focal points in the cultural landscape of world. Areal differentiation of any phenomenon became not only complex but also dynamic posing challenges to geographical research.

1.1 Literature Review

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Influences of dietary inclusion of algae *Chaetomorpha aerea* enhanced growth performance, immunity, haematological response and disease resistance of *Labeo rohita* challenged with *Aeromonas hydrophila*

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ABSTRACT

The present study was investigated to the sequel of dietary supplementation of algae (*Chaetomorpha aerea*) on growth, exploitation of food, haematological, immunological parameters and disease resistance against *Aeromonas hydrophila* in *Labeo rohita* for 28-days trial period. A total of 180 fishes with a body weight of 55 ± 0.9 g initially, were selected and allotted to one of five dietary treatments, in which the basal diet supplemented with 0, 0.25, 0.5, 0.75, and 1.0 g kg^{-1} (w/w) of *C. aerea*. The fishes were subjected to challenge with *Aeromonas hydrophila* and relative percentage of survival (%) was recorded for 14 days after the feeding trial. Accordingly, the fishes fed with *C. aerea* increased the growth rate, feed conversion rate, specific growth rate, haemoglobin, neutrophil and lysozyme activity, when compared to the control group ($P < 0.05$). Moreover, *C. aerea* supplementation (0.25 g kg^{-1}) showed that the enhanced body weight, respiratory burst and lysozyme activity and resistance against *A. hydrophila* challenge. On the whole, the obtained results showed that this feeding approach can productively increase the growth and it could be considered as a probable immunostimulant in the organic aquaculture.

1. Introduction

About 15–20% for animal protein intake by humans, provided by the aquaculture and hence the efficient production is the way for ensuring the long lasting as well as efficient industry (FAO, 2010). The major carp in India, *Labeo rohita* is one of the most chosen species in the Asian sub-continent and it includes about 35% of the entire carp manufacture, due to the increased speedy growth along with the delicious taste, acceptable nature towards the feeds provided and the raised value in market (Jhingran and Pullin, 1998; Mishra and Samantaray, 2004; Dey et al., 2005; Rahman et al., 2007; Vutukuru et al., 2007; Kumar et al., 2009). *Aeromonas hydrophila*, has been found to be a predominant pathogenic organism for lower vertebrates, includes fishes as well as amphibians (Vivas et al., 2004; Karunasagar and Rosalind, 1991). The *A. hydrophila* affected fish shows the features like, necrosis, hemorrhagic septicaemia, ulcer formation in skin and exophthalmia that may cause increased death rate, which results in significant drawback in the economy of industries according to the Food and Agriculture Organization that involves the freshwater aquaculture (FAO, 2010; Parker and Shaw, 2011; Shen et al., 2013). The fish may be infected by the pathogens like bacteria due to many factors like intensive farming, pollution in the waters or changes in the external environment (Kumari and Sahoo, 2006). Apart from these factors, the nutritional eminence of the fish may also be a significant factor for the infection due to the inter-relationship with production of energy and the immunity towards the stress caused by the bacterial infection.

Seaweeds are edible and contain vital nutrients such as proteins, essential fatty acids, vitamins, and minerals for human growth. The

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Original article

Identification of a novel antibacterial protein from hemolymph of freshwater zooplankton *Mesocyclops leuckarti*

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ABSTRACT

Bacterial infections are the most important problem of health care worldwide. The hemolymph antibacterial proteins of *Mesocyclops leuckarti* was isolated for the first time and its antibacterial efficacy was evaluated against four different human pathogenic microbes viz., *Escherichia coli*, *Staphylococcus aureus*, *Klebsiella pneumonia* and *Shigella flexneri*. The antibacterial potential of the antimicrobial proteins of hemolymph samples from plankton cultured in water enriched with Cow Urine Distillate (CUD) was compared with normal ones. The results indicated that the hemolymph proteins were more potential against Gram negative bacteria than Gram positive bacteria. *Klebsiella pneumonia* was more susceptible to the hemolymph proteins exhibiting a zone of inhibition measuring 27 mm. The supplement of CUD to the culture media further enriched the antibacterial activity of the hemolymph proteins (29 mm). The SDS-PAGE analysis indicated two different types of clear bands representing proteins of 53 kDa and 19 kDa. Overall, this investigation signified that the microcrustaceans have a defence mechanism hemolymph of *Mesocyclops leuckarti* have a potential agent for novel antibiotics.

1. Introduction

Copepods represent about 20% of the mean annual zooplankton biomass. They are found in abundance in many aquatic ecosystems (Huys and Boxshall, 1991) and conspicuous member of aquatic biota that have adapted to various habitats such as damp moss, interstitial sand, subterranean localities and parasitic living. The cyclopoid copepods are successful inland water group animals and *Mesocyclops leuckarti* is the important planktonic cyclopoid copepods. In evolution, invertebrates have not developed acquired immune systems. However, they have been bestowed with non-specific immune mechanisms. Crustaceans show many antibacterial proteins in their hemolymph. However, the literature does not show any record of anti bacterial proteins in microcrustaceans including zooplankton (Iskratsch et al., 2009; Iwanaga, 1993; Kawabata et al., 1995; Mori and Stewart, 1978; Jayasankar and Subramoniam, 1999) (Table 1).

Hemolymph is the type of blood found in Arthropod's open circulatory system. It contains many bioactive molecules which have functional roles in the defence system. The molecules include lectins, complement, clotting factors, antimicrobial peptides (Vazquez et al., 2009).

Among them the antimicrobial peptides are the prime factors that give immunity to the animal. There are two types of antimicrobial peptides identified in hemolymph. They are high molecular weight large antimicrobial proteins (>100 amino acids) and low molecular weight small antimicrobial proteins. The high molecular weight antimicrobial proteins target the disrupt microbial biomolecules and small antimicrobial proteins disrupt the structure and/or the function of microbial cells (Aspan et al. (1995); Stabili et al. (1999); Fujimoto et al. (1995); Hall et al. (1995)). These antimicrobial peptides are secreted in

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A GEOGRAPHIC STUDY ON REPRODUCTIVE HEALTH CARE OF WOMEN IN THANJAVUR DISTRICT

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ABSTRACT

"Health is wealth", Health plays vital role in wealth of a society. Reproductive health determines the health of the future society. According to 2011 census 19.1% of population was young in India. It is estimated to have increased 34.33% of youth in total population by 2020. Reproductive health includes the prenatal and postnatal care of pregnant women. According to WHO (World Health Organization), "Reproductive health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity, in all matters relating to the reproductive system and to its functions and processes". Reproductive health is highly affected by socio, economic and psychological factors.Antenatal health care is heath support for during pregnancy time. ANC includes the Pregnancy registered within 12 weeks and regular checkups, regular vaccination, hemoglobin test, HIV test, Blood sugar, BP and intake of Iron and Folic Acid (IFA) tablets.

Keywords: *Reproductive health, Antenatal care, Socio economic status.*

1. INTRODUCTION

Maternal/Reproductive Healthcare includes the Prenatal, Postnatal care, family Planning, reduces maternal mortality and child Health care. A maternal health care service provides the safe motherhood. RCH Phase I provide the immunization, vitamin A, antenatal care visits, and Iron prophylaxis for pregnant women, and prevention of pneumonia, safe deliveries and postnatal care. The RCH Programme has given special attention to rural areas, Slums and Tribal areas. RCH phase II (2005), gives importance to essential obstetric care and strengthening referral system.

A Proposed Methodology for the Recognition and Classification of the Ancient Scripts from Epigraphy Images Using Histogram of BRISK Orientation Sign Code

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Abstract--- The extraction of ancient Tamil scripts from epigraphy images is a challenging problem in the pattern recognition area. Now-a-days, modern readers are faced with many difficulties to interpret ancient script from epigraphy images. In this paper, we present a proposed methodology to extract ancient scripts from epigraphy images and also a comparative study of previous work has been done. In this work, we introduce Histogram of BRISK (Binary Robust Invariant Scalable Key points) orientation sign code to extract the ancient scripts from epigraphy images easily and accurately.

Keywords---BRISK (Binary Robust Invariant Scalable Key Points), Histogram of BRISK Orientation Sign Code, Zernike Moment Descriptor, LOMO (Local Maximal Occurrence), Random Forest, K-Nearest Neighbor.

I. Introduction

An extraction of characters from document image is an easy process. Many techniques are available for the extraction of characters from document image. It is very difficult to extract characters from epigraphy images. The ancient script in epigraphy images is not having the same shape and similarity. Their writing style and size of the characters are different.

For these reasons, it is not easy toextract ancient scripts from epigraphy images.i) Inpreprocessing, Gabor filter and active contour are used to enhance the images. ii) After the preprocessing, BRISK (Binary Robust Invariant Scalable keypoints) is used to identify the valid points in the ancient character. Next, the proposed technique Brisk histogram of sign code is used toidentify the horizontal and vertical valid points in each and every ancient characters.

The combinational approach of Zernike moment descriptor, LOMO(Local Maximal Occurrence) andHistogram of BRISK orientation sign code are used as feature descriptors.iii)In classification, KNN(K-Nearest Neighbor) and RF (Random Forest) are used as classifiers and to select best classifier for this research work. This proposed method helps us to get good results and extracts ancient scripts from epigraphy images accurately and clearly.

This paper contains the following section 1 presents the overview of the work, section 2 explains the details of the BRISK technique, section 3 presents the details of the algorithm, section 4 discuss the details of feature extraction techniques, section 5 discuss the various types of classifiers, section 6 contains results and discussion, section 7 concludes the performance of the research.

II. BRISK (Binary Robust Invariant Scalable Key Points)

BRISK (Binary Robust Invariant Scalable Key points) proposed by Stefan Leutenegger [1] is used to detect the corners in scale space. It involves basically two steps: i) Scale Space Key point detection ii) Key point description. Key point detection means it detects the interest points in image and scale dimensions using a prominent criterion. The computation is done by identifying the key points in octave layers of the image pyramid as well as in layers in-between. Quadratic function fitting is used to calculate the location and scale of each key point in the continuous domain [2].

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Original article

Swift production of rhamnolipid biosurfactant, biopolymer and synthesis of biosurfactant-wrapped silver nanoparticles and its enhanced oil recovery

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ABSTRACT

Microbial enhanced oil recovery (MEOR) is a kind of enhanced oil recovery (EOR) development, often used as a tertiary stage where oil recovery is no longer possible utilizing primary and secondary conventional techniques. Among a few potential natural operators valuable for MEOR, biosurfactants, biopolymers and biosurfactant based nanoparticles assume key jobs. Biosurfactant which are produced by microorganisms' act as are surface active agents that can be used as an alternative to chemically synthesized surfactants. *Pseudomonas aeruginosa* TEN01, a gram-negative bacterium isolated from the petroleum industry is a potential biosurfactant (Rhamnolipid) producer using cassava waste as the substrate. This work focuses on production and characterization of rhamnolipid from *P. aeruginosa* TEN01 and its use in enhanced oil recovery. The effectiveness of Chitosan that is deacetylated form of chitin which is a biopolymer that provides density and viscosity to the fluids is not known in enhanced oil recovery yet and so it is studied. Moreover, the fabrication of biosurfactant-mediated silver nanocrystals and its application in enhanced oil recovery is also studied. Sand-Pack column was constructed and the mechanism of oil recovery in the column was studied. While incubating the crude oil containing sand packed column with Biosurfactant-biopolymer and brine flooding in the ratio of 1:2, and Biosurfactant incubation - flooding with 3 g/l of biopolymer was found to be 34.28% and 44.5% respectively. The biosurfactant based silver nanoparticles are non-toxic and have better stability when compared to chemically synthesized silver nanoparticles. The oil recovery percentage by chemical based Ag NPs and biosurfactant based Ag NPs are 14.94% and 14.28% respectively.

1. Introduction

From the earliest starting point of civic establishments, we are constantly subject to energizes, for example, wood, whale-oil or petroleum derivatives - coal, and raw petroleum related items (lamp oil, diesel, oil). Among each one of those diverse sort of energizes, non-renewable energy source assumed a major job in mechanical goals (Silva et al., 2014). Increase in oil costs based on market interest disparities are observed as of late resulted a decrease which is relied upon to remain at 30–60 $/bbl oil for a prolonged duration (Schulz, 2016; Banat, 1995; McInerney et al., 2005). Current situation of such an uncertain market at oil costs is a very tough path ahead for oil ventures and those nations which are exceptionally reliant on oil-based economy. Nevertheless, the

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Assessment of Flood hazard prone areas in parts of Thanjavur District, South India using FIGUSED Method

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Abstract: Thanjavur district is primarily an agricultural area enclosed with irrigation system of the Cauvery in Tamil Nadu. But during the monsoon period flooding has been disrupted the areas and directely effected the soil erosion in those areas. The flood hazard assessment is one of the important task to understand the soil erosion of the area due to natural hazards. In this context the present study to assess flood hazard prone areas using FIGUSED method adopted with remote sensing data and GIS technology. In FIGUSED method, seven parameters has been used such as flow accumulation, distance from the drainage network, elevation, land use, rainfall intensity and geology. The relative importance of each parameter for the occurrence and severity of flood has been connected to weight values. These values are calculated following a normalized weight parameter rating method. According to their weight values, information of the different parameters is superimposed, resulting to flood hazard mapping. The Flood Hazard Index (FHI) has been defined and a spatial analysis in a GIS environment has been applied for the estimation of its value. The historical flood events, accuracy and sensitivity analysis not examined in this study and it is only understand the flood hazard area. The study revealed that about 12% of the area falls under very high flood hazard and 26% high to moderate flood hazard zones and indicates that immediate attention have to be taken and protect the agricultural lands for the sustainable development of those areas.

Index Terms **– Normalized weight, flood prone area, GIS analysis, flood hazard area, South India**

1. INTRODUCTION

Flood is a major natural hazard with often immeasurable impact, affecting annually 170 million people (Kowalzig, 2008). Therefore, flood risk management needs to overcome national borders, geographic location and socio-economic limitations (Degiorgis et al., 2012). Flood risk management is usually divided into flood risk assessment and flood risk mitigation (Schanze et al., 2006). From sustainable development point of view, the flood hazard management is very essential for future (Schober et al., 2015). Tehrany et al., 2013 have studied 10 parameters with the relative importance of each parameter defined following a statistical analysis. During the JAL cyclone event (November to December 2010), severe floods, occurred in Thanjavur district and Thanjavur taluk which spreads at the margin of Cauvery River was one of the affected places. Cyclones ravage the district once in 3-5 years, during north east monsoon, resulting in flood and crop damage. During 1982-83, 1990-91 and 1992-93 cyclones of high intensity have affected the district. Every year monsoon cyclone flood and drought situation may occur during Rabi season which may also considerably affect the paddy production in Thanjavur district.

The application of GIS-based multi-criteria analysis in the context of flood risk assessment was rare until 2000. Black and Burns (2002) have studied the changes in the estimation of flood risk on Scottish rivers with time by re-analyzing flood records. An early attempt to use GIS on water-related hazards has been presented in Meja-Navarro et al. (1994). The present article deals with the first element of flood risk management, i.e. the definition of flood hazard areas in a specific region. The present study methodology adopted based on the Kazakis et al (2015) FIGUSED methods to identify flood hazard zones in parts of Thanjavur and the output of the results is very useful to the farmer and planners for the agricultural purposes in the study area.

2. STUDY AREA

Thanjavur district lies between 9° 50' and 11° 25' North latitude and 78° 45' and 79° 25' East longtitude (Fig.1). It is bounded on the North by Thiruchirapalli and Cuddalore districts, on the East by Tiruvarur and Nagapattinam districts, on the South by Palk Strait and Pudukottai district and on the west by Pudukkottai district and Tiruchirapalli districts. Total geographical of the study area is 1697 sq.km. The mean maximum temperature was 37.48°C during May - July. Similarly, the mean minimum temperature was 20.82°C during November-January. The north east monsoon provides much rainfall with 545.7 mm and 953.2 as normal and actual rainfall respectively, while southwest monsoon provides 342 and 303.1 mm as normal and actual rainfall respectively. The total population of Thanjavur district is 22,16,138. Thanjavur district stands unique from time immemorial for its agricultural activities and is rightly acclaimed as the granary of South India lying in the deltaic region of the famous river Cauvery and criss-crossed by lengthy network of irrigation canals. Therefore this coastal district abounds in green paddy fields, tall coconut groves, vast gardens of mango and plantain trees and other verdant vegetation.

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Versatile fabrication and characterization of Cu-doped ZrO_2 nanoparticles: enhanced photocatalytic and photoluminescence properties

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Abstract
Pristine ZrO_2 and molar ratios of Cu-doped ZrO_2 nanoparticles were synthesized by chemical precipitation. The XRD pattern of pristine ZrO_2 and Cu-doped ZrO_2 nanoparticles shows the formation of t-tetragonal phase and shifting of tetragonal phase to monoclinic phase. The average crystallite sizes of the pristine ZrO_2 and Cu-doped ZrO_2 nanoparticles were calculated as 2.9, 4.65, 4.76, 5.02, and 4.96 nm, respectively. The Cu (0.06 M)-doped ZrO_2 nanoparticles are present as spherical morphology and high agglomeration was confirmed by FE-SEM and TEM analyses. The XPS spectra affirmed the presence of Cu^{2+}, Zr^{4+}, and oxygen ions in the Cu (0.06 M)-doped ZrO_2 nanoparticles. The Cu-doped ZrO_2 nanoparticles exhibit two energy gaps at 5.30 and 3.05 eV, 5.21 and 2.22 eV, 4.65 and 2.11 eV, and 4.44 and 2.65 eV. The surface defects and oxygen vacancies were analyzed by PL and ESR spectroscopy. The ESR spectra are clearly asymmetric in shape and contain a peak signal related to the presence of the copper species (Cu^{2+}) in the distorted tetragonal coordination of ZrO_2. The photocatalytic activities of Cu (0.06 M)-doped ZrO_2 nanoparticles were successfully sought on degradation of the two azo dyes: methyl violet and methyl blue under sunlight irradiation. Cu (0.06 M)-doped ZrO_2 showed complete degradation at 70 min. The reusability of Cu (0.06 M)-doped ZrO_2 nanoparticles shows maximum degradation efficiency for six successive runs.

1 Introduction

Dyes are used in a variety of different commercial enterprises, for products such as leather, textiles, plastics, cosmetics, paper, and petrochemical industry. These different industries produce both organic and inorganic pollutants that are released into the water sources. The pollution of water has become a major issue and affecting the human beings, animals, and plants. Therefore, major drive to reduce the level of pollution before the release of industrial waste [1–3]. The scientific community has used various techniques to remove the organic/inorganic pollutants from water, like coagulation [4], bio-degradation [5], ultra-filtration [6], processes using membranes [7], reverse osmosis [8], advance oxidation processes (AOP) [9], and so on. Among these techniques, photocatalysis is one of the most important approaches and it can completely degrade the hazardous pollutants to H_2O and CO_2 [1–3].

Photocatalysis occurs when a photon is absorbed onto the surface of a semiconductor-based material, and electron–hole pairs are generated. The generated electron and hole pairs react with H_2O, inducing oxidation and/or reduction. This technique has proved useful for several applications such as air purification [10], wastewater treatment [11], water splitting [12], disinfection [13], CO_2 reduction [14], and in surface cleaning treatments [15]. Many oxide and sulfide materials such as ZnO [16], SiO_2 [17], SnO_2 [18],

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Biosynthesis of silver nanoparticles using *phyllanthus emblica* fruit extract for antimicrobial application

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ABSTRACT

Biological synthesis of metal nanoparticles is one of the effortless, cost - effective, environmental - friendly methods and scale down the handling of toxic chemicals. The silver nanoparticles were triumphantly synthesized from the silver nitrate solution through a greener route using Indian gooseberry (*phyllanthus emblica*) fruit extract and the prepared particles are of well-balanced shape and size. The stabilization and the bioreduction of silver nanoparticles were described by adopting UV–vis spectrometry interprets the surface plasmon resonance peak at 449 nm. The functional groups of *phyllanthus emblica* fruit extract and the silver nanoparticles were diagnosed by using Fourier transform Infrared spectrum (FTIR). The crystalline nature of face-centered cubic (FCC) was examined by X-ray diffraction (XRD) and the crystalline size ranges between 19 nm to 45 nm with an average size 30 nm. Scanning electron microscope (SEM) witnessed the hexagonal shape of silver nanoparticles and Energy-dispersive X-ray spectroscope (EDX) assured the well-established fabrication of nanocrystalline silver element. The synthesized nanoparticle exhibits significant antibacterial effects and very clear zone of inhibition against *Klebsiella pneumoniae* and *Staphylococcus aureus bacterias.*

1. Introduction

The research on metal nanoparticles is a foremost field of nanotechnology because of their massive applications in the areas of physics, chemistry, medicine and biology (Ponarulselvam et al., 2012). The most essential and specific properties of nanomaterials are having high surface area to volume ratio exhibits remarkable antibacterial properties (Ahmed et al., 2016). Due to their noble properties, silver nanoparticles may have vast applications in the areas of microelectronics, photonics and photo catalyst and lithography (Shankar et al., 2017). Therefore, nanoparticles can be formulated from different physicochemical methods and the drawbacks of physicochemical methods are mainly because of the handling of toxic chemicals, the production of harmful toxic wastes, requires high pressure and temperature (Iyyappa Rajan et al., 2017 & Valan Arasu et al., 2019). Because of these drawbacks, the valuable alternative and attractive biological methods were focused in the present work. The bio-inspired synthesis using plants are the nontoxic, easily available, low-cost, environmentally friendly methods (Ahmed and Ikram, 2015). Not only the greener method is environmentally friendly, but they can also be employed to fabricate large quantities of nanoparticles and free of contamination (Mittal et al., 2013).

Fabrication of nanoparticles by adopting plant extract is also differing from microbial synthesis because they are relatively fast, no need to maintain culture conditions and so this method was appropriate to fabricate nanoparticles of distinct size and shape (Tarannum et al., 2019). Bio-fabrication of silver nanoparticles using *phyllanthus emblica* fruit extract has been reported in the present work. It has been

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Multiple bright and dark soliton solutions in three component spinor Bose-Einstein condensates

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ABSTRACT

We investigate a quasi one dimensional spin-1 Bose-Einstein Condensates (BEC) in the absence of an external confinement governed by a system of three coupled Gross-Pitaevskii (GP) equation. Based on the Lax-pair, we construct one soliton solution employing gauge transformation method. In addition, the multiple bright and dark soliton solutions are obtained by properly choosing amplitude dependent parameter in the Lax-pair. The results of the paper emphasizes the richness in the structure of soliton solutions admitted by the spin components, a phenomenon which has never been brought out to the fore. We have also extended the gauge transformation method to generate two soliton solutions.

1. Introduction

A large amount of bosons would occupy the lowest energy state when they are cooled close to absolute zero. This novel state, proposed by Bose and Einstein in 1925, is named as Bose-Einstein condensate (BEC). It was experimentally realized by Eric Cornell, Carl Wieman and Wolfgang Ketterle in 1995 [1]. After that in 1998 [2], Tin-Lun Ho and Ohmi group observed BEC in Na^{23} and Rb^{87} using dipole optical trap. They were able to realize BEC with internal degrees of freedom corresponding to the three hyperfine spin states ($m_f = +1, 0, -1$ for $F = 1$). It is known as "spinor BECs". The important aspect of spinor BEC is that two or more hyperfine states of atoms in the condensates almost have same energy. So, the spin degrees of freedom impacts the evolution of condensates that are not present in the usual single-component BEC.

The dilute gaseous BEC with external trapping is modeled by Gross-Pitaevskii (GP) equation [3]. The nonlinearity in GP equation is governed by inter-atomic interaction which can be controlled by s-wave scattering length using external magnetic, optical or dc-electric field [4]. The possibility of controlling the inter atomic interaction in BECs has been witnessed in many experimental and theoretical studies.

Single component GP equation has been shown to admit bright solitons [5], dark solitons [6], vortices [7], etc., while two-component GP equation admits bright [8], ring dark [9], bright-dark [10], dark-dark and dark-bright solitons [11]. The multi component spinor BEC has been investigated and different types of solitons, like dark solitons [12], gap solitons [13], bright solitons [14], bright-dark soliton complexes [15], magnetic solitons [16], breathing solitons [17], dark-bright solitons [18], rogue waves [19], spin domains and spin textures [20–22] have been reported. The modulational instability of the spinor BEC model has been investigated in [23] and some exact solutions were reported in [24]. The non-autonomous three component GP equation has been analyzed in [25] and the dynamics of $F = 1$ spinor BEC has been investigated employing Hirota method. The three component defocussing nonlinear Schrödinger equation is analyzed in [26] using inverse scattering method. The dynamics of the polar bright soliton under the influence of SOC in spin-1 BECs is reported in [27] and some solutions were presented in Refs. [28–31].

Miki Wadati and co-workers had introduced three component integrable GP equation using 2×2 matrix [32]. They observed that bright solitons in spinor BECs show two spin states such as ferromagnetic (nonzero total spin) and polar (zero total spin) states. A specific

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Enhancement of photocatalytic activity of ZrO_2 nanoparticles by doping with Mg for UV light photocatalytic degradation of methyl violet and methyl blue dyes

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Abstract
In this study, pristine ZrO_2 (600 °C) and Mg (0.02, 0.04, 0.06, 0.08 M)-doped ZrO_2 nanoparticles were effectively synthesized at about 10 nm size and achieved complete degradation of methyl violet and methyl blue dyes under UV irradiation. The calcined products were analyzed by XRD, FTIR, UV-DRS, PL, FESEM-EDX, TEM-SAED pattern and XPS techniques. The tetragonal crystal structure of the pristine ZrO_2 and Mg (0.02–0.08 M)-doped ZrO_2 nanoparticles were affirmed by XRD analysis. The Mg (0.08 M)-doped ZrO_2 nanoparticles were approximately in quasi-spherical morphology and high agglomeration was confirmed by FESEM and TEM results. The surface defects and oxygen vacancies were analyzed by PL spectroscopy. The Mg (0.08 M)-doped ZrO_2 nanoparticles exhibited enlarged photocatalytic activity with 94% and 90% degradation of methyl violet and methyl blue dyes under UV irradiation.

1 Introduction

The various organic dyes are increasingly applied in many industries such as leather tanning, textile, plastic, paper, food, pharmaceutical, cosmetics, photo-electrochemical cells, hair coloring, rubber and agricultural research and so on [1–3]. These types of industries subsequently discharge their colored wastewater containing pigments and dyes. Colored wastewater (dyes) significantly attributed to environmental pollution and health risk [4]. Almost these colored wastewaters are toxic and non-biodegradable. Various physical, biological and chemical techniques have been applied for its removals such as precipitation, activated carbon, ozonation, membrane separation, Fenton, photo-Fenton catalytic reaction, bioremediation, adsorption, reverse osmosis, coagulation and ultra-filtration [1–3, 5]. Among these techniques, photocatalysis is the most important approach because of it's low cost, eco-friendliness and totally oxidizes the pollutants to H_2O and CO_2 [1–3].

There are many materials applied for photocatalytic degradation including TiO_2 [6] ZnO [7], WO_3 [8], ZrO_2 [9], SnO_2 [10], In_2O_3 [11], Fe_2O_3 [12], NiO [13], CuO [14] CdS [15], and PbS [16]. Among these, zirconium oxide (ZrO_2) is a most attractive material. ZrO_2 is a wide band gap (5.0–5.5 eV) semiconductor, and this oxide material had detected broad application in ceramics, catalysts, gas sensors, fuel cell, solid-state electrolytes, barrier coatings and optical devices [17–21]. It exhibits excellent thermal, mechanical, electrical and optical properties, such as low thermal conductivity, high hardness, high fracture toughness, high refractive index, optical transparency, high corrosion resistance and polymorphic nature [17–22]. Zirconium oxide (ZrO_2) exhibits three kinds of polymorphs as follows: Monoclinic (m-ZrO_2), tetragonal (t-ZrO_2) and cubic (c-ZrO_2). The m-monoclinic (m-ZrO_2) phase is stable below at < 1170 °C, t-tetragonal (t-ZrO_2) phase is stable at $1170 - 2370$ °C, and c-cubic (c-ZrO_2) phase is stable at > 2370 °C, respectively [23]. These crystal phases strongly depend on thermal condition and preparation method [24].

Moreover, the t-tetragonal phase (t-ZrO_2) has strongly improved photocatalytic activity compared to c-cubic (c-ZrO_2) and m-monoclinic (m-ZrO_2) phase zirconium oxide (ZrO_2) materials [25, 26]. Pristine zirconia is essentially a poor oxide ion conductor at lesser temperature. Hence,

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Photocatalytic degradation of Rhodamine B dye by Ni doped TiO_2 nanoparticles under solar irradiation

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Abstract

Ni -doped TiO2 nanocomposite was synthesized by the sol-gel method. The structural properties of nano composites have been characterized by X-Ray diffraction (XRD), Fourier –Transform Infrared (FT-IR), Scanning Electron Microscope (SEM). The photocatalytic activity of the synthesized nano composites was measured by the degradation of Methylene blue (MB) under solar the effects of initial ion concentration, Catalyst dosage, pH on removal efficiency through batch studies were investigated. The results showed that the degradation efficiency is decreased with an increase in initial concentration of MB from 50-150 mg/l.

KeyWords : Homogeneous photocatalysis, Heterogeneous photocatalysis, Photo catalyst, Photo degradation, Ni doped TiO_2, Solar irradiation.

Introduction

Energy shortage and environmental issues are the most pivotal complications of our modernized world [1]. Even though science and technology are making our life very simple and stylish, Human beings could not healthily lead their life. According to the latest state of the environmental report, 17 rivers of West Bengal, 83% of open wells and most of the rivers in Kerala are highly contaminated by dyes, organic pollutants, and heavy metals. Those water sources unfit for even bathing. So the low availability of freshwater sources and the necessity of water for a high population pushed our researchers focusing on wastewater treatment. Several methods are available for treating polluted water [2, 3]. There are several methods available for treating the wastewater like Coagulation, Flocculation, Ion- Exchange method, Adsorption, Reverse Osmosis, Ozonation, Chlorination and Photocatalysis. High salinity of wastewater and recalcitrant nature of synthetic dyes are the primary reason for avoiding biological method. Chlorination and ozonation are extremely high costs [4-6]. Traditional methods such as adsorption, Ultrafiltration, Reverse osmosis, coagulation, ion-exchange methods are having issues in converting organic compounds from wastewater but discharging of secondary wastes [4]. Photocatalysis is a current trending scenario that has more advantages for the removal of pollutants even at low concentrations. Photooxidation is a complete oxidation of organic pollutants that occur within a few hours without the generation of any secondary toxins. Here the photocatalyst using for this process is highly effective and very cheap [7,8]. Homogeneous and Heterogeneous photocatalysis is the main classification of photocatalysis. Semiconductor

material TiO2, ZnO, SnO2, CeO2 used as photocatalyst. Semiconductor photocatalysts are generally choosing for its favoring electronic structure. While irradiating with a light source the electrons are excited from empty valence band to conduction band [9-18]. To avoid the electron-hole formation(e-/h+) which is the reason for less photodegradation, doping of transition metals and non-metal ion are suggested. The transition metal such as Fe[19-21], ZnO [22,23], Cu [24,25], Mg [26], Cd[27] , Mn [28] are the most promising metals doped with TiO_2 Solar light and UV light are generally used as light source [29].Nickel is particularly suitable for industrial applications and its optimum level of cost, non - toxic nature, controlling morphology and improving bandgap [30]. The previous literature survey reveals that Ni doping in TiO_2 can improve the visible light responsive activity against organic and toxic pollutants. It is reported that Ni doping can introduce and impurity charge [illegible] Conduction band

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Anti-cancer, anti-biofilm, and anti-inflammatory properties of hen's albumen: A photodynamic approach

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ABSTRACT

The albumen plays a major role in the protection of eggs against microorganisms. It contains an arsenal of natural antimicrobial molecules and antibacterial proteins, including the well-known ovotransferrin and lysozyme, which exert their activities against a range of bacteria. In the present study, the hen's albumen extract treated with the dried insect body of blister beetle *M. pustulata* was assessed for antibacterial, antibiofilm, anti-inflammatory and anti-proliferative activity. The zone of inhibition against Gram positive *E. faecalis* and *S. aureus* was 10.8 mm and 12.1 mm respectively at 100 µg mL^{-1}. However, it was 13.6 mm and 15.3 mm for Gram negative *P. aeruginosa* and *P. vulgaris* respectively. The biofilm of tested bacteria was significantly inhibited at 100 µg mL^{-1}. The hydrophobicity of bacterial biofilms was considerably condensed after treatment with the hen's albumen extracts at 100 µg mL^{-1}. The anti-inflammatory activity of hen's albumen extracts was confirmed by the inhibition of cyclooxygenase (COX) enzyme to 84.91% at 100 µg mL^{-1} with the relative IC_{50} of 8.26 µg mL^{-1}. The albumen extract effectively inhibited the viability (23.61%) of HepG2 hepatic cancer cells at 100 µg mL^{-1}. The anti-proliferative activity of the albumen extracts was further revealed by the induction of HepG2 apoptotic cell morphology. This study concludes that the hen's albumen extract treated with *M. pustulata* is a natural therapeutic agent to treat biofilm associated clinical bacteria, inflammations and human hepatic cancer cells.

1. Introduction

Biofilms are bacterial exopolysaccharides that are formed on solid surfaces [1–10]. Inflammation is a biological defense against infection or injury [11]. It helps us to eliminate the foreign bodies or injurious agents. Furthermore, it removes damaged tissues and assists in healing process. However, many acute and chronic human diseases are due to uncontrolled inflammation [12].

Hepatocellular carcinoma (HCC) is the second leading cause of deaths worldwide [13–18]. Hence, the progress of an efficient anti-cancer agent is a vital need for administration of HCC. The study on the potency of animal-born drugs to treat hepatocellular carcinoma has received considerable attention due to their safety compared to chemotherapeutics.

Since ancient times, insects have been used to cure diseases. In traditional medicine, insect bodies, eggs and secretions was used for different ailments. Recent scientific studies have shown the pharmaceutical applications of insect extractions including anti-bacterial, anti-inflammatory and anti-tumor activities [19]. The blister beetles commonly called as ''oil beetles'' belong to the family Meloidae. They secrete yellow coloured, pungent smelling oily droplets of haemolymph from the leg joints when disturbed. The exudation contains the toxic material 'cantharidin' or cantharidin [20–24]. Cantharidin and its derivatives have been found to contain anti-tumoral properties against breast, colorectal, melanomas, bladder, pancreatic, hepatic cancers and leukemia [25]. The blister beetle of this study *M. pustulata* are black and

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Impact of pesticide monocrotophos on microbial populations and histology of intestine in the Indian earthworm *Lampito mauritii* (Kinberg)

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ABSTRACT

Soil contamination has enlarged over the decades due to intensive use of pesticides and chemical fertilizers in agronomy. Earthworms are significant organisms in the soil community. Earthworms are the major role in soil fertility in most ecological system and the production of biogenic structures. Moreover, earthworm gut mucus enhances the beneficial soil microorganism potential biological activities. They are used as model organisms for assessing the ecological risks of chemicals. Enrichment of essential nutrients in soil through earthworm is a cost-effective and eco-friendly approach. In India, the organophosphorus pesticide monocrotophos is commonly used to control agricultural pests. Hence, it is important to study the effect of monocrotophos on the gut microbiota in *Lampito mauritii*. A 15-day exposure to a low (1/10th of the LC_{50} after 96 h i.e., 0.093 ppm kg^{-1}) and high sublethal concentration (1/3rd of the LC_{50} after 96 h i.e., 0.311 ppm kg^{-1}) of monocrotophos led to reduced proliferation of the gut microbiota in *L. mauritii*. However, exposure for 30 days led to a recuperation of the microbial populations to near control values. Among the eight bacterial and five fungal species that inhabit the gut of *L. mauritii*, only six bacterial and three fungal species were able to survive after exposure to monocrotophos. In addition to the study, histopathological changes were observed in the intestine of *L.mauritii* after application of lower sublethal concentration of monocrotophos. Severe pathological changes such as vacuolization, degenerated nuclei, damaged villi and congestion of the blood sinuses were noticed in the intestine on 1st and, 5th day of the experiment. But in 30th day the damages were slowly recovered due to degradation of monocrotophos by the presence of some pesticides degrading bacterial and fungal species and regenerative capability of chloragogen cells in the intestine. The results suggested that reduced microbial populations and pathological damages in intestine were observed during the application of monocrotophos. So, the monocrotophos have several harmful impacts on earthworms.

1. Introduction

There is a growing concern for soil contamination due to the widespread and global use of agropesticides. Knowledge about the effect(s) of pesticides in the soil environment is imperative since the resident soil organisms may be adversely affected. Depending on the type of soil organisms affected, this may have damaging consequences for soil fertility. A large proportion (80%) of the biomass of terrestrial invertebrates comprises earthworms that are important for structuring and increasing the nutrient content of soil. Therefore, they are suitable bioindicators for the chemical contamination of soil in terrestrial ecosystems that can be used to provide an early warning for deteriorating soil quality [1,2]. This is important for protecting the natural environments and is of increasing interest in protecting human health [3] as well as other terrestrial vertebrates that prey on earthworms. Earthworms are suitable bioindicators of soil toxicity since they ingest large quantities of decomposed litter, manure, and other organic matter deposited on soil, thereby aiding the conversion into rich topsoil [4]. The pesticides in soil may accumulate in worms via ingesting contaminated soil or the absorption from soil water. Monocrotophos (dimethyl (E)-1-methyl-2-(methylcarbamoyl) vinyl phosphate) is an organophosphorus pesticide that is used to control a broad spectrum of

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ORIGINAL PAPER

Dynamics of solitons in the fourth-order nonlocal nonlinear Schrödinger equation

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Abstract We consider the fourth-order nonlocal nonlinear Schrödinger equation and generate the Lax pair. We then employ Darboux transformation to generate dark and antidark soliton solutions. The highlight of the results is that one ends up generating a two-soliton solution characterized by one spectral parameter alone, a property which has never been witnessed so far.

Keywords Nonlocal nonlinear equations · Lax pair · Darboux transformation · $\mathcal{PT}$ symmetry · Soliton

1 Introduction

The advent of femtosecond pulse propagation through optical fibers [1] prompted the necessity to go beyond the classical integrable nonlinear Schrödinger (NLS) equation [2,3] to study higher-order effects on ultra short pulse transmission. In fact, this resulted in the investigation of several higher-order integrable NLS equations like Hirota equation [4] , quintic NLS equation [5], etc. However, all these integrable equations are local equations, i.e., the evolution of the solution depends on local space and time.

On the other hand, optical systems exhibiting parity-time ($\mathcal{PT}$) symmetry have gained the attention of the researchers in the last few years [6–10]. The optical beam dynamics in such systems is described by the Schrödinger equation with a complex potential which can be realized through a judicious inclusion of refractive index and gain/loss regime. If the dependence of the refractive index on electric field intensity is introduced [11,12], then the dynamical system can be mathematically modeled by the celebrated $\mathcal{PT}$ symmetric NLS equation [13]

$$i\,\partial_t q(x,t) + \partial_x^2 q(x,t) + 2\alpha q(x,t)q(x,t)\overline{q}(-x,t) = 0 \tag{1}$$

In the above equation, the potential is both $\mathcal{PT}$ symmetric and nonlinear simultaneously. In a single word, the above equation does not have a direct application in optics; it can describe prospectives meta-magnetic materials by the virtue of its gauge equivalent magnetic spin systems [14]. In fact, rich dynamics exhibited by Eq. (1) [15–19] has proved to be a catalyst to open new vistas in nonlocal integrable equations. In addition, the recent investigation of several $\mathcal{PT}$ symmetric nonlinear partial differential equations (pdes) [20–22] in the field of nonlinear optics, hydrodynamics, and atmospheric sciences has underscored the emphasis to penetrate deep into the domain of nonlocal $\mathcal{PT}$ symmetric

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SYNTHESIS OF PURE AND BIO MODIFIED CALCIUM OXIDE (CaO) NANOPARTICLES USING WASTE CHICKEN EGG SHELLS AND EVALUATION OF ITS ANTIBACTERIAL ACTIVITY

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ABSTRACT: Calcium oxide nanoparticles (CaO NPs) gain great value in the areas of energy storage and drug delivery systems. Due to good porosity, it finds its part in storage systems and its biocompatibility earns it a good value in drug delivery and gene transfection. Synthesis of nanoparticles by waste materials and plants of metal oxide is gaining considerable interest due to environmentally friendly reactants and room temperature synthesis. This is most using method of preparation of nanoparticles as it makes use of pollution-free chemicals and encourages the use of non-toxic solvents such as water and plant extracts. In this present study, the calcium oxide nanoparticles synthesized by the eco-friendly green synthesis using environmentally begin waste chicken egg shells. CaO nanoparticles show better antibacterial activity. CaO was bio modified by *Cissus quadrangularis, Acalypha indica, Solanum nigrum, Phyllanthus niruri* to enhance the antibacterial activity, then the antibacterial activity of pure CaO and bio modified CaO was investigated against *B. substilis, S. aureus* and *E. coli* species. The synthesized nanoparticles have been characterized by XRD. Antimicrobial activity of synthesized nanoparticles were also analyzed in this study.

INTRODUCTION: Nanotechnology, a newly evolved discipline aims the creation, manipulation and application of structures in the nanometer size range. Over a past few decades, nanoparticles have been extensively applied in various fields of public interest. Nanotechnology has the potential to revolutionize the pharmaceutical industry with new tools for the molecular treatment of diseases, and rapid disease detection.

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It advances materials with a nano-dimension provides several means for innovative design of nano-size drug delivery systems (Nano systems) to overcome biological barriers in order to direct the drug [1].

Nanoparticles have also been successfully used to enhance the immobilization and activity of catalysts, in medical and pharmaceutical nano-engineering for delivery of therapeutic agents, in chronic disease diagnostics, and in sensors. The increasing adaptability of clinical microbial strains to antimicrobial drug resistance demands highly effective compounds for the treatment of critical microbial infection. Nanoparticles have demonstrated antimicrobial activities; the development of novel applications in this field makes them an attractive

alternative to conventional dispensesions. Metal oxide nanoparticles (NPs) are known to possess strong antimicrobial properties. Inorganic metal oxides are being increasingly used for antimicrobial applications and these nanoparticles are well known for inherent antimicrobial activity [2]. In this study, a new antimicrobial nanoparticle (CaONPs) was synthesized and assessed for antimicrobial activities using a panel of bacterial and fungal pathogen.

CaO is of particular interest as it is regarded as safe material to human beings and animals and it has excellent antimicrobial potential and adeptness to indolent microbial endotoxin [3, 4]. Due to idiosyncratic structural and optical properties of CaO it acts as a potential drug delivery agent [5].

organic antimicrobial agents. Basic metal oxides such as MgO and ZnO, have been shown to exhibit antibacterial activity, where the particle size of the oxides appears to have an impact [12].

Recent studies have shown that green biologically based methods using microorganisms and plants to synthesize nanoparticles are safe, inexpensive, and an environment-friendly alternative. Both micro-organisms and plants have long demonstrated the ability to absorb and accumulate inorganic metallic ions from their surrounding environment. These attractive properties make many biological entities efficient biological factories capable of significantly reducing environmental pollution and reclaiming metals from industrial waste [13]. Recently, the biological synthesis of nanoparticles

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Synthesis and characterization of crustin capped titanium dioxide nanoparticles: Photocatalytic, antibacterial, antifungal and insecticidal activities

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ABSTRACT

Current scenario of bio-nanotechnology, successfully fabrication of ultrafine titanium dioxide nanoparticles (TiO_2NPs) using various biological protein sources for the multipurpose targets. The present research report involves synthesis of TiO_2NPs using antimicrobial peptide (AMP) crustin (Cr). Crustin previously purified from the blue crab, *Portunus pelagicus* haemolymph, by blue Sepharose CL-6B matrix assisted affinity column chromatography. Synthesized Cr-TiO_2NPs was physico-chemically characterized by UV–Visible spectroscopy (UV–Visible), X-ray Diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), High-resolution transmission electron microscopy (HR-TEM) and zeta potential examination. X-ray diffraction analysis for crystalline nature and phase identification of titanium dioxide nanoparticles was absorbed. Functional groups were found through FTIR ranges between 1620 and 1700 cm^{-1}. HR-TEM analysis showed that the synthesized Cr-TiO_2NPs tetragonal shape and sizes ranging from 10 to 50 nm. Finally, the surface charge of the Cr-TiO_2NPs was confirmed through zeta potential analysis. Furthermore, the characterized Cr-TiO_2NPs exhibited good biofilm inhibition against GPB - *S. mutans* (Gram Positive Bacteria- *Streptococcus mutans*), GNB - *P. vulgaris* (Gram Negative Bacteria- *Proteus vulgaris*) and fungal *Candida albicans*. Moreover, photocatalysis demonstrated that the Cr-TiO_2NPs was effectively explored the degradation of dyes. The results suggest that Cr-TiO_2NPs is an excellent bactericidal, fungicidal and photocatalytic agent that can be supportively used for biomedical and industrial applications.

1. Introduction

In recent years, pollution has become a major problem, with pollutants such as wastes and pathogens found in various bodies of water, especially from industrial organic dyes [1]. These dyes are used in textiles, printing, paints and sunscreen materials and are extracted from natural sources and also used extensively in biological stains [2]. Nowadays, chemicals are used to prepare different dyes and they are highly demanded by the textile industry [3]. Hence various dyes or pollutants totally change the land and water ecosystem cause severe health problems for society. The continuous discharge and accumulation of dye effluents in the water ecosystem inhibits the growth of microorganisms by preventing sunlight [4]. There have been many attempts to reduce water pollution, especially dye effluents, through various physical, chemical and mechanical methods, but less impacts has been obtained, with low efficiency, high time consumption and high cost [5]. Such effluents are difficult to remove from bodies of water; major research is therefore needed to minimize dye effluent pollution in bodies of water.

TiO_2 nanoparticles play a vital role in the dye degradation process because of their efficient dye degradation processes with no contaminants. The unique features of titanium have found various usages,

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Facile synthesis of haemocyanin-capped zinc oxide nanoparticles: Effect on growth performance, digestive-enzyme activity, and immune responses of *Penaeus semisulcatus*

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ABSTRACT

ZnO nanoparticles (NPs) synthesized using haemocyanin (Hc-ZnONPs) purified from haemolymph of *Penaeus semisulcatus* were characterized using various techniques. HR-TEM and SEM microscopy indicated Hc-ZnONPs had a typical size of 20–50 nm and were spherical. The objective of current investigation was to assess the effects of dietary supplementation of Hc-ZnONPs on the development and activity of digestive and metabolic enzymes, as well as the antioxidant levels in *P. semisulcatus*. Trial basal diets were supplemented with Hc-ZnONPs at rates of 0, 10, 20, 40, 60, and 80 mg kg^{-1} (dry feed weight) and were fed to *P. semisulcatus* for 30 d. For 60 mg kg^{-1} Hc-ZnONPs-supplemented feed, significantly ($P < 0.05$) enhanced endurance, development, and activity of the digestive enzyme were observed. The enzymatic antioxidants and metabolic enzymes activities in the muscle exhibited no significant changes when 10–60 mg kg^{-1} Hc-ZnONPs-supplemented feed was fed to *P. semisulcatus*. Conversely, feeding the *P. semisulcatus* with 80 mg kg^{-1} Hc-ZnONPs produced a harmful outcome, with significant increase in the enzymatic antioxidants and metabolic enzymes. Consequently, 80 mg kg^{-1} Hc-ZnONPs was identified as lethal to *P. semisulcatus*. Hence, it is proposed that the diet of *P. semisulcatus* can be supplemented with up to 60 mg kg^{-1} Hc-ZnONPs for improving the endurance, development and immunity.

1. Introduction

Aquaculture is the most important major food manufacturing sector, after agriculture. The green tiger prawn *Penaeus semisulcatus* is the major species supporting the marine fishery along the southeast shore of India [1]. Micronutrients play crucial roles in the physiological, biological, and immunological functions of organisms. Zn is a necessary mineral for stabilizing cellular membranes and is a trace element in the organs [2]. It is important in numerous metabolic pathways and essential for the development, protein synthesis, carbohydrate metabolism, cell division, and immune systems of all organisms [3–5]. Zn dietary requirements differ among species, and the purposes of Zn for endurance, development, muscle composition, antimicrobial action, immune response, and stress tolerance in several aquatic animals have been described [6–9]. Zn insufficiency may restrain the role of pointing molecules related to the replication of DNA and organism repair. The assimilation of Zn restrains the reproductive recital, development, and mineral consumption in fish and shellfish [10–12].

Nanoscience is a widespread and multidisciplinary field of study that is currently expanding. The productivity of fish and shellfish businesses can be increased through nanotechnology, by using novel devices to improve the capacity of cultivable animals to uptake nutrients, vaccines, and hormones [13]. Se, Al, Fe, ferrous oxide, Zn, and zinc oxide nanoparticles (NPs) play essential roles in aquaculture processes. Conversely, the surfeit of dietary NPs may be poisonous to aquatic animals [14,15]. The crucial achievement of aquaculture is resolute through the endurance, development and health of the cultivable species. Still, there is requiring of information pertaining to ZnONPs on the fundamental physiology and biochemistry of crustaceans. Green synthesis approaches are ahead attention to avoid the high expenses and practice of toxic chemicals and cruel circumstances for reduction and

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PAPER

Facile precipitation synthesis, structural, morphological, photoluminescence and photocatalytic properties of Ni doped ZrO_2 nanoparticles

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Abstract

In this study, Pure ZrO_2 (600 °C) and Ni (0.02, 0.04, 0.06, 0.8 M) doped ZrO_2 (600 °C) nanoparticles were obtained by facile precipitation method. The obtained products have been characterized by XRD, FTIR, UV-DRS, PL, FESEM-EDX, TEM-SAED pattern and XPS. The tetragonal structure of ZrO_2 (600 °C) gradually increases with the increasing Ni doping concentration and then a small NiO diffraction peak was detected at increasing Ni content. The Ni (0.08 M) doped ZrO_2 (600 °C) nanoparticles were approximately in spherical morphology was confirmed by FESEM and TEM results. The energy gap value of the pure ZrO_2 (600 °C) and Ni doped ZrO_2 (600 °C) nanoparticles decreased from 5.12 to 3.2 eV with enhancing nickel concentration. The surface defects and oxygen vacancies were analyzed by PL spectroscopy. This peak intensity gradually decreased with increase in nickel concentration. The photocatalytic activities of the Ni (0.08 M) doped ZrO_2 (600 °C) catalysts were studied by the photodegradation of MV and MB aqueous solution under sunlight irradiation. The Ni (0.08 M) doped ZrO_2 (600 °C) catalyst exhibited good photocatalytic efficiency and the enhanced photocatalytic mechanism was discussed.

1. Introduction

Water is an important necessity of life and it is used for several households with industrial activities. Water is the most vital natural resources, unluckily exploited the most. The main reason is population growth, increased industrialization and urbanization. Nowadays, all over the world is the confronting water crises because of the unlimited and too much exploitation of groundwater by several industries: namely textile, paper, cosmetic, leather, plastics, food, printing and pharmaceutical and so on. These industries are generating large amounts of harmful colored dyes, surfactants, toxic metal components when released into water resources consequence in ecological problems [1].

The greatly important task to the scientist to remove hazardous effluents from contaminated water. Therefore, numerous physical, chemical and biological treatment have been used to remove the organic/inorganic pollutants from water by applying chemical coagulation, floatation, reverse osmosis, advanced oxidation, bioremediation, Filtration, membrane process, adsorption and chemical precipitation. Among the techniques, the photocatalytic activity one of the most important methods that can be applied efficiently to attain high elimination rate of colored dyes from water. Photocatalytic degradation methods, which are eco-friendly and low cost in comparison to the other techniques [1, 2]. The several metal oxide and sulfate materials play an important role in the photocatalytic degradation of colored dyes. For example, TiO_2 [3], CuO [4], ZnO [5], Co_3O_4 [6], Fe_3O_4 [7], WO_3 [8], CeO_2 [9], NiO [10], CdS [11], ZnS [12] and so on. Among the oxide and sulfate materials, zirconium oxide is a most important semiconductor material, since it posses unique properties like high chemical inertness, high surface area, good thermal stability, reusability and low cost. In addition, it has

An Extraction Of Ancient Tamil Scripts From Epigraphy Images Using Gabor Filter, Active Contour And Lomo

S.Sundareswari, Dr.I.Kaspar Raj

Abstract : The extraction of Ancient script from epigraphy images is a tough task. Many techniques are available to extract the characters from the document image. Most of the authors have given their ideas to extract the characters from the document image. The extraction of ancient Tamil script from epigraphy images is a challenging problem in pattern recognition area still. In this paper, we present an efficient approach to extract the ancient Tamil script from epigraphy images. Recognizing the ancient Tamil script from epigraphy images is a very tough task. The proposed methodology consists of three stages: preprocessing, segmentation and feature extraction and classification. Experimental results show that the proposed methodology is more effective and efficient and also it extracts the ancient Tamil script from epigraphy images accurately.

Keywords: Tamil Ancient Characters , Gabor Filter and Active Contour, Feature Extraction(Zernike and Lomo), Classification(KNN and RF)

1 INTRODUCTION

Epigraphy is the study of the science of epigraphs or inscriptions, especially of ancient inscriptions. An epigraph is any kind of text from a single character to a lengthy document. Texts in epigraphy images are different from written texts of each culture [1]. In this work, we have used Ancient Tamil Script epigraphy images as input images. Segmentation of text or character from document image is an easy process. In epigraphy images, the engraved characters are different in size, color, and writing style. Mostly the epigraphy images have broken characters, uneven character intensity, touching characters each other and direction variations within symbols [2]In preprocessing Gabor filter and active contour are used to enhance the image clearly without any noise. Then the combinational approach of two different feature extractions like Zernike moment and Lomo are used. Finally, in classification, two classifiers such as KNN(K-Nearest Neighbor) and RF(Random Forest) are used and tested. This paper is made as follows: Section 1 contains the initiation of epigraphy images, Section 2 explains the details of proposed methodology through various steps involved, Section 3 presents the details of combinational approach of feature extraction techniques, Section 4 discuss the various types of classifiers, Section 5 discussion on results, Section 6 concludes research performance.

2 PROPOSED METHODOLOGY

This proposed methodology involves the following steps: i) Image Acquisition: Read an input image and convert into suitable format. ii) Preprocessing: Gabor filter and Active contour used to remove the noise. iii) Feature Extraction: The combinational approach of Zernike moment and Lomo are used to extract the ancient Tamil scripts from epigraphy images. iv) Classification: In this proposed methodology two classifiers like K-Nearest Neighbor, Random Forest are used and tested. In this proposed methodology, Gabor filter and Active contour are used for preprocessing and for feature extraction techniques combinational approach of Zernike Moment and Lomo features are used. Hence the combinational of these two feature extraction techniques may improve the overall detection rate of the characters in epigraphy images. Next, we have used two different classifiers like RF (Random Forest) and KNN (K Nearest Neighbor) is used and tested to select the best classification algorithm for this research work

2.1 Proposed Algorithm :

Step 1: Read the following inputs like Image,ɵ (theta), f (frequency),threshold value($g_m$thr) Step 2: Read the testing image as Img. Step 3: Initial parameter for Gabor filter GF as ɵ ← 90 and frequency value is 0.2 and threshold value is 50. Step 4: Apply Gabor filter using the equation 4.1. 4.1) [Img_{gFC} ,Img_{gFI}) ← GF (Img) where ɵ =90, f = 0.2. Step 5: for each pixel in image ← Img $Img_{gF\ mag}$ = SQRT (Img_{gFR}^2 + Img_{gFI}^2) End Step 6: Find Gabor filter magnitude binary mask as GF_{BW} ← $Img_{gF\ mag}$ > $g_m$thr . Step 7: Extract the Contour of the image Img using GF_{BW} as intial mask in Active Contour mode. Img_{ACBW} ← ACmode (Img,GF_{BW}). Step 8: for each connected label ← Img_{ACBW} Extract the characters by using the following feature extraction techniques. Zfeat ← Zernike(BWc) Lfeat ← Lomo(Img(BW_C) end Step 9: Feature vector = [Zernike(BWC),Lomo(Img(BW_C) Step 10: Predict Charaters ← Classifiers(Training feature, feature extraction). In this proposed methodology, first character samples are trained and tested. In preprocessing Gabor filter and Active contour are used. In Gabor filter, first read the input image,theta (ω),frequency(f) and threshold value ($g_m$thr).Next, read the testing image as Img. Then set the initial parameters for Gabor filter is ɵ is 90 and the frequency value is 0.2 and the threshold value is 50. Applying Gabor filter using the equation [Img_{gFC} ,Img_{gFI}) ← GF (Img)] and get real and imaginary part of each pixel value using the above parameters. Then find out the Gabor filter magnitude binary mask of images as GF_{BW} ← $Img_{gF\ mag}$ > $g_m$thr This value should be greater than the threshold value. Next, extract the contour of the image Img using GF_{BW} as initial mask in Active Contour mode as Img_{ACBW} ← ACmode (Img,GF_{BW}). Finally, for each connected

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New insecticides and antimicrobials derived from *Sargassum wightii* and *Halimeda gracillis* seaweeds: Toxicity against mosquito vectors and antibiofilm activity against microbial pathogens

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ABSTRACT

Phytochemicals derived from seaweeds offer a novel source of compounds to develop new insecticides and antimicrobials. In the present study, two seaweed species, the brown *Sargassum wightii* and the green *Halimeda gracilis*, were investigated. Extracts were obtained using five solvents of varying polarity (acetone, chloroform, methanol, ethanol, and water). The total phenolic content, total flavonoid content and the antioxidant activities of the extracts were estimated. The ethanol extract from *S. wightii* exhibited more potent antioxidant activity compared to that of the *H. gracilis* extracts. The ethanol extract from *S. wightii* possessed higher values of total phenolics, flavonoids, and antioxidant activity compared to those of the *H. gracillis* ethanol extract. The total phenolic and flavonoid content for ethanol extracts of *S. wightii* and *H. gracillis* was 5.5 mg gallic acid equivalent (GAE)/g, 3.8 mg GAE/g, 10 mg quercetin equivalent (QE)/g, and 8.3 mg QE/g, respectively. The total antioxidant activity of the seaweed extracts was 47 mg ascorbic acid equivalent (AAE)/g for *S. wightii* and 35.9 mg AAE/g for *H. gracilis*. Additionally, the bioactive compounds present in these seaweeds were characterized by FTIR spectroscopy and GC–MS analysis, and the antimicrobial activity of these extracts was then tested against the biofilm formation capabilities of three pathogenic Gram-negative bacteria. The ethanol extracts from *S. wightii* and *H. gracillis* presented the highest inhibitory effect with up to a 40–75% significant reduction in biofilm formation by Gram-negative bacteria. Finally, their insecticidal potential was assessed against late third instar larvae of malaria vectors (*Anopheles stephensi*), dengue and Zika virus vectors (*Aedes aegypti*), and the Japanese encephalitis vector (*Culex tritaeniorhynchus*). LC_{50} values estimated for the *S. wightii* ethanol extract were lower than 50 ppm against all tested mosquito species. Light microscopy revealed that morphological changes were triggered upon exposure to seaweed extracts. Overall, the present study sheds light on the relevant bioactivity of phytochemicals obtained from two widespread seaweeds, suggesting the possibility that these seaweeds can be used to develop novel and biodegradable pesticides and also antimicrobial drugs that can be used to inhibit the development of microbial biofilms.

1. Introduction

For centuries, marine algae and seaweeds have been used by humans for various purposes that range from food sources to drug development (Mohy El-Din and El-Ahwany, 2016). In particular, seaweeds represent an abundant unexplored source of highly diverse phytochemicals (Smit, 2004) that possess various biological functions such as antimicrobial and anti-tumor activities (Kolanjinathan et al., 2009; Chakraborthy et al., 2010; Manivannan et al., 2011). For example, natural products containing energetic biocompounds that possess effective antibacterial and antioxidant activity have recently been used in aquaculture to prevent diseases (Atanasov et al., 2015; Gopinath et al., 2016).

Seaweeds are exposed to elevated concentrations of oxygen and light intensity. To survive in these challenging environments, seaweeds possess an abundance of antioxidants within their tissues to prevent oxidative damage (Gupta and Abu-Ghannam, 2011; Souza et al., 2011; Chakraborty et al., 2015). Consequently, marine seaweeds provide a

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ANALYSE OF SELECTED HEAVY METAL CONTAMINATION IN THE MUDIKONDAN RIVER NANNILAM THIRUVARUR DISTRICT TAMIL NADU INDIA

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ABSTRACT

The present short-review briefly summarizes the status of heavy metal in Cauvery River and its sources and the status and effect of heavy metals in the river sediments and water. The difference in the heavy metals in different parts of the pathways of the river Cauvery is provided in addition to the pollution level and the effect of polluted water or enriched heavy metals on living systems. The pollution status and heavy metal contaminants level varies in water and in sediments with reference to different locations. The rapid population growth along the Mudikondan River has necessitated proper conservation and efficient utilization of freshwater bodies for sustainable development. This is necessary because there has been accelerated deterioration of water quality and also because of increased domestic, municipal and agricultural activities. Effluent discharge, urbanization and deforestation are the main causes of environmental degradation within the catchment.

KEYWORDS: Cauvery River, Contamination, Heavy metals, Pollution and Sediments.

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Synthesis of ZnO nanoparticles using insulin-rich leaf extract: Anti-diabetic, antibiofilm and anti-oxidant properties

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Biological properties

ABSTRACT

Here, we report the novel fabrication of ZnO nanoparticles using the *Costus igneus* leaf extract. Gas chromatography-mass spectrometry (GC–MS) and proton nuclear magnetic resonance (^{1}H NMR) spectroscopy to determine the bioactive components present in the plant extract. The synthesis of *Ci*-ZnO NPs (*C. igneus*- coated zinc oxide nanoparticles) was accomplished using a cost-effective and simple technique. *Ci*-ZnO NPs were specified using UV–visible spectroscopy, FTIR, XRD, and TEM. *Ci*-ZnO NPs was authenticated by UV–Vis and exhibited a peak at 365 nm. The XRD spectra proved the crystalline character of the *Ci*-ZnO NPs synthesized as hexagonal wurtzite. The FTIR spectrum illustrated the presence of possible functional groups present in *Ci*-ZnO NPs. The TEM micrograph showed evidence of the presence of a hexagonal organization with a size of 26.55 nm typical of *Ci*-ZnO NPs. The α-amylase and α-glucosidase inhibition assays demonstrated antidiabetic activity of *Ci*-ZnO NPs (74 % and 82 %, respectively), and the DPPH [2,2-diphenyl-1-picrylhydrazyl hydrate] assay demonstrated the antioxidant activity of the nanoparticles (75%) at a concentration of 100 µg/ml. The *Ci*-ZnO NPs exhibited promising antibacterial and biofilm inhibition activity against the pathogenic bacteria *Streptococcus mutans*, *Lysinibacillus fusiformis*, *Proteus vulgaris*, and *Vibrio parahaemolyticus*. Additionally, the *Ci*-ZnO NPs showed biocompatibility with mammalian RBCs with minimum hemolytic activity (0.633 % ± 0.005 %) at a concentration of 200 µg/ml.

1. Introduction

Costus igneus Nak (Family: Costaceae), generally identified as insulin plant or spiral flag. Insulin plant, inhabitant to America, has been recently introduced to India. It is believed that consuming these leaves reduces glucose levels in the blood. The leaves of *C. igneus* were traditionally used by the ethnic community from Kolli hills of Tamil Nadu, India for treating diabetes [1]. Shetty et al. [2] reported that the leaves of *C. igneus* condensed the fasting and postprandial blood sugar levels in dexamethasone-induced hyperglycemia in rats. Kalailingam et al. [3] reported that diosgenin isolated from the *C. igneus* leaf extract acts as an effective hypoglycemic compound. It stimulates the renewal of β-cells in pancreas and pancreatic insulin secretion. Further, diosgenin plays a role in diminishing cardiovascular risk by reducing LDH release and by upregulating the antioxidant enzymes to scavenge glucose induced free radicals. Diosgenin has physiological effects similar to that of insulin. It is proficient at diminishing blood glucose level via oral administration as compared to its intraperitoneal administration [4].

In the history, the fabrication of nanoparticles has been considered as one of the most dynamic fields and highly preferred in the field of nanotechnology due to their enviable characteristics [5–7]. Among them, metal oxide nanoparticles have gained increased interest and are being incorporated into a diversity of products based on their catalytic capacity, electronic and antimicrobial properties [8,9].

Currently, scientist are spotlight on fabrication of metallic nanoparticles from zinc, gold, silver, platinum, palladium, iron, titanium and

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Novel and Facile Synthesis of Sea Anemone Adhesive Protein-Coated ZnO Nanoparticles: Antioxidant, Antibiofilm, and Mosquito Larvicidal Activity Against *Aedes aegypti*

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Abstract

Recently, marine bio-products have provided a new insight on biomaterials for pharmaceutical applications. Herein, the use of adhesive protein in the fabrication of bio-inspired nanomaterials noted to the possible realization of vital biomedical applications. This study illustrates the biosynthesize ZnO nanoparticles (ZnO NPs) using adhesive protein from sea anemone *Stichodactyla haddoni* (*Sh*Ap). *Sh*Ap-ZnO NPs were characterized via SDS-PAGE, UV–Visible, XRD, FTIR, TEM and SAED. The molecular weight of the adhesive protein was determined by SDS-PAGE to be between 36 and 42 kDa. The UV–Vis peak of *Sh*Ap-ZnO NPs was revealed at 210 nm while XRD exhibited the crystalline nature of *Sh*Ap-ZnO NPs. FTIR revealed that functional group of *Sh*Ap-ZnO NPs, which exhibited peaks at 3441.31–1073.36 cm^{-1}. HR-TEM revealed that *Sh*Ap-ZnO NPs obtained structure were hexagonal with 10 nm diameter. The antioxidant properties of *Sh*Ap, zinc acetate, and *Sh*Ap-ZnO NPs were noted at 100 µg/mL. Further, microscopic analysis demonstrated that 50 µg/mL *of Sh*Ap, zinc acetate, and *Sh*Ap-ZnO NPs efficiently repressed the biofilm formation of both $Gram^{(+)}$ and $Gram^{(-)}$ bacteria. In addition, maximal larvicidal effects were noticed at 100 µg/mL of *Sh*Ap-ZnO NPs against the 3rd instar of *Aedes aegypti*. Overall, the *Sh*Ap-ZnO NPs could have entomological and pharmaceutical applications.

Keywords *Stichodactyla haddoni* · Adhesive protein · Antibiofilm · Antioxidant · Insecticide

Introduction

Currently, researchers focusing on bioactive molecules have discovered a wide range of sources of organic compounds from marine ecosystems [1, 2]. Few of these compounds have been reported to have industrial and toxicological applications; however, most of them have not been extensively studied [3, 4]. In invertebrates, the adhesive proteins from marine organisms in the phylum Cnidaria, including sea anemones, play a vital role in

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Toxicology

Chronic exposure of *Oreochromis niloticus* to sub-lethal copper concentrations: Effects on growth, antioxidant, non-enzymatic antioxidant, oxidative stress and non-specific immune responses

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ABSTRACT

Background: Trace elements of copper (Cu) are one of the main forms of ecological noxious waste in freshwater systems that affect the survival and development of organisms. The objective of the current study was to investigate the effects of chronic exposure to Cu on the growth, oxidative stress, immune and biochemical response in the Nile tilapia, *Oreochromis niloticus*.

Methods: Three groups of *O. niloticus* were tested as follows; the first group was used as the control (not treated with Cu in water), while the 2nd and 3rd groups were exposed to (low) 40 μg L^{-1} and (high) 400 μg L^{-1} concentrations of Cu added to water, respectively. The duration of the experiment, which was conducted in triplicate, was 60 d. End points were evaluated on days 30 and 60. Following 30 d and 60 d of exposure to Cu, the fish were removed from experimental tanks to determine growth. Consequently, blood samples were collected from caudal veins at the end of the trial period (30 d and 60 d) and serum was separated to evaluate different immunological parameters, such as lysozymes (LYZ), respiratory burst activity (RBA) and myeloperoxidase (MPO). Gill and liver tissues were collected for evaluation of Cu and certain biochemical parameters as follows: antioxidant enzymes such as superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPx) and glutathione-S-transferase (GST); non-enzymatic antioxidants such as glutathione (GSH) and metallothionein (MT), and oxidative stress indicators such as malondialdehyde (MDA) and protein carbonyl (PCO). The results pertaining to treatments and the control were compared using two-way ANOVA and Tukey's HSD test. The level of significance was set at $P \leq 0.05$. Data were expressed as mean ± SD.

Results: Chronic exposure to Cu did not induce any mortality in fish during the test period. However, following exposure to Cu, growth of fish in the exposed groups was affected more than that in the control group (unexposed to Cu). In addition, accumulation of Cu in the liver tissue was higher than that in the gill tissues of fish exposed to Cu, compared to that in the control. Gill and liver tissues of Cu-exposed fish showed a significant ($P \leq 0.05$) reduction in the activities of the antioxidant enzymes, SOD, CAT, GPx, and GST, compared to those of unexposed fish. Non-enzymatic antioxidants, GSH and MT, in gill and liver tissues were significantly increased ($P \leq 0.05$) in fish exposed to both concentrations of Cu, compared to those in unexposed fish. Oxidative stress indicators, MDA and PCO in gills and liver of Cu-exposed fish was significantly ($P \leq 0.05$) at both tested concentrations, when compared to control group. Non-specific immune response of LYZ, RBA, and MPO activity in serum decreased significantly ($P \leq 0.05$) in Cu-exposed fish, compared with that of unexposed fish.

Conclusion: Overall, the present results highlighted that chronic exposure to Cu ions may exert a strong effect on the antioxidant and immune responses of *O. niloticus*. Changes in antioxidant enzymes, oxidative stress effects and immune parameters during post-chronic metal exposure may indicate the potential of these parameters as biomarkers of metal toxicity in aquatic ecosystems.

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An Improved Naive Bayes Classifier on Imbalanced Attributes

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ABSTRACT

Data plays a major and prominent role in this modern information era. Classification is a data mining task to discover the hidden information from large amounts of data stored in the repository. This process becomes extremely challenging in case of highly imbalanced dataset. Prediction from imbalanced attributes cannot be done accurately in the following case: During the training phase, the categorical variable is not observed but the test phase encounters the categorical variable and hence it assigns zero probability which leads to false prediction. To overcome this scenario, this article proposes a novel smoothing technique called optimized laplace smoothing estimation. This technique adds a bias value function to improve the accuracy of imbalanced attributes. For example, a child dataset has more attributes and the classification model is used to predict the child weight. Some of the attribute values may not be present in the child dataset due to which Naive Bayes assigns a zero for incomplete and an empty attribute. This leads to inaccurate prediction. In such cases, Naive Bayes can be further tuned by adding some new parameters as well as altering the existing optimization method. Experimental analysis shows that this novel smoothing technique enhances the classification accuracy by means of accurate predictions for imbalanced attributes.

KEYWORDS

Child Dataset, Classification, Imbalanced Attributes, Naive bayes

1. INTRODUCTION

Classification is a supervised (Caruana & Niculescu-Mizil, 2006; John & Langley, 1995) learning algorithm where the attribute labels are known. But in some cases (Nguyen et al., 2011), the attribute label is missing or the attribute label is incomplete which leads to an imbalance in the attributes. This dataset imbalance affects the prediction accuracy. Some of the applications which face this attributes imbalance problem are intrusion detection in networks, medical diagnosis, credit card fraud detection, document classification etc (Gonzalez-Abril et al., 2008). The main objective of classification algorithm is that the model constructed using the training data should improve the prediction accuracy. The performance of the classification algorithms achieves better classification accuracy since it does not consider the imbalance between the attributes in the dataset while constructing the classification model.

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A STUDY ON MATERNAL AND SOCIO - ECONOMIC FACTORS INFLUENCING INFANT BIRTH WEIGHT IN THANJAVUR DISTRICT, TAMIL NADU

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ABSTRACT

Birth weight of a baby is important for their health. Low birth weight is one of the main reasons for infant mortality. Birth weight of less than 2500g is defined as Low birth weight (WHO). A study conducted on how socio-economic and demographic factors affecting the birth weight of a baby. It was conducted on Primary Health care centers of Thanjavur District. The study has taken into 805 new born babies.198 low birth weight babies, 482 Normal birth weight and 125 above normal weight babies taking into consideration. Statistical Analysis and Chi Square tests used for Analysis. Occupation of Husband, Income of Husband, Young age marriage, low income and employment of pregnant women are taken as the main factors for low birth weight. From the study economic, social and demographic factors have not significant effect on birth weight. Maternal health care factors have an significant effect on birth weight.

Key words: *Birth weight, maternal factors, health of mothers.*

1. INTRODUCTION

WHO defines Birth weight of less than 2500g is Low birth weight. Birth weight is a major indicator for reproductive health of a woman. Low weight babies can face many health issues like infection, breathing and feeding, inability to maintain body temperature and so on. To grow a healthy baby, mothers need good nutrition and rest, adequate antenatal care, and a clean environment (UNICEF). UNICEF estimates almost every third new born baby in India is Low birth weight. According to NFHS 4 Report 20% of low birth weight babies births to mothers from the poorest families. A. F. Roche and S. S. Sun et.al (2003) Socio-economic state is a concept devised to measure some aspects of education, occupation, and social prestige of a person or a social group. Ashraf Mohammadzadeh et.al. (2010). The variables which show the most significant association were birth weight, sex, economic status, and educational level of the

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parents. In this study, maternal and paternal education has significant influence on weight although this effect on height was not significant.

2 AIM

The Aim of the study to identify what are the factors affecting the birth weight of the new born babies.

3. REVIEW OF LITERATURE

Birth weight of the newborn is believed to be influenced by a number of factors. The maternal age and parity have a significant effect on birth weight, as shown by Dhall & Bagga (1995). Jolanta Dickute et al (2004). low education, unstable marital status and low income are the major factors for low birth weight. Maternal unfavorable socio-economic factors increased the risk to deliver low birth weight baby. Joshi H.S et.al (2010). The main factors significantly associated with LBW were maternal education, stature, age at delivery; short inter pregnancy interval, inadequate antenatal care, and per capita income of family. Shabbeer Ahmed et.al (2016) The main factors which were significantly associated with LBW were education, community, burden of labor and per capita income of family. Rashidul Alam Mahumud et.al (2016). explained that delayed conception, advanced maternal age, and inadequate ANC visits had independent effects on the prevalence of LBW. Prerna Bansal et.al (2018) Socio-cultural and maternal risk factors like rest received in the afternoon during pregnancy, dietary intake during pregnancy and period of gestation were found to be significantly associated with low birth

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CRITERION III - RESEARCH, INNOVATIONS AND EXTENSION

FRONT PAGE OF PUBLISHED PAPERS

2019

An Efficient Feature Extraction Approach for Extracting the Ancient Tamil Scripts from Stone Inscription Images

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Abstract - **Ancient Tamil script recognition is more complex due to enormously large character set and high similarity between characters. The extraction of ancient Tamil script from stone inscription images is a challenging problem in pattern recognition area. In this paper,we present an efficient approach to extract the ancient Tamil script from stone inscription images. Recognizing the ancient Tamil script from stone inscriptions is a very tough task. The proposed approach consists of three stages: preprocessing, segmentation and feature extraction and classification. Therefore this proposed approach helps to extract the characters from stone inscriptions easily and accurately. Experimental results show that the proposed methodology is more effective.**

Keywords- Tamil Ancient Characters; Feature Extraction; Classification.

I. INTRODUCTION

Ancient Tamil script have large variations of individual writing style. Ancient script extraction from stone inscription images becomes very complex. It involves the following steps: 1) Collection of sample images.2) Pre-processing on collected samples in order to get a clear image.3) Feature extraction technique is required to extract features to form a feature vector. In this work, the combinational approach of three different feature extractions like HOG (Histogram of Gradient), Zernike moment, and Projection label are used.4) After the feature extraction, a classification algorithm is used to classify the character samples. In this paper, three different classification techniques like SVM(Support Vector Machine), RF(Random Forest), KNN(K-Nearest Neighbor) are used and tested in order to select the best classification algorithm. Some of the stone inscription images with ancient Tamil script are given below in Figure 1,2,3.

Fig.1.

Fig.2.

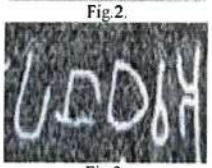

Fig.3.

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ORIGINAL PAPER

Facile and Cost-Effective Ag Nanoparticles Fabricated by *Lilium lancifolium* Leaf Extract: Antibacterial and Antibiofilm Potential

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Abstract

In the present study one-pot green fabrication of silver nanoparticles (Ag NPs) with aqueous leaf extract of *Lilium lancifolium*. Synthesized Ag NPs were illustrated by UV–Vis, FT-IR, XRD, AFM and TEM analysis. A surface plasmon resonance peak was noticed at 411 nm in UV–Vis analysis. XRD patterns of Ag NPs showed high crystalline nature with face centered cubic structure. AFM and TEM analysis of Ag NPs exhibit special and anisotropic morphology with accurate particle size about 10–70 nm and average mean value of 45 nm. Ag NPs were tested for antibacterial and anti-biofilm activity against Gram positive and Gram-negative bacterial strains. The exposure to 25 µL exhibited better antibacterial activity and 50 µL significantly control the bacterial biofilm growth. Overall, the proposed green synthesis method of Ag NPs is facile, convenient, less time consuming and environmentally safe.

Keywords *Lilium lancifolium* · Green synthesis · Nanoparticle · AFM and TEM · Antibacterial and antibiofilm activity

Introduction

Since the concept of nanotechnology became famous in the early 1990s, scientists have been developing new techniques by incorporating nanoparticles and nanomaterials into various fields of science. The concept of nanomaterials, although new, has been a part of our civilization since a very long time. Silver nanoparticles (Ag NPs) have been keen attention due to their special properties of size, shape, and self-assembly. They are commonly used in wide range of industries like pharmacology [1, 2], biomedical devices [3, 4], textiles [5, 6], water purification [7, 8] and cosmetics [9, 10]. Many methods are available for synthesis of Ag NPs which include physical, chemical and biological synthesis. In which, biological means of synthesis gained good-attention compared to other two methods due to low cost, simple, environmentally friendly and efficient substitute for the mass production of nanoparticles [11]. In biological methods, Ag NPs are synthesized via using fungus [12, 13], microbes [14, 15] and plants [16–22]. Compare to the fungus and microbes, plants are promising source for nanoparticles production. The advantages of the plant-mediated synthesis of nanoparticles include cost efficient, large-scale production and require low maintenance [23–27]. Important point of using plants in nanoparticles production instead of fungus or bacteria is the lack of pathogenicity [28]. In the past researches, silver nanoparticles are synthesized using extracts from different plant materials such as *Azadirachta indica* [29], *Catharanthus roseus* [30], *Origanum vulgare* [31], *Buddleja*

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ANALYSE OF SELECTED HEAVY METAL CONTAMINATION IN THE MUDIKONDAN RIVER NANNILAM THIRUVARUR DISTRICT TAMIL NADU INDIA

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ABSTRACT

The present short-review briefly summarizes the status of heavy metal in Cauvery River and its sources and the status and effect of heavy metals in the river sediments and water. The difference in the heavy metals in different parts of the pathways of the river Cauvery is provided in addition to the pollution level and the effect of polluted water or enriched heavy metals on living systems. The pollution status and heavy metal contaminants level varies in water and in sediments with reference to different locations. The rapid population growth along the Mudikondan River has necessitated proper conservation and efficient utilization of freshwater bodies for sustainable development. This is necessary because there has been accelerated deterioration of water quality and also because of increased domestic, municipal and agricultural activities. Effluent discharge, urbanization and deforestation are the main causes of environmental degradation within the catchment.

KEYWORDS: Cauvery River, Contamination, Heavy metals, Pollution and Sediments.

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Assessment of Flood hazard prone areas in parts of Thanjavur District, South India using FIGUSED Method

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Abstract: Thanjavur district is primarily an agricultural area enclosed with irrigation system of the Cauvery in Tamil Nadu. But during the monsoon period flooding has been disrupted the areas and directely effected the soil erosion in those areas. The flood hazard assessment is one of the important task to understand the soil erosion of the area due to natural hazards. In this context the present study to assess flood hazard prone areas using FIGUSED method adopted with remote sensing data and GIS technology. In FIGUSED method, seven parameters has been used such as flow accumulation, distance from the drainage network, elevation, land use, rainfall intensity and geology. The relative importance of each parameter for the occurrence and severity of flood has been connected to weight values. These values are calculated following a normalized weight parameter rating method. According to their weight values, information of the different parameters is superimposed, resulting to flood hazard mapping. The Flood Hazard Index (FHI) has been defined and a spatial analysis in a GIS environment has been applied for the estimation of its value. The historical flood events, accuracy and sensitivity analysis not examined in this study and it is only understand the flood hazard area. The study revealed that about 12% of the area falls under very high flood hazard and 26% high to moderate flood hazard zones and indicates that immediate attention have to be taken and protect the agricultural lands for the sustainable development of those areas.

Index Terms **– Normalized weight, flood prone area, GIS analysis, flood hazard area, South India**

1. INTRODUCTION

Flood is a major natural hazard with often immeasurable impact, affecting annually 170 million people (Kowalzig, 2008). Therefore, flood risk management needs to overcome national borders, geographic location and socio-economic limitations (Degiorgis et al., 2012). Flood risk management is usually divided into flood risk assessment and flood risk mitigation (Schanze et al., 2006). From sustainable development point of view, the flood hazard management is very essential for future (Schober et al., 2015). Tehrany et al., 2013 have studied 10 parameters with the relative importance of each parameter defined following a statistical analysis. During the JAL cyclone event (November to December 2010), severe floods, occurred in Thanjavur district and Thanjavur taluk which spreads at the margin of Cauvery River was one of the affected places. Cyclones ravage the district once in 3-5 years, during north east monsoon, resulting in flood and crop damage. During 1982-83, 1990-91 and 1992-93 cyclones of high intensity have affected the district. Every year monsoon cyclone flood and drought situation may occur during Rabi season which may also considerably affect the paddy production in Thanjavur district.

The application of GIS-based multi-criteria analysis in the context of flood risk assessment was rare until 2000. Black and Burns (2002) have studied the changes in the estimation of flood risk on Scottish rivers with time by re-analyzing flood records. An early attempt to use GIS on water-related hazards has been presented in Meja-Navarro et al. (1994). The present article deals with the first element of flood risk management, i.e. the definition of flood hazard areas in a specific region. The present study methodology adopted based on the Kazakis et al (2015) FIGUSED methods to identify flood hazard zones in parts of Thanjavur and the output of the results is very useful to the farmer and planners for the agricultural purposes in the study area.

2. STUDY AREA

Thanjavur district lies between 9° 50' and 11° 25' North latitude and 78° 45' and 79° 25' East longtitude (Fig.1). It is bounded on the North by Thiruchirapalli and Cuddalore districts, on the East by Tiruvarur and Nagapattinam districts, on the South by Palk Strait and Pudukottai district and on the west by Pudukkottai district and Tiruchirapalli districts. Total geographical of the study area is 1697 sq.km. The mean maximum temperature was 37.48°C during May - July. Similarly, the mean minimum temperature was 20.82°C during November-January. The north east monsoon provides much rainfall with 545.7 mm and 953.2 as normal and actual rainfall respectively, while southwest monsoon provides 342 and 303.1 mm as normal and actual rainfall respectively. The total population of Thanjavur district is 22,16,138. Thanjavur district stands unique from time immemorial for its agricultural activities and is rightly acclaimed as the granary of South India lying in the deltaic region of the famous river Cauvery and criss-crossed by lengthy network of irrigation canals. Therefore this coastal district abounds in green paddy fields, tall coconut groves, vast gardens of mango and plantain trees and other verdant vegetation.

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AN EVALUATION OF MATERNAL HEALTH CARE SERVICES IN PRIMARY HEALTHCARE CENTERS (PHC) IN THANJAVUR DISTRICT TAMIL NADU

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ABSTRACT

This study covers the services of Primary Healthcare Centers in Thanjavur District. It examines the visitors' view of how they utilized these PHC Services. The study concentrates on How PHC helps to the rural population. Moreover, what are factors controlling PHCs. To identify the challenges that prevent PHCs from utilizing resources, the study has been conducted in All PHCs of Thanjavur district. A survey was done on the PHC users and asking about their services. The main purpose of this study is to evaluate the current services of PHCs in Thanjavur district from the perspective of patients. A Questionnaire created and used to collect the information using by direct investigation method. The questions asked to mother and collect feedback directly. From the Findings, the PHCs of Thanjavur district is good in providing health services. It observed that the people effectively utilizing the services of PHC and Health sub-centers for vaccination and emergency basis. They have awareness about the utilization of PHC services, drugs, vaccinations and Government schemes. The contribution of village nurses is to improve the people's knowledge about PHCs Services in their area. Frequent awareness programs is required to reach government schemes among users.

KEYWORDS: Primary Health Center, Maternal Health, Patient, Village Nurses & Respondents

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Original Article

INTRODUCTION

Nowadays, society is decided to create awareness between people like "A Healthy Society is an indication of Wealthy Nation." A primary health center provides health care services for economically backward people. Primary health centers started from the ideal of healthcare that was received in the declaration of the International Conference on primary health care held in, "Alma Ata," Kazakhasta in 1978. According to WHO (World Health Organization) goal is "Health for all." The ultimate goal of PHC is to give better health services to all. PHC is a federally qualified center that provides primary health care services, maternal, and healthcare, including family planning, education on health problems. It also explores how to control them and adequate and safe water supply and sanitation.

STUDY AREA

Thanjavur district is located between 10° 47' to 13.19" North latitude and 79° 8' to 16.17" East longitude. It is bounded by the districts on the north by Thiruchirapalli and Cuddalore, on the east by Tiruvarur and Nagapattinam, on the south by palkstrait and Pudukkotai and Thiruchirapalli districts. The total geographical area of Thanjavur district is 3,602.86 sq.km. Thanjavur district is divided into Eight taluks for administrative purposes

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Urban Population Growth Using GIS in Kumbakonam Municipality, Tamilnadu,India

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Abstract

Urbanization is the processes by which villages turn into towns and towns develop into cities. It is a process and can be interpreted that there is an increasing economic specialization and advancing technology which results in the accumulation of people. Kumbakonam Municipality, located in South India has experienced rapid urbanization in the past two decades. Urban population growth occurs in the study area with major processes led to a slow by slow transformation of agricultural land into urban land-uses leading to increase in more built-up area. This study attempt to measure and analyze urban growth in the study area using temporal data changes for years 2000 and 2015 using ARC GIS.

Keywords: Urban Population Growth,Built-up area Mapping, Buffer Analysis and GIS

1.0 Introduction

Urbanization is the processes by which villages turn into towns and towns develop into cities. Two major causes are responsible for the growth of urbanization and its rapid spread from the beginning of the 21th century. The first is development of technology and rapid industrialization, and the second is unplanned migration to large cities from the rural areas. Urbanization is two way processes because it involves not only movement from village to cities and change from agricultural activities to commercial and service activities but it also involves change in the attitudes and behavior patterns of migrant peoples. Man has always tried to improve his lifestyle everybody, because the new invention of instruments helps to reduce the working time which in turn brought changes in human lifestyle change.Change detection analysis is an important key to understanding changes took place over time.Towns and cities have acted as focal points in the cultural landscape of world. Areal differentiation of any phenomenon became not only complex but also dynamic posing challenges to geographical research.

1.1 Literature Review

A STUDY ON MATERNAL AND SOCIO - ECONOMIC FACTORS INFLUENCING INFANT BIRTH WEIGHT IN THANJAVUR DISTRICT, TAMIL NADU

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ABSTRACT

Birth weight of a baby is important for their health. Low birth weight is one of the main reasons for infant mortality. Birth weight of less than 2500g is defined as Low birth weight (WHO). A study conducted on how socio-economic and demographic factors affecting the birth weight of a baby. It was conducted on Primary Health care centers of Thanjavur District. The study has taken into 805 new born babies.198 low birth weight babies, 482 Normal birth weight and 125 above normal weight babies taking into consideration. Statistical Analysis and Chi Square tests used for Analysis. Occupation of Husband, Income of Husband, Young age marriage, low income and employment of pregnant women are taken as the main factors for low birth weight. From the study economic, social and demographic factors have not significant effect on birth weight. Maternal health care factors have an significant effect on birth weight.

Key words: *Birth weight, maternal factors, health of mothers.*

1. INTRODUCTION

WHO defines Birth weight of less than 2500g is Low birth weight. Birth weight is a major indicator for reproductive health of a woman. Low weight babies can face many health issues like infection, breathing and feeding, inability to maintain body temperature and so on. To grow a healthy baby, mothers need good nutrition and rest, adequate antenatal care, and a clean environment (UNICEF). UNICEF estimates almost every third new born baby in India is Low birth weight. According to NFHS 4 Report 20% of low birth weight babies births to mothers from the poorest families. A. F. Roche and S. S. Sun et.al (2003) Socio-economic state is a concept devised to measure some aspects of education, occupation, and social prestige of a person or a social group. Ashraf Mohammadzadeh et.al. (2010). The variables which show the most significant association were birth weight, sex, economic status, and educational level of the

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parents. In this study, maternal and paternal education has significant influence on weight although this effect on height was not significant.

2 AIM

The Aim of the study to identify what are the factors affecting the birth weight of the new born babies.

3. REVIEW OF LITERATURE

Birth weight of the newborn is believed to be influenced by a number of factors. The maternal age and parity have a significant effect on birth weight, as shown by Dhall & Bagga (1995). Jolanta Dickute et al (2004). low education, unstable marital status and low income are the major factors for low birth weight. Maternal unfavorable socio-economic factors increased the risk to deliver low birth weight baby. Joshi H.S et.al (2010). The main factors significantly associated with LBW were maternal education, stature, age at delivery; short inter pregnancy interval, inadequate antenatal care, and per capita income of family. Shabbeer Ahmed et.al (2016) The main factors which were significantly associated with LBW were education, community, burden of labor and per capita income of family. Rashidul Alam Mahumud et.al (2016). explained that delayed conception, advanced maternal age, and inadequate ANC visits had independent effects on the prevalence of LBW. Prerna Bansal et.al (2018) Socio-cultural and maternal risk factors like rest received in the afternoon during pregnancy, dietary intake during pregnancy and period of gestation were found to be significantly associated with low birth

RISK MANAGEMENT IN EQUITY INVESTMENTS – A STUDY WITH REFERENCE TO THANJAVUR DISTRICT

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ABSTRACT

The researcher studied risk management of investors in equity investments in Thanjavur district. The sample size was 384 and primary data were collected from them using well-structured questionnaire. The researcher applied simple percentage and correlation analysis as statistical tools to analyze the data. The study found that respondents in the study area management risk while making investment decisions efficiently. The respondents considered risk before making investment decisions. Majority of the respondents had wider portfolio in order to reduce risk, they were cautious about sudden ups and downs in the market, they held shares when prices were increasing, they kept distance when the market was not good, they avoided shares which did not perform good and they disinvested when they determine that bearish market begins. But majority of the respondents did not consider inflation rate and did not discuss with experts about risk before making investment decisions. Educational level of the respondents had significant positive relationship with risk management. Similarly monthly trading volume traded by them, investment frequency and investment experience had significant positive relationship with risk management in the study area. Percentage of total investment to stock market investment did not have significant relationship with risk management.

Key terms: Stock market, equity, investment, risk and inflation.

INTRODUCTION

People who have excess of income over their expenditure are intended to save their money. For this purpose they seek for best investment type among availability of many number of investment avenues. Type of investment is chosen by the investor is based on their need and their attitude towards investments. The rate of return on investments varies based on risk vested in the investments. Generally risk and returns have direct relationship, i.e, if there is high risk in an investment there is high rate of return on it and if the risk level is low in an investment there is low rate of return on such investment. Investors, who have high risk taking capacity, will go for type of investments which have more risk. In recent decades stock market is becoming as one of the most attractive investment

A STUDY ON FACTORS INFUENCING STOCK MARKET INVESTMENTS IN THANJAVUR DISTRICT – A SPECIAL REFERENCE TO RETAIL INVESTORS

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Abstract

Investments in stock market by retail investors are keeping on increasing during recent years. Many factors are influencing the investors to make investments in stock market. Hence the researcher studied the selected factors influencing stock market investments in Thanjavur district. For this purpose the researcher collected primary data from 384 respondnets in Thanjavur district using well structured questionnaire. The researcher applied simple percentage and chi-square test as statistical tools to analyse the data. The researcher found that the factors influence of brokers / sub-brokers, expectation of high returns, continues bullish market, having risk taking capacity and influence of advertisements influenced more on the investments in stock market. It was also found that economic and financial factors and market factors influenced the respondents more on the investments in stock market. The study also found that there was significant association in factors influencing investments in stock market with gender, age, annual savings of the respondents and experience of the respondents in stock market investments. No significant association was found in factors influencing stock market investments with education, income and occupation of the respondents.

Key words: Stock market, equity, factors, return and investments.

Introduction

Stock market is a place where shares and securities are traded. Stock markets are exchanging the securities from a person to another person which are already listed in their stock exchange. In other words, stock markets are dealing with second securities. Stock market is playing as a most preferable investment avenue for all type of investors such as retail investors, domestic institutional investors and foreign institutional investors. Investments in stock market gives high rate of return compared to other type of investments in India. Apart from this feature many other features of stock market investments such liquidity, capital appreciation etc are also attracting the investors towards investment in stock

A Proposed Methodology for the Recognition and Classification of the Ancient Scripts from Epigraphy Images Using Histogram of BRISK Orientation Sign Code

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Abstract--- The extraction of ancient Tamil scripts from epigraphy images is a challenging problem in the pattern recognition area. Now-a-days, modern readers are faced with many difficulties to interpret ancient script from epigraphy images. In this paper, we present a proposed methodology to extract ancient scripts from epigraphy images and also a comparative study of previous work has been done. In this work, we introduce Histogram of BRISK (Binary Robust Invariant Scalable Key points) orientation sign code to extract the ancient scripts from epigraphy images easily and accurately.

Keywords---BRISK (Binary Robust Invariant Scalable Key Points), Histogram of BRISK Orientation Sign Code, Zernike Moment Descriptor, LOMO (Local Maximal Occurrence), Random Forest, K-Nearest Neighbor.

I. Introduction

An extraction of characters from document image is an easy process. Many techniques are available for the extraction of characters from document image. It is very difficult to extract characters from epigraphy images. The ancient script in epigraphy images is not having the same shape and similarity. Their writing style and size of the characters are different.

For these reasons, it is not easy toextract ancient scripts from epigraphy images.i) Inpreprocessing, Gabor filter and active contour are used to enhance the images. ii) After the preprocessing, BRISK (Binary Robust Invariant Scalable keypoints) is used to identify the valid points in the ancient character. Next, the proposed technique Brisk histogram of sign code is used toidentify the horizontal and vertical valid points in each and every ancient characters.

The combinational approach of Zernike moment descriptor, LOMO(Local Maximal Occurrence) andHistogram of BRISK orientation sign code are used as feature descriptors.iii)In classification, KNN(K-Nearest Neighbor) and RF (Random Forest) are used as classifiers and to select best classifier for this research work. This proposed method helps us to get good results and extracts ancient scripts from epigraphy images accurately and clearly.

This paper contains the following section 1 presents the overview of the work, section 2 explains the details of the BRISK technique, section 3 presents the details of the algorithm, section 4 discuss the details of feature extraction techniques, section 5 discuss the various types of classifiers, section 6 contains results and discussion, section 7 concludes the performance of the research.

II. BRISK (Binary Robust Invariant Scalable Key Points)

BRISK (Binary Robust Invariant Scalable Key points) proposed by Stefan Leutenegger [1] is used to detect the corners in scale space. It involves basically two steps: i) Scale Space Key point detection ii) Key point description. Key point detection means it detects the interest points in image and scale dimensions using a prominent criterion. The computation is done by identifying the key points in octave layers of the image pyramid as well as in layers in-between. Quadratic function fitting is used to calculate the location and scale of each key point in the continuous domain [2].

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An Extraction Of Ancient Tamil Scripts From Epigraphy Images Using Gabor Filter, Active Contour And Lomo

S.Sundareswari, Dr.I.Kaspar Raj

Abstract : The extraction of Ancient script from epigraphy images is a tough task. Many techniques are available to extract the characters from the document image. Most of the authors have given their ideas to extract the characters from the document image. The extraction of ancient Tamil script from epigraphy images is a challenging problem in pattern recognition area still. In this paper, we present an efficient approach to extract the ancient Tamil script from epigraphy images. Recognizing the ancient Tamil script from epigraphy images is a very tough task. The proposed methodology consists of three stages: preprocessing, segmentation and feature extraction and classification. Experimental results show that the proposed methodology is more effective and efficient and also it extracts the ancient Tamil script from epigraphy images accurately.

Keywords: Tamil Ancient Characters , Gabor Filter and Active Contour, Feature Extraction(Zernike and Lomo), Classification(KNN and RF)

1 INTRODUCTION

Epigraphy is the study of the science of epigraphs or inscriptions, especially of ancient inscriptions. An epigraph is any kind of text from a single character to a lengthy document. Texts in epigraphy images are different from written texts of each culture [1]. In this work, we have used Ancient Tamil Script epigraphy images as input images. Segmentation of text or character from document image is an easy process. In epigraphy images, the engraved characters are different in size, color, and writing style. Mostly the epigraphy images have broken characters, uneven character intensity, touching characters each other and direction variations within symbols [2]In preprocessing Gabor filter and active contour are used to enhance the image clearly without any noise. Then the combinational approach of two different feature extractions like Zernike moment and Lomo are used. Finally, in classification, two classifiers such as KNN(K-Nearest Neighbor) and RF(Random Forest) are used and tested. This paper is made as follows: Section 1 contains the initiation of epigraphy images, Section 2 explains the details of proposed methodology through various steps involved, Section 3 presents the details of combinational approach of feature extraction techniques, Section 4 discuss the various types of classifiers, Section 5 discussion on results, Section 6 concludes research performance.

2 PROPOSED METHODOLOGY

This proposed methodology involves the following steps: i) Image Acquisition: Read an input image and convert into suitable format. ii) Preprocessing: Gabor filter and Active contour used to remove the noise. iii) Feature Extraction: The combinational approach of Zernike moment and Lomo are used to extract the ancient Tamil scripts from epigraphy images. iv) Classification: In this proposed methodology two classifiers like K-Nearest Neighbor, Random Forest are used and tested. In this proposed methodology, Gabor filter and Active contour are used for preprocessing and for feature extraction techniques combinational approach of Zernike Moment and Lomo features are used. Hence the combinational of these two feature extraction techniques may improve the overall detection rate of the characters in epigraphy images. Next, we have used two different classifiers like RF (Random Forest) and KNN (K Nearest Neighbor) is used and tested to select the best classification algorithm for this research work

2.1 Proposed Algorithm :

Step 1: Read the following inputs like Image,ɵ (theta), f (frequency),threshold value($g_m$thr) Step 2: Read the testing image as Img. Step 3: Initial parameter for Gabor filter GF as ɵ ← 90 and frequency value is 0.2 and threshold value is 50. Step 4: Apply Gabor filter using the equation 4.1. 4.1) [Img_{gFC} ,Img_{gFI}) ← GF (Img) where ɵ =90, f = 0.2. Step 5: for each pixel in image ← Img $Img_{gF\ mag}$ = SQRT (Img_{gFR}^2 + Img_{gFI}^2) End Step 6: Find Gabor filter magnitude binary mask as GF_{BW} ← $Img_{gF\ mag}$ > $g_m$thr . Step 7: Extract the Contour of the image Img using GF_{BW} as intial mask in Active Contour mode. Img_{ACBW} ← ACmode (Img,GF_{BW}). Step 8: for each connected label ← Img_{ACBW} Extract the characters by using the following feature extraction techniques. Zfeat ← Zernike(BWc) Lfeat ← Lomo(Img(BW_C) end Step 9: Feature vector = [Zernike(BWC),Lomo(Img(BW_C) Step 10: Predict Charaters ← Classifiers(Training feature, feature extraction). In this proposed methodology, first character samples are trained and tested. In preprocessing Gabor filter and Active contour are used. In Gabor filter, first read the input image,theta (ω),frequency(f) and threshold value ($g_m$thr).Next, read the testing image as Img. Then set the initial parameters for Gabor filter is ɵ is 90 and the frequency value is 0.2 and the threshold value is 50. Applying Gabor filter using the equation [Img_{gFC} ,Img_{gFI}) ← GF (Img)] and get real and imaginary part of each pixel value using the above parameters. Then find out the Gabor filter magnitude binary mask of images as GF_{BW} ← $Img_{gF\ mag}$ > $g_m$thr This value should be greater than the threshold value. Next, extract the contour of the image Img using GF_{BW} as initial mask in Active Contour mode as Img_{ACBW} ← ACmode (Img,GF_{BW}). Finally, for each connected

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Multi-Level Credit Card Fraud Detection

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Abstract: ***Fraud detection in credit card transactions is one of the major requirements of the current business scenario due to the huge amount of losses associated with the domain. This work presents a multi-level model that can provide highly effective fraud detection in credit card transactions. The model is based on the amount for which the transaction is committed. The proposed MLFD model identifies the nature of the transaction and depending on the significance level of the transaction, the appropriate learning model is selected. Experiments were performed with the standard benchmark data and comparisons were performed with existing model in literature. Results shows that the proposed model exhibits high performance compared to the existing model.***

Keywords: Credit card fraud detection, Decision Tree, Multi-Level Modelling , Naïve Bayes, Random Forest.

I. INTRODUCTION

The process of fraud detection in credit card transactions is used to determine if a transaction is fraudulent or legitimate. The detection process is governed by the historical transactions. The past labelled transaction data is used to train the model for predicting the current transactions. This is a challenging task mainly due to the change in the spending behaviors of the users. Spending behaviors of users often tend to vary with time, which is considered as seasonal changes and also gradually varies over long time periods, which can be treated as trends in the behaviors. This results in the historical models becoming obsolete due to the absence of recent data. Further, fraudsters are also creating evolving models to compete with the recent advancements in the detection strategies.

Recent research shows that credit card fraud losses have resulted in significant losses for organizations and also for banks. It was observed that the losses due to credit card increased by 300% in five years (2010 to 2015) [1]. By the year 2020, the global loss due to fraud is expected to touch $31.67 billion. The two major sources of card frauds were identified as counterfeit card based frauds and frauds at point-of-sale regions. Both these span globally and are not confined to bank premises. Hence they inadvertently require effective prediction mechanisms to stop the fraud from happening at those locations itself. This calls for a model that operates in real-time and also accurately. However, when it was viewed from a business perspective, not all predictions are to be considered significant. Every prediction involves a certain cost. Identifying a transaction as fraudulent requires business models to raise fraud alarms to customers, while falsely flagging a fraudulent transaction as legitimate incurs losses. It would be more appropriate to concentrate on higher Valued transactions, which can help balance the cost factors. This work presents a multi-level fraud detection model that aims to consider the amount involved in the transaction to determine the type of prediction model to be used for prediction. The amount directly corresponds to significance of the transaction. Transactions with low significance are predicted using fast predictors, while transactions with higher significance are predicted with better prediction models. This enables the models to provide cost sensitive and faster prediction.

This remainder of this work is presented as follows: Section II presents a review of literature, Section III presents a detailed description of the working of the proposed model, Section IV presents the results and discussion and Section V concludes the work.

II. LITERATURE REVIEW

Credit card fraud detection is considered to be one of the major domains of analysis in the research world. This is due to the huge amount of losses associated with the domain. This section presents some of the significant works in the fraud detection domain.

Risk based modelling involving cost has become a major factor in the current fraud detection models. A risk based model was proposed by Bahnsen et al. [2]. This method is based on Naïve Bayes to identify the risk levels to be used for the final prediction. The work by Pozollo et al. [3] aims to provide testing mechanisms for models handling concept drift. A cost based model was proposed by Mahmoudi et al. [4]. This technique considers cost as a major factor for the prediction process involving credit card transactions. The method is based on Fisher Discriminant Analysis. A Game Theory based analysis for credit card fraud detection was proposed by Gianini et al. [5]. A Big Data based credit card fraud detection model that utilizes Big Data based techniques was proposed by Vaughan [6]. A customer incentive based model was proposed by Wang et al. [7].

Feature engineering is one of the mostly incorporated methods into the credit card fraud detection strategy. The behavioral change in users has made fraud detection in credit card transactions a complex process. In order to leverage the best rules, it becomes mandatory to mine as much information as possible from the transaction data. Feature engineering strategies perform the exam same process. A feature engineering based model for detecting frauds in credit card transactions was proposed by Lucas et al. [8]. This work aims at using HMM for the prediction process. Multiple perspectives are obtained by identifying several features that constitute behavioral nature of the customer. The method

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A STUDY ON MUNICIPAL BORROWINGS IN TAMIL NADU

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ABSTRACT:

The Local Authorities Loans Act, 1914 regulate the municipal borrowings. Most states generally allow municipalities to secure their borrowings against revenue/funds and not immovable property. In early days financial needs of the urban infrastructure meet by budgetary allocations and borrowings from state-owned institutions like HUDCO and LIC backed by state government guarantees. The commercial sources and volume of borrowings are Government Institutions, Capital Markets, Specialized Infrastructure Finance Entities, Sector Specific Municipal Development Funds/Facilities, and Tamil Nadu Urban Development Fund (TNUDF).

KEYWORDS: *Municipalities, Borrowings, Tamilnadu.*

INTRODUCTION:

In India urban areas are the drivers for sustaining economic growth and reducing incidence of poverty. It contributes about 65% of GDP in the year 2011. Urban economic activities depends on infrastructure such as power, telecom, roads, water supply and mass transportation, coupled with civic infrastructure such as sanitation and solid waste management. In large cities urban population increase day by day, which brings tremendous pressure on urban services such as water supply, sewerage, drainage, solid waste management and urban transportation networks and systems. Hence, it is mandatory for municipal governments to generate resources for meeting operations and maintenance expenses as well as administration. In this context, it is important to encourage municipal governments to leverage their resources and borrow from various sources. The Local Authorities Loans Act, 1914 regulate the municipal borrowings. Most states generally allow municipalities to secure their borrowings against revenue/funds and not immovable property.

OBJECTIVES OF THE STUDY

- To know the various Sources Municipal Borrowings.
- To understand the Municipal Borrowings in Tamil Nadu.

METHODOLOGY

This study is primarily based on secondary data collected from various published sources.

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Bioinorganic chemistry

Enhanced antibacterial activity of hemocyanin purified from *Portunus pelagicus* hemolymph combined with silver nanoparticles – Intracellular uptake and mode of action

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ABSTRACT

Recently, biogenic nanoparticles have been considered promising candidates for manufacturing antibacterial nanodrugs. Here, we synthesized AgNPs using the crab-borne antibacterial agent hemocyanin and assessed the antibacterial action against several pathogenic bacteria. In this study, the crustacean immune protein hemocyanin (*Pp*-Hc, 78 kDa) purified from *Portunus pelagicus* hemolymph was used to fabricate silver nanoparticles. Characterization of hemocyanin-fabricated AgNPs (*Pp*-Hc AgNPs) were achieved using ultraviolet-visible spectrophotometer, X-ray powder diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), high-resolution-transmission electron microscopy (HR-TEM), and energy-dispersive X-ray spectroscopy. The antibacterial efficacy of $AgNO_3$, *Pp*-Hc and *Pp*-Hc AgNPs was compared by growth inhibition, antibiofilm and live and dead analyses. Based on the results, *Pp*-Hc AgNPs was more efficient than *Pp*-Hc and $AgNO_3$ against pathogenic bacteria. Mechanistic analysis revealed membrane damage and reactive oxygen species (ROS) generation, suggesting that *Pp*-Hc and *Pp*-Hc AgNPs rely to similar modes of action. Intracellular protein molecules and nucleic acid leakage confirmed that *Pp*-Hc AgNPs increase membrane permeability, leading to cell death. Based on our results, capping of the exterior surface of nanoparticles with antimicrobial crab-borne peptides, such as *Pp*-Hc, improves their functions as potential agents against bacterial diseases, which may be useful in clinical applications.

1. Introduction

Antibiotics are highly important in the fight against bacterial infections, to reduce the morbidity and mortality of humans, as well as in livestock and pets worldwide. However, in the past few years, an increase in antibiotic resistance of microorganisms – largely due to the overuse of antibiotics – has become a severe problem worldwide [1–3]. An approach for overcoming this problem is to use novel, low-cost, and efficient antimicrobial agents that have biological ability to reduce the rate and spread of resistance development of target microorganisms [4,5]. An increased incidence of infections caused by antibiotic-resistant microbial strains expanded the attention about antimicrobial properties of silver and its composites [6,7]. Silver has been used as an antimicrobial complex since before the beginning of antibiotics in the 1940s, and is currently used in a broad array of medicinal purposes because of its antibacterial effects and relatively small toxicity to human cells [8–10]. However, the cost burden and current identification of silver-resistant bacteria pointed out the inadequate use of raw silver as possible alternative to broad-spectrum antibiotics [11].

Nanotechnology has rapidly advanced in the current century because of the stunning potential of nanomaterials, with special reference to nanosize, which radically modifies their physical, chemical, and

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Haematological status of common carp, *Cyprinus carpio* L. exposed to sublethal dose of organophosphorus pesticide, monocrotophos

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Abstract
The introduction of organophosphorus insecticide into the aquatic ecosystem through agricultural runoffs, rainwater seepage adversely affects many non-target organisms including fishes. The chronic effect of organophosphorus pesticide, Monocrotophos on the haematological parameters of freshwater fish, *Cyprinus carpio* has been investigated in the present study. *Cyprinus carpio* were procured and their sublethal, median lethal and lethal concentrations for 120 hrs were assessed. Two sub-lethal concentrations (T2) and (T3) were selected to which the fishes were exposed for 30 days. Control set up without monocrotophos (T1) was run simultaneously. Blood from anaesthetised fishes were collected after 30 days of exposure period. Hemoglobin (Hb), Red Blood Cells (RBCs) and hematocrit (Hct) significantly decreased with the increasing concentration of monocrotophos during the experimental periods. But White Blood Cells (WBCs) significantly increased in the treated fishes when compared to the control depicting negative effects of monocrotophos on the hematological parameters of *Cyprinus carpio*.

Keywords: *Cyprinus carpio,* chronic effect, haematology, monocrotophos, sublethal concentration

1. Introduction
Applications of pesticides have been increasing ever since the onset of green revolution to feed the overgrowing population of the world. This phenomenon is evident over the last few decades especially in tropical countries like India, where majority of the population is reliant on agriculture for their livelihood. Now the use of pesticides has become inevitable in current agriculture practices to ensure increased productivity through the pest control. However, the indiscriminate use of pesticides ultimately leads to pollution of aquatic environment and becomes hazardous to the non - target aquatic life. Among the innumerable aquatic organisms, fishes occupy an important position in the field of aquatic toxicology (Giulio and Hinton, 2008) [7] not only because of their position at topmost trophic level of the aquatic food chain but also due to the high accumulation of pesticides in their body by bioaccumulation and biomagnification processes. Hence different concentrations of insecticides and pesticides present in water bodies found their way to fishes affecting these non-target species (Talebi, 1998; Uner *et al.*, 2006; Banaee *et al.*, 2008) [18, 20, 1].
Various stressors and pollutants generally cause rapid changes in biological characteristics of fish (Sahan *et al.*, 2007) [15]. These changes can be measured and used as indicators or biomarkers for effects of such toxicants. These biomarkers enable the rapid assessment of the health of the organisms and warn about environmental risks associated with the toxicants. Among biological changes, haematological parameters are considered potential biomarkers of exposure to toxicants, since the latter can induce an increase or decrease in the various haematological parameters (Oost *et al.*, 2003) [12]. Blood is the most important and abundant body fluid acting as a vehicle for quickly mobilizing defense against trauma and diseases. Its composition often reflects the total physiological condition of the body. The main route of entry for any pesticide is through the gills from which it gets transported to various parts of the body via the blood stream. Henceforth blood provides an ideal medium for toxicity studies and haematological variables of fish under stress are of great significance in assessing the impacts of pollutants in the biota of a particular ecosystem.
Among the various pesticides used in farming practices, the organophosphate pesticide, Monocrotophos often referred to as the "farmer's benevolent pesticide" is most preferable by farmers because of their low cumulative ability, high insecticidal property, low mammalian

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Microbial exopolymer-capped selenium nanowires – Towards new antibacterial, antibiofilm and arbovirus vector larvicides?

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ABSTRACT

Arboviral diseases and microbial pathogens resistant to commercially available drugs are on the rise. Herein, a facile microbial-based approach was developed to synthesize selenium nanowires (Se NWs) using microbial exopolymer (MEP) extracted from the *Bacillus licheniformis* (probiotic bacteria). MEP-Se NWs were characterized using UV–Visible, XRD, FTIR, HR-TEM, FE-SEM and EDX. An UV–Visible peak was detected at 330 nm while XRD spectrum data pointed out the crystalline nature of MEP-Se NWs. FTIR spectrum revealed functional groups with strong absorption peaks in the range 3898.52–477.97 cm^{-1}. FE-SEM and HR-TEM revealed that the obtained structures were nanowires of 10–30 nm diameter. Se presence was confirmed by EDX analysis. MEP-Se NWs at 100 µg/ml highly suppressed the growth of both Gram $^{(-)}$ and Gram $^{(+)}$ bacteria. Further, microscopic analysis evidenced that 75 µg/ml MEP-Se NWs suppressed biofilm formation. Hemolytic assays showed that MEP-Se NWs were moderately cytotoxic. In addition, LC_{50} values lower than 10 µg/ml were estimated testing MEP-Se NWs on both *Aedes aegypti* and *Culex quinquefasciatus* 3rd instar larvae. Morphological and histological techniques were used to elucidate on the damages triggered in mosquito tissues, with special reference to midgut, post-exposure to MEP-Se NWs. Therefore, based on our findings, MEP-Se NWs can be considered for entomological and biomedical applications, with special reference to the management of biofilm forming microbial pathogens and arbovirus mosquito vectors.

1. Introduction

Mosquito (Diptera: Culicidae) vectors pretense a key threat to millons of people worldwide in tropical and subtropical areas [1–3]. *An. stephensi, Ae. aegypti* and *Cx. quinquefasciatus* are the most important vectors of numerous pathogens and parasites clerical for enormous mortality and morbidity worldwide including malaria, dengue and filariasis, respectively [4]. In particular, arboviral vector threads have recently become more common in neglected geographical regions with over 2.5 billion peoples at risk [5]. The WHO estimates 50–100 millions of dengue infections worldwide every year [6]. However, the utilize of synthetic insecticides to control mosquito larvae populations led to resistance, high operational costs & adverse environmental effects. Therefore, the development of ecofriendly control tools is an important public health challenge [7–9].

In this scenario, the biosynthesis of one-dimensional nanomaterials, such as nanowires, have generated considerable attention because of their distinctive physicochemical properties, which remarkably differ from those of bulk materials, along with their applicability in nanodevices [10–13]. Although metals and semiconductors have been extensively investigated, the potential of metalloids such as selenium (Se) are yet to be analyzed [14]. Selenium is particularly interesting as it is a crucial micronutrient for numerous organisms. It is a fundamental cofactor of glutathione peroxidase, formate dehydrogenase and

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Inelastic dromions, rogue waves and lumps of (2+1) dimensional long dispersive wave equation

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ABSTRACT

In this paper, we revisit the (2+1) dimensional long dispersive wave equation employing the truncated Painlevé approach. We then generate the solutions in the closed form in terms of lower dimensional arbitrary functions of space and time. By suitably harnessing the arbitrary functions present in the solution, we then construct localized solutions such as dromions, lumps and rogue waves. We have also explicitly brought out the generality of the localized solutions compared to the localized solutions generated earlier. The collisional dynamics of dromions, lumps and rogue waves is then explored.

1. Introduction

In recent times, there is a profound interest among physicists to study the nature of rogue waves, due to their wide range of applications, arising in multiple physical situations [1–4]. Generally, rogue waves which are also known as freak waves, occur in deep ocean. These waves are like shock waves and appear only for a short duration of time. The important feature of rogue waves is that they come from nowhere and disappear with no trace. Rogue waves find applications in various fields like, hydrodynamics [5], nonlinear optics [6–8], Bose–Einstein condensates [9,10], plasma physics [11], etc. Another interesting class of solutions which occur in (2+1) dimensional integrable systems is Dromions [12–15]. They arise essentially by virtue of coupling the field variable to a mean field/potential, thereby preventing wave collapse. Like dromions, there exists another class of solutions called lumps [16,17]. Unlike dromions, lumps do not interact with each other while rogue waves are found to be unstable in nature. Even though dromions and their collisional dynamics have been investigated in (2+1) nonlinear partial differential equations (PDEs) [18–24], the existence of lumps and rogue waves besides their dynamics has not yet been brought out explicitly in several nonlinear partial differential equations.

In this paper, we consider the (2+1) dimensional long dispersive wave (2LDW) equation introduced by Chakravarthy, et al. [25], by symmetrically reducing the self-dual Yang–Mill's equation. This equation is a generalization of the one dimensional long dispersive wave equation [26–28]. This equation holds significance in plasma physics under specific circumstances. Radha and Lakshmanan have established that the 2LDW equation is Painlevé integrable and constructed multi-dromion solutions [29] employing Hirota method. Later, Z. J. Fang and W. F. Min have also derived (1,N) dromion solution through a direct method [30]. Estevez [31] has also investigated the 2LDW equation using singular manifold method

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Research Article

SUBLETHAL EFFECT OF ATRAZINE ON THE INTESTINE OF AN INDIAN EARTHWORM *LAMPITO MAURITII* (KINBERG) (ANNELIDA; OLIGOCHAETA)

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ABSTRACT

The present study has investigated the toxic effect of Atrazine on the intestine of the earthworm *L. mauritii* in a laboratory experiment. A sub-lethal concentration of Atrazine (1/5th of 96 h LC_{50} value-1.99 mg/kg) was applied for 30 days. The changes such as vacuolization, degenerated nuclei, damaged epithelial lining of villi and congestion of blood sinuses were observed in the intestine of 1st, 5th and 15th day of Atrazine exposure. In the 30th day of exposure, slight damages were observed. These results suggest that Atrazine could severely affect the intestine of 1st, 5th and 15th day of exposure when compared to 30th day. Histopathological study in *L. mauritii's* intestine is a suitable parameter for detection of soil contamination by application of pesticides in agricultural field.

Keywords: Atrazine, Earthworm, Intestine, Soil, Toxicity.

INTRODUCTION

Increasing population growth and urbanization, especially in a developing country like India, necessitates producing more food. Food crops require fertile soil to grow. For terrestrial ecosystems, soil serves as a medium of entry to the nutrients. Continuous agricultural activities tend to decrease the soil fertility. However, the increasing application of herbicides and pesticides has also threatened the human environment and the ecosystems with deleterious consequences. Insecticide residues reach the soil in a variety of ways, causing toxicity to beneficial organisms. Earthworm represent the greater fraction of biomass of invertebrates in the ground (>80%). They can play a variety of important roles in agro ecosystems. Their feeding and burrowing activities incorporate organic residues and amendments into the soil, enhancing decomposition, humus formation, nutrient cycling, and soil structural development (Kladivko *et al.*, 1986). Therefore, earthworms can be used as bio indicators to detect pesticide contamination in agricultural soil. A pesticide is a chemical intended to kill, or disrupt the population of pest organisms. Pests are unwanted insects, mites, plants, disease causing organisms, and other organisms that interfere with health or commerce. Pesticides are classified into insecticides, herbicides, fungicides, nematicides, rodenticides, etc. based on their action on type of pest. Insecticide target insects, herbicides target plants, fungicides target disease causing fungi, nematicides target nematodes and so on. The most common of there are herbicide which account for approximately 80% of all pesticide use. Atrazine is one of the most commonly used herbicides to prevent pre and post emergence broadleaf weeds in crops such as sugarcane and maize and on turf, such as golf courses and residential lawns. Atrazine is prepared from cyanotic chloride, which is treated sequentially with ethylamine and isopropylamine. The chemical name of atrazine is 2-chloro-4-ethylamino-6-isopropylamino-s-triazine. It is colourless solid and soluble in water.

Histology is the most useful tool for determining the influence of agricultural pesticides, industrial pollutants, organic wastes etc., at tissue level of an organism as it provides useful information concerned with the growth, damage and disorganization of tissues. Histopathological studies may signal a damaging effect of organisms resulting from prior or ongoing exposure to toxic agents. Earthworms have been shown to be affected by the

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Searching for crab-borne antimicrobial peptides: Crustin from *Portunus pelagicus* triggers biofilm inhibition and immune responses of *Artemia salina* against GFP tagged *Vibrio parahaemolyticus* Dahv2

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ABSTRACT

Marine organisms represent a huge source of novel compounds for the development of effective antimicrobial drugs. The present study focus on the purification of the antimicrobial peptide crustin from the haemolymph of the blue swimmer crab, *Portunus pelagicus*, by blue Sepharose CL-6B matrix assisted affinity column chromatography. Crustin showed a single band with a molecular mass of 17 kDa in SDS-PAGE analysis. The XRD analysis exhibited peaks at 32° and 45° while a distinct peak with a retention time of 1.8 min resulted in high performance liquid chromatography (HPLC) pointing out the crystalline nature and purity of crustin, respectively. Crustin purified from *P. pelagicus* (*Pp*-Cru) showed immunological activities, triggering encapsulation, phagocytosis on Sepharose beads and yeast (*Saccharomyces cerevisiae*) respectively. Furthermore, encapsulation of GFP tagged *V. parahaemolyticus* in *Artemia salina* and challenging study were assessed under CLSM and the potential of *Pp*-Cru was examined *in vivo*. In addition, the growth reduction and biofilm inhibition potential of *Pp*-Cru on *Staphylococcus aureus, Enterococcus faecalis* (Gram- positive bacteria) and *Pseudomonas aeruginosa, Escherichia coli* (Gram-negative bacteria) was evidenced by inverted and confocal laser scanning microscopic analysis, revealing that 100 µg/ml of *Pp*-Cru can disrupt the biofilm matrix thereby the thickness of biofilm was significantly reduced. Overall, the present investigation might provide a sensitive platform to realize the significant function of *Pp*-Cru in crustacean immune mechanism as well as its potential to bacterial growth inhibitor. The functional properties of purified *Pp*-Cru antimicrobial peptide may lead to a superior understanding of innate immune response in *P. pelagicus* species, which suggest the promising application for drug development in aquaculture.

1. Introduction

Natural products, including those isolated from marine organisms, are outstanding sources of molecules multipurpose applications (Gobi et al., 2016; Benelli, 2016, 2018a,b,c; Anjugam et al., 2017; Ishwarya et al., 2018). An antimicrobial peptide (AMP) is a molecule acting as an integral component of the humoral part participated in the innate immune defense mechanism of vertebrates and invertebrates. AMPs represent an evolutionary and protection strategy of an organism against invading pathogens, including bacteria and viruses (Malanovic and Lohner, 2016; Abinaya et al., 2018). AMPs act as an effective defensive weapon and are present in higher concentration of haemocytes, playing an essential role in the flourishing evolution of intricate multicellular organisms. Since crustaceans lack in adaptive immune system responses, the AMPs have a major role as immune effectors against microbial infections (Antony et al., 2010). Crustacean-borne AMP has antibacterial activity which independently led to the lysis of bacterial cell wall. It can be able to function at very low concentrations as bactericidal agent against both Gram positive as well as Gram negative bacteria with haemocyte lysate supernatants (HLS) (Schnapp et al.,

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Toxicology

Nanosilver crystals capped with *Bauhinia acuminata* phytochemicals as new antimicrobials and mosquito larvicides

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ABSTRACT

To develop novel nanoformulated insecticides and antimicrobials, herein we produced Ag nanoparticles (AgNPs) using the *Bauhinia acuminata* leaf extract. This unexpensive aqueous extract acted as a capping and reducing agent for the formation of AgNPs. We characterized *B. acuminata*-synthesized AgNPs by UV–vis and FTIR spectroscopy, XRD and TEM analyses. UV–vis spectroscopy analysis of *B. acuminata*-synthesized AgNPs showed a peak at 441.5 nm. FTIR shed light on functional groups from the phytoconstituents involved in nanosynthesis. XRD of *B. acuminata*-synthesized AgNPs suggested a face-centered cubic structure, with a highly crystalline nature. TEM of *B. acuminata*-synthesized AgNPs revealed mean size of 25 nm, with round shape. AgNPs tested at 60 µg/mL inhibited the growth of 5 bacteria and 3 fungal pathogens. In the insecticidal assays on important mosquito species, LC_{50} of the aqueous extract of *B. acuminata* leaves on the larvae of *Anopheles stephensi*, *Aedes aegypti*, and *Culex quinquefasciatus* were 204.07, 226.02, and 249.24 µg/mL, respectively. The *B. acuminata*-synthesized AgNPs exhibited higher larvicidal efficacy, with LC_{50} values of 24.59, 27.19, and 30.19 µg/mL, respectively. Therefore, herein we developed a single-step, reliable, inexpensive, and environmentally non-toxic synthesis process to obtain AgNPs with high bioactivity against pathogens and vectors. Given the effective antimicrobial and larvicidal activity, nanoparticles fabricated using plant extracts and extremely low concentrations of trace elements, such as silver, can be exploited for multipurpose activities. Our results pointed out that *B. acuminata*-synthesized AgNPs have a promising potential in antimicrobial food packaging, as well as a foliar spray to control plant pathogens in the field, and to synergize the efficacy of fungicidal and larvicidal formulations.

1. Introduction

Over 5000 years ago, the Egyptians, Greeks, Persians, and Romans used to store food in silver-based vessels [1]. Similarly, ancient Indians used silver, gold, and copper-based jewelry such as bangles, belts, and anklets, as well as drinking vessels and kitchen utensils. These metals have good antibacterial activity, controlling microbial growth [1,2]. Furthermore, the ancient medicine system of Ayurveda uses powdered forms of copper, iron, silver, and gold in various formulations [2–4]. The shift in the use of metal vessels or adornments to metal powders indicates a shift from the bulk level to nano-size. Thus, the traditional Indian system of medicine was rooted in knowledge about micro/nano-materials for drug carrier applications as early as around 2000 BCE [3,4]. For the preparation of nanomaterials, plant-based extracts were used for reducing and capping purposes, and the samples were then calcined to obtain the powder form. Such formulations were used as drug carriers and in the treatment of diseases like cancer and skin infection [4–6].

In the past decade, silver nanoparticles (AgNPs) have been subjected to extensive research owing to the typical physical and electrochemical

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Biocompatible properties of nano-drug carriers using TiO_2-Au embedded on multiwall carbon nanotubes for targeted drug delivery

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ABSTRACT

Nanomaterial-based drug carriers have become a hot spot of research at the interface of nanotechnology and biomedicine because they allow efficient loading, targeted delivery, controlled release of drugs, and therefore are promising for biomedical applications. The current study made an attempt to decorate the multiwalled carbon nanotubes (MWCNT) with titanium dioxide-gold nanoparticles in order to enhance the biocompatibility for doxorubicin (DOX) delivery. The successful synthesis of nano drug carrier (NDC) was confirmed by XRD, XPS and UV–Visible spectroscopy. FESEM and TEM revealed that the morphology of NDC can be controlled by manipulating the reaction duration, MWCNT concentration and TiO_2-Au source concentration. Results showed that TiO_2 and Au nanoparticles were well coated on MWCNT. NDC had finely tuned biocompatible properties, as elucidated by hemolytic and antimicrobial assays. NDC also showed a high antioxidant potential, 80.7% expressed as ascorbic acid equivalents. Commercial DOX drug was utilized to treat A549 and MCF7 cancer cell lines showing improved efficiency by formulating it with NDC, which selectively delivered at the pH 5.5 with drug loading capacity of 0.45 mg/mL. The drug releasing capacity achieved by NDC was 90.66% for 10 h, a performance that far encompasses a wide number of current literature reports.

1. Introduction

Nanomaterials were widely used as drug carriers in the field of pharmacology due to their unique characteristics, which includes effectual loading capacity, targeted drug delivery and controlled drug release [1,2]. The current expansion in the area of controlled drug delivery has led to significant applications in biomedicine and nanotechnology. Various classes of nanoparticles have been successfully used for in the fight against parasites and vectors, as well as for other biological applications [3–6]. Doxorubicin hydrochloride (DOX) is an anticancer drug, also known as Adriamycin, which has shown high efficacy against several cancer cells. The nonspecific interaction between DOX and the physiological pathways can cause side effects, including allergic reactions such as anaphylaxis, heart damage (heart valves blockage), tissue damage, radiation recall, and treatment-related leukemia. Also, it led to common clinical side effects includes vomiting, hair loss, bone marrow suppression, rash, and mouth inflammation [7]. In addition to this, DOX shows dose dependent cardiotoxicity, which makes an urge to develop a targeted DOX delivery system [8–11]. It is required the targeted releasing towards the cancer cells or tissue by different carrier biomolecules, dendrimers, liposome, and micelles [12–14]. For this purpose, synthetic polymers (polyethylene glycol), bio polymers (chitosan) [15–18], nanomaterials in form of metal [19], metal oxides [20], and carbon based materials (*e.g.,* carbon nano tubes, CNT) [21], graphene [22], quantum nanodots [23] can be investigated. Among them, nanomaterials showed unique properties, are often cheap, highly stable and biocompatible. Hence, several nanoparticles have been considered for drug delivery, and carbon nanotubes are highly suitable for targeted drug delivery [24–26], as well as for biosensors [27], tissue engineering [28], bone regeneration [29], and

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Derivations on GK algebra

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Abstract: **In this paper, we introduce the concept of derivation of GK algebra and also obtain some properties about this concept.**

I. INTRODUCTION

The structure of GK algebra was introduced by us in 2018[4].A GK algebra is an algebra of non-empty set X together with a binary operation * and a constant 1,satisfying the following axioms

(i) $x*x=1$
(ii) $x*1=x$
(iii) $x*y=1$ and $y*x=1$ implies $x=y$
(iv) $(y*z)*(x*z)=y*x$
(v) $(x*y)*(1*y)=x$ for all x,y,z in X.

Let the commutative ring R with identity.Let X be an algebra over R. An R linear mapping $f:X\rightarrow X$ is called a derivation if $f(xy)=f(x)y+xf(y)$ for all x,y in X.The derivation of ring is wide area, many researchers started their work in this concept[1],[2],[3]. Inspired by these works, in a same way, we introduce the concept of derivation on GK algebra and discuss some properties in this paper.

II.PRELIMINARIES

A. *Definition:*2.1[4]

A non-empty set X with fixed constant 1and a binary operation *is called GK algebra if it satisfying the following axioms

(i) $x*x=1$
(ii) $x*1=x$
(iii) $x*y=1$ and $y*x=1$ implies $x=y$
(iv) $(y*z)*(x*z)=y*x$
(v) $(x*y)*(1*y)=x$ for all x,y,z in X.

B. *Definition:*2.2[4]

GK algebra X is said to be commutative if it satisfies for all x,y in X, $(x*y)*y=(y*x)*x$.

C. *Definition*:2.3[3]

Let X be a d-algebra. A map $\theta:X\rightarrow X$ is a left-right derivation (l,r)- derivation of X it satisfies the identity $\theta(x*y)=(\theta(x)*y)\wedge(x*\theta(y))$ for all x, y in X. If θ satisfies the identity $\theta(x*y)=(x*\theta(y))\wedge(\theta(x)*y)$ for all x,y in X then θ is a right-left derivation (r,l) derivation of X.

D. *Definition:*2.4[2]

Let (X,*,0) be a TM algebra.A self map $d:X\rightarrow X$ is said to be a (l,r) derivation of X if $d(x*y)=(d(x)*y)\wedge(x*d(y))$.A self map $d:X\rightarrow X$ is said to be (r,l) derivation on X if $d(x*y)=(x*d(y))\wedge(d(x)*y)$.

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BEHAVIOURAL ANOMALIES IN *CYPRINUS CARPIO* L. INDUCED BY MONOCROTOPHOS INTOXICATION IN SUBLETHAL DOSES

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ABSTRACT

Though plenty of research is available for short term impact of pesticides on fishes yet study on the quantification of behavioural implications were not carried out so far. In the present study, an attempt has been made to investigate the impact of chronic toxicity of Monocrotophos on the behavioural responses of freshwater fish, *Cyprinus carpio*. A static renewal bioassay was conducted to determine the acute toxicity of commercial grade organophosphorus pesticide, Monocrotophos (36% SL) to Common carp, *Cyprinus carpio*. The LC_{50} concentrations of monocrotophos to carp fingerlings for 96 hrs was found to be 15.53 ppm. The fishes were exposed to the sublethal concentrations $1/5^{th}$ and $1/10^{th}$ of LC_{50}96 hrs for 30 days. The impact of toxicity on the behaviour and movement of fishes were assessed at five sampling points viz. at 0, 7, 14, 21 and 28 days of the exposure period. Even though the mortality was insignificant in the sublethal concentrations, considerable variations in behavioural responses such as lethargy, increased mucous secretion, surfacing, gulping of air, skin discolouration, respiratory distress and lack of appetite were observed. The one way Anova results showed that treated fishes showed significant differences in the movement when compared to their movement prior to intoxication at the same interval of time (F value = 3.328, $p < 0.05$).

KEYWORDS: Bioassay, Behaviour, *Cyprinus carpio*, Monocrotophos, Sublethal concentration, Movement

INTRODUCTION

Application of synthetic fertilizers, insecticides and pesticides are increasing now-a-days with increasing demand of agricultural food materials throughout the world. There is a high chance of aquatic ecosystem to be contaminated, located in industrial or agricultural areas, through runoff or ground water leaching of a variety of chemicals (Todd and Leuwen, 2002), thereby affecting many other organisms away from the primary target. It is estimated that only 0.1% of the pesticide reaches the specific target (Agular, 2002). Exposure of aquatic ecosystems to these pesticides is difficult to assess because of their short persistence in the water due to low solubility and rapid degradation. Yet monitoring of these pesticides is important because they are highly toxic and pose greater hazards to the aquatic organisms especially fishes (Talebi, 1998; Uner *et al.*, 2006; Banaee *et al.*, 2008). Pesticides, upon entering into the organs and tissues of fishes significantly damage certain physiological and biochemical processes.

Monocrotophos (3-(dimethoxyphosphinyloxy)-N-methylisocrotonamide) is a synthetic organophosphate, nonsystemic, broad spectrum insecticide and acaricide, acting as a cholinesterase inhibitor with contact, stomach and respiratory action. The major use of monocrotophos in farming is to protect crops against a variety of insect pests from soft bodied insect to leaf eating beetles.

Fishes, as they occupy the top most trophic level of aquatic food chain are able to take up and retain chemicals dissolved in water not only via active or passive processes but also by biomagnification. They represent good model systems to detect and document pollutants released into their environment. The deterioration of water quality can be detected easily by any change in the behaviour and physiology of fishes, hence they are excellent biological indicators. Moreover, as the mammalian and piscine systems exhibit similar toxicological and adaptive responses to oxidative stress, there is a growing concern in understanding the physiological mechanisms associated with fish responding to environmental stress. A long term exposure to sublethal concentrations of pesticides in aquatic environments cause more prominent structural and functional changes in aquatic organisms rather than mortality. Since monorotophos has

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RESEARCH ARTICLE

Structural characterization of *Bacillus licheniformis* Dahb1 exopolysaccharide—antimicrobial potential and larvicidal activity on malaria and Zika virus mosquito vectors

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Abstract

Microbial polysaccharides produced by marine species play a key role in food and cosmetic industry, as they are nontoxic and biodegradable polymers. This investigation reports the isolation of exopolysaccharide from *Bacillus licheniformis* Dahb1 and its biomedical applications. *Bacillus licheniformis* Dahb1 exopolysaccharide (*Bl*-EPS) was extracted using the ethanol precipitation method and structurally characterized. FTIR and ^{1}H-NMR pointed out the presence of various functional groups and primary aromatic compounds, respectively. *Bl*-EPS exhibited strong antioxidant potential confirmed via DPPH radical, reducing power and superoxide anion scavenging assays. Microscopic analysis revealed that the antibiofilm activity of *Bl*-EPS (75 μg/ml) was higher against Gram-negative (*Pseudomonas aeruginosa* and *Proteus vulgaris*) bacteria over Gram-positive species (*Bacillus subtilis* and *Bacillus pumilus*). *Bl*-EPS led to biofilm inhibition against *Candida albicans* when tested at 75 μg/ml. The hemolytic assay showed low cytotoxicity of *Bl*-EPS at 5 mg/ml. Besides, *Bl*-EPS achieved LC_{50} values < 80 μg/ml against larvae of mosquito vectors *Anopheles stephensi* and *Aedes aegypti*. Overall, our findings pointed out the multipurpose bioactivity of *Bl*-EPS, which deserves further consideration for pharmaceutical, environmental and entomological applications.

Keywords Exopolysaccharide · ^{1}H-NMR · Dengue fever · Insecticide · Drug development · Microbial pathogens · Pesticide · Yellow fever

Introduction

Microbial exopolysaccharides (EPS) are macromolecules of high molecular weight polymers with glycosidic linkages. Recently, natural polymers have been increasingly requested for numerous industrial applications. EPS can be secreted by several microorganisms, including bacteria, fungi, and algae during their growth (Wang et al. 2010a, b; Ismail and Nampoothiri 2010; Poli et al. 2010; Zhang et al. 2016). As a general trend, it has been highlighted

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CRITERION III - RESEARCH, INNOVATIONS AND EXTENSION

FRONT PAGE OF PUBLISHED PAPERS

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Digging into the Elusive Localised Solutions of (2+1) Dimensional sine-Gordon Equation

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Abstract: In this paper, we revisit the (2+1) dimensional sine-Gordon equation analysed earlier [R. Radha and M. Lakshmanan, J. Phys. A Math. Gen. **29**, 1551 (1996)] employing the Truncated Painlevé Approach. We then generate the solutions in terms of lower dimensional arbitrary functions of space and time. By suitably harnessing the arbitrary functions present in the closed form of the solution, we have constructed dromion solutions and studied their collisional dynamics. We have also constructed dromion pairs and shown that the dynamics of the dromion pairs can be turned ON or OFF desirably. In addition, we have also shown that the orientation of the dromion pairs can be changed. Apart from the above classes of solutions, we have also generated compactons, rogue waves and lumps and studied their dynamics.

Keywords: Compactons; Dromions; Lumps; Rogue waves; Truncated Painlevé Approach.

1 Introduction

The advent of localised solutions in terms of doubly periodic Jacobian elliptic functions [1–3] using the Painlevé Truncation Approach has completely revived the interest in the study of (2+1) dimensional integrable models and has given a filip to the identification of more general localised structures. The fact that the exponentially localised solutions called 'dromions' generated by Boiti et al. [4] fits into this category of solutions only as a special case has given a new dimension to the investigation of (2+1) dimensional integrable models in an effort to generate other elusive localised solutions like rogue waves, lumps etc. Rogue waves which are another interesting class of solutions, finds application in various fields [5, 6] such as hydrodynamics [7–10], nonlinear optics [11–18], Bose Einstein condensates [19, 20], plasma physics [21]. The important feature of rogue waves is that they come from nowhere and disappear with no trace. Lumps [22] which are algebraically localised solutions do not interact with each other. In this context, it would be interesting to revisit the (2+1) sine-Gordon equation in an attempt to extract such localised solutions in it.

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2 (2+1) Dimensional sine-Gordon Equation

Konopelchenko and Rogers [23, 24] have proposed an interesting symmetric generalisation of the sine-Gordon equation to (2+1) dimensions through a reinterpretation and generalisation of a class of infinitesimal Bäcklund transformations originally introduced in gas dynamics by Loewner [25] as far back in 1952 to give the system of equations

$$\left[\frac{\phi_\xi}{\sin\theta}\right]_\xi - \left[\frac{\phi_\eta}{\sin\theta}\right]_\eta + \frac{(\phi_\eta\theta_\xi - \phi_\xi\theta_\eta)}{\sin^2\theta} = 0, \tag{1}$$

$$\left[\frac{\phi'_\xi}{\sin\theta}\right]_\xi - \left[\frac{\phi'_\eta}{\sin\theta}\right]_\eta + \frac{(\phi'_\xi\theta_\eta - \phi'_\eta\theta_\xi)}{\sin^2\theta} = 0, \tag{2}$$

where $\theta_t = \phi + \phi'$. If we assume that $\phi' = 0$ and that $\theta_t = \phi$ is independent of y, then (1, 2) becomes trivial and (1) gives the (1+1) dimensional sine-Gordon equation

$$\theta_{\xi t} = \sin\theta. \tag{3}$$

Eventhough the (2+1) dimensional sine-Gordon equation has more representations, a more convenient and elegant representation is given by

$$\theta_{xyt} + \frac{1}{2}\rho_x\theta_y + \frac{1}{2}\rho_y\theta_x = 0, \tag{4}$$

$$\rho_{xy} = \frac{1}{2}(\theta_x\theta_y)_t, \tag{5}$$

where

$$\rho_x = -\frac{[\phi_y - \phi'_y] + \theta_{yt}\cos\theta}{\sin\theta}, \rho_y = \frac{[\phi_x - \phi'_x] - \theta_{xt}\cos\theta}{\sin\theta}, \tag{6}$$

SYNTHESIS OF BIODIESEL FROM NEEM OIL VIA TRANSESTERIFICATION PROCESS USING MG DOPED TITANIUM DI OXIDE

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Abstract

The Mg doped TiO_2 is synthesized by sol-gel method. The prepared solid nanocatalyst was characterized by XRD, FT-IR . The catalyst showed the highest yield of 89% for transesterification reaction at 65°C, 6 hour with 150mg catalysts loading. The reusability of the catalyst was moderate and future studies focusing on regeneration and enhancing the reusability of the catalyst are recommended.

Introduction

Biodiesel fuel is well known as a biodegradable, renewable, nontoxic, and eco-friendly that can substitute petro-diesel perfectly(Meng et.al 2013)which can be used directly or diesel mixture in engine with little changes(Dehkordi and Ghasemi et al 2012). The majority of world's energy is supplied through petrochemical sources, coal and natural gases. New renewable sources have been widely studied due to the reduction of petroleum reserves and increase in environmental and health concerns [1]. The demand of petroleum –based fuels also increases with increase in the industrialization and motorization of the world. So there is an alternate solution is need to alleviate all the problems .Biodiesel is the opt way to rectify the fuel demand and the environmental issues produced by petroleum productions. bio-diesel is also reduce the dependency on natural resources and greenhouse gas emissions [2]. Conversion of crude oil, coal and natural gas to fuels and chemical feed stocks, production of a variety of petrochemical and chemical products and emission control of CO, hydrocarbons, and NO, are rely on catalytic technologies [3]. The application of nanotechnology in the domain of harmful dye degradation, pesticide degradation, Water purification, Biodiesel synthesis, in drug synthesis are highly marketable. The particle size of the catalyst is one of the most important factors for their catalytic activity [4]. Various Nano catalysts have been investigated for biodiesel production such as Wen et al Catalytic technologies are critical to present and future energy, chemical process and environmental industries. [5-7] The main objective of this work is to synthesize the maximum amount of biodiesel in the presence of Mg doped TiO_2 nanocatalyst, here the efficacy of reusability of nanocatalyst also analysed.

2.Methods

2.1Materials and Methods

Refined Neem oil (NO) was purchased from local market. Methanol (>99% purity) and all other materials were of analytical grade purchased from E-Merck, India and were used as received without purification. Mg doped TiO_2 was prepared by sol-gel method. Titanium tetra-n-butoxide[ti(o-Bu)4]Magnesium nitrate obtained from E-merck AR grade, were used as titanium and magnesium sources for prepuring Pure TiO_2 (anatase form) and Mg^{2+} doped TiO_2 photocatalysts. All other chemicals and reagents are of merck(India) Analytical grade.

Initially 21ml of Titanium tetra-n-butoxide[ti(o-Bu)4] was dessolved in 80 ml of absolute ethanol (100%) and the resulting solution was stirred vigorously. Then 2ml of water and 0.5 ml of acetic acid 50% were added to another 80ml of ethanol to make ethanol-water-acetic acid solution. The later solution was slowly added to the ti(O-Bu)4 ethanol solution under vigorous stirring. When the resulting mixture turned to sol, the magnesium nitrate solution was added drop-wise. The resulting transparent colloidal suspension was stirred for more than 2 hours and aged at 25°C until the formation of gel. The gel was dried at 70°C in Vacco pressure of 600psi and then ground. The resulting powder was calcined at 400°C for 2 hours in 50°C increments for every 30 minutes until reaching 400°C after calcination period, the furnace was allowed to cool for 2 hours. The calcined powders were crushed using pestle and mortar under similar conditions in attempt to produce powders with similar fineness and particle size distribution.

2.2Transesterification of Neem oil

The production of biodiesel from ethanol and Neem oil has been used in the transesterification process. Mg doped Tio_2 have been selected as catalyst. First 20 ml of ethanol was mixed with Mg doped Tio_2 with different ratio (0.50mg -300mg).This is an exothermic reaction,so the mixture would get hot. Then the mixture was preheated about 65°C. Then the mixture was shaken

for 5 minute in a glass beaker. After completion of the methanolysis reaction (6 hour), the catalyst was recovered from the reaction mixture by centrifugation and excess methanol was recover in distillation unit. When the product was cooled, an oil phase clearly separated from a glycerol phase. The top oil phase i.e. biodiesel was collected. The percentage of biodiesel yield was defined as

Yield of Biodiesel:- volume of Biodiesel (V

Volume of Neem oil(

2.3Characterization of Catalyst

The crystallinity was determined by XRD using Bruker D8 advance X ray diffractometer equipped with Cu ka

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Phenoloxidase activation, antimicrobial, and antibiofilm properties of β-glucan binding protein from *Scylla serrata* crab hemolymph

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ABSTRACT

In this study, we purified β-GBP from hemolymph of *Scylla serrata* crabs using affinity chromatography. The purified *S. serrata* β-GBP (*Ss*-β-GBP) had 100 kDa molecular mass in the SDS-PAGE. MALDI-TOF/TOF analysis was conducted, revealing that the purified 100 kDa protein had 96% similarity with β-GBP of *Astacus leptodactylus*. *Ss*-β-GBP was characterized using high-performance liquid chromatography (HPLC), X-ray diffraction (XRD) analysis, circular dichroism (CD) and Fourier transform infrared (FTIR) spectroscopy, which confirmed the structure of the *Ss*-β-GBP. The purified *Ss*-β-GBP was functionally analyzed by yeast agglutination and phagocytic reaction assays. Moreover, the PO enhancing ability of *Ss*-β-GBP was evidenced through PO activity. Specifically, the antibacterial activity of the *Ss*-β-GBP against Gram-positive (*Enterococcus faecalis* and *Staphylococcus aureus*) and Gram-negative (*Escherichia coli* and *Pseudomonas aeruginosa*) bacteria was evaluated by determining its minimum inhibitory concentration (MIC) < 60 μg/ml for all tested species. Furthermore, the antibiofilm efficacy of *Ss*-β-GBP at 50 and 100 μg/ml was outlined using light microscopy and confocal laser scanning microscopy (CLSM). Bacterial viability assays also outlined the dose-dependent activity of *Ss*-β-GBP based on the ratio of live/dead bacterial cells. The results of this study revealed that crab-borne *Ss*-β-GBP might be widely used to suppress the growth of pathogenic bacteria.

1. Introduction

In response to the growing global population and the projected increasing protein-based food requirements of coming generations, crustaceans have been a focus as a source of animal proteins with several potential applications. For instance, crustacean-based proteins have host defense properties, including prevention of the growth of pathogenic microorganisms [1]. The innate immunity has a critical role in protecting against pathogenic bacteria and fungi, which is mediated by pattern recognition proteins, including Gram-negative bacteria-binding proteins (GNBP) [2,3], peptidoglycan recognition proteins (PGRPs) [4], lipopolysaccharide β-glucan binding proteins (LGBP) [6,7] and β-glucan binding proteins (β-GBP) [8]. β-GBPs are plasma proteins that precisely bind to β-1, 3-glucan. They are numerous, playing a key role in crustacean effective defense system against invading pathogenic organisms [9]. Furthermore, GNBP led to the production of antibacterial peptides that appear to have an effective role to deactivate pathogenic bacteria [10]. LGBP from *Eriocheir sinensis* show binding activity towards Gram-positive bacteria, while the same is not true for peptidoglycans, because of the complex cell wall composition [11]. The interaction of LGBP with the microbial membrane and the subsequent antimicrobial activity may initiate the immune system mechanisms [12].

Crustacean proteins like lectin and pattern recognition proteins can kill microbial pathogens [13,14]. Furthermore, the antimicrobial activity and diversity of antimicrobial peptides (AMPs) have been investigated as potential and promising drugs for pharmaceutical industries [15].

AMPs are active molecules that play a crucial role by associating with selective cellular membranes to exhibit antimicrobial activity. The structural requirements for AMP activity include α-helical and β-sheet

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Identification, characterization and immune response of prophenoloxidase from the blue swimmer crab *Portunus pelagicus* and its antibiofilm activity

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ABSTRACT

Prophenoloxidase is a conserved Cu-containing enzyme acting as a major defense molecule in the immune response of crustaceans. In the present research, we purified prophenoloxidase from the haemolymph of *Portunus pelagicus* (*Pp*-proPO) by Blue Sepharose CL-6B chromatography. *Pp*-proPO exhibited only one band with molecular weight of 75 kDa on SDS-PAGE. The purified *Pp*-proPO was characterized through X-ray diffraction (XRD) and high-performance liquid chromatography (HPLC). *Pp*-proPO showed phagocytic activity on the yeast *Saccharomyces cerevisiae* as well as encapsulation on sepharose CL-6B beads associated with CM sepharose and beads of sodium alginate. *Pp*-proPO also led to strong agglutination on human erythrocytes. Furthermore, *Pp*-proPO showed magnified PO activity when altered with activated particles acting as pathogen combined molecular patterns (PAMPs), metal ions or other chemicals. *Pp*-proPO showed relevant antibiofilm activity on Gram negative bacteria *Pseudomonas aeruginosa* and *Escherichia coli*. Overall, the above results allowed us to claim that *Pp*-proPO play a key role in immune defense mechanisms of *P. pelagicus* crabs, in particular towards microbial pathogens; notably we added basic information to the functional characterization of *Pp*-proPO, as well as to understand its immunological role in crustaceans defense systems.

1. Introduction

The prophenoloxidase stimulating system (proPO) plays a crucial role in non-self detection systems characterizing arthropods, and is probably responsible for the non-self-concession method of crustaceans' defenses [1,2]. In invertebrates, proPO plays a main role in the immune recognition processes [3–5]. The proPO acts on cellular reply, with mechanisms comprising phagocytosis, encapsulation, and nodule formation, even as the humoral reaction contains the synthesis of an extensive range of effective antimicrobial proteins [6,7]. This proPO-activating enzyme (PPAE) - previously activated by microbial structure constituents [4]-can modify the inactive enzyme ancestor, proPO, to phenoloxidase (PO), which is the main enzyme concerned with native immune system of invertebrates [1]. It has been reported for a range of arthropods that the proPO system can influence the pathogen survival [8,9]. Although, in crustaceans proPO is confined to haemocyte granules [10] and its isolation can be done from a haemocyte lysate supernatant [11,12].

Currently, the research on crustacean defense mechanisms is rapidly growing, in order to face a number of pathogens threatening the economic importance of crustacean aquaculture [13]. In this framework, the actuating device of proPO system in crustaceans, activated by constant factors, have been well recorded [4,14]. Indeed, the proPO system acts as a part of coagulation, with opsonic and antimicrobial properties [2], and is supposed to have a key role in host resistance mechanisms [15]. The pro-PO activating system can be physiologically important not only for defense reaction, but also for wound healing purposes. To elucidate the proPO activation process at molecular level, isolation and delineation of proPO, as well as proPO activating components engaged in the related activation process should be carried out.

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A Comparative Study of Image Filtering Techniques for Stone Inscriptions

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Abstract – **Stone Inscriptions are used to know about the past life of our ancestors and various types of the ancient characters belonging to various centuries. It can be used to establish literacy, archaeological, and historical antiquity on the basis of engravings. Tamil language has the largest number of inscriptions which includes knowledge rich contents. Importance of inscriptions to mankind is remarkable. Nowadays modern readers are faced many difficulties to interpret ancient script from stone inscriptions. Enhancement of inscription image is very important before segmentation process. The need for digitizing this inscriptions arise which help in sharing the content. Enhancement of such inscription image is difficult and still challenging process. The objective of the analysis issues provides to historical document preservation. In this paper discusses the various filtering techniques to enhance the Tamil Brahmi inscription images. The existing filtering techniques are also discussed in this paper to enhance the quality of the inscription images.**

Keywords - Tamil Brahmi Inscriptions, Image Quality Factors, Image Noises, Filtering Techniques.

1. INTRODUCTION

In Tamil Nadu, old inscriptions are found in three types of scripts, namely vatteluttu, Tamil and Grantha. The vatteluttu and Tamil Scripts were used to write the Tamil language and the Grantha script was used to write Sanskrit. The Tamil and Grantha scripts are becoming visible only from the 7th century A.D. These inscriptions were engraved on stone and copper plates recording information mostly about constructions of templates, donations to temples etc [1]. In this research work contributes an experiment method is concerned for enhancement of Tamil Brahmi stone inscriptions using filtering techniques.

This paper is organized as follows: In Section 1 the details of Tamil Brahmi inscription is given. In Section 2 the details of image quality factors are discussed. The types of noise are highlighted in Section 3, Section 4 discusses the various filtering techniques and Section 5 tells about the quality measures. Section 6 describes experimental results and discussion. The proper conclusion is provided in Section 7.

Some of the Tamil Brahmi Stone Inscription images are given below in Figure 1,2,3,4

Fig. 1.

Fig. 2

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Drone like dynamics of dromion pairs in the (2+1) AKNS equation

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ABSTRACT

We employ Truncated Painlevé Approach (TPA) to the (2+1) dimensional AKNS equation and construct the solutions in closed form in terms of lower dimensional arbitrary functions of space and time. The highlight of our investigation is that we are able to generate dromions undergoing inelastic and elastic collisions. We observe that the conventional dromions undergo inelastic collision not only exchanging their energy, but also their phase while the dromion pair undergoes elastic collision. In particular, we observe that, we are able to turn ON or OFF the dynamic property of dromion pair by selectively choosing the lower dimensional arbitrary functions with a suitable initial condition. Similar to "drones", Unmanned Aerial Vehicles (UAVs), dromion pairs can be driven anywhere in the two dimensional plane by selectively giving the initial conditions. In addition to dromions, we have also generated a wide class of localized solutions such as rogue waves and lumps. We observe that while the rogue waves are found to be unstable and stationary, lumps do not interact with other, when they travel in the two dimensional plane.

1. Introduction

Rogue waves, also known as Freak waves occur in deep ocean [1–4]. The important feature of rogue waves is that they "come from nowhere and disappear with no trace" i.e. they appear for a short duration of time, like a shock wave. Recently, Rogue waves have received much attention in many fields such as hydrodynamics [5], Nonlinear optics [6–8], Bose Einstein Condensates [9,10], Plasma Physics [11], etc. In contrast to the Rogue waves, there is another interesting class of solutions which occur in (2+1) dimensional integrable systems, known as dromions [12–18]. They originate at the cross point of the intersection of two nonparallel ghost solitons, decay exponentially in all directions and are driven by lower dimensional boundaries or velocity potentials. There exists another class of localized solutions called lumps [19,20] which decay algebraically and do not interact with each other. The quest towards unearthing localized solutions in (2+1) dimensional nonlinear partial differential equations (pdes) with exotic behaviour continues even today.

In this paper, we consider the (2+1) dimensional AKNS equation [21] and employ Truncated Painlevé Approach (TPA) [22–26] to construct its solutions in closed form in terms of lower dimensional arbitrary functions of space and time. For a similar (2+1) dimensional Nonlinear equation [27], Lax pair is obtained using Singular Manifold method and Solitonic solutions such as Line solitons and dromions are constructed using Darboux Transformation. Even though the (2+1)

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Research paper

New classes of solutions in the coupled $\mathcal{PT}$ symmetric nonlocal nonlinear Schrödinger equations with four wave mixing

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ABSTRACT

We investigate generalized nonlocal coupled nonlinear Schorödinger equation containing Self-Phase Modulation, Cross-Phase Modulation and four wave mixing involving nonlocal interaction. By means of Darboux transformation we obtained a family of exact breathers and solitons including the Peregrine soliton, Kuznetsov-Ma breather, Akhmediev breather along with all kinds of soliton-soliton and breather-soltion interactions. We analyze and emphasize the impact of the four-wave mixing on the nature and interaction of the solutions. We found that the presence of four wave mixing converts a two-soliton solution into an Akhmediev breather. In particular, the inclusion of four wave mixing results in the generation of a new solutions which is spatially and temporally periodic called "Soliton (Breather) lattice".

1. Introduction

Since the invention of the laser, optical solitons [1] have played an important role in nonlinear physics. The optical soliton in fibres is probably the best studied form of solitons because of its remarkable behavior that agrees well with theoretical predictions and its potential as optical information carrier. The propagation of optical pulses through optical birefringent fibres is described by the celebrated Manakov model of the following form [2],

$$i q_{1t} + q_{1xx} + 2\left(g_{11}|q_1|^2 + g_{12}|q_2|^2\right)q_1 = 0, \tag{1a}$$

$$i q_{2t} + q_{2xx} + 2\left(g_{21}|q_1|^2 + g_{22}|q_2|^2\right)q_2 = 0, \tag{1b}$$

where, q_1 and q_2 are wave envelopes, x, t are space and time variables and i is the imaginary unit. The interaction coefficients g_{11} and g_{22} correspond to the Self-Phase Modulation (SPM) and g_{12} and g_{21} represent the Cross-Phase Modulation

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An economic analysis of women in informal sector - a study in Ariyalur district, Tamil Nadu

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Abstract

The present paper aims at understanding of the status of women in informal sector. In this chapter can well study in three distinct economic sectors. Agriculture, business, and service sector workers, and especially analysis of income, expenditure, savings and debts of women in informal sector in ariyalur district. A small survey has been conducted in this district to find the realities. 90 informal sector women (30 sampling from each sector. Agriculture, Business, Service sector, viz,,),(15 sampling from each block. Ariyalur, Thirumanur, Jayankondam, Andimadam, T.Palur, Sendurai) of ariyalur district were randomly selected with the help of black development officers and village administrations. However it may appear presumptuous on part of the author to claim its generalization for the country, but, a numbers of similar studies conducted in other parts of this district by other scholars support the contention.

Key Words: Working and Living condition, Informal sector, Women, Workers

Introduction

A great majority of the people lives under the poverty line. They are deprived of adequate access to the basic needs of life such as food, dress, shelter, health, education, security, employment, equality and justice. Issues of sustainable livelihood, lack of social and political participation of the vulnerable groups are the major problems in the developing and under developed countries. The government makes some policies for poor people to uplift from the below of poverty line. But, which one of the government has not given sufficient attention to the full implementation of it. So, they are living as third-class people in the country. But unfortunately, among the lower-class and upper-class differences, no one can imagine. But, can well understand the status of women in the society, because, they are only being bottom of the society. So the study deals with the Status of Women in Society. What is Informal Sector? , What they are doing there?, Is it solve their problem?. Come let's see.

Objectives

The following are the objectives of the study:

1. To study the socio-economic status of women in informal sector in the study area.
2. To make a study on the working conditions of women in informal sector.
3. To identify the women workers exploitation and gender discrimination.
4. To offer concrete suggestions for the betterment of women workers and conclusion based on the outcomes of the study.

Methodology

a) Reasons for Choosing the Aria

1. It is well-known fact that Ariyalur district is one of the most backward districts in Tamilnadu.
2. In Ariyalur district, women constitute more than half work in informal sector.
3. In 2011, woman population is higher than the men population. Sex ratio is 1015 females for every 1000 males.
4. In 2011-12 ariyalur district per capita income (Rs.19467). This onlylowest district in per capita income compared to other district.
5. In 2011, total workers in Ariyalurdistrict 34.30per cent were engaged in agriculture as agricultural labourers. But more than 80 per cent of the workers depend on informal sector.

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A Study on Impact of Goods and Service Tax on Indian Economy

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Abstract- **Goods and Services Tax is the largest indirect tax reform of India. Goods and Services Tax is a single tax system on the contributor of goods and services. It is a destination based tax. It has subsumed taxes like Central Excise Law, Service Tax Law, VAT, Entry Tax, Octroi, etc. Goods and Services Tax is guessed to bring together state economies and develop overall economic growth of the country. The implementation of a tax reform like Goods and Services Tax in a varied country like India necessitated a lot of efforts on the state and national level and drew a lot of challenges like the reconciliation of interests of diverse States with that of the Centre. Some of these issues included origin-based versus destination-based taxation, rate structure and compensation, dispute settlement, inclusion of Alcohol and Petroleum products under Goods and Services Tax. However, there is a positive impact of Goods and Services Tax is on the logistics industry in India had to maintain multiple warehouses across states to evade Goods and Services Tax and state entry taxes on inter-state movement. Most of the times, these warehouses were enforced to operate below their capacity, thus increasing their operating costs. With Goods and Services Tax, restrictions on inter-state movement are lessened and the logistics sector can start consolidating warehouses across the country. Diminution in unnecessary logistics costs will increase profits for businesses involved in supply of goods through transportation. Factors like reduced logistics costs, simplified procedures, lower tax burden, removal of cascading effect, etc. make the Goods and Services Tax regime especially beneficial to startups in the country. Threshold of Rs. Twenty lakhs is beneficial for small businesses. Goods and Services Tax also has helped widen the tax base, with the number of registrations crossing ten million. International Monetary Fund has projected that the Goods and Services Tax reform in India is projected to drive the medium term economic growth rate to beyond 8 per cent.**

Keywords: **Indirect Tax; Goods and Service Tax; Single tax system; Central GST; State GST**

I. INTRODUCTION

Goods and Service Tax is the largest tax reform has established on the idea of "one nation, one market, and one tax" is finalized in India. The moment that the Union government was waiting for a decade has finally arrived. The single biggest indirect tax management has jerked into force, dismantling all the inter-state obstructions with admiration to trade. The Goods and Service Tax squash, with a single stroke, has converted India into an amalgamated market of 1.3 billion nationals. Primarily, the 2.4 trillion dollar economy is attempting to change itself by doing away with the internal tariff obstacles and subsuming Union, state and local taxes into a unified Goods and Service Tax. The thought of introducing Goods and Service Tax was first recommended by the then Union Finance Minister, P. Chidambaram in his Budget for 2006-07. The discussion on Goods and Service Tax took precise pronouncement with the introduction of the Constitutional Bill of 122nd Amendment, 2014. The Bill was passed by the Parliament on 8 August 2016. This was followed by the authorization of the Bill by more than fifteen states. On 12 April 2017, the Union Government passed four Goods and Service Tax bills are listed below.

a. Central Goods and Services Tax (CGST) Bill
b. Integrated Goods and Services Tax (IGST) Bill
c. Union Territory Goods and Services Tax (UTGST) Bill
d. The Goods and Services Tax (Compensation to States) Bill

In the Indian economy, the service sector contributes to over fifty five per cent. Separate taxation of goods and services is neither viable nor desirable. Goods and Services Tax in India has been launched to reduce the tax burden that's on both companies and consumers. In the earlier system, there were multiple taxes added at each step of the supply chain, without taking credit for taxes paid at previous stages. As a result, the end cost of the product does not clearly show the actual cost of the product and how much tax was applied. The tax structure was multifaceted. Goods and Service Tax incorporated most of the taxes into one single tax, where the customers are benefited. This system provides Input Tax credit remunerated on the purchase of goods and services, which can be equalize with the tax to be remunerated on the supply of goods and services. As an end result, this diminishes the overall expenditure, with the end

A NEW FLAVONOID ISOLATED FROM *THEVETIA PERUVIANA* AND EVALUATION OF ANTI-BACTERIAL ACTIVITY OF QUERCETIN-3-O-RUTINOSIDE

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Abstract : The isolation of Quercetin-3-O-rutinoside flavonoid was obtained from *Thevetia peruviana* and the structure was established based on analysis of UV, ^{1}H NMR and ^{13}C NMR spectroscopy methods. Moreover, the absence of toxicity of plant extracts and the isolation of active compounds are important to propose these plants as alternative approaches to resistance management and the results indicate the potential utility of isolated compounds, in the treatment of various bacterial infections.

IndexTerms **- *Thevetia peruviana*, Apocynaceae, Flavonoid, Quercetin-3-O-rutinoside.**

I. INTRODUCTION

Phytochemicals derived from plants have delivered the basis for numerous commercial prescriptions used today for the treatment of a wide range of diseases. Phytochemical technique mainly applies to the quality control of herbal medicine of different chemical constituents such as tannins, saponins, alkaloids, volatile oils, flavonoids and anthraquinones. It is essential to use the phytochemical methods to screen and analyze bioactive components, not only for the quality control of crude drugs, but also for the interpretation of their therapeutic mechanisms.[1] The study of the distribution of flavonoids in plants is a continuing exercise and known flavonoids are being regularly exposed from new sources.[2]

Thevetia peruviana belongs to the family Apocynaceae and it often known as yellow oleander.[3] *Thevetia peruviana* has been deliberated as a hypothetically important plant for industrial and pharmacological application. Research admired that phytochemicals, working together with nutrients found in fruits, vegetables and nuts, may help slow the aging process and reduce the risk of numerous diseases such as high blood pressure, pain, asthma, cancers, heart diseases and urinary tract infections.[4]

The ethno-medical uses of *Thevetia peruviana* is seeming in treating the external wounds, infected area, ring worms, tumours etc., the use of grinded leaves of *Thevetia peruviana* in ethno-veterinary medicine is the evidence for its plenteous use for healing of wounds.[5] In the present study, yellow flowers of *Thevetia peruviana* were selected and the flavonol glycoside has been isolated and its therapeutic applications have been investigated.

II. MATERIALS AND METHODS

2.1. Extraction and fractionation

The fresh flowers (2 kg) of *Thevetia peruviana* (Apocynaceae) collected from Kumbakonam were extracted with 85 % MeOH (5 X 500 mL) under reflux. The alcoholic extract was concentrated *in vacuo* and the aqueous concentrate successively fractionated with peroxide - free ether (4 X 250 mL) and ethyl acetate (8 X 250 mL). The EtOAc fraction alone was taken up for the study.

2.2. Ether fraction: flavonol - quercetin

The Et_2O fraction was concentrated *in vacuo* and left in an ice chest for about a week. A yellow solid that separated was filtered and studied. It came out as pale yellow needles m.p. 315-317°C on crystallization from MeOH. It was soluble in organic solvents and sparingly soluble in hot water. It gave a red colour with Mg-HCl, olive green with alc.Fe^{3+}, golden yellow colour with NH_3 and NaOH and appeared yellow under UV and UV/NH_3. It answered the Horhammer-Hansal, Wilson's boric acid and Gibb's tests. It had λ_{max}^{MeOH} nm 256, 268 sh, 370; +NaOMe 261 sh, 321, 422; +$AlCl_3$ 266, 302, 457; + ($AlCl_3$ - HCl) 268, 303, 352, 427; +NaOAc 274, 327, 390 and + (NaOAc - H_3BO_3) 261, 303 sh, 385 nm. The aglycone part of the compound was identified as quercetin and the same was confirmed by CO, mixed PC and m.m.p. with an authentic sample of quercetin from *Wrightia tinctoria*.[6]

2.3. Ethyl acetate fraction: Quercetin-3-O-rutinoside

The ethyl acetate fraction was concentrated *in vacuo* and left in an ice-chest for few days. A yellow solid that separated was filtered and studied. It developed a green colour with alc. Fe^{3+} and a pink colour with Mg-HCl. It appeared deep purple under UV that turned yellow on exposure to NH_3. It responded to Wilson's boric acid, Molisch and Gibb's tests, but did not answer the