Chemical Science & Engineering Research

Ariviyal Publishing

Research Article

DOI:10.36686/Ariviyal.CSER.2022.04.11.065

Chem. Sci. Eng. Res., 2022, 4(11), 43-47.

Infrared (Attenuated Total Reflection) Study of Lithium Salts Dissolved in Non-Aqueous Aprotic Solvents

Sharda Sundaram Sanjay,*[a] Mrigank Mauli Dwivedi[b] and Kamlesh Pandey[b]

[a]*Department of Chemistry, Ewing Christian College, University of Allahabad, Allahabad-211002, U.P., India.*
[b]*National Center of Experimental Mineralogy and Petrology, University of Allahabad, Allahabad-211002, U.P., India.*

***Corresponding author E-mail address**: sharda100@rediffmail.com (Sharda Sundaram Sanjay)

ISSN: 2582-3353

Crossref

Publication details
Received: 04th November 2022
Revised: 17th November 2022
Accepted: 17th November 2022
Published: 03rd December 2022

Abstract: The role of the solvent becomes critically important during ion transport when the electrolyte solute and solvent compete for coordination. Improved ionic conductivity requires ionic dissociation. The 'hip-hop' transition of the cations requires that ion pairs split and become solvated with solvent molecules during dissolution. To achieve these hopping transitions, lithium salts are the best choice. We have investigated the vibrational spectra of lithium nitrate and lithium triflate in two different non-aqueous organic solvents, namely THF and DMSO, through ATR-FTIR spectroscopy in order to investigate ion-solvent and ion-ion interactions, to learn more about solvents' lower and higher frequency vibrations, and factors affecting the identifiable characteristics, functioning, and interaction of ionic compounds with solvents.

Keywords: FTIR; Lithium Nitrate; Lithium Triflate; THF; DMSO; Solute-Solvent Interaction

1. Introduction

The most important part of a battery is the electrolyte medium, through which the ions' transition occurs. Since solute electrolyte solute and solvent compete for coordination during ion transport, the role of the solvent becomes crucially significant. Ionic dissociation is required for improved ionic conductivity, and obviously the free energy of dissolution should be negative for the process to occur. Ion pairs must dissociate and get solvated with solvent molecules during dissolution in order to provide the 'hip-hop' transition of the cations. Lithium salts are the ideal option to achieve these hopping transitions.

Among various lithium salts, lithium nitrate ($LiNO_3$) is the most researched co-salt and additive for lithium-sulfur (Li-S) batteries for preventing the redox reactions of soluble lithium polysulfide which manifests as an improvement in the battery's coulombic efficiency and cycling stability as well as a decrease in the self-discharge rate.[1] Due to its ability to stabilize the lithium anode by forming a solid electrolyte interaction, its low degree of dissociation in aprotic solvents, and its catalytic effect against oxygen transformation response in rechargeable lithium oxide batteries, it has recently been proposed as a promising salt for lithium oxide batteries.[2]

Lithium triflate (LiTF, $LiCF_3SO_3$) is another fascinating lithium salt. If polymer hosts are used for batteries, it is worth mentioning that it reduces crystallinity and increases chemical and thermal stability.[3]

The electrolyte in which the ions are carried is the most crucial component. Transportation of ions is applicable to all kinds of electrolytes, whether it is liquid, gel, or solid polymer electrolytes. Ion transition in electrolytes depends on the heteroatom present in solvent, specifically how it coordinates with the salt. Owing to the application of organic solvents in lithium-based batteries with high energy densities, in recent years, the structure of the lithium salt solution in organic solvents has attracted a lot of interest.[4]

Dimethylsulfoxide (DMSO) is one of the dialkylsulfoxides that has found being used in this field. DMSO has its capacity to form inter - molecular self-associative formations in liquid or in solution. It should be emphasised that the self-association of DMSO molecules is caused by both intermolecular hydrogen bonds of the type SO-HC as well as dipole-dipole interactions between SO groups. Spectroscopic findings show a variety of fairly stable structural aggregates exist, notably cyclic dimers, open chains, dimers, and polymers.[5,6] It must be emphasised that in addition to Li+ cation solvation, there may be an anion- molecular interaction comprising the CH_3 groups of DMSO.[7]

For usage in lithium-oxygen (Li-O_2) batteries, Dimethylsulfoxide (DMSO)-based electrolytes are desirable due to their stable charge-discharge behaviour. The structure of the electrolyte is considered to have an impact on side products in Li-O_2 cells if the source of side products during discharge is primarily due to the dissociation of electrolytes.[8]

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Materials Today: Proceedings

Volume 68, Part 7, 2022, Pages 2772-2780

A brief review on synthesis and application of polymer–nanodiamond composite

Kamlesh Pandey [a], Mrigank Mauli Dwivedi [a], Sharda Sundaram Sanjay [b]

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https://doi.org/10.1016/j.matpr.2022.09.032

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Abstract

Recent research and findings have drawn attention to the emergence of nano diamond-based polymer nanocomposites. The unique nanoscale carbon structural units known as nanodiamonds have a variety of exceptional mechanical, chemical, optical, and biological features that make them important andeffective species serving as carriers for technical and biomedical applications. To produce high-performance composites that may be employed in electrochemical energy storage devices, the nano diamond-polymer nanocomposites mitigate the different challenges that arise in the pursuit of high performance polymeric compounds. The focus of this review is on the fundamental characteristics, fabrication methods, surface engineering strategies, toxicity concerns, energy production and biomedical applications of composites made of polymers -nanodiamond composites.

Introduction

On a technical, industrial, and biological spectrum, nanodiamond (ND) has emerged as a significant nanomaterial [1], [2], [3], [4], [5]. It has a huge exploitable exterior and an inert diamond core of about 5 nm. The usual dimension scales of ND, that may be an allotropic nanocarbon, ranges from 1 to 100 nm. It may exhibit a variety of different forms, such as, diamondoids, nanocrystallites, ultra-nanocrystalline particles etc. Detonation nanodiamond (DND) or ultradispersed diamond are 4–5 nm-sized nanoparticles that are incredibly small. Mechanical, thermal, electrical, optical, and biocompatibility are only a few of their significant characteristics. Implementations of ND are found in a number of domains, such as in biomedicine, in fabricating nanocomposites, in electronics and aerospace [6], [7], [8]. Polymer-based nanocomposites are promising alternatives that incorporate the characteristics of the polymer matrices with the nanofillers. It dramatically changes the physical and mechanical attributes. Recent investigations of polymer-ND composites have demonstrated that integration of ND could enhance the physical traits of polymer matrices [9], [10]. These investigations have mostly concentrated on epoxy, poly (vinyl alcohol), or

poly (lactic acid)-based polymers[11], [12]. To effectively take advantage of the ND features, the ND in a matrix should be distributed uniformly. These may be functionalized or reconfigured in many ways to produce homogeneous dispersion. The *N*-V centre in diamonds is an interesting potential solid state qubit option [13], [14], [15]. NDs have a wide range of benefits and applications, but they also possess some drawbacks. For example, as compared to the conventional organic dyes, the emissions of an *N*-V centre is modest. Coupled NDs may introduce structural and functional changes in associated proteins, making it difficult to distinguish from the ambient fluorescence. Additionally, ND is incorporated with the polymer matrix implementing a variety of dispersing approaches, including sonication, vortex mixing, in situ approach, solution blending, and others. By using melt mixing, solution processing, and other mixing processes, functionalized NDs are chemically coupled with the amide and imide group of polymers. [16], [17].

Section snippets

Nanodiamonds' structure

A newest family member of carbon nanoparticles, nanodiamond (ND), exhibits advanced diamond-like properties due to its compressed octahedral morphology. Two closely packed, interpenetrating, face-centred cubic lattices make up the crystal structure of the nanodiamonds. One of the lattices is slightly offset from the other along the diagonal of the basic cube space. The word "nanocrystalline diamond" (NCD) refers to materials with facets smaller than 100 nm, whereas the phrase…

Polymer dispersion approaches for nano diamond (ND)

In comparison to other carbon nanoparticles like CNT or GO, spherical NDs provide tremendous potential for nanoscale dispersal in polymer matrix materials. For the dispersion of ND aggregates in polymer matrices, there are indeed various pretreatment techniques. For greater dispersion in matrix materials, techniques such as ball milling, moderate or high power sonication, and shear blending were applied. Ball milling might offer NDs in polymer matrix in a fine dispersed state with improved ND…

Functionalization of NDs

The majority of the surface functionalization of NDs are done by –OH, $–CH_3$, $–CH_2$, CO_2 and -C═O groups (Fig. 12). There are many surface ionogenic groups also (such as ether—C —O – C; peroxide—C —O — O –; carbonyl—C—O, and hydroxyl-type C — O — H bonding,) and hydrocarbon remnants that can be used to functionalize the surface of NDs. Bio-active compounds can also be used to alter the surface via adsorption, chemical immobilisation (covalent or non-covalent or both).

When NDs are oxidised or hydrogenated,…

Polymer nanodiamonds for different applications

The application of NDs as fillers in polymer composites for thermoplastics, thermosets, biopolymer-based products and elastomeric materials has been investigated. According to the investigations, the mechanical attributes of these materials are enhanced by the incorporation of NDs. Both the agglomeration and the unequal distribution of NDs in the matrix are disadvantages of these materials. These reduce their active surface area, which worsens the efficacy of physical reinforcement. Extra…

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RESEARCH ARTICLE

Elemental concentration in renal stones by wavelength dispersive X-ray fluorescence spectrometry

Varun Bali, Yugal Khajuria, Ashok K. Pathak, Upendra Kumar, Pradeep K. Rai, Charles Ghany, Vivek K. Singh

First published: 28 February 2023
https://doi.org/10.1002/xrs.3338

Funding information: University Grants Commission (UGC), Grant/Award Number: 8-4(57)/2015(MRP/NRCB); UGC-DAE CSR Kolkata Centre

Abstract

Renal stone formation inside the kidney is one of the major causes of renal failure all over the world. To create preventative measures, it is crucial to examine renal stone's composition and identify the minerals that are responsible for their pathogenesis. Various concerns regarding the pathophysiology of renal stones remain unresolved and have been put forward. However, till date, the complete information is still unclear. In recent years, spectroscopic studies have gained much attention in identifying the chemical compositions that lead to the formation and growth of renal stones. This work employed wavelength-dispersive X-ray fluorescence (WDXRF) and Fourier transform infrared (FTIR) spectroscopy to study renal stones. WDXRF results of renal stone samples give the presence of numerous heavy and trace elements. Different elemental constituents like zinc (Zn), copper (Cu), iron (Fe), molybdenum (Mo), nickel (Ni), strontium (Sr), chromium (Cr), zirconium (Zr), palladium (Pd), bromine (Br), ruthenium (Ru), lead (Pb), and arsenic (As) were detected and quantified in the renal stones. Vibrational spectroscopic studies were carried out to know the chemical compositions of renal stones such as calcium oxalate monohydrate (COM), uric acid (UA), and carbonate apatite (CA). Quantitative results of WDXRF have been compared with the results from atomic absorption spectroscopy (AAS) of these stone samples. The available clinical details of the patients were correlated with the spectroscopic results obtained using WDXRF and FTIR spectroscopy.

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Review Article Volume 5 Issue 1

(FG,σ)- Purity and Semi-simple Modules

Ashok Kumar Pandey*

Department of Mathematics, Ewing Christian Post Graduate College (An Autonomous College of University of Allahabad, Prayagraj), Allahabad, India

***Corresponding Author:** Ashok Kumar Pandey, Department of Mathematics, Ewing Christian Post Graduate College (An Autonomous College of University of Allahabad, Prayagraj), Allahabad, India.

Received: October 04, 2022; **Published:** December 13, 2022

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Abstract

The torsion sub-module of A⊆M is denoted by σ(A). Since it was proved by Walker [18] that the class of I- pure (J- copure) sequences form a proper class whenever I(J) is closed under homomorphic images (sub-modules) of a R- module M and if I(J) is closed under factors (sub-modules) then for any I- pure (J- copure) sequence E:0->A ->B ->C ->0 if E ∈π^(-1) (I) (E ∈i^(-1) (I)) and hence in this case Walker's I- purity (J- copurity) coincides with the earlier notion of purity. We also study about class of R-modules dual to the modules of B. A sequence E:0⟶A ⟶B ⟶C ⟶0 is I- pure (J- copure) if and only if given C^'≤C∈ I, there existsB'≤B such that B^'≅C' and A∩B^'=0 ;we consider another notion of purity stronger than the Cohn's purity [13]. If FG denotes the class of all finitely generated R-modules, since, this class is closed under factors. We shall try to give some characterizations of FG-purity and to determine its relationship with the FG-flat modules. We relativist this concept and also relate it with that of finite projectivity of Azumaya [10] with respect to a torsion theory and to study the inter-relationship between these concepts. We also try to consider finite σ-projectivity or (FG,σ)- pure flatness, cyclically σ- pure projectivity and cyclically σ- pure flatness, the concept of locally σ- projectivity and locally σ- splitness and study its inter-relationship with (FG,σ)- purity and semi-simple module.

Keywords: R- Modules; (FG,σ)- Purity; σ- Pure Projective; R-Modules; I- Pure (J- copure; FG-flat Modules; Cyclically σ- Pure Projectivity; σ- Pure Infectivity; Locally σ- Splitness; Semi-Simple Module. Subject classification: 16D99

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ISSN (Online): 0975-8232,
ISSN (Print): 2320-5148

INTERNATIONAL JOURNAL OF
PHARMACEUTICAL SCIENCES AND RESEARCH

INDEXED IN Embase An Elsevier Product

An International Journal published monthly

An Official Publication of Society of Pharmaceutical Sciences and Research

ANTI-BACTERIAL EFFICACY OF PHYTO-SYNTHESIZED ZINC OXIDE NANOPARTICLES USING MURRAYA PANICULATA L. LEAF EXTRACT

Abstract

Human beings always tried to protect their body from pathogenic microbes, whereas these pathogens always mimic and mutate themselves to infect humans. Nanotechnology is new and upgrading itself as well as enhancing its applicability in pharmaceuticals. Due to their nano-size structure, property drastically changes from their parent elements. Nanoparticles are used widely in biomedical sciences. Focusing on these perspectives, the present study investigates the impact of phyto-synthesized Zinc Oxide Nanoparticles (ZnO NPs) using *Murraya paniculata* leaf extracts. The characterization of synthesized ZnO NPs was 32 nm with a more optical stable showing peak value at 355 nm (UV-vis). Further, toxicological efficacy of ZnO NPs was checked against human pathogens *viz.*, *Salmonella typhimurium* (causing typhoid), *Staphylococcus aureus* (causing tooth decay and rheumatic fever) and *Escherichia coli* (causing tooth decay in infants and dysentery). The anti-bacterial bioassay was done using a well diffusion method and compared with the standard drug streptomycin. The test pathogens were found more sensitive towards phyto- synthesized ZnO NPs with a Zone of Inhibition Diameter (ZID) value almost more than 22 mm for all three test pathogens as well as compared with earlier reports and found a potential herbal anti-bacterial agent. From the present investigation, the phyto-synthesized ZnO NPs showed promising results and may be used in dentistry as tooth filling agents and as nano-drugs in pharmaceuticals.

Article Information

Sr No: 38

Page No: 864-871

Size: 1215 KB

Download: 528

Cited By: 1

Language: English

Licence: IJPSR

Authors: Ajay Kumar Tiwari, Saket Jha *, Rahul Agrawal, Sheo Kumar Mishra, Ashok Kumar Pathak, Abhimanyu Kumar Singh, Anupam Dikshit and Ram Rashile Awasthi

Authors Address: Department of Botany, Institute of Professional Studies, University of Allahabad Prayagraj, Uttar Pradesh, India.

Email: jhasaket90@gmail.com

Received: 12 April 2021

Revised: 10 June 2021

Accepted: 09 June 2021

DOI: 10.13040/IJPSR.0975-8232.13(2).864-71

Published: 01 February 2022

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PAPER

Study of Pharmaceutical Samples using Optical Emission Spectroscopy and Microscopy

Vishal Dwivedi[1], Prerna Chauhan[5,2], Gulab Singh Maurya[6,1,3], Alicia Marín Roldán[1], Pavel Veis[7,1] and Ashok Kumar Pathak[7,1,4]

Published 8 June 2022 • © 2022 Astro Ltd

Laser Physics, Volume 32, Number 7

Citation Vishal Dwivedi *et al* 2022 *Laser Phys.* **32** 075604

DOI 10.1088/1555-6611/ac641c

Pavel.Veis@fmph.uniba.sk
akpathak75@gmail.com

[1] DEP, FMPI, Comenius University, Mlynská dolina F2, Bratislava 842 48, Slovakia

[2] IEE, Slovak Academy of Sciences, Dúbravská cesta 9, 841 04 Bratislava, Slovakia

[3] Department of Chemistry, Indian Institute of Technology Kanpur, Kanpur, U.P. 208016, India

[4] Department of Physics, Ewing Christian College, Prayagraj, U.P. 211003, India

[5] Present address: Research Center for Applied Sciences, Academia Sinica, Nankang, Taipei 115-29, Taiwan.

[6] Present address: Faculty of Physical Sciences, INSH, Shri Ramswaroop Memorial University, Barabanki, U.P. 225003, India.

[7] Authors to whom any correspondence should be addressed.

1. Received 22 March 2022
2. Accepted 1 April 2022
3. Published 8 June 2022

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Abstract

The growth of the pharmaceutical industry to keep pace with the well-being of humans worldwide has posed many challenges related to quality control. This paper reports on the potential application of a modern optical spectroscopic technique popularly known as laser-induced breakdown spectroscopy (LIBS) to address some quality aspects such as the sample constituents, hardness, and classification of five different pharmaceutical samples. The surface analysis of these samples has been carried out using optical microscopy (OM) and atomic force microscopy (AFM). The LIBS spectra of different pharmaceutical samples of different brands have been recorded in air at atmospheric pressure using a high-energy Nd:YAG laser and an echelle spectrometer coupled with an intensified charge-coupled device camera. The LIBS spectrum provides the spectral signatures of lighter elements like carbon (C), hydrogen (H), nitrogen (N), oxygen (O), and the CN violet band, along with inorganic elements like calcium (Ca), magnesium (Mg), etc. Two different multivariate analysis methods, principal component analysis (PCA) and artificial neural network (ANN), have been employed with the LIBS spectral data matrix to obtain the classification of these samples. OM and AFM were used to investigate the surface quality of the tablets, which helps the pharmaceutical industry in increasing the life of pharmaceutical products. The LIBS-based hardness of the sample matrices is estimated, and a correlation has been established with AFM-based RMS roughness. The results illustrate the strength of the LIBS coupled with multivariate analysis like PCA and ANN for a rapid and reliable analysis of pharmaceutical products. Also, LIBS coupled with OM and AFM might be an effective way to address surface quality aspects of pharmaceutical samples.

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Article

Innovative Investigation of Zinc Oxide Nanoparticles Used in Dentistry

Ajay Kumar Tiwari [1], Saket Jha [2], Abhimanyu Kumar Singh [3,*], Sheo Kumar Mishra [4], Ashok Kumar Pathak [5], Rudra Prakash Ojha [6], Raghvendra Singh Yadav [7] and Anupam Dikshit [2]

1 Department of Physics, Nehru Gram Bharati (Deemed to be University), Prayagraj 221505, India; ajayngbv@gmail.com
2 Biological Product Laboratory, Department of Botany, University of Allahabad, Prayagraj 211002, India; jhasaket90@gmail.com (S.J.); anupambplau@gmail.com (A.D.)
3 Department of Physics, Shyama Prasad Mukherjee Government Degree College, University of Allahabad, Prayagraj 211013, India
4 Department of Physics, Indira Gandhi National Tribal University, Amarkantak 484886, India; sheokmishra@igntu.ac.in
5 Department of Physics, Ewing Christian College, University of Allahabad, Prayagraj 211003, India; akpathak75@gmail.com
6 Department of Zoology, Nehru Gram Bharati (Deemed to be University), Prayagraj 221505, India; drrudrapojha266@gmail.com
7 Centre of Polymer Systems, Tomas Bata University in Zlin, Trida Tomase Bati 5678, 76001 Zlin, Czech Republic; yadav@utb.cz
* Correspondence: abhimanyu.kr.singh@gmail.com

Abstract: Dental caries is a major lifestyle concern as dental components affect the face of an individual. The issue of tooth decay occurs in every age group throughout the globe. Researchers are probing incipient implements and techniques to develop filling agents for decayed teeth. Zinc oxide (ZnO) powder is utilized mostly as a filling agent. Nanotechnology enhanced the efficiency of compounds of metal oxides utilized for dental caries. The present study aims to investigate the properties of ZnO nanoparticles (NPs) synthesized chemically (using $ZnCl_2$ and NaOH) as well as biologically (using aqueous leaf extract of *Murraya paniculata*). The XRD patterns confirm that ZnO NPs have a hexagonal crystalline structure with particle sizes of 47 nm and 55 nm for chemically and biologically synthesized NPs, respectively. The FE-SEM data confirm the nanorod and spherical/cubical shape morphologies for the chemically and biologically synthesized ZnO NPs, respectively. FTIR data show the peaks between 4000 and 450 cm^{-1} of the functional groups of –OH, C-O, –C-H-, and Zn-O bonds. The UV–Vis absorption study indicates a peak around 370 nm and a hump around 360 nm corresponding to the chemically and biologically synthesized ZnO NPs, respectively. An antibacterial bioassay was performed and compared with commercially available ZnO bulk powder against tooth decaying pathogens, viz., *Streptococcus mutans*, *Staphylococcus aureus*, *E. coli*, and *Lactobacillus fermentum*, and found that both ZnO NPs had results closer to those of the standard drug (rifampicin). Thus, the synthesized ZnO NPs may be utilized as nano-drugs for the application of tooth decaying filling agents. Even biologically synthesized ZnO NPs may be considered more environmentally friendly and less toxic to human health concerns.

Keywords: ZnO nanoparticles; dental caries; tooth decaying pathogens; antibacterial bioassay; broth microdilution; tooth filling agents

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Citation: Tiwari, A.K.; Jha, S.; Singh, A.K.; Mishra, S.K.; Pathak, A.K.; Ojha, R.P.; Yadav, R.S.; Dikshit, A. Innovative Investigation of Zinc Oxide Nanoparticles Used in Dentistry. *Crystals* **2022**, *12*, 1063. https://doi.org/10.3390/cryst12081063

Academic Editor: Dinadayalane Tandabany

Received: 1 July 2022
Accepted: 27 July 2022
Published: 29 July 2022

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1. Introduction

Teeth play a generalized role in the individual personality. They not only help in verbalizing, but also affect one's countenance. Dental caries adversely affects an individual's personality and is a major concern in human welfare. Tooth decay is now becoming an incurable disease and is found to be a major concern for every age group. The people of

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Radiation Physics and Chemistry

Volume 199, October 2022, 110353

Formation of self-organized nano-dimensional structures on InP surfaces using ion irradiation and their wettability: A study based on experimental and theoretical concepts of surface

Indra Sulania [a], Pravin Kumar [a], P.K. Priya [b], H.P. Bhasker [c], U.B. Singh [d], Ranjeet K. Karn [e], Chetna Tyagi [f], R.P. Yadav [g]

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Highlights

- Formation of self-organized nanodots on InP surfaces upon bombarding these with 50keV Ar^+ ion beam is reported.
- Surface becomes Indium rich with ion beam irradiation.
- Surface contact angle increases with ion irradiation and stabilizes at higher fluences.
- Theoretical simulations support formation of dots.
- Thus, wetting nature of any solid surface may be tuned by optimizing the ion beam parameters in a desired way.

Abstract

InP surfaces are bombarded with 50keV Ar^+ ion beam at normal incidence with fluences ranging from~2×10^{16} to 8×10^{16} ions/cm^2. The formation of self-organized nanodots on Indium Phosphide (InP) are captured by Atomic Force Microscope (AFM) and Scanning Electron Microscope (SEM). Uniformity in size of dots is improved for the higher fluences and the surface becomes Indium rich with ion irradiation.

Wettability studies show that the surface contact angle (CA) increases with ion irradiation and stabilizes for later fluences. The autocorrelation and height-height correlation function are applied for surface correlation and fractal nature of AFM images. Wetting properties of fractal surfaces are explored. The interface-width is found to increase with the ion fluences. The lateral correlation length is computed using auto-correlation function, while roughness exponent and the fractal dimension were estimated using height-height correlation function. Larger values of interface width indicate the larger self-organized nanodots on the surface. Fractal formations are able to capably disperse or collect mass, energy, and information over large spatial and temporal dimensions. Due to these properties, artificial fractal structures are becoming an essential and fundamental topic of study in applied research.

Introduction

Implantation of various surfaces with ion beams is one of the important tools for the fabrication of different kinds of self-organized nanopatterns on diverse substrate surfaces (Hofs ä ss et al., 2016; Panchal et al., 2021). Beam parameters like ion energy, ion fluence and angle of incidence etcetera play a significant role in deciding the shape and size of the pattern (ripple or dots) onto a surface (Panchal et al., 2021; Sulania et al., 2008, 2013, 2016; Valbusa et al., 2002). The self-organized procedure of pattern fabrication is simple and cost-effective route for the fabrication of large-area nanostructured surfaces for the deposition of nanowires (Oates et al., 2008). Such low-dimensional patterns have important applications in quantum nanodots for optoelectronics (Mussi et al., 2006) and quantum devices (Jacak et al., 1998). However, such self-assembled nanostructures show a wide range of size distribution. For practical application, it is necessary to have a precise control over shape and size of these self-organized nanostructures. Dot pattern using low energy ion beam sputtering (IBS) was already demonstrated for various semiconductors such as Si (Panchal et al., 2021; Gago et al., 2001), InP (Sulania et al., 2010, 2022), GaSb and InSb (Facsko et al., 2001), Ge (Sulania et al., 2015; Kumar et al., 2016), CdS (Sulania et al., 2012) which occur due to a reciprocation of sputtering induced roughening and surface diffusion induced smoothing (Valbusa et al., 2002).

Many research groups have fabricated well-ordered self-assembled nanostructures with a uniform size distribution using low energy ion beam implantation (Gago et al., 2001; Frost and Rauschenbach, 2003; Frost et al., 2000). However, the nanodot pattern formation in InP depends on ion energy and ion fluences due to the preferential sputtering of P over In (Sulania et al., 2008, 2016; MacLaren et al., 1992). InP is a direct band gap compound semiconductor, it exhibits an excellent optical property which is useful for photonic applications, namely light emission, modulation and photo detection. But there are fewer reports which investigate the effects of ion fluence and energy on the formation of nanostructures and requires a detailed experimental investigation. Moreover, wettability of substrate surface with water drop can be manipulated using ion beam implantation. The shape of water droplet depends upon the inter-facial properties like liquid surface tension, solid surface roughness and surface energy as described by Young's equation (Young, 1805; Lu et al., 2015; Good et al., 1998). There are reports which suggests that surface composition plays a decisive part in tuning wettability properties of surfaces using ion beams. Such tuned surfaces have many potential applications in narrow channel fluid-flow technology (Extrand, 2006; Kusumaatmaja et al., 2008), self-cleaning (F ü rstner et al., 2005), drag reduction (Ou et al., 2004; Choi and Kim, 2006), anti-icing (Wang et al., 2016; Cao et al., 2009), improved phase change heat transfer (Boreyko and Chen, 2009; Miljkovic et al., 2013), anticorrosion (Zhao et al., 2014) and many more.

The wetting of flat and smooth solid surface can be effectively described by young's equation as reported in ref (Young, 1805). In addition, Wenzel's and Cassie-Baxter's formalism (Wenzel, 1936; Cassie and Baxter, 1944) may be used to define wetting on rough solid surfaces. Although, many research groups have studied the wetting properties of tuned surfaces but very few have accounted the effect of fractal parameters on

International Journal of Entomology Research
www.entomologyjournals.com
ISSN: 2455-4758
Received: 25-11-2022, Accepted: 11-12-2022, Published: 27-12-2022
Volume 7, Issue 12, 2022, Page No. 147-149

Evaluation of seed protectants and the state of wheat pests in storage- A Review

Sanjay Cyril Masih, Ravindra Kumar Pathak
Department of Zoology, Ewing Christian Post Graduate College, Allahabad, Uttar Pradesh, India

Abstract
The economic value of protecting wheat against various insect and pest infestations throughout storing. One of the most extensively used pest control methods, integrated pest management also uses fumigants and a variety of contact and residual insecticides. Today's top issues include residual issues and human health risks, which have made it necessary to restrict or even ban the use of synthetic pyrethroids. Pests have evolved resistance to the majority of the synthetic pesticides and fumigants that are now on the market. This article covers a wide range of topics, such as insect pest storage losses, the negative impacts of using pesticides to protect grains, using plant products instead of synthetic ones, classifying plant-based chemicals, and powder and oil compositions as grain protectants.

Keywords: pest infestations, integrated pest management, grain protectants and wheat pests

Introduction

The most significant cereal crop, wheat (*Triticum aestivum* L.), is a member of the Poaceae (Graminae) family and is a member of the genus Triticum. It is said to have originated in South-West Asia and belongs to the oldest cereal crop still being grown today. It has been called the "King of Cereals" because of its great productivity and significant role in the global commerce of food grains. For the entire human population, it contributes around 20% of the total food calories. One billion people worldwide eat wheat as a staple meal in 43 different nations [1]. The words "wheat" come from several different languages, particularly the English, German, and Welsh. All cultures most frequently refer to wheat as "that which is white" due to its physical traits as a light-colored crop. The three primary species of the genus Triticum comprise the majority of the cultivars of wheat. These include the hexaploid *T. aestivum* L. (bread wheat), the tetraploid T. durum Desf, and the diploid *T. dicoccum* Schrank and *T. monococcum*. The most significant species worldwide, accounting for 90% of the area, is bread wheat (*T. aestivum* L.). The second-most popular wheat is durum, which occupies around 9% of the total surface area, while *T. diccoum* and *T. monococcum* wheat occupy just under 1% of the total surface area [2]. India is the world's second-largest producer and consumer after China. One-fourth of one percent (14.13%) of the world's wheat is produced in India. In the past 68 years, only wheat has witnessed its production increase by more than 16 times (from 6.5 million tonnes in 1950 to 99.87 million tonnes in 2018. About 20% of the food calorie consumption by the entire world's population, or close to 55 percent, come from wheat [3].

Around 70% of the food typically stays only with farmers for seeds and other purposes, with 10% of that quantity being lost in post-harvest processing and storage due to insect, rat, bird, mite, microbe, and moisture attacks. In addition, losses in terms of quality and quantity occur as a result of the decline in the nutritional value of dietary grains. As a result, every year a million metric tonnes of grain crops costing several thousand crores of rupees either are destroyed or lost due to ignorance about and failure to adapt to scientific methodology of storage. Due to infestations of the insect pests *Trogodarma granarium*, *Rhyzopertha dominica*, and *Tribolium castaneum*, wheat suffers both quantitative and qualitative losses throughout storage. Among the biggest pests of grains and numerous other stored goods among the khapra beetles is *Trogoderma granarium* Everts (Coleoptera: Dermestidae) [4-6]. Its indisputable economic significance is based on its capacity to feed stored grains, which results in significant physical and qualitative losses. The harmless adults have an oblong-oval form and measure 1.6-3.0 mm in length and 0.9-1.7 mm in width. The wing covers of the males are reddish-brown to black with faint brown patterns on them. The head is tiny and typically deflexed in females, who are also slightly bigger and lighter in colour than males. The adults have a limited lifespan, with mated females living for 4–7 days, unfertilised females for 20–30 days, and males for 7–12 days; they are flightless, and they consume very little food [7]. According to estimates, post-harvest losses from storage bugs could reach up to 9% in industrialised nations, but up to 20% in impoverished ones. In India, post-harvest loss for cereals represented 7–10% of the entire production from the field to the consumer. High infestations levels of the Khapra beetle can cause significant harm in the area. With rising productivity, post-harvest damages to seeds are rising each year. Despite numerous advances in seed technology, we haven't been able to decrease the losses caused by insect pest and diseases during storage [8-10]. The best tools for cleaning and safeguarding stored seeds and grains are seed protectants (botanicals and synthetic pesticides). The control of the storage predatory insects

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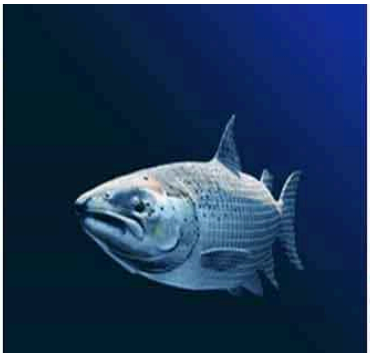

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VOL. 7, ISSUE 12 (2022)

Odonate ecology and diversity- A review

Authors

Sanjay Cyril Masih, Ravindra Kumar Pathak

Abstract

One of the most prevalent insects flying over forests, fields, meadows, lakes, and streams are dragonflies and damselflies, which are collectively known to as odonates. The number of living species worldwide is about 6,000. With more over 500 species currently known, India is very diversified. One of the oldest groups of insects is the

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odonata. It first originated along with mayflies during the Carboniferous era, some 250 million years ago (Ephemeroptera). Monsters include up the Odonata group from the Carboniferous period; for instance, *Meganeuropsis americana* from that time had wingspan of 71 cm, which is almost as long as a pigeon. Ancient insect species like dragonflies and mayflies were some of the first to acquire wings and take to the air. Dragonflies have perfected the art of flight and are still skilled acrobats. The order Odonata is divided into three categories depending on morphology: the Anisozygoptera, the Zygoptera, and the dragonflies (Anisoptera). Epiophlebia laidlawi, one of the two species mostly in suborder Anisozygoptera, is documented from Darjeeling. In the field, dragonflies and damselflies are easily distinguished. Although their morphologies are very different, they have similar overall life histories.

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How to cite this article:

Masih S. C., Pathak R. K. "Odonate ecology and diversity- A review". International Journal of Entomology Research, Volume 7, Issue 12, 2022, Pages 150-152

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Title

GROWTH INHIBITORY AND ANTIFEEDANT EFFECTS OF BIORATIONAL INSECTICIDES AGAINST, SPILARCTIA OBLIQUA WALK (ARCTIIDAE : LEPIDOPTERA).

Authors

Sewak, Nishi; Sharma, Sujata

Abstract

Spilarctia obliqua is a gregarious, polyphagous and destructive pest which has become a menace to many agricultural crops. The damage that they cause has led to a need for timely as well as eco-friendly management of the pest. The toxicity of certain botanicals not only cause considerable mortality but also interfere with their normal growth and development in certain ways, that restricts their population growth. With this aim, research was carried out on growth and development parameters on Spilarctia obliqua where it was found that Neem Seed kernel extract 5% showed maximum antifeedancy against the larvae, caused maximum larval mortality and was also responsible for the extension of larval and pupal durations when compared to control. Larval weight reduction was significant at 3 and 7 days after treatment and normal adult emergence also got inhibited. Larval-pupal intermediates obtained and pupal mortality was highest in Neem leaf extract 5%, while the extracts of chilli 3%, garlic 2% and chilli + garlic 5% were responsible for the formation of maximum malformed adults. NSKE at 5% was also found to cause extension of larval and pupal durations over control. It was thus inferred that NSKE, NLE and chilli + garlic at 5 per cent concentrations interrupted the normal growth and development of the insect life cycle over control.

Publication

Journal of Experimental Zoology India, 2022, Vol 25, Issue 2, p2387

ISSN

0972-0030

Publication type

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Title

GASTRO-INTESTINAL OBSERVATION OF TWO EXOTIC FISH SPECIES CYPRINUS CARPIO AND OREOCHROMIS NILOTICUS FROM THE GANGA RIVER, AT PRAYAGRAJ, INDIA.

Authors

Pathak, R. K.; Nathan, L. S.; Lall, P. V.; Trivedi, A.

Abstract

Food and feeding habits of fishes helps to explore their nature, environmental use (specially niche) and trophic interactions in the ecosystem. A study on stomach content analysis is vital in giving useful information of fish diets, role of fish in their habitat and to inducement stock assessment models. The Cyprinus carpio (Common carp) and Oreochromis niloticus (Nile Tilapia) are a freshwater fish species widely distributed in eutrophic waters of Asia, Europe and Africa. O. niloticus fed primarily on detrital aggregate. Plant material was the second most heavily consumed food and varied in its dietary contribution. C. carpio showed an overwhelming reliance on detrital aggregate throughout the season, there was a distinct but small dietary prey component which consisted mainly of chironomids. Both species have a great socioeconomic importance for the region and keeps providing for a population of about 1000 to 1500 fishermen at Prayagraj region, India. The fish samples of C. carpio and O. niloticus were collected from the fish markets of Teliarganj and Daraganj, Prayagraj, Uttar Pradesh during July 2017 to June 2019. The length of fishes varied from 132 to 826 mm for C. carpio and 89 to 427 mm for O. niloticus. Green algae, blue green algae, diatoms, protozoans, rotifers, insect parts, sands and unidentified items were recorded from gut during all seasons in both species which were collected from the Ganga river. Present study indicated that C. carpio and O. niloticus were herbivorous fish species from the Ganga river at Prayagraj, India.

Publication

Journal of Experimental Zoology India, 2022, Vol 25, Issue 1, p535

ISSN

0972-0030

Publication type

Water Supply

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Water Supply Vol 22 No 6, 6157 doi: 10.2166/ws.2022.185

Physicochemical analysis of wastewater discharge and impact on Ganges River of major cities of North India

Ramendra Soni[a,†], Arun Kumar Pal[a,†], Pooja Tripathi[b], Pawan Kumar Jha[c] and Vijay Tripathi[a,*]

[a] Department of Molecular and Cellular Engineering, Jacob Institute of Biotechnology and Bioengineering, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Allahabad 211007, India
[b] Department of Computational Biology and Bioinformatics, Jacob Institute of Biotechnology and Bioengineering, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Allahabad 211007, India
[c] Center for Environment Studies, University of Allahabad, Prayagraj, UP 211002, India
*Corresponding author. E-mail: vijay.tripathi@shiats.edu.in
†These authors contributed equally to this work.

VT, 0000-0002-6103-0890

ABSTRACT

The inadequate practice of discharge of wastewater into receiving water bodies alters physicochemical parameters, which ultimately disturbs the livelihood of aquatic flora and fauna. The present study was focussed on the evaluation of the efficiencies of wastewater treatment plants based on different technologies through analysing the physicochemical parameters of wastewater collected from each treatment step including inlet, outlet and downstream Ganges River in Prayagraj, Varanasi and Kanpur (India) during winter and summer seasons. The removal efficiency of the MBBR technology of Prayagraj WWTP was observed to be better than that of the ASP and UASB technologies of Varanasi and Kanpur respectively for both seasons. Correlation analysis explained the strong negative correlation of pH and DO with nearly all the parameters of the study; whereas TDS, hardness, ammonia and BOD were highly correlated with each other in each city. The factor analysis suggested the best fit amongst the physicochemical parameters, with four factors elucidating 78.00% of the total variance, which further explained that DO, TDS, total alkalinity, nitrate, COD, and temperature were the major components for pollution. The results indicated that most of the samples were not appropriate for direct discharge into water bodies and irrigation purposes and thus needed further implementation of advanced technologies in their treatment procedure.

Key words: Ganges River, physicochemical parameters, seasonal variation, wastewater, wastewater treatment plant

HIGHLIGHTS

- Efficiencies of wastewater treatment plants based on different technologies were evaluated.
- Maximum COD removal was achieved by MBBR technology.
- MBBR technology was found to be more efficient over ASP and UASB.
- Conventional technologies need advancement in their treatment procedure.

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Water Supply Vol 22 No 11, 8080 doi: 10.2166/ws.2022.365

Assessment of antibiotic resistance profile of bacteria isolated from Ghaghara River, India

Nirdesh Kumar Ravi [a,†], Arun Kumar Pal [b,†], Ramendra Soni [b,†], Pooja Tripathi [c], Anjali Singhal[d], Pawan Kumar Jha [a] and Vijay Tripathi [b,*]

[a] Center for Environment Studies, University of Allahabad, Prayagraj, UP 211002, India
[b] Department of Molecular and Cellular Engineering, Jacob Institute of Biotechnology and Bioengineering, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, India
[c] Department of Computational Biology and Bioinformatics, Jacob Institute of Biotechnology and Bioengineering, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, India
[d] Department of Botany, University of Allahabad, Prayagraj, UP 211002, India
*Corresponding author. E-mail: vijay.tripathi@shiats.edu.in
†Authors have equally contributed

NKR, 0000-0002-0304-0791; AKP, 0000-0002-2687-7447; RS, 0000-0001-6481-6293; PT, 0000-0001-7764-0792; PKJ, 0000-0002-4838-2875; VT, 0000-0002-6103-0890

ABSTRACT

Excessive anthropogenic activities play a significant role in the emergence and dissemination of antibiotic resistance in urban streams and river sediment. The objectives of the present study were to investigate the antibiotic susceptibility profile, molecular detection of antibiotic resistance genes (ARGs), and identification of multidrug-resistant bacterial isolates in the mainstream and tributaries of the Ghaghara River. The obtained data indicated that the majority of the isolates were identified as *Bacillus* spp. (40%) followed by *Klebsiella quasipneumoniae* (20%), *Exiguobacterium undae* (13.33%). Most of the bacterial isolates were resistant against penicillin G (P) (24%), *cefuroxime* (CXM) (20%), amoxicillin (AMX) (18%), and ampicillin (AMP) (17%) in sediments samples, whereas penicillin G (27%), cefuroxime (CXM) and erythromycin (E) was 13%, AMP and cefaclor both showed 12% in water samples respectively. This study provides insight into the prevalence of multiple antibiotic-resistant bacterial diversity in the Ghaghara River and provides the route to disseminate the multidrug-resistant pathogens in the human and animal population through the aquatic environment.

Key words: antibiotic resistance, antibiotic resistance genes (ARGs), aquatic environment, Ghaghara River, multidrug resistance (MDR)

HIGHLIGHTS

- 16S rRNA analysis for bacterial identification and microbial study.
- MDR bacterial community in water and sediment of Ghaghara River.
- *Bacillus* species bacteria are dominant in multidrug resistance nature.
- Penicillin and cefuroxime antibiotics showing resistance against most of bacteria.
- ARGs like bla_{KPC}, bla_{NDM}, and aminoglycoside (ant3″) are dominant in all water and sediment samples.

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