CRITERION-III

RESEARCH, INNOVATIONS AND EXTENSION

3.3 RESEARCH PUBLICATIONS AND AWARDS

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

Link to website of the Journal

Index

Research papers published in 2021

Sr. No.	Title of paper	Name of the author/s	Department of the teacher	Name of journal ISSN number	Link to article / paper / abstract of the article
1	Optical, electrical and morphological studies of βHgS thin film prepared by improved chemical bath deposition technique	KR Sanadi, PD Sanadi, ML Gaur, AV Mali, GS Kamble	Chemistry	Bulletin of material Science 0250-4707	https://link.springer.com/article/10.1007/s12034-020-02340-y
2	Structural, magnetic, and electrical properties of manganese-substituted magnesium chromate spinel structure	SP Deshmukh, KR Sanadi, RS Diggikar, VB Koli, AV Mali	Chemistry	Journal of Materials Science: Materials in Electronics 0957-4522	https://doi.org/10.1007/s10854-021-05386-8
3	UV light-activated photocatalytic degradation of rhodamine B dye and Suzuki cross-coupling reaction by Ni ferrite catalyst synthesized by sol–gel auto-combustion method	K R Sanadi,, K C Rathod, M L Gaur, R R Pawar, V G Parale, R S Patil, S H Burungale And A V Mali	Chemistry	Bull. Mater. Sci. 0973-7669	https://doi.org/10.1007/s12034-020-02340-y

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4	Facile extractive separation studies of unranium (VI) assisted by dicyclohexano-18-crown-6 through green approach	Shivaji H. Burungale and Sunil B. Zanje	Chemistry	Journal of Radioanalytical and Nuclear Chemistry 0236-5731	https://doi.org/10.1007/s10967-021-07698-9
5	A high performance flexible solid-state asymmetric supercapacitor based on composite of reduced graphene oxide@ dysprosium sulfide nanosheets and manganese oxide nanospheres	P. P. Bagwade, D. B. Malavekar, T. T. Ghogare, S. B. Ubale, V. J. Mane, R. N. Bulakhe, I. In, C. D. Lokhande	Chemistry	Journal of Alloys & Compound 0925-8388	https://doi.org/10.1016/j.jallcom.2024.173591
6	Lanthanum sulfide-manganese sulfide/graphene oxide (La_2S_3-MnS/GO) composite thin film as an electrocatalyst for oxygen evolution reactions	V. J. Mane, S. B. Kale, S. B. Ubale, V. C. Lokhande, U. M. Patil, C. D. Lokhande	Chemistry	Journal of Solid-State Electrochemistry 1432-8488	https://doi.org/10.1007/s10008-021-04945-7
7	SILAR synthesized nanostructured ytterbium sulfide thin film electrodes for symmetric supercapacitors	S. B. Ubale, S. B. Kale, V. J. Mane, P. P. Bagwade, C. D. Lokhande	Chemistry	Journal of Solid-State Electrochemistry 1432-8488	https://doi.org/10.1007/s10008-021-04941-x
8	Biowaste to biopolymer (polyhydroxyalkanoates) conversion technologies: production strategy, challenges, and perspective	S. K. Bhatia, **S. V. Otari**, J-M. Jeon, R. Gurav, Y-K. Choi, A. Pugazhendhi, V. Kumar, J. R. Banu, K-Y. Choi, Y-H. Yang	Microbiology	Bioresource technology 0960-8524	https://www.sciencedirect.com/science/article/abs/pii/S0960852421000729
9	Composition of Essential Oils in *Bothriochloa bladhii* from Maharashtra.	Tarbej Shaikh, Pooja Mane and Girish Potdar .	Botany	Bioinfolet 0973-1431	https://www.indianjournals.com/ijor.aspx?target=ijor:bil&volume=18&issue=1b&article=030

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10	Environmentally Green Synthesis of α-aminophosphonates	Rahul Patil, Shivaji Burungale, Uday Lad, Uttam More	Chemistry	Der Pharma Chemica 0975-413X	https://www.derpharmachemica.com/pharma-chemica/environmentally-green-synthesis-of-aminophosphonates-81359.html#:~:text=One%20pot%20multicomponent%20condensation%20of,free%20condition%20at%20room%20temperature.
11	Green And Sustainable Synthesis of Silica Nanoparticals	Sudip D. Karande, Shivaji H. Burungale	Chemistry	Nanotechnology for Envirnomental Engineering 2365-6387	https://doi.org/10.1007/s41204-021-00124-1
12	*Capillipedium yashwantraoi*, a new species of Poaceae from Madhya Pradesh, India.	Tarbej and Girish Potdar	Botany	Phytotaxa 1179-3163	https://phytotaxa.mapress.com/pt/article/view/phytotaxa.502.2.6
13	Enhanced specific energy of silver doped MnO_2/GO electrodes as facile fabrication symmetric supercapacitor device	V. J. Mane, S. B. Kale, S. B. Ubale, V. C. Lokhande, C. D. Lokhande	Chemistry	Materials Today Chemistry 2468-5194	https://doi.org/10.1016/j.mtchem.2021.100473
14	Characterization and production of groundnut-shell degrading cellulase of Streptomyces mutabilis	Shinde G.M., Jadhav A.G	Microbiology	Bulletin of Environment, Pharmacology and Life Sciences 2277-1808	https://bepls.com/beplsjuly2021/18.pdf
15	Removal of Lead (II)With poly 3-(aza-18 crown-6)silica Bonded Phase from succinate medium and sample analysis	Shivaji Burungale, Rahul Patil, Ankush Mali	Chemistry	Journal of Advanced Scientific Research 0976-9595	https://www.sciensage.info/index.php/JASR/article/view/705
16	Environmentally Green Synthesis of α-aminophosphonates	Rahul Patil, Shivaji Burungale, Uday Lad, Uttam More	Chemistry	Der Pharma Chemica 0975-413X	https://www.derpharmachemica.com/pharma-chemica/environmentally-green-synthesis-of-aminophosphonates-81359.html#:~:text=One%20pot%20multicomponent%20condensation%20of,fr

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17	Evaluation of Antibacterial and cytotoxic activity of Beta-glucogallin.	Kirtane Sushama A. and Jadhav Prakash D.	Botany	Int. J. All Research Education and Scientific Methods (IJARESM). 2455-6211	https://www.ijaresm.com/evaluation-of-antibacterial-and-cytotoxic-activity-of-beta-glucogallin
18	Supercapacitor devices based as SILAR synthesized ytterbium sulfide @ graphene oxide nanocomposite flexible thin film electrodes	S. B. Ubale, S. B. Kale, V. J. Mane, U. M. Patil, C. D. Lokhande	Chemistry	Journal of Electroanalytical Chemistry 1572-6657	https://doi.org/10.1016/j.jelechem.2021.115589
19	Characterization of Dy_2S_3 thin films deposited by successive ionic layer adsorption and reaction (SILAR) method	P. P. Bagwade, D. B. Malavekar, S. B. Ubale, T. T. Ghogare, R. N. Bulakhe, I. In, U. M. Patil, C. D. Lokhande	Chemistry	Journal of Solid-State Science 2162-8769	https://doi.org/10.1016/j.solidstatesciences.2021.106693
20	Evaluation of Arabian Vascular Plant Barcodes (rbcL and matK): Precision of Unsupervised and Supervised Learning Methods towards Accurate Identification.	Jamdade, R., Upadhyay, M., Al Shaer, K., Al Harthi, E., Al Sallani, M., Al Jasmi, M., & Al Ketbi, A.	Zoology	Plants 2223-7747	https://doi.org/10.3390/PLANTS10122741
21	Multicomponent Synthesis of Pyrano (3, 2-c) Quinolone Fused Spirochromenes	R. V. Kupwade, A. M. Kulkarni, U. P. Lad	Chemistry	Polycyclic Aromatic Compounds 1563-5333	https://www.tandfonline.com/doi/full/10.1080/10406638.2021.2015398

22	Green synthesis of silver-decorated magnetic particles for efficient and reusable antimicrobial activity	S. V. Otari, V. C. Kalia, A. Bisht, I-W. Kim, J-K. Lee	Microbiology	Materials 1996-1944	https://www.mdpi.com/1996-1944/14/24/7893

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Optical, electrical and morphological studies of βHgS thin film prepared by improved chemical bath deposition technique

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MS received 27 April 2020; accepted 30 September 2020

Abstract. Polycrystalline mercury sulphide (HgS) thin film at room temperature and in acidic condition was deposited on amorphous glass substrate by using improved chemical bath deposition technique. The structural and morphological analysis of as-deposited and annealed films was carried out by X-ray diffraction and scanning electronic microscopic technique. Ultraviolet and d.c. electrical resistivity measurement were made to study electrical and optical properties of the thin films. The outcome indicates formation of well-crystallized pure βHgS thin films having good electrical and optical properties. For this reason, HgS thin film in acidic medium was deposited properly by using chemical bath deposition technique.

Keywords. HgS thin film; crystal structure; SEM; semiconductor.

1. Introduction

In current years, chalcogenide semiconductors have been successfully applied as absorber layer for thin film solar cells [1]. At present an important matter in Materials science is the solar energy conversion, an escalating number of studies mainly related to materials structured on the nanometre length scale can be found in journalism in the last decade [2]. Polycrystalline materials have diverse properties and frequently better to those of predictable coarse-grained materials [3]. In the middle of the binary semiconductor compound, HgS belongs to II–VI compound material. Due to big absorption coefficient and composition, its bandgap varies among 1.8 and 2.70 eV. It is one of the most hopeful optical absorbers for high efficiency thin film solar cells [4,5]. The HgS thin films are used in infrared detectors, photo-electrochemical cells, storage cells and photoconductors [6,7].

As we know variety of techniques are used for the preparation of HgS thin films, e.g., successive ionic layer adsorption and reaction (SILAR) trend [8], rf-sputtered HgS films [9], sonochemical methods [10,11]. The chemical bath deposition process for metal chalcogenide thin film preparation draws significant interest, as it is relatively less expensive, simple and appropriate for huge area deposition. Bhushan *et al* [12], Lokhande *et al* [13], Kale and Lokhande [14], Najdoski *et al* [15] and Gadave *et al* [16] prepared HgS thin films by chemical bath deposition technique. They prepared HgS thin films in acidic as well as in basic conditions by using ethylenediamine and triethanolamine as a complexing agent. Due to toxicity of ethylenediamine and triethanolamine, it is not environment friendly and they have also high affinity for complexation and produces precipitate quickly, which affects thickness and uniformity of films. The film in alkali conditions also provoke the deposition of Hg (OH) Xs, which roughly affect the conversation efficiency of the solar cells. We prepared uniform single-phase βHgS thin films by using tartaric acid as a caping agent in acidic condition, which should be advantageous to get enhanced HgS thin film.

This study reports the unbeaten deposition of HgS thin films at 32°C at pH 5 using improved chemical bath deposition method and the deposition conditions were optimized to get good quality, well adherent films on the top of glass substrate. The electrical resistivity, optical absorption, X-ray diffraction (XRD) and scanning electron microscopic (SEM) studies are reported for characterization of the prepared films.

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Structural, magnetic, and electrical properties of manganese-substituted magnesium chromate spinel structure

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ABSTRACT

Manganese-substituted magnesium chromate spinel structure with composition $Mg_{1-x}Mn_xCr_2O_4$ (x = 0.0, 0.25, 0.50, 0.75, 1.0) was synthesized by sol–gel auto-combustion route. The polycrystalline powder was characterized using XRD, TGA/DTA, SEM/EDAX, TEM, and FTIR spectroscopy. XRD analysis unveiled the single cubic spinel structure without any additional peak and the lattice constant upsurges with the amount of manganese content were augmented. Thermal analysis reveals the decomposition of organic moieties at different steps and the stability of the spinel structure. Furthermore, SEM measurement shows that grain size lies between 1.74 to 3.17 μm, and EDAX measurement demonstrates stoichiometry according to its composition. TEM also reveals the average particle size around 20 nm. Continuous increase in saturation magnetization and magnetic movement gives information about Mg^{2+} completely replaced by Mn^{2+} in A site. At the same time, B site Cr^{3+} is not interfering with the A site in this particular situation. A persistent decrease in electrical properties and the increase in magnetic movement concerning temperature indicate the replacement of Mg^{2+} by Mn^{2+} in A site, while B site Cr^{3+} is unaffected by Mn^{2+}.

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UV light-activated photocatalytic degradation of rhodamine B dye and Suzuki cross-coupling reaction by Ni ferrite catalyst synthesized by sol–gel auto-combustion method

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MS received 26 April 2021; accepted 15 June 2021

Abstract. Nanocrystalline nickel ferrite ($NiFe_2O_4$) was synthesized by economical sol–gel auto-combustion method. XRD pattern confirms existence of cubic spinel phase with average crystallite size of 28.37 nm. The magnetic and morphological properties of the sample were studied by using vibratory sample magnetometer (VSM) and scanning electron microscope (SEM), respectively. The prepared samples were used to study photocatalytic degradation of rhodamine B dye solution. The effect of UV light irradiation time, metal doping and kinetic parameters of photocatalysis with nickel ferrite catalyst was studied in detail. The catalyst was also utilized for a two-element coupling system of phenyl halide and phenyl boronic acid. The influence of solvent, temperature and metal loading of the catalyst was conjointly mentioned.

Keywords. Sol–gel auto-combustion; Photo catalyst; cross-coupling; magnetic properties.

1. Introduction

Recently, nanocrystalline ferrites have extensive interest due to their distinctive properties, such as electrical, magnetic and optical and wide applications in various technological fields. Nickel ferrite is of cubic spinel ferrimagnetic material that has attracted concentration of many researchers due to its large porosity at high frequency and high electrical trends. These materials have extensive applications in numerous fields like biomedical, microwave, magnetic media, ferrofluid, magneto-caloric refrigeration and gas sensors, etc. [1–8]. Semiconductor ferrites have distinctive magnetic, optical, electric and chemical properties and due to these properties, they are widely used for environmental application [9].

In inverse spinel-structured nickel ferrite ($NiFe_2O_4$), all divalent Ni^{2+} and half of trivalent Fe^{3+} cations occupy octahedral sites and rest of the trivalent at tetrahedral sites [10]. These semiconductor materials are chemically and thermally stable and hence, they are used in magnetic materials, pigments, catalysts, photo catalysts, drug delivery and resonance imaging (MRI) [11–13].

Nowadays, to fulfill increasing demand of our modern society there are increasing varieties of industries. Most of these industries directly dump their effluents into river and due to this, our society is facing increasing water, air and soil pollution. Some of the effluents from dye industries contain several dangerous consumable organic dyes like rhodamine B (RB). The RB is water soluble and when it enters the body of living organisms, it causes hazardous effects on them. Hence, purification of wastewater is essential due to contamination by bionutrients, organic, inorganic and microorganisms [14–17]. Metal oxide-catalysed cross-coupling reactions have flexible applications in organic synthesis [18–20]. Phenyl halides and phenyl boronic acids undergo Suzuki cross-coupling reaction and produce most useful biphenyl and polyphenyl products [21,22]. These prepared Suzuki products have been widely used as drug intermediates, insecticides, natural products, functional materials and

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Facile extractive separation studies of uranium(VI) assisted by dicyclohexano-18-crown-6 through green approach

Shivaji H. Burungale[1] · Sunil B. Zanje[2]

Received: 5 January 2021 / Accepted: 26 March 2021

Abstract
A reliable precise analytical method has been developed for the extraction of uranium(VI) from 1 M ammonium thiocyanate and 1 M acetic acid with 0.001 M dicyclohexano-18-crown-6 in nitrobenzene. Various parameters like ammonium thiocyanate concentration, acetic acid concentration, reagent study, solvent study, strippant study and loading capacity were studied. Uranium(VI) were selectively extracted and separated from diverse ion and ternary mixture. The proposed method was also used for the determination of uranium(VI) from rock and monazite sand sample.

Keywords Analysis of rock sample · Extraction · Uranium(VI) · Dicyclohexano-18-crown-6

Introduction

Uranium is a naturally occurring significant radioactive metal. Nowadays uranium is used as a nuclear fuel in nuclear power generation. Uranium is a significant strategic resource [1]. Uranium resources are broadly employed in medicine, scientific research, national defence, industry, and other fields [2, 3]. The quick growth of nuclear technology has steadily increased the requirement of uranium mining and smelting products, resulting in a huge quantity of uranium tailings [1, 4]. Therefore time requires that it should be extracted and lastly in pure form.

It is significant to extract uranium from natural resources by environmental friendly approaches. Different strategies for the separation of uranium have been investigated. Along with solvent extraction is most often employed strategy. Different extractants have been used for the extraction of uranium such as dibenzo-24-crown-8 [5], dibenzo-18-crown-6 [6], trioctylphosphine oxide (TOPO), triphenylphosphine-oxide (TPPO), tri *iso*-octylamine [7], tributylphosphate [8], KROPHOS-18 [9]. Cyanex-272 [10], Tri-n-dodecylamine [11], 2-ethylhexylphosphonic acid (PC88A) [12], UTEVA [13], didodecylphosphoric acid (DDPA) [14], N,N,N′,N′-tetrabutylmalonamide [15], N,N-dialkylamide [16].

Calcium chloride ($CaCl_2$) roasting and nitric acid (HNO_3) leaching were used for the extraction of uranium [17]. Wen-Jiwang studied the distribution of Dicyclohexano-18-crown-6 in 1, 2-dichloroethane at two phases [18]. The potential analytical abilities of dicyclohexano-18-crown-6 is high, therefore it was used for extraction of U(VI) through solid-phase extraction [19], also, it was employed for extraction of U(VI) from mixed aqueous-organic solutions [20], its fate was applied for extraction of U(VI) with Re(VII) [21]. The N, N, N, N-tetra octyl diglycomide (TODGA) has been investigated for extraction of uranium in nitric acid medium [22].

According to the robustness of the work is concerned, in the former work, U(VI) was extracted with different extractants as given in Table 1. However, those necessitate a high concentration of mineral acid media, maximum concentration of extractant and more time of extraction etc. Whereas, in the projected system, the extraction was carried out in a mixture of 1 M acetic acid and 1 M ammonium thiocyanate medium, dicyclohexano-18-crown-6 concentration was 1×10^{-3} M, demonstrating the system is comparatively eco-friendly and a step ahead in the direction of green chemistry.

The goal of the present study was to extend a more specific and greener method for the extraction of U(VI). The extraction scheme has been optimized by studying various parameters. The uniqueness of the scheme lies in a smaller

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A high performance flexible solid-state asymmetric supercapacitor based on composite of reduced graphene oxide@dysprosium sulfide nanosheets and manganese oxide nanospheres

P.P. Bagwade [a], D.B. Malavekar [a], T.T. Ghogare [a], S.B. Ubale [a], V.J. Mane [a], R.N. Bulakhe [b], I. In [b c], C.D. Lokhande [a]

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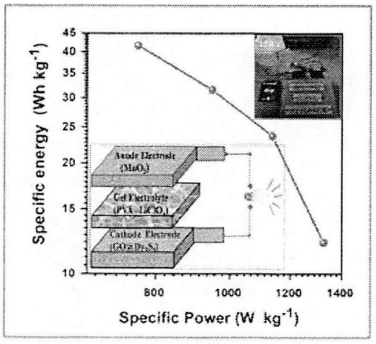
Abstract

The reduced graphene oxide@dysprosium sulfide ($rGO@Dy_2S_3$) composite and MnO_2 films are synthesized using successive ionic layer adsorption and reaction and from chemical bath deposition methods, respectively. Addition of rGO in Dy_2S_3 film enhances specific surface area from 40 to 78 m^2g^{-1}. Using these films flexible solid-state symmetric; $rGO@Dy_2S_3//Dy_2S_3@rGO$ and asymmetric; $MnO_2//Dy_2S_3@rGO$ supercapacitor devices are fabricated. The solid-state asymmetric supercapacitor device exhibits specific energy of 41 Wh kg^{-1} at specific power 1330 W kg^{-1}. The stability of asymmetric supercapacitor is 86% after 5000 cycles and flexibility of 82% at the bending angle 165°. This work highlights the first time use of $rGO@Dy_2S_3$ composite thin film material to fabricate symmetric and asymmetric supercapacitor devices and also demonstrates the superior performance of asymmetric device than symmetric one.

Graphical abstract



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Lanthanum sulfide-manganese sulfide/graphene oxide (La_2S_3-MnS/GO) composite thin film as an electrocatalyst for oxygen evolution reactions

Original Paper Published: 09 April 2021

Volume 25, pages 1775–1788, (2021) Cite this article

Vikas J. Mane, Shital B. Kale, Shivaji B. Ubale, Vaibhav C. Lokhande, Umakant M. Patil & Chandrkant D. Lokhande

Abstract

In this study, the lanthanum sulfide-manganese sulfide (La_2S_3-MnS) nanosheet composite films with different thicknesses were grown on graphene oxide (GO) (LMS/GO) coated stainless steel substrate using binder-free successive ionic layer adsorption and reaction (SILAR) method, for the first time. The formation of crystal structure and chemical states was identified using X-ray diffraction analysis and X-ray photoelectron spectroscopy, respectively. The nitrogen sorption analysis showed the micro-/mesoporous structure of La_2S_3-MnS-90/GO thin film exhibiting a specific surface

SILAR synthesized nanostructured ytterbium sulfide thin film electrodes for symmetric supercapacitors

Original Paper Published: 08 April 2021

Volume 25, pages 1753–1764, (2021) Cite this article

Journal of Solid State Electrochemistry

Aims and scope

Submit manuscript

S. B. Ubale, S. B. Kale, V. J. Mane, P. P. Bagwade & C. D. Lokhande

Abstract

A simple and inexpensive successive ionic layer adsorption and reaction (SILAR) method was used for synthesis of ytterbium sulfide (Yb_2S_3) thin film. The valence states and crystal structure of Yb_2S_3 thin film material were identified using X-ray photoelectron spectroscopy and X-ray diffraction analysis, respectively. Wettability test of Yb_2S_3 thin film showed hydrophilic nature with the value of 21.70°. The surface texture of Yb_2S_3 thin film was examined using field emission scanning electron microscope (FE-SEM). The specific surface area and pore size distribution were measured using the Brunarer-Emmet-Teller (BET) and Barrette-Joynere-Halendar (BJH) methods. The supercapacitive performance of Yb_2S_3 thin film was studied using cyclic voltammetry, galvanostatic

2020-21

Bioresource Technology 326 (2021) 124733

Contents lists available at ScienceDirect

Bioresource Technology

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

Biowaste-to-bioplastic (polyhydroxyalkanoates): Conversion technologies, strategies, challenges, and perspective

Shashi Kant Bhatia [a,b], Sachin V. Otari [c], Jong-Min Jeon [d], Ranjit Gurav [a], Yong-Keun Choi [a], Ravi Kant Bhatia [e], Arivalagan Pugazhendhi [f], Vinod Kumar [g], J. Rajesh Banu [h], Jeong-Jun Yoon [d], Kwon-Young Choi [i], Yung-Hun Yang [a,b,*]

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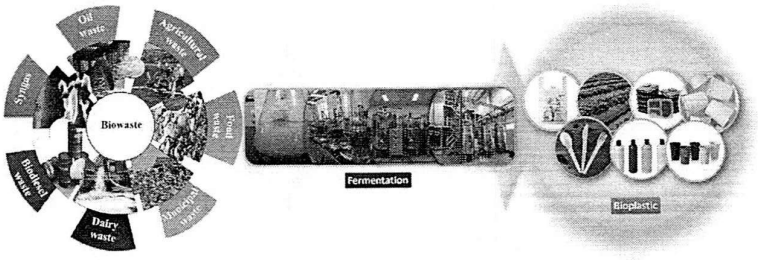
HIGHLIGHTS

- PHA production from biowaste is an economic and ecofriendly approach.
- Microbes are able to recover resource from waste and produce PHA.
- C, N, P and dissolved oxygen are the main factors that affect PHA production.
- The downstream process has a big impact on whole cost of PHA production.
- Functionalization of PHA has potential to improve their applications.

GRAPHICAL ABSTRACT



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Biodiesel waste
Bioplastic
Lignocellulosic biomass
Municipal waste
Polyhydroxyalkanoates

ABSTRACT

Biowaste management is a challenging job as it is high in nutrient content and its disposal in open may cause a serious environmental and health risk. Traditional technologies such as landfill, bio-composting, and incineration are used for biowaste management. To gain revenue from biowaste researchers around the world focusing on the integration of biowaste management with other commercial products such as volatile fatty acids (VFA), biohydrogen, and bioplastic (polyhydroxyalkanoates (PHA)), etc. PHA production from various biowastes such as lignocellulosic biomass, municipal waste, waste cooking oils, biodiesel industry waste, and syngas has been reported successfully. Various nutrient factors i.e., carbon and nitrogen source concentration and availability of dissolved oxygen are crucial factors for PHA production. This review is an attempt to summarize the recent

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COMPOSITION OF ESSENTIAL OILS IN *BOTHRIOCHLOA BLADHII FROM MAHARASHTRA*

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Key words: *Bothriochloa bladhii*, Essential oil, Poaceae, Maharashtra.

The essential oil extracted form plants are generally used as raw material for various industrial applications, like medicinal adjuncts, perfumery, insect repellent, food and cosmetics (Hamid *et al.* 2011). The genus *Bothriochloa* Kuntze is represented as second largest genera of aromatic grasses (Gupta and Deniel 1982). Previously many workers had analyzed essential oil of *Bothriochloa bladhii* from various regions of India (Melkani *et al.* 1984; Bhandari *et al.* 1993; Verma *et al.* 2008; Billy 1965; Bahl et al. 2014). During present investigation oil was extracted from dried aerial parts of naturally growing *B. bladhii* and analyzed by Gas-chromatographic and mass spectrometric (GC-MS) methods.

Naturally growing plants of *Bothriochloa bladhii* were collected at flowering stage from Maval, District Pune, and identified following Bor (1960); Blatter and McCann (1984); and Potdar et al. (2012). The voucher specimen (*Shaikh Tarbej* YCCSK 268) has been deposited in the Department of Botany, Shivaji University, Kolhapur (SUK). Shade dried plant material was distilled for 3 hours in Clevenger type distillation apparatus (Clevenger 1928). The distillate was isolated in glass screw cap tube and stored in dark at 4°C until analyzed.

The analysis of the essential oil was performed using Shimadzu GC-2010 (Kyoto, Japan), equipped with Rtx-1 MS capillary column (30 m × 0.25 mm). An electron impact ionization system with ionization energy of 70 eV was used. For this purpose, 1.0 µl of oil was diluted with hexane (1:100 v/v) and this sample was injected manually in the split mode. Helium was the carrier gas at a flow rate of 1.04 ml/min. Injector and MS transfer line temperatures were set at 250°C. Column temperature was initially at 40°C, and then gradually increased to 280°C at the rate of 5°C 2 min^{-1}.

The components were identified on the basis of comparison of their relative retention time (RT) and mass spectra with those of NIST library data of the GC-MS system (NIST 2018), and reported in the literature.

Bothriochloa bladhii (Retz.) S. T. Blake yielded 0.78 % oil (v/w) from aerial part, on dry weight basis. Seven different compounds were recognized from oil extract of *B. bladhii* during present investigation (Table 1).

The major constituents of essential oil were bicyclic monoterpen hydrocarbons (70.52%), tricyclic monoterpen hydrocarbons (27.39%), transition metal (1.46%), keton group (0.39%) and mono-cyclic saturated hydrocarbon (0.24%). The compounds identified from the sample were camphene (41.39%), A-pinene (27.83%) and tricyclene (27.39%), Bornylene (1.30%) and Molybdenum (1.46%). The essential oil was found to be rich in camphene, A-pinene and tricyclene. The cyclopentane and ethanon were reported for the first time in trace amount, during present investigation.

As Camphene has been reported in high proportion, present species can be considered as an alternate source for camphor synthesis, production of perfumes and deodorants.

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Environmentally Green Synthesis of α-aminophosphonates

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ABSTRACT

One pot multicomponent condensation of aldehyde, amine and diethylphosphite for the synthesis of α-aminophosphonates catalysed by environmentally green EPZG catalyst was found to be efficient and direct protocol under solvent free condition at room temperature. The green process offers advantages such as simple work up procedure, shorter reaction time, high yield and reusability of the catalyst.

Keywords: α-aminophosphonates; environmentally green; EPZG; diethylphosphit

INTRODUCTION

Organic chemistry deals with study of C-C bonds and a few compounds carry C-P bonds. Organo phosphorous compounds are made from the Phosphorous naturally or synthetically [1]. Attraction of the chemists increases towards these compounds due to their antibacterial, antimicrobial, antiviral, enzyme inhibitory properties and plant growth regulators, anti-cancer, [2-6]. The innovation of the amino phosphonic acid and other biologically active compound has wide purpose in agricultural and medicinal field [7-9]. Some organophosphorous compounds are key for pesticides [10], bactericides [11-13], α-pyrones analog of phosphorus act as HIV protease inhibitors [14]. Among the organo phosphorous compound α-aminophosphonic acid is significant motifs due to structural similarities with α-aminoacids [15-16]. The majority of the ester and acid derivatives of α-aminophosphonic acid has demonstrate advanced biological activity such as herbicidal and anticancer [17-22].

Kabachnik M. [23-25] and Fields E. [26] reported primary synthesis of α-amnophosphonic acid by the route of condensation of aldehyde or ketone with amine and dialkyl phosphate, latter on many reported technique used for the synthesis of α-aminophosphonates such as Indium triflate and Ytterbium triflate [27], gallium triiodide [28], VCl_3 [29], silica sulfuric acid [30], copper salt [31], tetramethylguanidine [32], samarium di-iodide [33], lithium perchlorate [34], organocatalyst (R)-3,3'[4-fluorophenyl]$_2$-1,1'-bisnaphthol phosphate [44], ionic liquid media [bmim][PF_6] [35], Amberlite-IR 120 [36], L-Lactic Acid [37], $ZrOCl_2.8H_2O$ and $ZrO(ClO_4)_2.6H_2O$, diterpinic dehydroabietylamine [38] Nickel (II) chloride Hexahydrate, N,N'-dioxide-Sc (III) complex [39], $Mg(ClO_4)_2$ or molecular iodine [40], $InCl_3$ [41], Montmorillonite KSF, Amberlyst-15 and Amberlite-IR 120 [42], microwave irradiation [43]. But, one pot multicomponent synthesis of α-aminophosphonates reported methods have drawbacks like long reaction time, use of organic solvent, reactivity with catalyst, complicated separation procedure. To overcome this drawback, here in we have reported the synthesis of α-aminophosphonates by the application of environmentally benign inorganic, heterogeneous EPZG as a clay catalyst having Lewis acid and Bronsted acidic property. Envirocat EPZG^R synthesized and supplied by Contract Chemicals, UK [44-54].

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MINI-REVIEWS

Green and sustainable synthesis of silica nanoparticles

Sudip D. Karande[1] · Sushilkumar A. Jadhav[2] · Harshada B. Garud[3] · Vilas A. Kalantre[3] · Shivaji H. Burungale[1] · Pramod S. Patil[2,4]

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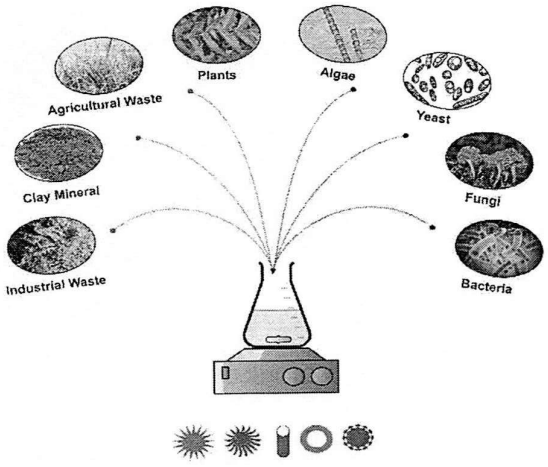
Abstract

Silica nanoparticles (SiNPs) have shown a wide range of applications in various technological fields. It is due to their unique properties such as biocompatibility, stability, tunable pore size, high surface area and surface reactivity. The ease of surface functionalization of SiNPs further extends their applications in biomedicine, targeted drug delivery and biosensing applications. Most of the works on SiNPs are focused on their synthesis by chemical methods for different applications. However, SiNPs can be prepared by green synthetic protocols that utilize plants, agriculture waste, industrial waste, fungi, bacteria, yeast, clay/mineral, worms, actinomycetes, etc. The green and sustainable methods offer distinctive encouraging features to produce nanomaterials with desired properties. The green synthesis of silica nanoparticles is an important area of research having considerable potential for further future developments. In this mini review, collective information on current green approaches for the synthesis of SiNPs is presented. The various green methods of synthesis for SiNPs are discussed with examples from the literature. The future challenges and expected advances are also pointed out which will decide the direction of research in this field.

Graphic abstract



Silica NPs with different morphologies

Keywords Silica nanoparticles · Silicon dioxide · Green synthesis · Plant extracts · Microorganisms

Extended author information available on the last page of the article

Introduction

Silica nanoparticles (SiNPs) and porous SiNPs have shown wide range of applications in various technological fields ranging from nanocomposites and ceramics to diagnosis tools and drug delivery [1]. Stöber et al. synthesized silica nanoparticles in 1962 by using tetraethyl orthosilicate (TEOS) as the silica precursor, ethyl alcohol and water as solvents and ammonia as an alkaline catalyst [2]. The scheme of synthesis of SiNPs by Stöber's method using TEOS as silica source is shown, in Fig. 1. Then onwards, there are several reports in the literature about the synthesis of SiNPs. The synthesis was done by modifying the reaction conditions, varying the base or catalyst and by using different precursors [3, 4]. The nanoparticles can be synthesized by "top-down" and "bottom-up" approaches [5]. The bottom-up methods use various hazardous chemicals and expensive processes that can cause potential environmental and biological hazards [6]. The SiNPs can also be synthesized by different physical and chemical methods, such as sol–gel synthesis [7], chemical vapour condensation [8], flame synthesis [9], laser ablation [10], reverse microemulsion synthesis, etc. [11].

However, these methods have some disadvantages. For instance, sol–gel and hydrothermal synthesis methods need costly raw materials and they also need very high-temperature furnace or heating devices [12]. The chemical vapour

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Capillipedium yashwantraoi, a new species of Poaceae from Madhya Pradesh, India

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Abstract

New species in the genus *Capillipedium* Stapf is described and illustrated from Amarkantak hills of Madhya Pradesh, India. New species is similar to *Capillipedium assimile* (Steud.) A.Camus and *C. nagense* Bor but mainly diverges by having 4–6 cm panicle, 2–2.5 cm racemes, about 11–13 pairs of sessile and pedicelled spikelets in each raceme; joints and pedicels without translucent groove, 2–2.5 mm sessile spikelets and 3–3.2 mm pedicelled spikelets. A taxonomic key for genus *Capillipedium* in India is given to facilitate easy identification of species.

Keywords: Amarkantak, *Capillipedium yashwantraoi*, Madhya Pradesh, *sp. nov.*, Poaceae

Introduction

The genus *Capillipedium* Stapf commonly known as scented-tops grass belongs to subtribe Andropogoninae of tribe Andropogoneae (Poaceae) (Soreng *et al.* 2017). *Capillipedium* was first described by Otto Stapf (Daniel 1917). *Capillipedium* consisting about 18 species distributed in tropical Eastern Africa, tropical Asia to Australia and New Caledonia (Mabberley 2017). In India *Capillipedium* is represented by 08 species (Deshpande 1984).

During a floristic exploration at Amarkantak of Madhya Pradesh, authors collected an interesting species of *Capillipedium*. After detailed and critical morphological observations, consultation of relevant literature (Bor 1960, 1964, Clayton 1986, Deshpande 1984, Potdar *et al.* 2012, Shukla *et al.* 2009, Studel 1855) revealed that the species was closely related to *C. assimile* (Steud.) A.Camus and *C. nagense* Bor but differs in many distinguished characters provided in table 1. After consultation of protologue and type specimens of *C. assimile* (Studel 1855, *H. Zollinger* 859 [P00746710]) and *C. nagense* (Bor 1964, *N. L. Bor* 353 [K001057405]) authors reached at conclusion that the collected unknown interesting species is new to the science world, thus undescribed species of *Capillipedium* is described here.

Taxonomic treatment

Capillipedium yashwantraoi Tarbej & Potdar, *sp. nov.* (Fig. 1 & 2)

A species is very similar to *Capillipedium assimile* (Steud.) A.Camus and *Capillipedium nagense* Bor, but mainly differs in its 4–6 cm panicle (vs. 6–8 cm of *C. assimile*; 8–12 cm of *C. nagense*), 2–2.5 cm racemes with 11–13 pairs of sessile and pedicelled spikelets (vs. 0.5 cm with 3–4 pairs of sessile and pedicelled spikelets of *C. assimile*; 1–1.5 cm with 4–6 pairs of sessile and pedicelled spikelets of *C. nagense*), joints and pedicels without translucent groove (vs. joints and pedicels with translucent groove in *C. assimile* and *C. nagense*) and 2–2.5 mm sessile spikelets (vs. 2.5–3 mm of *C. assimile*; 3-4 mm of *C. nagense*) and 3–3.2 mm pedicelled spikelets (vs. 3.5–4 mm of *C. assimile*; 4-5 mm of *C. nagense*).

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Enhanced specific energy of silver-doped MnO_2/graphene oxide electrodes as facile fabrication symmetric supercapacitor device

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Abstract

The present work is about the preparation of silver (Ag)-doped manganese oxide (MnO_2)/graphene oxide (GO) composite thin films are deposited by a facile and binder-free successive ionic layer adsorption and reaction (SILAR) method for the first time. The Brunauer-Emmett-Teller (BET) study revealed the nanosheets of MnO_2–Ag3/GO exhibit high specific surface area of $192\,m^2g^{-1}$. The tailored flower-like morphology and interconnected nanosheets of MnO_2–Ag3/GO electrodes achieved high electrochemical performance. The maximum specific capacitance (Cs) of $877\,Fg^{-1}$ at the scan rate of $5\,mVs^{-1}$ is obtained for MnO_2–Ag3/GO electrode tested in 1 M sodium sulfate (Na_2SO_4) electrolyte with capacity retention of 94.57% after 5000 cycling stability. The MnO_2–Ag3/GO composite-based flexible solid state symmetric supercapacitor (FSS-SSC) device delivered Cs as $164\,Fg^{-1}$ with specific energy of $57\,Wh\,kg^{-1}$ at specific power of $1.6\,kW\,kg^{-1}$ and capacitive retention of 94% after 10,000 cycles.

Graphical abstract

Figureshowing the specific energy versus specific power and flexible solid state symmetric supercapacitor device of configuration MnO_2–Ag3/GO//PVA-Na_2SO_4//MnO_2–Ag3/GO electrodes.

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ORIGINAL ARTICLE **OPEN ACCESS**

Characterization and production of groundnut-shell degrading cellulase of *Streptomyces mutabilis*

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ABSTRACT

Groundnut is a leguminous crop, grown for seed and oil worldwide. Groundnut shells are the residual agriculture waste remained after removal of seed from its husk, this has very low degradation rate under natural conditions.The residues have 65.5 % cellulose content. The use of GNS substrate for enzyme production by actinomycetes strains is less explored area. In present study a cellulase degrading isolate of actinobateria identified by biochemical and 16S rRNA sequence comparison as Streptomyces mutabilis was selected for cellulase production under submerged condition using Groundnut shell. This was also screened for extracellular enzymes such as amylase, pectinase and cellulase using a novel substrate, Ground nut shell (GNS). Along with purified substrates, crude materials were also efficiently degraded and hydrolysis of different substrates accomplished after 24 h of incubation, where CMC substrate was maximally hydrolyzed by the crude enzyme preparation. The results showed that medium containing 3% (w/v) GNS and 0.3% (w/v) ammonium sulphate resulted in the highest production of cellulase (0.051 U mL^{-1}), after 24 hours. The results revealed that S. mutabilis capable to utilize GNS and thus can be explored processes.

Keywords: *Streptomyces mutabilis, Ground nut shell, cellulase, agriculture waste, degradation.*

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INTRODUCTION

Agriculture wastes are leftover after use or removal of usable product, majority of it is not treated and widely available. The major components of these agricultural residues consist cellulose, hemicelluloses and lignin containing substrates and. These components are resistant to natural biodegradation if disposed in a natural environmental and degraded slowly. In some part of the globe these are burned imposing environmental pollution hazards [17]. According to the National policy for management of crop residues (NPMCR) [22] 501.73 Mt residues generate in India, amongst that most used as domestic and industrial uses but there is still 140.84Mt surplus residues out of that 92.81Mt were burned every year [8]. This suggest the need of methodology for management of waste and converting or using this in a value aided product formation like food, feed, paper and bioenergy industries [26, 6, 27,8, 9].

Groundnut is used for its seed and oil purpose throughout the world. Groundnut shell is a leftover after the removal of seed from its pod, an abundant agro-industrial waste which has a very slow degradation rate under natural conditions [28]. The residue have a 65.5 % cellulose content (dry weight) in its cell wall makes it an appropriate substrate for variety of process. Since it is a nontoxic, various studies showed that it is used for variety of purposes including production of biodiesel, Hydrogen, SCP and biosorbant in dye removal etc. and thus this waste can be a beneficial bio-waste [3, 1, 12].

The degradation of several such wastes is majorly influenced by its composition. The bioconversion of wheat straw is enhanced by its relatively low lignin content and higher amount of degradable hemicellulose. The activity essential for degradation of lignin [23, 4] along with the cellulose and hemicellulose degradation was reported in various actinomycetes [14]. For the degradation of cellulosic waste material to glucose, from various substrates, the saccharifying activity of *Streptomyces* strains may be of considerable interest. Present study highlighted hydrolysis of GNS and its component by *Streptomyces mutabilis* and suggested its utilization for production of hydrolytic enzymes.

MATERIAL AND METHODS

Isolation and screening for Cellulose degrading bacteria.

Soil sample collected from wooden waste (saw mill) site, Aurangabad (19°52'43.4"N 75°20'20.3"E19.878710, 75.338971) (MH, India). The sample inoculated in medium containing CMC 2.0

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Research Article

REMOVAL OF LEAD (II) WITH POLY 3-(AZA-18-CROWN-6) SILICA BONDED PHASE FROM SUCCINATE MEDIUM AND SAMPLES ANALYSIS

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ABSTRACT

A method was described for the determination of micro amount of lead (II) with Poly 3-(Aza-18-crown-6) Silica bonded phase employed as an ion-pair forming a neutral complex from Sodium succinate medium (0.01 to 3.0 M). The adsorbed ion-pair complex was back eluted with 0.5 M hydrochloric acid and determined spectrophotometrically with PAR. The various parameters like concentration of acid, equilibrium time, back eluting agents, loading capacity were optimized for quantitative adsorption of lead (II). The applicability of the proposed method was successfully applied to the analysis of diverse ions, binary mixture of associated metal ions, ternary mixtures, alloys, ayurvedic samples and water samples and lead (II) was determined with the PAR and results of analysis were confirmed by AAS.

Keywords: Poly 3-(Aza-18-crown-6) Silica bonded phase, Lead (II), Real sample analysis.

1. INTRODUCTION

The separation and determination of trace metals in natural water has increased in the last decades because of the environmental problems and public health studies. Lead deficiency caused anemia and may cause several health problems (cancer, heart disease, arthritis, and diabetes and liver diseases). Lead was restricted to 0.1 mg L^{-1} by Granular entrapped adsorbents of crown ether-phosphotungstic acid (PW) and crown ether-phosphomolybdic acid (PMA) in polyacrylamide [1, 2]. Due to the very low concentration of iron and the interfering effect of the matrix, its determination demand very sensitive analytical techniques, Removal of lead and nickel from aqueous solutions by SiO_2 doped potassium titanate, XAD7 impregnated resins with organophosphorus extractants [3]. Extraction of Pb(II) by XAD7 impregnated resins with organophosphorus extractants (DEHPA, Biosorption of Cadmium, Lead, Nickel, and Zinc by Algae [4] Adsorption of Pb(II) onto Modified Rice Bran [5]. Separation and pre concentration were applied to overcome these difficulties. Many procedures are well characterized for such a purpose [6-9]. Solid phase extraction (SPE) has attracted a great attention owing to its simple operation, rapid phase separation, no emulsification, high enrichment factor and easy automation. Organic chelating resins [10], polymer inclusion sorbents [11], modified nanometer-sized alumina [12]. Adsorbent selectively adsorbed Pb (II) from wastewater again interfering ions [13], controlled-pore glass [14], PS-EDTA resin [15]. A novel polyvinyl-tetrazole-grafted resin with high capacity for the adsorption of heavy metal ions was prepared *via* surface-initiated atom transfer radical polymerization (SI-ATRP) of acrylonitrile on chloromethylated cross linked styrene-divinylbenzene resin and a subsequent cyanotetrazole conversion reaction under microwave assistance [16]. nanofibers, polyacrylonitrile, amidoxime polyacryl-onitrile, adsorption [17]. A new method for the preparation of an azacrown ether-bonded silica gel stationary phase has been developed by the authors on the basis of a successive reaction pathway to form the crown ether cycle on the surface of the silica gel [18]. This research article describes in detail the sorption study and separation of lead (II) form other associated elements in sodium succinate medium. The concentration of sodium succinate required for quantitative sorption of lead (II) is very low, a clear cut separation was achieved.

2. EXPERIMENTAL

2.1. Apparatus and Reagents

A Ziess Spectrophotometer (German), Digital pH meter (Model LI-120, ELICO, and India) with glass and calomel electrodes and a digital Flame photometer (PI, Model No. 041, and India) were used. A Stock solution of lead (II) was prepared by dissolving 1.59 g of Lead nitrate in 100mL of distilled deionized water and

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Environmentally Green Synthesis of α-aminophosphonates

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ABSTRACT

One pot multicomponent condensation of aldehyde, amine and diethylphosphite for the synthesis of α-aminophosphonates catalysed by environmentally green EPZG catalyst was found to be efficient and direct protocol under solvent free condition at room temperature. The green process offers advantages such as simple work up procedure, shorter reaction time, high yield and reusability of the catalyst.

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INTRODUCTION

Organic chemistry deals with study of C-C bonds and a few compounds carry C-P bonds. Organo phosphorous compounds are made from the Phosphorous naturally or synthetically [1]. Attraction of the chemists increases towards these compounds due to their antibacterial, antimicrobial, antiviral, enzyme inhibitory properties and plant growth regulators, anti-cancer, [2-6]. The innovation of the amino phosphonic acid and other biologically active compound has wide purpose in agricultural and medicinal field [7-9]. Some organophosphorous compounds are key for pesticides [10], bactericides [11-13], α-pyrones analog of phosphorus act as HIV protease inhibitors [14]. Among the organo phosphorous compound α-aminophosphonic acid is significant motifs due to structural similarities with α-aminoacids [15-16]. The majority of the ester and acid derivatives of α-aminophosphonic acid has demonstrate advanced biological activity such as herbicidal and anticancer [17-22].

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Evaluation of Antibacterial and cytotoxic activity of Beta-glucogallin

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ABSTRACT

Studies have confirmed the medicinal potential of the Beta-glucogallin. While effects of the Beta-glucogallin bacteria and Brine shrimp lethality using their different concentrations has not been previously explored. Present study shows Beta-glucogallin exhibited antibacterial and cytotoxic activity.

The findings of present work provide promise for the development of new molecules of treat microbial infections and cancer.

Keywords: Beta-glucogallin; Antibacterial activity; Brine shrimp lethality assay.

INTRODUCTION

Beta-glucogallin is an important tannin precursor naturally found in a variety of plants such as gooseberry (fruits of *Embellica officinalis*), raspberry, amla fruit extracts, and date palms (β-D-glucogallin present in fruits of *Phoenix dactylifera L.var.*), etc.[1- 3] Beta-glucogallin was reported to be a potential therapeutic agent in the management of a variety of diseases including diabetic complications such as diabetic cataract, prevention of cataract development and progression, retinal degradation in diabetic eyes, hyperglycemia, and inflammatory diseases and associated stress. [1- 6] It was found to possess hepatoprotective, anti-hyperlipidemic, nephroprotective, cardioprotective, and significant photoprotective efficacy against UV-induced cytotoxicity and enhanced melanogenesis. β-D-glucogallin was reported to posses antioxidant, anticancer, antibacterial, antimutagenic, and antiprotozoal activities.[1-6].

However, so far the Anti-Bacterial and Cytotoxic Activity of Beta-glucogallin, has not been studied. Thus, the main aim of this present study was to investigate the antibacterial and cytotoxic effects of Beta-glucogallin in selected models.

MATERIALS AND METHODS

The Beta-glucogallin (BGG) [(2*S*,3*R*,4*S*,5*S*,6*R*)-3,4,5-trihydroxy-6-(hydroxymethyl)oxan-2-yl] 3,4,5-trihydroxybenzoate (Product code: G012; Lot. no.: T18D239) was purchased from Natural Remedies Pvt. Ltd., Bangalore. Purity of BGG was determined by the manufacturer by HPLC area normalization and was certified as 95.4%.

Antibacterial assay [7-9]

The antibacterial assay was carried out by employing 24hrs cultures of *Staphylococcus aureus, Bacillus subtilis, Escherichia coli* and *Klebsiella pneiumonieae*. Activity of Beta-glucogallin was tested separately using Agar well diffusion method. The medium was sterilized by autoclaving at 120°c (15 lb/in2). About 30 ml of the Agar medium with the respective strains of bacteria was transferred aseptically in to each sterilized Petri plate. The plates were left at room temperature for solidification. A well of 5 mm diameter was made using a sterile cork borer. The standard drug and extracts were placed in 6mm diameter well. Antibacterial assay plates were incubated at 37 ± 2°C for 24h. The standard disc 5 mm diameter with ciprofloxacin (100µg/disc) was used as a positive control for antibacterial activity.

Brine shrimp lethality bioassay /Cytotoxicity assay [10-12]

Brine shrimp lethality bioassay is widely used in the bioassay for the bioactive compounds. The bioassay was carried out against a simple zoological organism, brine shrimp nauplii. The brine shrimp lethality bioassay was carried out on Beta-glucogallin using standard procedure. Briefly, brine shrimp (*Artemiasalina* Leach) eggs were hatched in a hatching chamber filled with fresh sea water. The chamber was kept under illumination using a fluorescent bulb for 48 hrs for the eggs to hatch into shrimp larvae. 30 mg of each extract were separately dissolved in 3 ml of DMSO, and from these 300, 150, 100, 50 and 10 µg/ml were prepared by serial dilution. Each concentration was tested in triplicate,

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Supercapacitor devices based as SILAR synthesized ytterbium sulfide @ graphene oxide nanocomposite flexible thin film electrodes

S.B. Ubale [a], S.B. Kale [a b], V.J. Mane [a], U.M. Patil [a], C.D. Lokhande [a]

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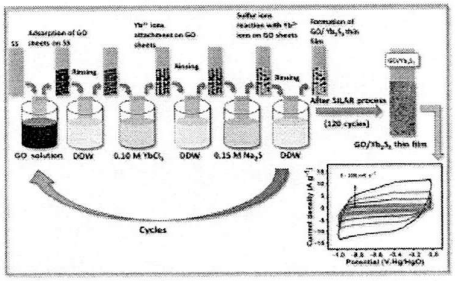
Abstract

Ytterbium sulfide (Yb_2S_3), graphene oxide (GO), and graphene oxide/ytterbium sulfide (GO/Yb_2S_3) composite thin films were synthesized by binder-free successive ionic layer adsorption and reaction (SILAR) method. Formation of Yb_2S_3, GO and GO/Yb_2S_3 composite thin films was confirmed by XRD and XPS techniques. Surface morphology and particle size of these films were observed through FE-SEM and TEM analyses. All thin films showed hydrophilic nature. The Yb_2S_3, GO and GO/Yb_2S_3 composite thin films exhibited the maximum specific capacitance of 181, 193 and 376 F g^{-1}, respectively in 1 M Na_2SO_4 electrolyte at scan rate of 5 mV s^{-1}. The flexible solid state supercapacitor (FSS-SSC) symmetric device was fabricated with GO/Yb_2S_3 composite electrodes as an anode and a cathode and a flexible solid state asymmetric supercapacitor (FSS-ASC) device were fabricated with GO/Yb_2S_3 as an anode and MnO_2 as a cathode electrode with the PVA-Na_2SO_4 gel electrolyte. The FSS-SSC device showed specific capacitance 58 Fg^{-1}, energy density 23 Wh kg^{-1} and power density 0.43 kW kg^{-1}. The FSS-ASC device showed specific capacitance 92 Fg^{-1}, energy density 42 Wh kg^{-1} and power density 0.84 kW kg^{-1}. Both FSS-SSC and FSS-ASC devices showed coulombic efficiency of 88 and 79% for 10,000 GCD cycles, respectively. The FSS-ASC device showed better performance than the FSS-SSC device. The FSS-ASC device showed better performance than the FSS-SSC device.

Graphical abstract



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Solid State Sciences
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Characterization of Dy_2S_3 thin films deposited by successive ionic layer adsorption and reaction (SILAR) method

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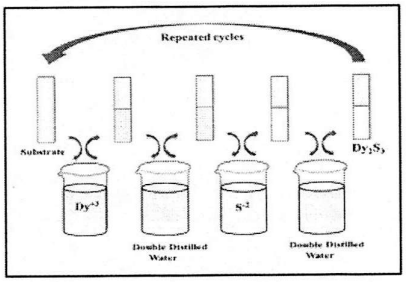
Abstract

The successive ionic layer adsorption and reaction (SILAR) method was used for the deposition of dysprosium sulfide (Dy_2S_3) thin films on stainless steel (SS) substrate. The X-ray diffraction (XRD) study showed orthorhombic crystal structure of Dy_2S_3. Scanning electron microscopic study revealed microstructure with randomly distributed spherical nanostructured particles. The films exhibited hydrophilic nature with a contact angle of 50° and a specific surface area of 48 m^2g^{-1}. The electrochemical properties of Dy_2S_3 films in 1 M Na_2SO_4 electrolyte displayed maximum specific capacitance (C_s) of 273 Fg^{-1} at a scan rate of 5 mVs^{-1}.

Graphical abstract



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Introduction

Increasing energy demands contrasted with diminishing non-renewable energy sources invites a considerable intensification of efforts to develop environment-friendly energy storage devices. The growing need for batteries, supercapacitors, and fuel cells becomes more pronounced [1,2]. Energy storage systems consisting of batteries have low life cycles and need larger space for system [3]. On the other hand, supercapacitors (SCs) with remarkable

plants

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Article

Evaluation of Arabian Vascular Plant Barcodes (rbcL and matK): Precision of Unsupervised and Supervised Learning Methods towards Accurate Identification

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Abstract: Arabia is the largest peninsula in the world, with >3000 species of vascular plants. Not much effort has been made to generate a multi-locus marker barcode library to identify and discriminate the recorded plant species. This study aimed to determine the reliability of the available Arabian plant barcodes (>1500; rbcL and matK) at the public repository (NCBI GenBank) using the unsupervised and supervised methods. Comparative analysis was carried out with the standard dataset (FINBOL) to assess the methods and markers' reliability. Our analysis suggests that from the unsupervised method, TaxonDNA's All Species Barcode criterion (ASB) exhibits the highest accuracy for rbcL barcodes, followed by the matK barcodes using the aligned dataset (FINBOL). However, for the Arabian plant barcode dataset (GBMA), the supervised method performed better than the unsupervised method, where the Random Forest and K-Nearest Neighbor (gappy kernel) classifiers were robust enough. These classifiers successfully recognized true species from both barcode markers belonging to the aligned and alignment-free datasets, respectively. The multi-class classifier showed high species resolution following the two classifiers, though its performance declined when employed to recognize true species. Similar results were observed for the FINBOL dataset through the supervised learning approach; overall, matK marker showed higher accuracy than rbcL. However, the lower rate of species identification in matK in GBMA data could be due to the higher evolutionary rate or gaps and missing data, as observed for the ASB criterion in the FINBOL dataset. Further, a lower number of sequences and singletons could also affect the rate of species resolution, as observed in the GBMA dataset. The GBMA dataset lacks sufficient species membership. We would encourage the taxonomists from the Arabian Peninsula to join our campaign on the Arabian Barcode of Life at the Barcode of Life Data (BOLD) systems. Our efforts together could help improve the rate of species identification for the Arabian Vascular plants.

Keywords: Arabian Peninsula; plant DNA barcoding; unsupervised method; supervised learning; alignment and alignment-free analysis

Citation: Jamdade, R.; Upadhyay, M.; Al Shaer, K.; Al Harthi, E.; Al Sallani, M.; Al Jasmi, M.; Al Ketbi, A. Evaluation of Arabian Vascular Plant Barcodes (rbcL and matK): Precision of Unsupervised and Supervised Learning Methods towards Accurate Identification. *Plants* **2021**, *10*, 2741. https://doi.org/10.3390/plants10122741

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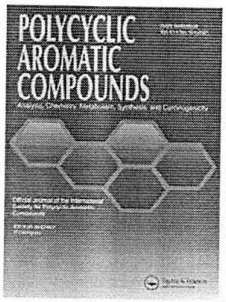
1. Introduction

The Arabian Peninsula is the largest peninsula in the world and consists of nine countries. Saudi Arabia is the largest country (830,000 m^2) that covers almost four-fifths of the Arabian Peninsula [1], whereas Bahrain is the smallest country (295.5 m^2). In the case of plant species diversity estimates, there are more than 3500 native plants in the Arabian Peninsula [2]. Accordingly, Iraq exhibits the most diverse flora with more than 3300 species [3], followed by Yemen (number of species (n) = 2838) [4], Jordan (n = +2500) [5],



Polycyclic Aromatic Compounds

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Multicomponent Synthesis of Pyrano (3, 2-*c*) Quinolone Fused Spirochromenes

Ravindra V. Kupwade, Aparna M. Kulkarni & Uday P. Lad

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Article

Green Synthesis of Silver-Decorated Magnetic Particles for Efficient and Reusable Antimicrobial Activity

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Abstract: Metal and metal hybrid nanostructures have shown tremendous application in the biomedical and catalytic fields because of their plasmonic and catalytic properties. Here, a green and clean method was employed for the synthesis of silver nanoparticle (Ag NP)-SiO_2-Fe_2O_3 hybrid microstructures, and biomolecules from green tea extracts were used for constructing the hybrid structures. The SiO_2-Fe_2O_3 structures were synthesized using an ethanolic green tea leaf extract to form Bio-SiO_2-Fe_2O_3 ($BSiO_2$-Fe_2O_3) structures. Biochemical studies demonstrated the presence of green tea biomolecules in the $BSiO_2$ layer. Reduction of the silver ions was performed by a $BSiO_2$ layer to form Ag NPs of 5–10 nm in diameter in and on the $BSiO_2$-Fe_2O_3 microstructure. The reduction process was observed within 600 s, which is faster than that reported elsewhere. The antimicrobial activity of the Ag-$BSiO_2$-Fe_2O_3 hybrid structure was demonstrated against *Staphylococcus aureus* and *Escherichia coli*, and the nanostructures were further visualized using confocal laser scanning microscopy (CLSM). The magnetic properties of the Ag-$BSiO_2$-Fe_2O_3 hybrid structure were used for studying reusable antimicrobial activity. Thus, in this study, we provide a novel green route for the construction of a biomolecule-entrapped SiO_2-Fe_2O_3 structure and their use for the ultra-fast formation of Ag NPs to form antimicrobial active multifunctional hybrid structures.

Keywords: hybrid structure; green synthesis; antimicrobial activity

Citation: Otari, S.V.; Kalia, V.C.; Bisht, A.; Kim, I.-W.; Lee, J.-K. Green Synthesis of Silver-Decorated Magnetic Particles for Efficient and Reusable Antimicrobial Activity. *Materials* **2021**, *14*, 7893. https://doi.org/10.3390/ma14247893

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1. Introduction

For the last seven decades since the discovery of antibiotics, their uncontrolled use has led to a generation of antibiotic-resistant strains that are unresponsive to currently available conventional antibiotics, creating a major concern for the health sector [1,2]. More new-generation antibiotics have been introduced in the field of medicine; however, the toxicity and adverse effects of these antibiotics are worrying factors for implementation [3,4]. Therefore, alternate therapeutic strategies have been studied for the last two decades, and several types of nanomaterials have been tested for their antimicrobial activity that is nontoxic to human and nonhuman hosts [5–7]. Silver nanoparticles (Ag NPs) have been extensively studied because of their effective antimicrobial activity known since ancient times [8]. A detailed study of the antimicrobial activity of Ag NPs against a wide range of pathogenic microorganisms was performed; it was demonstrated that the Ag NPs act by releasing Ag+ ions, which act on bacteria through reactive oxygen species [8]. The antimicrobial activity of the Ag NPs decreases with aggregate formation, where Ag NPs form a bulky material that makes it difficult for them to act on small bacteria and viruses [9–11]. In addition, Ag NPs are not only toxic to the bacteria but also to mammalian cells, which is a major concern for the therapeutic use of Ag NPs [12]. Therefore, several functionalizations or immobilization procedures have been used to enhance their antimicrobial efficiency and avoid the aggregation and toxicity of Ag NPs before release into the environment [13]. Currently, extensive research is ongoing for the