



## YASHWANTRAO CHAVAN COLLEGE OF SCIENCE, KARAD

### 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

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2	Biochar based photocatalyst for degradation of organic aqueous waste: A review	S. V. Otari, S. S. Sutar, J. P. Jadhav	Microbiology	Chemosphere 0045-6535	<a href="https://www.sciencedirect.com/science/article/abs/pii/S0045653521026722">https://www.sciencedirect.com/science/article/abs/pii/S0045653521026722</a>

  
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	<b>SILAR synthesized dysprosium selenide (Dy<sub>2</sub>Se<sub>3</sub>) thin films for hybrid electrochemical capacitor</b>	S. D. Khot, D. B. Malavekar, R. P. Nikam, S. B. Ubale, P. P. Bagwade, D. J. Patil, V. C. Lokhande, C. D. Lokhande	Chemistry	Synthetic Metal 0379-6779	<a href="https://doi.org/10.1016/j.synthmet.2022.117075">https://doi.org/10.1016/j.synthmet.2022.117075</a>
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A Tetraphenylethene-Based Aggregation-Induced Emission Luminogen (AIEgen) With Mechanochromic Phenomena for Highly Selective Naked-Eye Detection of MnO <sub>4</sub> <sup>-</sup> Directly in Aqueous Media	Kishor S. Jagadhane, S.R. Bhosale, A.A. Moyo, G.B. Kolekar, K.K. Sharma, H.M. Yadav, P. V. Anbhule*	Chemistry	Chemistry Select 2365-6549	<a href="https://doi.org/10.1002/SLCT.202203185">https://doi.org/10.1002/SLCT.202203185</a>
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Formation of CuO nanostructures via chemical route for biomedical applications	S.R. Bhosale, S.A. Ghatage, P.N. Wahane, R.R. Bhosale, Kishor S. Jagadhane, D.N. Patil, P. V. Anbhule*	Chemistry	Chemical Physics Letters 0009-2614	<a href="https://doi.org/10.1016/j.cplett.2022.140122">https://doi.org/10.1016/j.cplett.2022.140122</a>

  
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<p>Mesoporous carbon encapsulated zinc oxide nanorods derived from plant species 'Argyrea sharadchandrajii' for live cell imaging of drug delivery and multimodal bioactivities</p>	<p>Sneha R Bhosale, Kishor S. Jagadhane, Rakhee R Bhosale, Sharadrao A Vanalakar, Mohammad H Qureshi, Devashree N Patil, Rushikesh P Dhavale, Vinod B Shimpale, Govind B Kolekar, Prashant V Anbhule*</p>	<p>Chemistry</p>	<p>New Journal of Chemistry 1369-9261</p>	<p><a href="https://doi.org/10.1016/j.cplett.2022.140122">https://doi.org/10.1016/j.cplett.2022.140122</a></p>
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ISSN 0975-413X  
CODEN (USA): PCHHAX

Der Pharma Chemica, 2022, 14(1): 34-38  
(<http://www.derpharmachemica.com/archive.html>)

## Effect of sintering temperature on selectivity of zinc ferrite as gas sensors

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Received: 3-Jan-2021, Manuscript no: dpc-22-51179, Editor assigned: 5-Jan-2021, PreQC No: dpc-22-51179, Reviewed: 21-Jan-2022, QC No: dpc-22-51179, Revised: 25-Jan-2022, Manuscript No: dpc-22-51179, Published: 1-Feb-2022, DOI: 10.4172/0975-413X.14.1.34-38

### ABSTRACT

The effect of variation of sintering temperature (500-900°C/4h) of  $ZnFe_2O_4$  synthesized by using co-precipitation method on the gas sensing characters. The spinel structure and the presence of residual phases were checked by XRD analysis. Gas sensing response was evaluated as a function of operating temperature for different test gases/vapours such as ammonia ( $NH_3$ ), chlorine ( $Cl_2$ ), LPG,  $CO_2$ , hydrogen sulphide ( $H_2S$ ) and Hydrogen ( $H_2$ ). Maximum gas response activity was achieved at 300°C concentration for hydrogen sulphide gas.

**Keywords:** Zinc ferrite; Sintering; Electrical conductivity; Morphology; Gas sensor

### INTRODUCTION

Various oxide as well as dioxides has been well studied as a sensor material to detect most of the reducing gases [1-3]. The gases being explosive, toxic and flammable such as hydrogen sulphide ( $H_2S$ ) and Hydrogen ( $H_2$ ) and volatile organic compounds vapour etc. create major problem related to environmental safety and human health. Therefore, prime importance to gas analysis, detection and alarms are of great concern to the industry and the society.

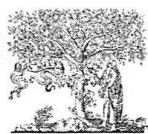
A stream of studies has shown that metal oxide semiconductor (MO) sensors are considered to be effective solutions to detection of harmful gases, owing to their advantages of high sensitivity, fast response and easy integration [4]. Single metal oxides have been widely studied as gas sensing materials. These include zinc oxide (ZnO) [5], tin oxide ( $SnO_2$ ) [6], tungsten oxide ( $WO_3$ ) [7,8], titanium oxide ( $TiO_2$ ) [9,10] and iron oxide ( $Fe_2O_3$ ). As a typical spinel ferrite,  $ZnFe_2O_4$  is a semiconductor with a narrow band gap (~1.9 eV), which possesses various excellent properties. It has attracted much attention in the applications of gas sensors [11,12], catalyst [13], magnetic materials [14] and lithium battery materials [15]. The sensing effect mainly takes place on material surface; the control of particle size will be one of the first requirements for enhancing the sensor's humidity sensitivity. In recent years, the preparation methods of  $ZnFe_2O_4$  based gas sensing materials mainly include co-precipitation [16,17], sol-gel [18] and template synthesis method [19], which can prepare  $ZnFe_2O_4$  nanomaterials with different morphology, such as nanorods, nanotubes, nano-thin films and core-shell microspheres.  $ZnFe_2O_4$  based gas sensing materials mainly include pure  $ZnFe_2O_4$  nanomaterials, metal element doping  $ZnFe_2O_4$  and oxide -  $ZnFe_2O_4$  composite materials, which are mostly used to detect reducing gases. Zinc ferrite based gas sensors in this paper belong to the semiconductor gas sensor family, which shows a response to various reducing gas via converting chemical signals to electrical signals.

In present work we have reported the phase formation, morphology and electrical properties of Zinc ferrite. These allowed us to correlate these results with sensitivity towards different gases/vapours at various conditions.

### EXPERIMENTAL

The zinc ferrite has been synthesized by using co-precipitation technique. A. R. grade zinc sulphate and ferrous sulphate were dissolved in appropriate proportion. The metal salts were then precipitated as hydroxides using 10% NaOH solution maintaining 10pH. Hydroxides were then oxidized using 30%  $H_2O_2$  (100Vml) solution. The precipitate was washed and filtered till it is free from sulphate and excess alkali. The precipitate was dried in vacuum cryostat at 110°C and sintered at different temperatures from 500-900°C for 4 hour.

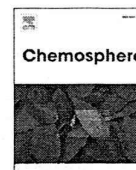




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# Biochar based photocatalyst for degradation of organic aqueous waste: A review

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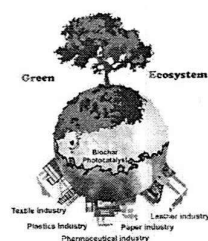
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## HIGHLIGHTS

- The increased organic compound contamination to the ecosystem has raised concerned.
- Synchronous adsorption and degradation by BC-photocatalyst composite were discussed.
- The role of BC in enhanced photocatalytic performance was demonstrated.
- Challenges in contaminants removal by BC-photocatalyst composite were elucidated.

## GRAPHICAL ABSTRACT



## ARTICLE INFO

Handling Editor: Y Yeomin Yoon

### Keywords:

Biochar  
Biomass sources  
Photocatalyst  
Functionalization  
Organic waste  
Water treatment

## ABSTRACT

The advancement in the treatment technology for wastewater containing recalcitrant pollutants to lower the overall cost and time of the treatment processes is the prime demand. Biochar (BC) based photocatalyst have proved their potential application in the photo-degradation of a wide range of organic pollutants. The structural and chemical properties of the BC enhance the efficacy of photocatalyst, improving its optical properties with increased stability. This review gives an overview of the progress that occurred during the last five years in BC-based photocatalyst for degradation of recalcitrant organic waste in the aqueous system, emphasizing the role of BC in the photocatalytic performance with a brief discussion regarding the various sources of BC and different strategies used to modify the BC. Further, the critical challenges are discussed, which would be confronted during the scaling up and real-time application in wastewater treatment.

## 1. Introduction

The recent surge of human civilization, industry and technology has resulted in several ecological concerns. The need for pure water is increasing, along with a slew of other issues, owing to the increased use of readily available freshwater, which has resulted in increased wastewater discharge. As a result, wastewater remediation has arisen as one of

the century's major challenge due to ignored pollution management initiatives and the large discharge of various industrial effluents in the aqueous environment (Alansi et al., 2018; Leichtweis et al., 2021a). Wastewater generated by different manufacturing companies comprises significant quantities of dyes, pharmaceutical wastes, heavy metals, pesticides and various phenolic chemicals. Advanced oxidation processes (AOPs) are potential mechanisms for causing significant chemical

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<https://doi.org/10.1016/j.chemosphere.2021.132200>

Received 2 July 2021; Received in revised form 4 September 2021; Accepted 6 September 2021

Available online 7 September 2021

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## (II) *Datura discolor* (Solanaceae): An addition to the flora of Maharashtra, India

The genus *Datura* L. is represented by 14 species and native to south-west and south central of the USA, northern Mexico and Caribbean Islands (POWO, widely naturalized many parts of the world. In India, it is represented by 6 species (Swamy *et al.*, 2020). While revising the genus *Bothriochloa*, the first author collected an interesting *Datura* species in flower and fruit, which was later identified as *Datura discolor* Bernh. Scrutiny of literature revealed that this species reported from Andhra Pradesh (Swamy *et al.*, 2020) and Karnataka (Kumbhalkar and Nandikar, 2017). It has not been recorded in the flora of Maharashtra (Cooke, 1905; Singh *et al.*, 2001; Gaikwad and Garad, 2015) the present collection forms the first report of the species in the state and third from the Indian states after Andhra Pradesh and Karnataka. A detailed description with photo plate Plate 1 A and B provided to facilitate easy identification.

### Taxonomic treatment

*Datura discolor* Bernh. in Neues J. Pharm. Aerzte 26: 149. 1833; Kumbhalkar and Nandikar in *Curr. Sci.*, 113(5): 855-856. 2017; Swamy *et al.* in *Nelumbo* 62(1): 54-56.2020. *Datura thomasi* Torr. in *Pacif. Railr. Rep. Parke, Bot.* 5: 362. 1857. (Fig. 1).

Annual herb with spreading branches up to 1 m high; stem greenish-purple, terete, dense pubescent on younger parts, sparsely pubescent or glabrous on older parts. Leaves simple, alternate, sub-opposite at apex; petiole 1-3 cm long, lamina deltoid to apparently pedate, 2-7 × 5-9 cm, oblique-unequal at base, sinuate to dentate along margin, acuminate at apex, glabrescent above, densely pubescent beneath especially on nerves, rectipinnate, lateral nerves 4-5 per side. Flowers solitary, white, from the fork of branches; pedicel 1-1.5 cm long. Calyx tubular, tube 5-10 cm long, sparsely pubescent, angular fluted, 5-lobed; lobes 1-1.5 cm long, unequal, triangular, acuminate at apex. Corolla funnel shaped 11-16 cm long, white with streaks of lilac to purple throat. Stamens 5, epipetalous, included; filaments 5.5-8.5 cm long; anthers 0.4-0.7 cm long. Ovary 0.2-0.5 cm long; style 8.6-13.8 cm long with persistent calyx, greyish densely glandular pubescent, sparsely aculci-echinate spines; spines 60-80 up to 1.3 cm long, dense glandular pubescent, dehiscent from top into 4 valves. Seeds ca. 0.26 × 0.3 cm, reniform with hilar residue, black, bullate-verucose.

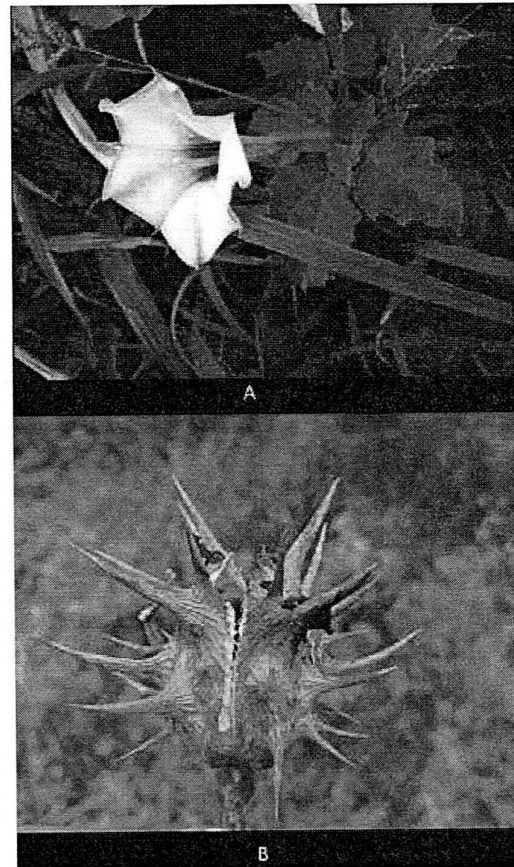


Fig. 1: A. Flowering branch B. Capsule

**Flowering and fruiting:** Almost major parts of the year.

**Distribution:** Andhra Pradesh and Karnataka (Swamy *et al.*, 2020) and now from Maharashtra.

**Habitat:** Occasional in waste lands, along the road sides and in sugarcane fields; associated with *Alternanthera sessilis* (L.) R.Br. ex DC., *Hyptis suaveolens* (L.) Poit., *Senna tora* (L.) Roxb., and *Setaria verticillata* (L.) P.Beauv.

**Specimens examined:** India, Maharashtra, Satara District, Karad, Wathar, 17.185228° N, 74.182735° E, 566 m.s.l., 06.11.2020, Pooja R Mane 3894 (KMR)



## Typifications in the genus *Dichanthium* (Andropogoneae: Poaceae)

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### Abstract

*Dichanthium aristatum* (Poir.) C.E. Hubb., *D. foulkesii* (Hook.f.) S.K. Jain & Deshp., *D. mccannii* Blatt., *D. panchganiense* Blatt. & McCann and *D. paranjpyeanum* (Bhide) Clayton are lectotypified, the selection of lectotype is discussed.

**Keywords:** *Dichanthium*, lectotype, Poaceae

### Introduction

*Dichanthium* Willemet (1796:11) belongs to tribe Andropogoneae and sub-tribe Andropogoninae of family Poaceae (Soreng *et al.* 2017) consist of about 22 species distributed in tropical eastern Africa, tropical Asia to Australia and New Caledonia (Mabberley 2017). The genus *Dichanthium* is represented in India by 12 species, of which 8 are endemic to the country viz. *D. armatum*, *D. concanense*, *D. foulkesii*, *D. mccannii*, *D. oliganthum*, *D. panchganiense*, *D. paranjpyeanum* and *D. tuberculatum* (Kellogg *et al.* 2020, Deshpande 1984). During the revision of the genus *Dichanthium* in India, a thorough search and critical analysis of the literature and specimens demonstrated that the names *D. aristatum*, *D. foulkesii*, *D. mccannii*, *D. panchganiense* and *D. paranjpyeanum* need lectotypification, which is accomplished by the following Article 9.3 of ICN (Turland *et al.* 2018, hereafter ICN).

### Typifications

*Dichanthium aristatum* (Poir.) C.E. Hubb. (Hubbard 1939:654). (Fig. 1)

Basionym:—*Andropogon aristatus* Poir. (Poiret 1811:585).

**Lectotype** (designated here):—FRANCE. *Commerson P.* 166 [P03459113 (P, image!)]).

**Note:**—Describing *Andropogon aristatus*, Poiret (1811) cited the Commerson collection from the island of France [Ile de France] in the protologue. Attempts were made to locate the type specimens at K, P, L, G, LINN and UPS, we found single gathering of three sheets made by Commerson (P03459095, P03459113 and P03459122) at National Museum of Natural History, France (P). In accordance with Article 9.6 of ICN, all the representatives of the type collections are syntypes (McNeill 2014). One of the specimens from this gathering (France, *Commerson P.* 166 [P03459113]) is designated here as the lectotype, as it agrees well with the protologue, possesses a collection number and has enough floral and vegetative parts on sheet.

*Dichanthium foulkesii* (Hook.f.) S.K.Jain & Deshp. (Jain & Deshpande 1978: 134). (Fig. 2).

Basionym:—*Andropogon foulkesii* Hook.f. (Hooker 1897: 174).

**Lectotype** (designated here):—INDIA. Tamil Nadu: Nilghiries; Kaity, 1850, *Foulkes T. s.n.* [K000245669 (K, image!)]).







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

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### ARTICLE INFO

#### Keywords:

Xanthomonas sp.  
Xanthomonadin  
Pigments  
Silver nanoparticles  
SPF  
Biocidal  
Antioxidant

### ABSTRACT

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

### Introduction

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

Several methods were successfully used to produce nano-materials to meet market demand; chemical and physical methods. However, these are considered non eco friendly and potentially hazardous due to utilizing the toxic chemicals and high energy to reduce bulk metal into nano-formed. Besides, several carcinogenic and non-biodegradable chemicals use in a chemical method as reducing and stabilizing

agents, which raise potential human and environmental concerns [4,5]. Due to the limitations of chemical and physical methods, in recent times, researchers have been focused on green approaches to develop simple, eco-friendly, non-hazardous procedures consisting of non-toxic chemicals as reducing and stabilizing agents [6].

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

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

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## Sulfur-Doped Graphene as a Rational Anode for an Ionic Liquid Based Hybrid Capacitor with a 3.5 V Working Window

Navajsharif S. Shaikh, Vaibhav C. Lokhande, Pimsuda Pansa-Ngat, Shivaji Ubale, Jasmin S. Shaikh, Supareak Praserttham, Sandip R. Sabale, Chandrakant S. Lokhande, Teekasa J. and Pongsakorn Kanjanaboos\*

**Cite this:** *Energy Fuels* 2022, 36, 5, 2799–2810

Publication Date: February 9, 2022

<https://doi.org/10.1021/acs.energyfuels.1c03625>

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


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

**SI** Supporting Info (1) »**SUBJECTS:** Electrical properties, Electrodes, Electrolytes, Energy density, Oxides





# Novel electrodes for supercapacitor: Conducting polymers, metal oxides, chalcogenides, carbides, nitrides, MXenes, and their composites with graphene

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## Abstract

The recent electronic appliances and hybrid vehicles need a high energy density supercapacitor that can deliver a burst and a quick power supply. The high energy density supercapacitor can be obtained by designing proper electrode materials along with appropriate electrolytes. This review begins with different mechanisms of energy storage, giving a brief idea regarding how to design and develop different materials to achieve proper electrodes in the pursuit of high-energy density supercapacitor without compromising its stability. This review later focuses on the engineering of different electrode materials like conducting polymer, metal oxides, chalcogenides, carbides, nitrides, and MXenes. Lastly, the hybrid electrodes made up from composites between graphene and other novel materials were investigated. The hybrid electrodes have high chemical stability, long cycle life, good electronic properties, and efficient ionic transportation at the electrode-electrolyte interface, showing great potential for commercial usage.



## Introduction


Researchers across the globe look for green energy technology to decrease the dependence on fossil fuel to mitigate pollutants and their adverse effects. [1], [2] The development and implementation of renewable energy sources in the modern society are an urgent need. [3], [4] Renewable energy sources have adherent problems such as they depend upon the time of day and weather conditions. It is necessary to advance energy storage technology so energy will be available irrespective of time and energy source readiness. [5], [6] To address this concern, batteries and supercapacitors are considered as two types of most significant electrochemical energy storage devices. [7], [8], [9], [10], [11], [12] Batteries have features of high energy density, steady linear discharge at a high specific voltage which is implemented as energy back up for commercial applications. [6], [13] However, they have limitations like low power density, low cycle life, and explosive in nature. [14] Supercapacitors are ultimate candidates due to high power density, long cycle life (>100,000 cycles), quick charge and discharge, and quick burst power supply which is essential in electronic and electrical appliances. [4], [13], [15] The power output of supercapacitor is higher than that of the battery (0.5–10KWkg<sup>-1</sup>) but lower than that of a capacitor. Nevertheless, specific energy is the highest for supercapacitor. Supercapacitors have the advantage of high power performance down to 40°C, which is difficult for batteries. [16] Another advantage of supercapacitors is safe nature for high power delivery (during the charging-discharging process).








# Synthesis, characterization and supercapacitive application of nanocauliflower-like cobalt tungstate thin films by successive ionic layer adsorption and reaction (SILAR) method

P.P. Bagwade<sup>a</sup>, D.B. Malavekar<sup>a</sup>, S.B. Ubale<sup>a</sup>, R.N. Bulakhe<sup>b</sup>, I. In<sup>c</sup>, U.M. Patil<sup>a</sup>, C.D. Lokhande<sup>a</sup>  

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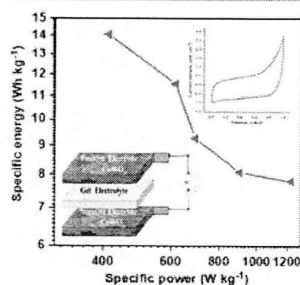
<https://doi.org/10.1016/j.electacta.2022.139933> 

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## Abstract

For the first time, cobalt tungstate (CoWO<sub>4</sub>) thin films were synthesized by successive ionic layer adsorption and reaction (SILAR) method. The monoclinic crystal structure of CoWO<sub>4</sub> film was confirmed from X-ray diffraction (XRD) technique. The elemental, surface morphological, structural, and electrical analyses were executed using Fourier transform infrared spectroscopy (FT-IR), field emission scanning electron microscopy (FE-SEM), energy dispersive X-ray analysis (EDAX), X-ray photoelectron spectroscopy (XPS), Brunauer-Emmett-Teller (BET), two point probe method, and contact angle measurement techniques. The surface morphology of CoWO<sub>4</sub> thin film consisted of islands of agglomerated cauliflower-like spherical nanoparticles with hydrophilic nature. The specific surface area of 60 m<sup>2</sup> g<sup>-1</sup> with an average pore size of 1.10 nm. The CoWO<sub>4</sub> thin film electrode exhibited specific capacitance of 1436.5 F g<sup>-1</sup> at a scan rate of 2 mV s<sup>-1</sup> in 1 M KOH as well as capacitance retention of 94% over 3000 galvanostatic charge discharge (GCD) cycles. Furthermore, flexible solid-state symmetric supercapacitor (FSS-SSC) device assembled using CoWO<sub>4</sub> thin films, showed specific capacitance of 101.32 F g<sup>-1</sup>, specific energy of 14.07 Wh kg<sup>-1</sup> and specific power of 1225.25 W kg<sup>-1</sup>. This work highlights simplistic preparation of CoWO<sub>4</sub> thin films for energy storage application.

## Graphical abstract



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# Structural, Morphological and Spectral Properties of $\text{La}_2\text{Mo}_2\text{O}_9$ Thin Films Synthesized by Spray Pyrolysis Technique

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**Abstract:** The  $\text{La}_2\text{Mo}_2\text{O}_9$  (LAMO) thin films were prepared successfully by using chemical spray pyrolysis method and annealed at 1000 °C for two hours. LAMO thin films were characterized by XRD, FESEM and EDAX tools. X-ray diffraction result shows the increase in crystallite size with deposition temperature LAMO thin film. The morphological investigation were done by analyzing FESEM. It is shows that, increase in grain size after the annealing. The investigated LAMO are potential application as an electrolyte for solid oxide fuel cell.

**Keywords:** LAMO, XRD, FESEM, EDAX.

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## 1. Introduction

From the discovery of  $\text{La}_2\text{Mo}_2\text{O}_9$  (LAMO) material, it plays a crucial role in the application of solid oxide fuel cell (SOFC) as an electrolyte because of its oxide ion conductivity at intermediate temperature [1-3].  $\text{La}^{3+}$  based compounds also shows beneficial parameters for SOFC applications [4, 5]. The most important factor affecting on the performance of electrolyte is their oxygen ion conductivity. Before the discovery of LAMO the YSZ (Ytria Stabilized Zirconia) used as electrolyte having good ionic conductivity  $0.1 \text{ S cm}^{-1}$  at 1000 °C [6]. YSZ necessitates not only costly interconnects but also contributes into cell ohmic loss, raising the cost of fuel cells. Lacorre et al. [7] discovered LAMO family of oxygen ion conductors in the 2000. The function of LAMO is based on concept of lone pair substitution (LPS) [8].

At intermediate temperatures, LAMO has higher oxygen ion conduction ability than YSZ [7]. Fournier et al. synthesized the first  $\text{La}_2\text{Mo}_2\text{O}_9$  compound in 1970. At around 580 °C, the compound phase transition from monoclinic to cubic phase [9, 10]. Fast oxide-ion conductors, has their potential applications in SOFC, oxygen sensors, and oxygen pumping devices [11-15]. The phase transition of LAMO takes place near about 580 °C from  $\alpha$ -monoclinic to  $\beta$ -cubic phase with enhancing ionic conductivity of order twice magnitude leading high ionic conductivity than YSZ. The ionic conductivity of electrolyte can be also enhanced by reducing the thickness of electrolyte or by discovering another type of electrolyte having high oxide ion conduction ability. Therefor the LAMO reported as another fast oxide ion conductor used as an electrolyte material for solid oxide fuel cell [16].

## 2. Experimental

### 2.1. Synthesis of LAMO thin films

The spray pyrolysis route was employed to deposit LAMO thin films on an alumina ( $\text{Al}_2\text{O}_3$ ) and glass substrates. The following analytical grade chemicals were directly used for the synthesis of  $\text{La}_2\text{Mo}_2\text{O}_9$  (LAMO) thin films without any further



Article

# DNA Barcodes for Accurate Identification of Selected Medicinal Plants (Caryophyllales): Toward Barcoding Flowering Plants of the United Arab Emirates

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Academic Editors: Morgan Gostel and W. John Kress

Received: 27 January 2022

Accepted: 17 March 2022

Published: 30 March 2022

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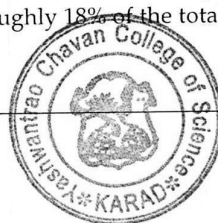
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**Abstract:** The need for herbal medicinal plants is steadily increasing. Hence, the accurate identification of plant material has become vital for safe usage, avoiding adulteration, and medicinal plant trading. DNA barcoding has shown to be a valuable molecular identification tool for medicinal plants, ensuring the safety and efficacy of plant materials of therapeutic significance. Using morphological characters in genera with closely related species, species delimitation is often difficult. Here, we evaluated the capability of the nuclear barcode ITS2 and plastid DNA barcodes rbcL and matK to identify 20 medicinally important plant species of Caryophyllales. In our analysis, we applied an integrative approach for species discrimination using pairwise distance-based unsupervised operational taxonomic unit “OTU picking” methods, viz., ABGD (Automated Barcode Gap Analysis) and ASAP (Assemble Species by Automatic Partitioning). Along with the unsupervised OTU picking methods, Supervised Machine Learning methods (SML) were also implemented to recognize divergent taxa. Our results indicated that ITS2 was more successful in distinguishing between examined species, implying that it could be used to detect the contamination and adulteration of these medicinally important plants. Moreover, this study suggests that the combination of more than one method could assist in the resolution of morphologically similar or closely related taxa.

**Keywords:** medicinal plants; DNA barcoding; nuclear barcode; plastid barcodes; unsupervised learning; supervised learning

## 1. Introduction

Large numbers of people in developing countries rely on wild plant species for their medicinal needs. Over thousands of plant species are used in traditional medicine in different parts of the world. During ancient and modern culture, the healing properties of certain plants have been identified, and these plants currently play a significant role in the treatment of various diseases [1]. Due to their medicinal properties, there is a continuous and perpetual interest in researching and utilizing these valuable natural resources, as demonstrated by a plethora of literature (e.g., [2–10]). Different plant species have been used in ethnomedicine in the Arabian Peninsula since ancient times [5,10]. Sakkir [11] provided an overview of the medicinal plants in the United Arab Emirates (UAE) flora and indicated that roughly 18% of the total plant species identified have medicinal values.





## Potassium ferrocyanide promoted an efficient synthesis of benzoxazoles and benzothiazoles under solvent free condition

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(Received December 03, 2021; Revised March 20, 2022; Accepted March 21, 2022)

**Abstract:** In the family of heterocycles that includes benzoxazoles and benzothiazoles, there exist compounds with a wide range of biological activity. Because of this characteristic, we designed a moderate and effective technique for the synthesis of 2-substituted benzoxazole and benzothiazole using condensation of aldehyde and 2-aminophenol or 2-aminothiophenol via oxidation of carbon-nitrogen bond. Potassium ferrocyanide catalyzed one-pot synthesis is efficient and provides for quick reaction times, simple set-up and high yields. As a result, we provide here a technique for the rapid solvent free synthesis of benzoxazoles and benzothiazoles. Some synthesized products were identified by <sup>1</sup>H-NMR, <sup>13</sup>C-NMR and MASS. The role of potassium ferrocyanide as a catalyst is represented by plausible reaction mechanism.

**Keywords:** Aldehyde; potassium ferrocyanide; benzoxazoles; benzothiazoles; solvent free.

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### 1. Introduction

Benzoxazoles and benzothiazoles are frequent heterocyclic scaffolds in physiologically active and pharmaceutically relevant chemicals and they belong to a large family of molecules. Benzoxazoles are essential scaffolds in natural compounds<sup>1-2</sup> and drug development<sup>3-5</sup>. Benzoxazole compounds with appropriate substitutions have been shown to exhibit a variety of medicinal properties including antibacterial activity<sup>6</sup>, antimicrobial<sup>7-10</sup>, antiviral<sup>11</sup>, topoisomerase I, II inhibitory<sup>12</sup>, antitumor activities<sup>13</sup>, anticancer agent<sup>14-15</sup> NSC-693638, L-697,661, antiviral<sup>16</sup> and antibacterial<sup>17</sup> UK-1, AJI9561. According to recent research, substituted 2-benzylbenzoxazoles exhibit antibacterial, antifungal<sup>18</sup>, antimicrobial<sup>19-21</sup> and anti-measles virus<sup>22</sup> properties (Figure 1).

The tiny and simple benzothiazole nucleus is found in compounds with intriguing biological properties such as anticonvulsant<sup>23-24</sup>, antimalarial<sup>25</sup>, antitubercular<sup>26</sup>, antimicrobial<sup>27-28</sup>, antitumor<sup>29-32</sup>, anthelmintic<sup>33</sup>, anti-inflammatory, analgesic properties<sup>34</sup>. The benzothiazole ring may be found in a variety of natural substances, both marine and terrestrial, that have significant biological activity. Many natural products, such as epothilone-A, lyngbyabellin A, dolastatin 10 & bleomycin, include thiazole nucleus molecules<sup>35</sup>. The synthesis of these molecules is of significant interest due to their substantial medicinal value. Riluzole is a benzothiazole derivative-containing medication used to treat amyotrophic lateral sclerosis. In certain patients, it may postpone the need for a tracheostomy or a ventilator and it

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# Monitoring and Assessment of Water Quality using Multivariate Statistics of Physico-chemical Parameters to establish Baseline Level around proposed Jaitapur Nuclear Power Plant (JNPP), India

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## Abstract

This study illustrates the usefulness of multivariate statistical techniques to provide straightforward data interpretation as well as valuable insights of datasets to get better information about the water quality and helps to design monitoring networks for effective management of available water resources. In this study, Multivariate statistical analysis, Cluster analysis, Principal Component Analysis, Factor Analysis, Water Quality Index and Piper diagram are used to analyze the water data and to prepare the baseline of water parameters around the proposed JNPP. Piper diagram indicates that the primary salinity ("non-carbonate alkali") exceeds 50 % which means that the chemical properties of water are dominated by alkalis and strong acids. Water quality indices indicate that water is non-polluted and fully fit for drinking purposes.

Principal component analysis and factor analysis applied for water parameters point towards the common source of minerals and high level of dissolved organic matter. Trace metal analysis shows significant but little participation of zinc, copper, nickel, iron and barium in water quality. The baseline developed and the data obtained will be useful for the water quality analysis after post-plant operation in this region.

**Keywords:** Water, JNPP Region, Physico-chemical parameters, Multivariate Statistics, Baseline.

## Introduction

Safe water is a basic human right and pre-condition for health and development, yet it is still denied to millions of people of the developing world. Poor sanitation and hygiene coupled with insufficient safe water cause water-related diseases leading to 3.4 million deaths per year and most of them are children<sup>21,23</sup>. India in 1974 enacted 'The Water Act' for prevention and control of water pollution to maintain and restore purity of water in the country. The act was further amended in 1992 and 2003. Currently, India's environment has become fragile and is of concern because of increasing industrialization, urbanization and growth in population<sup>9</sup>. Water quality expresses the suitability of water to sustain

various uses and processes. Every use or process requires certain physical, chemical and biological characteristics of water. Physical and chemical parameters of water are easily defined and hence, criteria set for water quality are largely based on physical and chemical conditions of the water. Biological methods of analyzing water quality are based on a diversity index derived from information theory. These indices express the relative importance of species, also they are dimensionless and independent of the sample size collected.

Once the water gets contaminated, it is difficult to restore its quality. Consequently, directly or indirectly everyone gets affected. Heavy metal contamination is a major problem in several communities and agricultural areas. Commercial agrochemicals, sewage water and industrial wastewater are the measured sources of heavy metal contamination<sup>15,16,25</sup>. The contamination in an aquatic community is of major concern because of its toxicity, abundance and persistence in the environment. This may contaminate the aquatic ecosystem or public health<sup>4,22</sup>. Thus the analysis of water quality is important to preserve the environmental system.

The application of basic and multivariate statistical methods including Cluster analysis (CA), Principal Component Analysis (PCA), Factor Analysis (FA) and Water Quality Index (WQI) for the investigation of water quality data are widely found in literature<sup>2,3,8,24,26</sup>. Government has responded to the water findings by implementing required appropriate action plans at diverse locations<sup>6</sup>. Hence it is important to provide the detailed composition of water parameters to help the local environmental policymakers.

## Study area

Jaitapur is a small village situated in the Rajapur Tehsil of Ratnagiri District, Maharashtra. It lies on the Arabian Sea coast. Nuclear Power Corporation of India Limited (NPCIL) proposed a Nuclear Power Plant with a 9900 MW capacity near Jaitapur. This project is located at 16.55° N; 73.35° E, a part of Konkan in the Western Ghats of Maharashtra. The issue was highlighted by different non-governmental organizations because of the adverse effects of radiation and different types of pollution. Also, many other industries like thermal power, mining of aluminium etc. are being constructed in this Konkan region. This Konkan region is famous for mango production and export especially





ORIGINAL RESEARCH PAPER

## Photocatalytic degradation study of Methyl Orange and Congo red using Mg-Co ferrite powder

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Received: 2022-03-05

Accepted: 2022-04-25

Published: 2022-05-01

### ABSTRACT

The photocatalytic degradation of methyl orange and Congo red dye was performed under the illumination of visible light (Philips 250Watt) as a source of photons. The complete distraction of the aromatic ring was ascertained by UV spectroscopic analysis. A decrease in dye concentration and an increase in the concentration of CO<sub>2</sub> indicate dye mineralization. The behavior of this reaction was pseudo-first-order and the maximum photodecolorization efficiency was ~85.16% for Methyl orange and ~95.40 for Congo red in 120-150 min. at 30°C.

**Keywords:** Ferrite, Co-precipitation, X-ray Diffraction, Scanning electron microscopy, Transmission electron microscopy (TEM), Photodegradation of dye.

### How to cite this article

Jadhav S. D., Patil R. S. Photocatalytic degradation study of Methyl Orange and Congo red using Mg-Co ferrite powder. J. Water Environ. Nanotechnol., 2022; 7(2): 170-179.  
DOI: 10.22090/jwent.2022.02.005

### INTRODUCTION

Water contamination is mainly caused due to toxic effluents drained by several chemicals, in agricultural and textile industries. It has been reported that about 25% of dyestuffs are discharged directly into the environment by the textile factory. Generally, wastewater generated by the textile industry contains a considerable amount of non-fixed dyes, especially azo dyes, and a huge amount of inorganic salts. Also contains several non-biodegradable substrates that could be harmful to the environment. Their toxicity, stability to natural decomposition, and persistence in the environment have been the cause of much concern to society and regulation authorities all around the world [1-4]. Environmental problems associated with toxic organic pollutants in water and air are the current issue to be solved for the development of a healthy environment.

Photocatalytic oxidation is one of the emerging

technologies for the decomposition of organic dyes such as Reactive black 5, Acid orange, Aniline yellow, Orange B, Methyl yellow, Methyl red, Methylene blue, Congo red & Methyl orange, etc. Azo dyes represent about one-half of the dyes used in the textile industry. Among azo dyes, Methyl Orange (MO) is highly water-soluble, even at very low concentrations, which hinders the penetration of light and therefore causes adverse effects on photosynthesis. Congo Red (CR) was the first synthetic dye that could dye cotton directly [5]. It is contained in wastewater effluents from the textile, printing and dyeing, paper, rubber, and plastics industries. CR is used in medicine as a biological stain and as an indicator since it turns from red-brown in a basic medium to blue in an acidic one. These are the different ways organic pollutants (dyes) continuously get added to water sources. The incomplete decomposition of organic pollutants may lead to the formation of more toxic byproducts than the parent pollutants. Therefore, to overcome such a problem, looking for a metal

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## Rational La-doped hematite as an anode and hydrous cobalt phosphate as a battery-type electrode for a hybrid supercapacitor †

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[Navajsharif S. Shaikh](#), <sup>ab</sup> [Vaibhav C. Lokhande](#), <sup>cd</sup> [Taeksoo Ji](#), <sup>\*cd</sup> [Shivaji Ubale](#), <sup>b</sup> [Vikas J. Mane](#), <sup>b</sup> [Chandrakant D. Lokhande](#), <sup>b</sup> [Haseen M. Shaikh](#), <sup>e</sup> [Jasmin S. Shaikh](#), <sup>f</sup> [Supareak Praserttham](#), <sup>f</sup> [Sandip Sabale](#) <sup>g</sup> and [Pongsakorn Kanjanaboos](#) <sup>\*ah</sup>

Author affiliations

### Abstract

In recent years, modern appliances require high energy density with a burst power supply. Hybrid supercapacitors show high performance based on high energy density without compromising power density and stability over thousands of charge–discharge cycles. In this work, the optimized hybrid electrodes using lanthanum-doped hematite (lanthanum-doped iron oxide) noted as 7.5%La-HMT as a negative electrode and hydrous cobalt phosphate (CoPO) as a battery-type positive electrode have been successfully fabricated *via* a simple hydrothermal method and a facile co-precipitation method, respectively. The 7.5%La-HMT showed excellent electrochemical performance due to doping of rare-earth La<sup>3+</sup> metal ions, resulting in improvised active sites and reduction in the equivalent resistance. The 7.5%La-HMT operated at a high potential window (0 to −1.2 V) with an ultra-high specific capacitance ( $S_p$ ) of 1226.7 F g<sup>−1</sup> at 1 A g<sup>−1</sup> with capacitance retention of 89.3% over 1000 cycles. CoPO could be operated at a high working window (0 to 0.45 V) with a specific capacity of 121.7 mA h g<sup>−1</sup> at a current density of 2 A g<sup>−1</sup> with capacitance retention of 85.4% over 1000 cycles. The configured CoPO//KOH//10%La-HMT aqueous hybrid capacitor device (Ag-HSC) could be operated at a potential window of 1.6 V and delivered a maximum energy density (E.D) of 83.6 W h kg<sup>−1</sup> at a power density (P.D)





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

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Received 14<sup>th</sup> June 2020; Revised 18<sup>th</sup> July, 2020; Accepted 7<sup>th</sup> Oct. 2021; Available online 1<sup>st</sup> July 2022

<https://doi.org/10.31032/IJBPAS/2021/11.7.6197>

**ABSTRACT**

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

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

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

**Keywords: Rubiadin; Antibacterial activity; Brine shrimp lethality assay**

**INTRODUCTION**



Rubiadin, 1,3- dihydroxy-2-methyl anthraquinone has been isolated from the *Rubia cordifolia* Linn (Rubiaceae). *Rubia cordifolia* is an important medicinal plant which is used for treatment of various ailments in Ayurvedic system of medicine [1, 2]. Rubiadin, isolated from the roots of *Rubia cordifolia* was found to have potent


antioxidant property [3]. In addition, rubiadin also have been found to inhibit lipid peroxidation [4] and the plant *Rubia cordifolia* have been reported for anti-inflammatory [5], immunomodulatory [6], anticonvulsant and anxiolytic [7] and anti-tumor activities [8]. While the results of the study by Guntupalli *et al.*, [9] strongly









# SILAR synthesized dysprosium selenide (Dy<sub>2</sub>Se<sub>3</sub>) thin films for hybrid electrochemical capacitors

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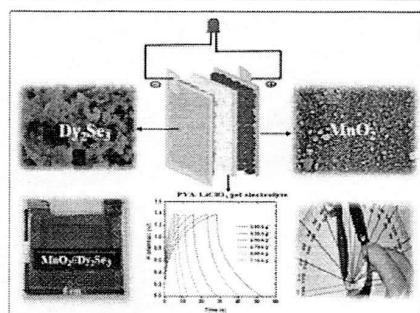
<https://doi.org/10.1016/j.synthmet.2022.117075> 

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## Abstract

As the necessity of energy storage is continuously increasing, new materials have been investigated for electrochemical energy storage, especially for electrochemical capacitors. These storage devices are rapidly convertible as well as air pollution free. Therefore, a number of materials have been explored as electrode materials for supercapacitors to fulfill different requirements of electrochemical energy storage. Herewith, dysprosium selenide (Dy<sub>2</sub>Se<sub>3</sub>) films were prepared using the simple successive ionic layer adsorption and reaction (SILAR) method and characterized using different physico-chemical techniques. The specific capacitance ( $C_s$ ) of 92 Fg<sup>-1</sup> was obtained at the current density of 2.85 Ag<sup>-1</sup> in 1 M LiClO<sub>4</sub> electrolyte with a retention of 85% over 5000 galvanostatic charge-discharge (GCD) cycles performed at a current density of 4 Ag<sup>-1</sup>. The flexible solid-state hybrid electrochemical capacitor of configuration Dy<sub>2</sub>Se<sub>3</sub>/LiClO<sub>4</sub>-PVA/MnO<sub>2</sub> showed  $C_s$  of 83 Fg<sup>-1</sup> and specific energy of 18 Whkg<sup>-1</sup> at a specific power of 2.7 kWkg<sup>-1</sup>. This hybrid device retained 92% of capacitance at a device bending angle of 160°. These results demonstrate the facile synthesis of Dy<sub>2</sub>Se<sub>3</sub> and its possible use in electrochemical energy storage applications.

## Graphical Abstract



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## Introduction





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

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MS received 3 July 2021; revised 8 March 2022; accepted 14 March 2022

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

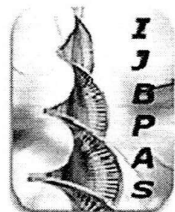
**Keywords.** Deccan Volcanic Province; basalt; mixing; assimilation fractional crystallisation; plume; SCLM.

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This article is part of the Topical Collection: Deccan Traps and other Flood Basalt Provinces – Recent Research Trends. Supplementary material pertaining to this article is available on the *Journal of Earth System Science* website ([http://www.ias.ac.in/Journals/Journal\\_of\\_Earth\\_System\\_Science](http://www.ias.ac.in/Journals/Journal_of_Earth_System_Science)).

Published online: 24 August 2022





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**IN-VIVO INVESTIGATIONS OF CHRONIC INFLAMMATORY PAIN  
MODULATING POTENTIAL OF NIRANTHIN**

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Received 16<sup>th</sup> Oct. 2021; Revised 20<sup>th</sup> Nov. 2021; Accepted 20<sup>th</sup> Jan. 2022; Available online 1<sup>st</sup> Sept. 2022

<https://doi.org/10.31032/IJBPAS/2022/11.9.6413>

**ABSTRACT**

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

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

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

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





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

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

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

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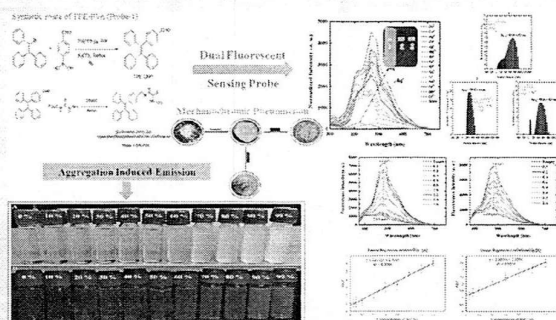
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**ABSTRACT:** It is critical to design a novel and simple bifunctional sensor for the selective and sensitive detection of ions in an aqueous media in environmental samples. As a result, in this study, tetraphenylethene hydrazinocarbothioamide (TPE-PVA),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



## 1. INTRODUCTION

Tetraphenylethylene (TPE)-based device materials have been of great interest in recent years for detecting metal ions in biological and environmental systems because of their aggregation-induced emission (AIE) properties,<sup>1</sup> high selectivity, sensitivity, and ease of evaluation. Tetraphenylethene is also a common building block for AIE photophysical phenomena. A carbothioamide derivative based on tetraphenylethene may exhibit AIE. Whenever illuminated with 365 nm ultraviolet (UV) light, dilute tetrahydrofuran (THF) solution of TPE-PVA emitted a modest yellowish color, whereas its solid emitted a strong yellowish color. Because of the hydrophobic nature of TPE, it is universally acknowledged that AIE-active sensors can be developed from TPE.<sup>2</sup> Aggregation-induced emission (AIE) compounds have a propeller-shaped structure, wherein  $\pi$ - $\pi$  stacking in aggregates and solids is avoided. Because of the hydrophobic characteristics of TPE, TPE-derived probes have long been recognized to be AIE-active.<sup>3</sup> Tetraphenylethylene has a propeller-shaped structure with rotating aromatic phenyl rings on the periphery. Recent research has discovered and proven that when in dilute

solutions, free rotation of the peripheral aromatic rings is allowed. Nonradiative disintegration (decay) is induced by the excited state.<sup>4</sup> As a result of their “aggregation-induced emission” properties, tetraphenylethylene derivatives are the most commonly used chromophores to explain complexation with metal ions. The functionalization of the tetraphenylethylene-based molecular architecture with pendant coordinating sites for metal ions is a way of developing novel chemosensors for metal ion detection.<sup>5</sup> The AIE characteristics of tetraphenylethylene, which are based on the interaction of chromophore receptor sites with analytes, determine the detection capability of the compound.<sup>6</sup>

Recently, tetraphenylethylene and other aggregation-induced emission derivatives were successful in detecting Hg<sup>2+</sup>

Received: June 2, 2022

Accepted: July 27, 2022



# A Tetraphenylethene-Based Aggregation-Induced Emission Luminogen (AIEgen) With Mechanochromic Phenomena for Highly Selective Naked-Eye Detection of $\text{MnO}_4^-$ Directly in Aqueous Media

Kishor S. Jagadhane,<sup>[a, c]</sup> Sneha R. Bhosale,<sup>[a]</sup> Alfredi A. Moyo,<sup>[a]</sup> Govind B. Kolekar,<sup>[b]</sup> Kirankumar K. Sharma,<sup>[c]</sup> Hemraj M. Yadav,<sup>[c]</sup> and Prashant V. Anbhule\*<sup>[a]</sup>

It is challenging to work on the detection of toxic anions and pollutants directly from aqueous media by using organic molecules. The ability to detect  $\text{MnO}_4^-$  selectively and sensitively is essential to improving human health and protecting the environment. As a result, a Tetraphenylethylene-based chemosensor was successfully synthesized and fully characterized with modern spectroscopic techniques and applied as a new rapid naked-eye detection for the  $\text{MnO}_4^-$  in a mixed aqueous media ACN:  $\text{H}_2\text{O}$  ( $v/v = 1/9$ ) by significantly switching off an emission in a mixed aqueous media over another anion. Chemosensor has been thoroughly studied, which shows remarkable photophysical properties such as aggregation-

induced emission (AIE) and mechanochromic phenomena. The linear regression ( $R^2$ ) is  $\approx 0.98 \mu\text{g mL}^{-1}$  and the LOD (the detection limit) as low as  $0.150418 \mu\text{g mL}^{-1}$  is possible for  $\text{MnO}_4^-$ . This work demonstrates structure-property and application relationships of TPEgen scaffolds and connects topics such as AIE, mechanochromic phenomenon, and naked-eye fluorescence sensing. The current study's fundamental knowledge helps improvement in the fields of TPEgen, anion coordination triggered emission and naked eye fluorescence sensing. As a result, a chemosensor can be developed into a prospective luminescent sensor for detecting  $\text{MnO}_4^-$ , as well as onsite detection by using the paper-based sensor.

## Introduction

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

Due to the hydrophobic nature of a chemosensor, it is universally acknowledged that the aggregation-induced emission of active sensors developed from tetraphenylethene.<sup>[7,8]</sup> It

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

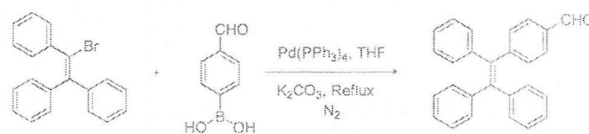
Recently, aggregation-induced emission and mechanochromic luminogens have been successful in detecting anions and harmful pollutants in aqueous media. So, the reported chemosensor having hydrazine carbothioamide sparked a lot of

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Supporting information for this article is available on the WWW under  
<https://doi.org/10.1002/slct.202203185>



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



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

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### Introduction:

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

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

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

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



## RESEARCH ARTICLE

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

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## OPEN ACCESS

**Citation:** Jamdade R, Al-Shaer K, Al-Sallani M, Al-Harhi E, Mahmoud T, Gairola S, et al. (2022) Multilocus marker-based delimitation of *Salicornia persica* and its population discrimination assisted by supervised machine learning approach. PLoS ONE 17(7): e0270463. <https://doi.org/10.1371/journal.pone.0270463>

**Editor:** Branislav T. Šiler, Institute for Biological Research, University of Belgrade, SERBIA

**Received:** January 28, 2021

**Accepted:** June 10, 2022

**Published:** July 27, 2022

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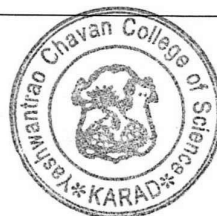
**Data Availability Statement:** Sequence data are available at NCBI GenBank under the accessions numbers MW514447-MW514530, OM397125-OM397363 and OM396936-OM396995.

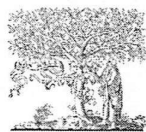
**Funding:** The author(s) received no specific funding for this work.

**Competing interests:** The authors have declared that no competing interests exist.

## Abstract

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

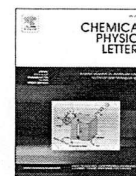




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Research paper

## Formation of CuO nanostructures via chemical route for biomedical applications

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### ARTICLE INFO

#### Keywords:

CuO nanostructure  
Co-precipitation  
Particle size  
Surface area  
Antimicrobial study

### ABSTRACT

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

### 1. Introduction

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

localized or universal [4,5].

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

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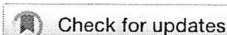
<https://doi.org/10.1016/j.cplett.2022.140122>

Received 26 July 2022; Received in revised form 6 October 2022; Accepted 10 October 2022

Available online 22 October 2022

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 Cite this: *New J. Chem.*, 2023, 47, 12739

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

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

 Received 5th January 2023,  
Accepted 5th June 2023

DOI: 10.1039/d3nj00071k

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## Introduction

In conjunction with the rapid growth of the population, human health issues have increased prominently worldwide due to hybridization. Cancer is indeed one of the world's most dangerous

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

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† Electronic supplementary information (ESI) available. See DOI: <https://doi.org/10.1039/d3nj00071k>

