Journal of Inorganic and Organometallic Polymers and Materials (2020) 30:4441–4451
https://doi.org/10.1007/s10904-020-01576-9

A Facile Green Approach of Cone-like ZnO NSs Synthesized Via *Jatropha gossypifolia* Leaves Extract for Photocatalytic and Biological Activity

B. Radha Krishnan[1] · M. Ramesh[2] · M. Selvakumar[3] · S. Karthick[4] · A. Sasikumar[5] · D. Varun Geerthi[6] · N. Senthilkumar[7]

Received: 14 March 2020 / Accepted: 4 May 2020 / Published online: 11 May 2020

Abstract
In the present work, cone-like zinc oxide (ZnO) nanostructures (NSs) were fabricated via a simple green approach by *Jatropha gossypifolia* leaves extract for improving the photocatalytic and biological activity. The crystallinity and surface morphology of synthesized NPs were characterized by powder X-ray diffraction (PXRD) and transmission electron microscopic (TEM) analysis. The presence of elements in the prepared ZnO NSs was determined by the energy dispersive X-ray (EDX) spectroscopy. The photocatalytic activities of ZnO NSs were investigated by the removal of methylene blue (MB) and malachite green (MG) organic dyes under UV light irradiation. The result demonstrates that the organic dye degradation efficiency of the MG and MB was achieved at 96% and 82% under UV light irradiation. The green synthesized ZnO NSs demonstrate superior antibacterial activity against gram-positive and gram-negative bacteria's and it has excellent antioxidant ABTS free radical scavenging activity. The inhibition of denaturation of protein and proteinase inhibitory was studied by anti-arthritic activity.

Keywords Cone like ZnO NSs · Green synthesis method · Photocatalytic and biological activity

1 Introduction

In the current scenario, waste dye waters are producing from the dye industries which affect the natural water body streams and water ecosystem [1, 2]. So, the photocatalysis process has the most significant process for solving water pollution problems [3]. In recent years, metal oxide nanoparticles like TiO_2 [4, 5], ZnO [6–8], WO_3 [9], Fe_2O_3 [10], Bi_2O_3 [11], etc. are gained much interest for eliminating organic pollutants from waste industrial water owing to their band gap, chemical stability, non-toxicity and inertness [12]. Due to their versatile properties, ZnO material focused on various applications such as photocatalysis, solar cells, chemical sensors, piezoelectric transducers and ultraviolet laser diode [13–16]. As well as, ZnO NPs is one of the most promising material for electronic and optoelectronic properties owing to its wide band gap energy (3.37 eV) with large excitation binding energy (60 meV) [17–19].

In addition, ZnO is an environmentally friendly material, which is described especially for bio-applications like bio-imaging, cancer detection and cosmetic products such as sunscreens [18]. The ZnO NPs are produced via various techniques like sol–gel method, wet chemical method,

✉ B. Radha Krishnan
radhakrishnankrce@gmail.com

[1] Department of Mechanical Engineering, Nadar Saraswathi College of Engineering and Technology, Theni 625 531, India

[2] Department of Mechanical Engineering, K. Ramakrishnan College of Engineering, Trichy 621 112, India

[3] Department of Biotechnology, University College of Engineering (BIT Campus), Tiruchirappalli 620 024, India

[4] Department of Physics, Muthayammal Engineering College, Rasipuram 637 408, India

[5] School of Computing, SASTRA Deemed University, Tanjore 613 401, India

[6] Department of Mechanical Engineering, Sri Ramakrishna Engineering College, Coimbatore 641 022, India

[7] Department of Electronics and Communication Engineering, Ariyalur Engineering College, Ariyalur 621 707, India