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Eco-friendly synthesis of zinc oxide nanoparticles using Ficus religiosa leaves

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Abstract

Green synthesis represents an innovative approach to nanomaterial production, leveraging biological entities such as plants, fungi, bacteria, and algae as reducing and capping agents. This sustainable methodology offers a compelling alternative to conventional chemical methods, which often rely on toxic chemicals and generate harmful byproducts [1]. Ficus religiosa, commonly known as the sacred fig or peepal tree, has emerged as a promising natural resource for the green synthesis of nanoparticles. This ancient tree, revered in many cultures, contains a wealth of bioactive compounds that can act as reducing and capping agents in the synthesis process.

This study presents a novel and green method for synthesizing zinc oxide nanoparticles (ZnO NPs) utilizing *Ficus religiosa* leaf extract as a renewable, non-toxic, and effective stabilizer. Optimizing the synthesis process to achieve specific nanoparticle properties, including size, shape, and crystallinity, is of significant importance. The amount of leaf extract, reaction temperature, and reaction time are crucial parameters that significantly influence the synthesis process and subsequent properties of the nanoparticles.

The quantity of leaf extract and calcination temperature in the synthesis of ZnO NPs were optimized and the volume of leaf extract=60 ml and T=400 ◦C were considered. Along with the synthesis and fabrication processes, it is necessary to characterize nanoparticles to assess their properties, so, information on the size, morphology, chemical composition, crystal structure, surface composition, optical band-gap value, and thermal stability were concluded using some of the most common characterization techniques, namely, UV–Visible spectroscopy, X-ray diffraction, field-emission scanning electron microscopy with energy dispersive X-ray spectroscopy, transmission electron microscopy, Fourier transform infrared spectroscopy and thermal gravimetric analysis. The results confirmed

the successful synthesis of ZnO nanoparticles, which exhibited a spherical morphology with an average size of 50 nm and a band gap energy of 3.14 eV.

Key words: Green synthesis, ZnO nanoparticles, *Ficus religiosa*. Leaf extract

References

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