

Biosynthesis and antibacterial activity of ZnO nanoparticles using *Buchanania obovata* fruit extract and the eutectic-based ionic liquid

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Abstract

The fruit extract of *Buchanania obovata* and the eutectic-based ionic liquid were utilized, in an eco-friendly, inexpensive, simple method, for synthesizing zinc oxide nanoparticles (ZnO NPs). The influence of the reducing, capping and stabilizing agents, in both mediums, on the structure, optical, and morphological properties of ZnO NPs was extensively investigated. The surface plasmon resonance peaks were observed at 340 nm and 320 nm for the fruit-based and the eutectic-based ionic liquid mediums, respectively, indicating the formation of ZnO NPs. XRD results confirmed the wurtzite structure of the ZnO NPs, exhibiting hexagonal phases in the diffraction patterns. The SEM and TEM images display that the biosynthesized ZnO NPs exhibit crystalline and hexagonal shape, with an average size of 40 nm for the fruit-based and 25 nm for the eutectic-based ionic liquid. The Brunauer–Emmett–Teller (BET) surface area analysis, revealed a value $\sim 13 \text{ m}^2 \text{ g}^{-1}$ for ZnO NPs synthesized using the fruit extract and $\sim 29 \text{ m}^2 \text{ g}^{-1}$ for those synthesized using the eutectic-based ionic liquid. The antibacterial activity of the biosynthesized ZnO NPs was assessed against clinically isolated Gram-negative (*E. coli*) and Gram-positive (*S. aureus*) bacterial strains using the inhibition zone method. The ZnO NPs produced from the eutectic-based ionic liquids confirmed superior antibacterial activity against both *S. aureus* and *E. coli* compared to those mediated by the utilized fruit extract. At a concentration of 1000, the eutectic-based ionic liquid mediated ZnO NPs displayed a maximum inhibition zone of 16 mm against *S. aureus*, while against *E. coli*, a maximum inhibition zone of 15 mm was observed using the fruit extract mediated ZnO NPs. The results of this study showed that the biosynthesized ZnO NPs can be utilized as an efficient substitute to the frequently used chemical drugs and covering drug resistance matters resulted from continual usage of chemical drugs by users.

Keywords: eutectic-based ionic liquid, ZnO nanoparticles, *Buchanania obovata*, green synthesis, antibacterial activity, fruit extract

1. Introduction

Nanotechnology has rapidly propelled the production of materials at the nanoscale, notably in interdisciplinary domains like the biosynthesis of metal nanoparticles [1]. Zinc oxide

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