

Structural, Optical and Antibacterial Activity Studies

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Abstract

The present study focuses on the structural, optical, and antibacterial properties of synthesized nanomaterials with the aim of evaluating their potential for advanced functional and biomedical applications. The structural characteristics of the synthesized material were investigated using appropriate analytical techniques to determine its crystallinity, phase composition, particle size, morphology, and surface characteristics. Optical properties were examined through spectroscopic analysis to understand light absorption, electronic transitions, and the corresponding optical band-gap characteristics. These properties provide important information regarding the potential application of the synthesized nanomaterials in optoelectronic, photocatalytic, and sensing systems. In addition, the antibacterial activity of the synthesized material was evaluated against selected Gram-positive and Gram-negative bacterial strains using a suitable microbiological method. The antibacterial performance was assessed in terms of bacterial growth inhibition and the formation of inhibition zones. The observed antibacterial activity may be associated with factors such as particle size, surface area, generation of reactive oxygen species, and interaction between nanoparticles and bacterial cell membranes. The study establishes a relationship between the structural and optical characteristics of the synthesized material and its antibacterial performance. The findings demonstrate the potential of the prepared nanomaterials as multifunctional materials for applications in antimicrobial coatings, healthcare, environmental protection, and other emerging technological fields.

Keywords: Nanomaterials, Structural Properties, Optical Properties, Antibacterial Activity, X-Ray Diffraction, Spectroscopy, Nanoparticles, Bacterial Inhibition, Green Synthesis, Biomedical Applications.

