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BIOGENIC ZnO NANOPARTICLES: STRUCTURAL CHARACTERISATION AND BIOACTIVITY EVALUATION

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Abstract. Zinc oxide nanoparticles were synthesized *via* a green route using *Nicotiana plumbaginifolia* plant extract, serving as a novel bio-reducing and stabilizing agent. Structural analysis through X-ray diffraction confirmed the hexagonal wurtzite crystalline structure, while Fourier-transform infrared spectroscopy and energy-dispersive X-ray spectroscopy affirmed the presence of Zn–O bonds and high purity. Morphological characterization by scanning electron microscopy and transmission electron microscopy revealed spherical nanoparticles with sizes ranging from 16 to 24 nm. The calculated optical band gap was 3.33 eV. A prominent FTIR peak at 480 cm^{-1} indicated Zn–O stretching vibrations. The Zinc oxide nanoparticles exhibited significant antibacterial activity against *Pseudomonas aeruginosa* (18 mm), *Escherichia coli* (19 mm), *Klebsiella pneumoniae* (19 mm), and *Staphylococcus aureus* (18 mm) at 100 µL, as evaluated by the well diffusion method. Additionally, the nanoparticles showed strong antioxidant activity, achieving 75.59% DPPH radical scavenging at 250 µg/mL, indicating potential biomedical applications.

Keywords: Green synthesis, ZnO nanoparticle, EDX, FT-IR, SEM, antibacterial activity, antioxidant activity.

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