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Green synthesis of zinc oxide nanoparticles using *Pandanus ceylanicus* leaf extract and investigation of their antibacterial activity

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Zinc oxide nanoparticles (ZnO NPs) are well known for their unique optical, photocatalytic, antibacterial and other properties due to their nanoscale size, high surface area and wide band gap, making them valuable in environmental and biomedical applications. This study reports the green synthesis of ZnO NPs using aqueous leaf extract of *Pandanus ceylanicus* as a natural reducing and stabilizing agent. This approach offers an eco-friendly alternative to conventional chemical and physical routes, minimizing the use of hazardous reagents and environmental impact. The NPs were synthesized using zinc nitrate as the precursor at a 0.2 mol dm-3 concentration, with a plant extract to precursor ratio of 1:1, at pH 12 and a temperature of 50 ºC. They were then characterized using UV-Visible spectroscopy, Fourier Transform Infrared spectroscopy (FTIR), X-ray Diffraction (XRD) and Scanning Electron Microscopy (SEM) to examine their optical properties, crystal structure, and surface morphology. The UV-Visible spectrum exhibited a distinctive peak at 359 nm confirming their formation and further characterization was performed. These green synthesized ZnO NPs have upsurge in applications across various sectors, including antibacterial activity which has gained a considerable attention, making them promising candidates for combating antibiotic resistant bacteria. Accordingly antibacterial activity was investigated against *Staphylococcus aureus* (Gram-positive, ATCC 25923) and *Escherichia coli* (Gram-negative, ATCC 25922). Results indicated that the inhibitory effect of the NPs increased proportionally to the NP concentration. It exhibited higher antibacterial activity against *S. aureus* with a minimum inhibitory concentration of 7000 µg/mL, compared to *E. coli*, which showed inhibition only at 40,000 µg/mL. This observed higher antibacterial activity of NPs against Gram-positive bacteria compared to Gram-negative bacteria is attributed to differences in their cell wall structure and interactions with the NPs, which is consistent with previously reported studies. Further studies on the antibacterial activity of these green synthesized ZnO NPs are underway, focusing on their underlying mechanisms and potential biomedical applications.

Keywords:

Pandanus ceylanicus; ZnO nanoparticles; Green synthesis; Antibacterial activity.