Green Synthesis of Ag and Zn Nanoparticles for Water Pollutant Treatment

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***Abstract*—**The synthesis of metal oxide nanoparticles (MONPs) from plants presents an eco-friendly and cost-efficient alternative to traditional methods in bioremediation. In this study, a green synthesis approach was employed using the extract of Phoenix dactylifera L. (date palm) leaf to fabricate silver (Ag) and zinc (Zn) nanoparticles. The synthesized nanoparticles underwent characterization via UV-Vis spectrophotometer, XRD, and FT-IR analyses to examine their morphological, crystalline, and structural properties. Remarkably, the Ag and Zn nanoparticles exhibited strong antibacterial effects against various waterborne pathogens, such as Escherichia coli, Pseudomonas aeruginosa, and Staphylococcus aureus. The results highlighted the significant antibacterial activity of the synthesized nanoparticles against all tested pathogens. Furthermore, the catalytic efficiency of the nanoparticles in removing methyl red dye was evaluated, demonstrating that the synthesized nanoparticles achieved approximately 90% decolorization of the dye. This study not only provided environmentally friendly Nano catalysts, but also demonstrated the efficacy of green biosynthesis in producing metallic nanoparticles and showcased their potential in the treatment of pollutants.

***Keywords*—** Zno, Ago, Nanoparticles, Green Synthesis, *Antibacterial*, Dye Removal, Water Pollution

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