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(57) Abstract :

The present invention discloses a green synthesis method for silver-doped zinc oxide nanoparticles (Ag-ZnO NPs) using Datura stramonium seed extract as a natural reducing and stabilizing agent. The synthesized nanoparticles exhibit controlled size, morphology, and high stability, with silver oxide as the primary component and zinc oxide as a dopant to enhance biological efficacy. Ag-ZnO NPs demonstrate potent broad-spectrum antibacterial activity against Gram-positive (*Bacillus subtilis*, *Staphylococcus aureus*) and Gram-negative (*Pseudomonas aeruginosa*, *Pseudomonas mendocina*) bacteria, including multidrug-resistant strains. Additionally, the nanoparticles show significant antioxidant potential, effectively scavenging free radicals as confirmed by DPPH assays. The eco-friendly synthesis avoids toxic chemicals, is cost-effective, and scalable, making the nanoparticles suitable for biomedical, pharmaceutical, and nutraceutical applications. This dual antibacterial and antioxidant functionality highlights their promise as sustainable therapeutic and protective agents.

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