Synthesis of zinc oxide nanoparticles via cellar spider extract for enhanced functional properties in antimicrobial activities

ABSTRACT

This study explores the green synthesis of zinc oxide nanoparticles (ZnO NPs) using cellar spider extracts as a sustainable alternative to traditional methods involving hazardous chemicals and radiation. The spider extracts effectively reduced zinc acetate dihydrate, yielding white precipitates indicative of ZnO NPs. Characterization through SEM revealed diverse morphologies, including spherical, rod-like, hexagonal, and uneven particles forming platelet-like aggregates. Further analyses, such as HPM, 3D nanoprofiler, and EDS, provided insights into size, shape, morphology, surface chemistry, thermal stability, and optical characteristics, quantifying the intended properties of the synthesized ZnO NPs. Antibacterial assays against E. coli and B. subtilis demonstrated significant antibacterial activity, affirming the nanoparticles' potential for antimicrobial applications. This green synthesis approach, validated through comprehensive characterization and quantitative measurements, offers a promising and environmentally friendly route for producing functional ZnO NPs.