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GREEN SYNTHESIS OF ZINC OXIDE NANOPARTICLES FROM *AMARANTHUS VIRIDIS* AND *COSTUS SPECIOSUS*: PROCESS OPTIMIZATION AND ANTIMICROBIAL POTENTIAL

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Nanomaterials have been emerging as a new generation of antimicrobial agents to mitigate the crisis associated with antimicrobial resistance. Among them, Zinc Oxide Nanoparticles (ZnO NPs) stand out due to their biocompatibility and easy synthesis. The objective of this study was to explore a simple, eco-friendly method to synthesize ZnO NPs using zinc acetate dihydrate as the precursor from aqueous leaf extracts of *Amaranthus viridis* (*Kurathampala*) and *Costus speciosus* (*Thebu*). Aqueous leaf extracts of both plants were prepared, and optimization of the synthesis in response to yield, characterization and antimicrobial activity determination were conducted. The effects of precursor concentration and reaction temperature and their interactions during the synthesis were determined by response surface methodology employing the central composite design. Within the chosen range, the precursor concentration was identified as a significant variable ($p < 0.05$) as opposed to the reaction temperature in the synthesis. From the PXRD patterns, ZnO NPs were highly pure, confined to the wurtzite structure with mean crystallite sizes of 20.01 and 15.99 nm for *A. viridis* and *C. speciosus* mediated synthesis, respectively, and most effectively calcinated at 450 °C. Investigation of FTIR spectra verified functional groups in charge of stabilizing and capping of ZnO NPs. Roughly spherical particles of average sizes < 60 nm were observed from SEM imaging. In comparison to Sigma-Aldrich ZnO (< 50 nm), ZnO NPs mediated via *A. viridis* and *C. speciosus* showed a high antifungal potential against a standard isolate of *Candida albicans* (ATCC 90028). A minimum inhibitory concentration of 5.12 mg/mL against standard isolates of gram-negative bacteria *Pseudomonas aeruginosa* (ATCC 27853) and *Escherichia coli* (ATCC 25922) were obtained for the ZnO NPs synthesized *via A. viridis* and *C. speciosus* from the agar dilution method, while the effect on gram-positive bacteria was not notable. Overall, the results elucidated a rapid, cost-effective, environmentally-friendly method for ZnO NP synthesis, which showed antimicrobial potential against fungal and gram-negative bacterial strains.

Keywords: Antimicrobial activity, Central composite design, Green synthesis, ZnO nanoparticles