BIOSYNTHESIS OPTIMIZATION OF SILVER NANOPARTICLES USING PLANT EXTRACTS

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Introduction. Advanced nanotechnology is a rapidly growing scientific field that has attracted significant interest in recent years due to its many applications in biology, nanochemistry, and applied biotechnology [1]. Promising applications of sustainable biotechnology include nanobiosensors, nanofertilizers, nanobioremediation, and nano-phytopharmaceuticals. In this context, the green synthesis of nanoparticles from plant extracts is becoming more significant than the synthesis using microorganisms. Plant-based nanoparticle biosynthesis is an eco-friendly, cost-efficient, and sustainable method compared to physical and chemical synthesis methods. *Hypericum perforatum* L. extracts contain phytochemicals with various biological activities and can be used to synthesize silver nanoparticles (AgNPs) [2]. The present study aimed to investigate the phytochemicals of *Hypericum perforatum* in callus and *in vivo* plant extracts, and optimize the biosynthesis of AgNPs using these extracts.

Methods. Callus cultures of *Hypericum perforatum* L. were formed in an MS medium supplemented with either BAP (1 mg/L) and 2,4-D (1 mg/L) or TDZ (0.5 mg/L) and IAA (0.1 mg/L). The concentrations of total phenolic compounds, phenolic acids, and flavonoids were determined in *Hypericum perforatum* callus culture or *in vivo* plant extracts. AgNPs were characterized based on their optical, structural, and morphological properties using various techniques.

Results. Detailed research on the bioactive properties revealed that *Hypericum perforatum* L. callus cultures grown in an MS medium containing TDZ (0.5 mg/L) and IAA (0.1 mg/L), as well as the blossom extracts, had the highest concentration of phytocompounds. X-ray diffraction analysis confirmed the presence of pure silver phases with a face-centered cubic crystalline structure. UV-Vis spectroscopic analysis revealed a clear absorption peak at 470 nm, which is characteristic of surface plasmon resonance in AgNPs. ATR-FTIR spectra revealed several characteristic vibrational bands that corresponded to the functional groups of the biomolecules involved in the formation of the nanoparticles. The particle size of the synthesised AgNPs ranged from 23 to 50 nm, as well as SEM and TEM observations confirmed that they were mostly spherical in shape. Furthermore, energy-dispersive X-ray analysis verified that silver was the dominant elemental component of the nanoparticles.

Conclusion. The environmentally friendly synthesis of AgNPs using *Hypericum perforatum* L. plant *in vitro* and *in vivo* extracts, which are rich in bioactive metabolites such as total phenolic compounds, phenolic acids, and flavonoids, provides a unique, renewable resource for the biosynthesis of nanoparticles.

REFERENCES

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