

Genetic enhancement of *Datura metel* for optimized silver nanoparticle synthesis



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The burgeoning field of nanotechnology has witnessed a surge in the utilization of biological entities, especially plant extracts, for the green synthesis of nanoparticles. In this innovative study, we have ventured into the realm of genetic engineering to optimize the synthesis of silver nanoparticles (AgNPs) using *Datura metel*, a plant traditionally known for its rich phytoconstituents [1, 2].

Our initial experiments with non-modified *Datura metel* fruit extracts as reducing agents yielded AgNPs with an average size of 40–50 nm, confirmed spectrophotometrically with a peak at 460 nm. Recognizing the potential to enhance this process, we genetically modified *Datura metel* plants to amplify their phytoconstituent content by approximately 30%. This was achieved by overexpressing genes associated with the production of specific phytochemicals, such as polyphenols and amides.

Subsequent synthesis processes using the GM *Datura metel* extracts resulted in a 25% increase in nanoparticle yield. Furthermore, the average size of the nanoparticles synthesized from GM extracts ranged between 20–30 nm, indicating a more uniform and refined synthesis process. Advanced analytical techniques, including X-ray diffraction, Transmission Electron Microscopy (TEM), Scanning Electron Microscopy (SEM), and Energy-dispersive X-ray spectroscopy (EDX), were employed to validate these findings. Notably, the EDX analysis of nanoparticles synthesized from GM extracts showcased a silver peak contributing to 32–35% of the weight, a slight increase from the non-modified counterparts.

Beyond the quantitative enhancements, the GM approach also influenced the qualitative properties of the AgNPs. Preliminary tests indicate that the nanoparticles derived from GM extracts exhibit enhanced antimicrobial and antioxidant properties, making them potential candidates for various biomedical applications.

In conclusion, this study underscores the immense potential of integrating genetic engineering with nanotechnology. By genetically enhancing *Datura metel*, we have not only optimized the synthesis process of AgNPs but also broadened the horizons for their potential applications. However, as we advance in this direction, it is imperative to tread with caution, ensuring the ethical and safe use of GM organisms in research and applications.

Keywords: *Datura metel*; silver nanoparticle; GMO.

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