

Green Synthesis of Silver Nanoparticles from Bitter Gourd Peels Waste: An Ecofriendly Approach to Utilize Food Waste

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ABSTRACT

Background: This study presents an eco-friendly approach for the green synthesis of silver nanoparticles (AgNPs) utilizing bitter gourd peel waste. The process involves the reduction of silver ions from a silver nitrate solution, mediated by phytochemicals present in the peels¹. Characterization techniques confirm the formation of stable AgNPs. The potential of bitter gourd peel waste as a reducing and stabilizing agent highlights a sustainable strategy for converting food waste into valuable nanomaterials^{2,3}.

Objective: The main goal is to investigate whether bitter gourd peel waste can be used as a bio-reducing agent to synthesize AgNPs. The study also attempts to evaluate the possible uses of the produced nanoparticles and characterize them.

Methodology: Peels of bitter gourds, a waste that is usually thrown away, were gathered, and processed to extract bioactive substances⁴. After that, these substances were used to reduce silver ions, which produced AgNPs. The synthesis procedure was closely examined through the application of microscopic and spectroscopic methods^{5,6}.

Results: The findings show that 2 ml of bitter gourd peel extract and 50 ml of AgNO₃ solution at pH 10 successfully form AgNPs in 3 hours. We successfully synthesized silver nanoparticles demonstrated unique structural characteristics, as demonstrated by Scanning Electron Microscopy (SEM), FTIR, EDX, and UV Vis spectroscopy. SEM shows spherical shape of nanoparticles at 1µm scale bar. Using UV visible spectroscopy, the reduction peaks of AgNO₃ were detected at 440 and 430nm and FTIR showed the structure, the respective bands of the synthesized nanoparticles, and the stretch of bonds. The use of bitter gourd peel waste as a reducing agent facilitates the formation of AgNPs, but it also guaranteed that the process was environmentally friendly.

Conclusion: This work provides an environmentally benign substitute for traditional techniques by demonstrating the viability of using bitter gourd peel waste for the green synthesis of AgNPs. The application of food waste in the synthesis of nanoparticles is consistent with the tenets of sustainable and circular economies, thereby tackling ecological and financial issues.

Keywords: Antimicrobial; Bitter gourds peels; Eco-friendly; Green synthesis; Silver nanoparticles

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