

Green Synthesis of Silver Nanoparticles using Five Varieties of Leaf Extracts from *Annona* Species: Evaluation of Antioxidant, Photocatalytic Properties, and Antibacterial Properties

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The development of eco-friendly and sustainable methods to synthesize silver nanoparticles (AgNPs) is a rapid field in nanotechnology due to its eco-friendly nature. In this study, five varieties of *Annona* leaves (*Annona muricata*, *Annona reticulata*, *Annona squamosa* green, *Annona squamosa* red, and *Annona glabra*) were used to synthesize AgNPs and the photocatalytic, antioxidant, and antimicrobial properties were investigated. One mL of AgNO₃ solution was mixed with 9 mL of the extract. Initially, the formation of AgNPs was observed by a colour change at room temperature after 24 hours. AgNPs were further confirmed by the UV-Vis spectroscopy which displayed a plasmon resonance peak between 420-440 nm. The size and shape of the AgNPs were analyzed by the scanning electron microscope and the analysis showed that AgNPs are spherical with a size of ≈40 nm. The antioxidant properties were analyzed by total flavonoid, total phenolic, and total antioxidant contents. All three antioxidant assays confirmed that the AgNPs have higher antioxidant activity than their respective water extracts. The photocatalytic activity of 267 ppm and 4000 ppm *Annona squamosa* red AgNPs was analyzed using methyl red under sunlight. The degradation of methyl red was achieved within 75 minutes. The antibacterial properties of AgNPs and the water extracts were analyzed against *E. coli* and *S. aureus* using the well diffusion method and showed a significant difference ($p= 0.001$ and 0.03 respectively) in the zone of inhibition. Therefore, the results confirmed that the green synthesis AgNPs from five varieties of *Annona* plants can be used in a variety of medical applications.

Keywords: silver nanoparticles, annona leaves, green synthesis, antioxidant, photocatalyst, antimicrobial