

An ecological approach for the green synthesis of silver nanoparticles using leaf extracts of six species of genus *Adiantum* and assessing their antibacterial, antioxidant and photocatalytic activity

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Biogenic synthesis of nanoparticles (NPs) is an efficient replacement of chemical and physical synthesis systems burdened with heavy cost and toxicity. Moreover, eco-friendly synthesis of metallic NPs is currently flourishing due to its wide applications in many fields of science, may it be in medicine or the sustainable development of the environment. This research focuses on the first report of synthesis of metallic silver nanoparticles (AgNPs) which were biosynthesized using six species of the genus *Adiantum* commonly known as Maiden-hair ferns. The six species which were utilized for the synthesis possess their own specialized uses in ethno medicine in different regions of the world ranging from Asia to Europe. While all six samples produced AgNPs they were first optimized under different time and temperature scales. Water extracts of the plant sample and AgNPs were assessed for antioxidant activity via Total Flavonoid Content (TFC), Total Phenol Content (TPC), Total Antioxidant Capacity (TAC), DPPH and IC50 assays. Photocatalytic activity of AHI (*Adiantum hispidulum*), the best sample of synthesized nanoparticles, was observed by the degradation of methylene blue. Antibacterial activity was tested using two common bacterial species *Escherichia coli* and *Staphylococcus aureus*. The TPC, TFC and TAC assays indicated high antioxidant capacity in synthesized AgNPs but contradictorily DPPH and IC50 showed lower antioxidant activity. The assessment of photocatalytic activity against methylene blue dye showed different rate constants for 100 and 500 ppm samples insinuating that concentration may enhance rate of degradation. TEM results of AHI AgNPs showed that their shapes as spherical, rod shaped, rectangular and triangular NPs. The sizes varied from 15nm-50nm. Antibacterial activity of AgNPs was higher in both *Escherichia coli* and *Staphylococcus aureus*. Thus, AgNPs biosynthesized from decorative and wild-grown species of genus *Adiantum* of which extraordinary medicinal and antibacterial properties have not been grasped by many is applicable in many industries around the world and can aid in the sustainable maintenance of the environment with nanotechnology.

Keywords: Nanoparticles, DPPH, Green-synthesis, Eco-friendly, Antibacterial

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