

## Green synthesis and detection of antioxidative, photocatalytic and antibacterial properties of silver nanoparticles synthesized from *Psidium* spp. Leaves extract

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In the ever-growing field of nanotechnology, synthesis methods that use bioproducts have been proven to be a safe, non-toxic alternative to toxic chemical compounds and traditional ways of manufacture. The research presented was performed to synthesize silver nanoparticles using the green synthesis method from six species of *Psidium* (Guava) leaf extracts. Five of six samples produced silver nanoparticles (AgNPs) using the optimum heating condition at 90°C for 1 hour. The AgNPs were observed under a transmission electron microscope at the Sri Lankan Institute of Nanotechnology (SLINTEC), Homagama, to determine the morphological features, which showed circular nanoparticles of 45 nm. The band-gap energy (2.95 eV) proved that the synthesized guava AgNPs were indeed semiconductors. Water extracts tested for phytochemicals (flavonoids, quinones, carbohydrates, proteins, saponins, steroids, tannins, terpenoids and anthraquinones), showed all positive results for the apple guava and variegated guava samples. The antioxidant content of AgNPs and water extracts were determined using Total Flavonoid Content (TFC), Total Phenolic Content (TPC), Total Antioxidant Content (TAC) tests and radical scavenging methods such as DPPH and IC50. Significant difference of antioxidant activity between AgNPs and water extracts was demonstrated by ONE-WAY ANOVA analysis at  $P < 0.05$ . There is a significant difference in TFC and TPC between AgNPs and water extracts although, a considerable difference between AgNPs and water extracts were not seen during TAC testing ( $P > 0.05$ ). The water extracts showed higher TPC, TAC, DPPH and IC50 while the AgNPs showed higher TFC. Pearson correlation demonstrated a strong positive (0.82) correlation between TAC and TPC demonstrating a simultaneous increase of both variables. Both TFC vs TAC (-0.34) and TPC vs TFC (-0.28) relationships had weak negative correlations. The degradation rate of methyl-red dye measured the photocatalytic activity of the AgNPs. The results were compared between two concentrations (100 ppm and 4000 ppm), with and without a catalyst. The degradation rate was highest with the sample of 4000 ppm with catalyst ( $R^2 = 0.74$ ). The antibacterial activity of the water extract and AgNPs were determined using the well diffusion method for *E. coli* and *S. aureus*. Water extracts showed higher zones of inhibition than AgNPs. ONE-WAY ANOVA analysis carried out on zones of inhibition observed by water extracts and AgNPs against *E. coli* and *S. aureus* showed no significant difference. The results obtained by the tests carried out on the *Psidium* water extracts and AgNP samples provide biocompatible solutions to antimicrobial therapies and azo-dye degradation due to antioxidative properties that can be used to improve the quality of life.

**Keywords:** *Psidium*, Guava, AgNPs, Total flavonoid content, Total phenolic content, Total antioxidant content, DPPH, *E. coli*, *S. aureus*.

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