ID 107

Bio-congruent Synthesis and Characterization of Silver Nanoparticles Using Aqueous Extracts of Justicia Genus Leaves: Investigation of Cytotoxicity, Antioxidant Capabilities, Antimicrobial Efficacy, Para-nitrophenol Reduction, and Photocatalytic Properties

A Premkumar[1], M Kandiah[1#], and O Perera[1]

[1]Department of Biomedical Science, School of Science, Business Management School, Sri Lanka

[#]mathi@bms.ac.lk

Nanotechnology involves precisely manipulating matter at the nanoscale. This study focused on developing non-toxic and economically sustainable "green" silver nanoparticles (AgNPs) for various versatile applications. The AgNPs in this study were synthesized from leaf extracts of the Justicia genus—specifically *J. adhatoda* (JA), J. paniculata (JPn), and J. procumbens (JPr). Qualitative phytochemical analysis of the water extracts (WE) revealed the presence of phytochemicals such as terpenoids, flavonoids, and cardiac glycosides. AgNPs were then synthesized from these species, and scanning electron microscopic analysis revealed spherical nanoparticles with diameters of 60-70nm. The AgNPs and their corresponding WE were evaluated for antioxidant potential through Total Flavonoid Content, Total Phenolic Content, Total Antioxidant Capacity, and DPPH scavenging activity. Notably, higher antioxidant activity was discovered in the synthesized AgNPs, compared to WE, with AgNPs also demonstrating lower IC_{50} for DPPH, indicating superior scavenging activity. AgNPs displayed antibacterial activity against *Staphylococcus aureus* and *Escherichia coli*. Studying their potential in bioremediation, the photocatalytic activity of AgNPs against Methylene Blue demonstrated the fastest reaction rate in 4000ppm JA-AgNPs under sunlight with NaBH4. Additionally, complete catalytic reduction of para-nitrophenol was observed within 3-11 minutes. These results were confirmed through kinetic studies, validating the catalytic properties of the AgNPs. The lack of cytotoxicity was confirmed by 100% cell viability in the brine-shrimp lethality assay when exposed to AgNPs for 24 hours. This study therefore highlights the potential of Justicia-derived AgNPs in applications ranging from treating free radical-initiated diseases to bioremediation of environmental pollutants, through a cost-effective and environmentally friendly alternative with minimal harm to organic life.

Keywords: *silver nanoparticles, biosynthesis, para-nitrophenol, photocatalytic, antioxidants, cytotoxicity*