Green Synthesis of Silver Nanoparticles Using *Hydnocarpus venenata* for Cytotoxicity and Wastewater Pollutant Degradation

P.A.Y.T. Dharmapriya[1], K.B.B. Gunaratne[1], H.O.T.O. Perera[1], M. Kandiah[*]
Faculty of Life and Medical Sciences, BMS Campus, Colombo 6, Sri Lanka
*mathi@bms.ac.lk

Frequent contamination of water bodies by toxic pollutants released from pharmaceutical and textile industries, such as para-nitrophenol (PNP) and azo dyes, has become a major environmental concern. Green synthesis of silver nanoparticles (AgNPs) has gained attention as an eco-friendly approach for pollutant remediation. This study aimed to synthesize AgNPs using aqueous extracts from six parts of *Hydnocarpus venenata* and evaluate their cytotoxicity, catalytic reduction of PNP, and photocatalytic degradation of Methyl Orange (MO). Aqueous extracts prepared from stem, bark, leaf, peel, fruit, and root were mixed with 1 mmolL^{-1} silver nitrate under varying conditions. Optimized AgNPs were confirmed by UV–Vis spectroscopy and scanning electron microscopy (SEM). Cytotoxicity was assessed using a 24 h brine shrimp lethality assay. Catalytic activity was evaluated through the reduction of PNP to p-aminophenol in the presence of $NaBH_4$, while photocatalytic degradation of MO under sunlight was monitored for up to 90 min in the presence and absence of $NaBH_4$, which facilitated electron transfer. The optimum synthesis condition was 60 °C for 30 min, where all samples showed nanoparticle formation with characteristic surface plasmon resonance peaks. SEM revealed mostly rounded to slightly irregular AgNPs with an average size of 75 nm. AgNPs showed 100% brine shrimp survival at 200 ppm and 800 ppm in all plant parts, indicating no observable acute toxicity under the tested conditions. In the catalytic assay, 4000 ppm AgNPs showed rapid PNP reduction, with complete reduction observed immediately in 0 min at 10 µL for all AgNPs. No MO degradation was observed without $NaBH_4$; however, in its presence, all AgNPs except peel- and root-derived AgNPs showed MO degradation at 4000 ppm. Although studies specifically on *H. venenata*-mediated AgNPs are limited, these findings highlight their potential as novel green nanomaterials for wastewater-related environmental applications.

Keywords: *Green nynthesis, Silver nanoparticles, Pollution, Pollutant remediation, Wastewater*