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In vitro Green Synthesis of *Artocarpus altilis* Copper Oxide Nanoparticles: A Nano-Catalytic Approach in Wastewater Treatment

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Abstract

In the industrial world, the pollution of water from toxic compounds and synthetic dyes remains a challenge to be resolved to achieve sustainable water management goals. This research was conducted to synthesis copper oxide nanoparticles (CuONPs) via a green, eco-friendly route using aqueous leaf, peel and bark extracts of Artocarpus altilis (breadfruit) also known as dell, a plant commonly found in Sri Lanka and other tropical regions. Optimal synthesis conditions of CuONPs was at 90°C for 2 hours. Phytochemical analysis confirmed the presence of flavonoids, tannins and alkaloids in the aqueous extracts, which act as reducing and capping agents in CuONP synthesis. Nanoparticle presence was confirmed by UV-Vis surface plasmon resonance peak at 580nm. Scanning Electron Microscopy revealed spherical 50nm Leaves_CuONPs. Zeta potential analysis presented a value of -34.1mV and PSA analysis revealed a value of 16.2nm for CuONPs synthesized from leaves_CuONPs. Para-Nitrophenol (PNP) catalysis took place instantly with the addition of synthesized bark, peel and leaves CuONPs. The best degradation with methyl orange (MO) was with Leaves_CuONP at 2400ppm and NaBH4 with a rate constant of 0.2643min-1. No degradation was observed with methylene blue (MB). Cytotoxicity of the nanoparticles was analyzed using Artemia salina and were observed to be 100% viable at concentrations of 5, 1 and 0.1ppm. These findings demonstrated that A. altilis-mediated CuONPs possess promising potential as catalysts in pollutant removal of PNP and MO with leaves CuONPs exhibiting the greatest performance while being used at lower concentrations to be a safe alternative method.

Keywords: *Artocarpus altilis; copper oxide nanoparticles; green synthesis; wastewater treatment*