WAT-127 ORAL PRESENTATION · WATER TRACK · NATURE-BASED WATER SOLUTIONS

Eco-Friendly Synthesis of Copper Oxide Nanoparticles from *Oryza sativa* Rice Husk Extracts for Water Pollutant Treatment

S. K. Nadeem1*, M. Kandiah[1], O. Perera[1], B. Gunaratne[1] and D. Perera[1]

[1]*Faculty of Life and Medical Sciences, BMS Campus, Colombo, Sri Lanka*

**Corresponding author: saharnadeem458@gmail.com*

DOI: https://doi.org/10.31705/ICEWSE.2026.53

Abstract

Non-degradable synthetic pollutants like azo dyes Methyl Orange (MO) and Methylene Blue (MB) released from textile effluents, and industrial chemicals like para-nitrophenol (PNP), threaten aquatic organisms, introducing the demand for low-cost, eco-friendly degradation methods. Rice husks (RHs), one of the largest underutilised agricultural wastes in Sri Lanka, can be valorised to meet this need. This study investigated eco-friendly synthesis of copper oxide nanoparticles (CuONPs) from RH extracts of five traditional Sri Lankan Oryza sativa varieties. Phytochemical analysis confirmed carbohydrates, flavonoids, phenols and tannins as capping and reducing agents, with nanoparticle synthesis optimised at 90°C for 2 hours. UV-Vis (255nm peak) and EDX confirmed the elemental composition of synthesised CuONPs. PNP catalytic degradation and MO and MB photocatalytic degradation were assessed separately across all five varieties, revealing over 30-fold variation in PNP rate constants. Kuruluthuda-derived CuONPs (KT_CuONPs) performed well across all three pollutants: PNP reduction was highest at 25 µL (0.1096 min^{-1}, R^2 0.97), MO degradation was highest at 2000 ppm (0.0045 min^{-1}, R^2 0.66), and MB degradation was highest at 2000 ppm (0.0039 min^{-1}, R^2 0.87), with Suwandal-derived CuONPs showing strong MB activity and the best model fit (R^2 0.99). Cytotoxicity analysis in Artemia salina and Danio rerio showed 100% viability across all tested concentrations, with no morphological abnormalities, indicating biocompatibility within these tested doses and organisms. Findings demonstrated that RH derived CuONPs are effective at degrading model water pollutants, supporting their potential as a low-cost, waste-derived tool for future sustainable water treatment applications, necessitating further economic and scale-up analysis.

Keywords: *copper oxide nanoparticles; green synthesis; Oryza sativa; photocatalytic degradation; rice husks; water resource management*