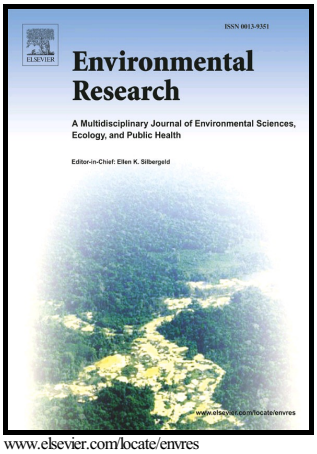


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# Green Synthesis of CuO Nanomaterials and their Proficient Use for Organic Waste Removal and Antimicrobial Application

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**Abstract**:

Copper oxide (CuO) nanomaterials (NMs) of different size and morphology were synthesized by Chemical precipitation, Microwave irradiation and Hydrothermal method and characterized by TEM, BET, FTIR, XRD and EDX analysis. As synthesized CuO NMs were utilized for elimination of harmful dyes viz. Direct Red 81 (DR-81) and Coomassie Brilliant blue R-250 (BBR-250) and pathogenic bacteria (*Staphylococcus Aureus*). Owing to their morphology, smaller size and relatively high surface area (40.320 $m^2$ $g^{-1}$), CuO NMs prepared by chemical precipitation method were observed to show better adsorption capacity for both the dyes (68.70 (DR-81) and 73.04 (BBR-250) mg $g^{-1}$). The influence of different experimental conditions was studied by the methodical assessments of various parameters such as pH, adsorbent dose, concentration and contact time. Moreover, different adsorption isotherms and pseudo-second order kinetic model were applied to understand the adsorption mechanism. Langmuir model was found to be best fit thus confirming the monolayer adsorption process. To ensure the practical utility of CuO NMs for organic waste removal, the adsorption studies were performed in the presence of different inorganic ions and real water samples. In addition, recovery of the dye and NMs were also carried out effectively by simple method, thus avoiding the secondary pollution. CuO NMs were observed to exhibit significant antibacterial activity against the human pathogenic bacteria. These studies demonstrated that synthesized CuO NMs showed good adsorption efficiency for the removal of harmful dyes and antimicrobial activity against the pathogenic bacteria, which vary as a function of size and surface area.