# Enhanced of Photocatalytic Activity of Biosynthesized ZnO/CuO/$Cu_2MgO_3$ Nanoparticles for the Degradation of Bromocresol Green

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**Abstact:**

The current investigation is centered on the sustainable synthesis, physical characterization, and performance evaluation of various metal oxide nanoparticles (NPs) produced utilizing an extract derived from Common Rue. Following the synthesis of metal oxide NPs, including ZnO/CuO/$Cu_2MgO_3$, a comprehensive characterization was carried out employing various techniques such as FTIR, UV, XRD, and SEM to scrutinize their chemical and physical attributes. Photocatalytic activity was evaluated by assessing their effectiveness in degrading bromocresol green, an anionic dye. The characterization results substantiated the successful fabrication of ZnO/CuO/$Cu_2MgO_3$ nanoparticles. X-ray diffraction analysis verified the presence of hexagonal ZnO and monoclinic CuO nanoparticles within the nanocomposite, along with cubic $Cu_2MgO_3$. Scanning electron microscopy illustrated well-defined, spherical nanocomposite particles with an average size of approximately 70 nm. Fourier transform infrared spectroscopy demonstrated the coexistence of both organic and inorganic components within the nanocomposite. These nanoparticles exhibited respective band gap energies of 1.5 eV. The study on photocatalytic activity revealed a substantial removal of the organic dye by the synthesized nanoparticles, achieving a degradation coefficient of 99.66% at 75 minutes. These findings underscore the efficacy of ZnO, MgO, and CuO nanoparticles, suggesting their potential as a cost-effective and environmentally safe alternative for water treatmen.

Keywords: Metal Oxide Nanoparticles; ZnO/CuO/$Cu_2MgO_3$; Photoactivity degradation; Biosynthesis