Synthesis and Characterization of a ZnO/CuO/Ag Composite and its Application as a Photocatalyst for Methyl Orange Degradation

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In this investigation we developed a supported photocatalytic system based on the Z-scheme. This system is of the type: zinc oxide nanorods (ZnO NRs)/cupric oxide nanoparticles (CuO NPs)/silver nanoparticles (Ag NPs). ZnO NRs were deposited electrochemically onto fluorine-doped tin oxide (FTO) thin films from $\text{Zn}(\text{NO}_3)_2$ aqueous solution. CuO NPs were obtained by a two-step synthesis involving the photodeposition of copper onto ZnO NRs, followed by heat treatment at 500°C for 1 hour. Ag NPs were deposited photochemically onto CuO NPs. Under illumination, the ZnO/CuO system follows Z-scheme charge separation and transfer mechanisms for the degradation of organic pollutants. The Ag nanoparticles on the CuO surface act as an electron scavenger from the conduction band, thus reducing the electron-hole recombination within the semiconductor. The photocatalytic activity was tested for the degradation of methyl orange.

Keywords: Heterogeneous photocatalysis, Z-scheme, zinc oxide, cupric oxide, photodeposition.

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