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p-CoFe₂O₄/n-AgCl-based photocatalyst for efficient removal of organic dyes from wastewater under visible light

Billal Brahimi^{1,*}, Elhadj Mekatel¹, Mounir Mellal², Mohamed Trari³

¹Laboratory of Transfer Phenomena, Faculty of Mechanical Engineering and Process Engineering, USTHB, BP 32, Algiers, Algeria, E-mail: bbrahimi@usthb.dz

²Laboratory of Valorisation and Recycling of the Material for Sustainable Development, Faculty of Mechanical Engineering and Process Engineering, USTHB, BP 32, Algiers, Algeria

³Laboratory of Storage and Valorisation of Renewable Energies, Faculty of Chemistry, USTHB, BP 32, Algiers, Algeria

A B S T R A C T

The widespread use of synthetic dyes in textile industries has raised environmental concerns due to their high stability and potential toxicity in water systems. In this context, the heterosystem (p-CoFe₂O₄/n-AgCl) was synthesised and evaluated for its photocatalytic performance in the degradation of Acid Orange 61 (AO61), a common azo dye in industrial wastewater. A simple precipitation–deposition method was employed for the synthesis of the composite to enhance the visible-light-driven activity of AgCl. Structural characterisation was performed via X-ray diffraction (XRD), and surface morphology was examined using scanning electron microscopy (SEM). A direct optical gap of 1.46, 3.20, and 2.22 eV was deduced for the CoFe₂O₄ (CFO), AgCl, and CFO/AgCl (25%/75%) samples, respectively, with CFO acting as a photosensitiser to enhance the photocatalytic performance of AgCl. The photocatalytic degradation was optimised with respect to mass ratio and catalyst dose. Under optimal conditions: CFO/AgCl (25%/75%), 1.25 g/L, pH ≈ 6, C₀ = 50 mg/L, a degradation efficiency of 93% was achieved within 240 min. The improved activity is attributed to efficient charge separation and enhanced electron transfer within the heterojunction.

Keywords: Heterosystem (p-CoFe₂O₄/n-AgCl); Photodegradation; Wastewater; Acid Orange 61 (AO61); Visible light

*Corresponding author