

ABSTRACT

Photocatalysis utilizing semiconductor materials is currently considered an environmentally friendly and effective method for the degradation of organic pollutants. Alumina extracted from Lapindo mud was used as a precursor of γ - Al_2O_3 in the synthesis of $\text{CuO}/\gamma\text{-Al}_2\text{O}_3$ composites by the sonication-hydrothermal method using a stearic acid template. This study aims to synthesize $\text{CuO}/\gamma\text{-Al}_2\text{O}_3$ composites and determine the effect of the mole ratio of Cu/Al (1:0, 0:1, 0.5:1, 1:1, 1.5:1, and 2:1) on the characteristics and photocatalytic activity of the composites in degrading methylene blue. The synthesized composites were analyzed using XRD, FTIR, and UV-Vis DRS, while the photocatalytic activity was tested using UV-Vis spectroscopy. The results showed that the extracted alumina had a content of 87.2%. XRD, FTIR, and UV-Vis DRS analyses confirmed the successful synthesis of the $\text{CuO}/\gamma\text{-Al}_2\text{O}_3$ composites. The 1:1 Cu/Al ratio composite showed the highest crystallinity of 62.53%, with a crystallite size of 22 nm and a band gap of 1.47 eV. The photocatalytic activity test under visible light of 665 nm showed that the 1:1 Cu/Al ratio composite had the best photocatalytic activity compared to other ratio variations with a degradation percentage of 73.33%. Kinetic analysis showed that the photodegradation process followed a pseudo-first-order model with a rate constant of 0.0089 min^{-1} . The results of this study indicate that the $\text{CuO}/\gamma\text{-Al}_2\text{O}_3$ composite has the potential to be used as an active photocatalyst material in the visible light region.

Keywords: Degradation, photocatalyst, composite $\text{CuO}/\gamma\text{-Al}_2\text{O}_3$, Lapindo mud, methylene blue

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