ABSTRACT

This study utilizes Lapindo mud as a source of alumina (Al_2O_3) which will be composited with CuO to determine its potential as an environmentally friendly catalyst in the degradation process of Methylene Blue (MB) dye. The purpose of this study is to synthesize and characterize CuO/γ-Al_2O_3 composites and determine their ability to photocatalyze Methylene Blue (MB) degradation. The initial stage of the study was carried out by extracting Al_2O_3 from lapindo mud which will be characterized using X-Ray Fluorescence (XRF). The synthesis of CuO/ γ-Al_2O_3 composites with the help of microwave irradiation was carried out with variations in the mole ratio of Cu/Al, then characterized using Fourier Transform Infrared Spectroscopy (FTIR), X-Ray Diffraction (XRD), and Diffuse Reflectance Spectroscopy UV-Vis (UV-Vis DRS). The application of this study is to degrade Methylene Blue (MB) dye waste under visible light irradiation. The XRF characterization results showed that Al_2O_3 had a purity of 87.18%. XRD analysis showed the formation of CuO and γ-Al_2O_3 phases with the best crystallinity of 89.77% in the C1A1 variation. The FTIR spectrum showed the presence of Al–O groups in the range of 700–689 cm^{-1}, Al–OH at 1386–1378 cm^{-1}, and Cu–O at 556–545 cm^{-1} which indicated the successful formation of the composite. The band gap value was in the range of 1.89–5.55 eV. The C1A1 variation was the best variation for photocatalysts using visible light. Adsorption reached equilibrium at 60 minutes with a total adsorption of 8.43%. Total photodegradation after 360 minutes was 32.76%. The photodegradation process follows a pseudo-first-order kinetic model with a rate constant of 0.0016 min^{-1}.

Keywords: lapindo mud, CuO/γ-Al_2O_3, methylene blue (MB), photodegradation