ABSTRACT

Water pollution by methylene blue (MB) waste from the textile, paper, and healthcare industries has become a serious environmental problem. This compound is persistent, toxic, and potentially carcinogenic, with concentrations in industrial waste reaching 10-200 mg/L. This study developed a CuO/GO composite as an alternative material for MB adsorption by utilizing the adsorption properties of graphene oxide (GO) with its high surface area and hydrophilic properties, as well as the photocatalytic activity of CuO. The objectives of this study were to synthesize and characterize the CuO/GO composite and evaluate its performance in adsorbing MB. GO was synthesized using a modified Hummer's method, while CuO was synthesized through a chemical precipitation method. The CuO/GO composite was then characterized using FTIR for functional group identification, XRD for crystal structure analysis, and gas adsorption-desorption analysis (GSA) for pore texture determination. Adsorption performance tests were conducted with varying contact times to study the MB adsorption kinetics. The characterization results showed that the CuO/GO composite was black with a yield of 80.1%. FTIR analysis identified the functional groups O-H (3383.57 cm^{-1}), C=O (1735.17 cm^{-1}), C=C (1575.83 cm^{-1}), C-O-C (1086.34 cm^{-1}), and Cu-O (600.26 cm^{-1}). The composite had a crystallinity of 23.18% with a specific surface area of 12.914 $m^2 \cdot g^{-1}$, a pore volume of 0.026 $cm^3 \cdot g^{-1}$, and a largest pore diameter of 7.764 nm. The acidity value of the material was 6.597 $mmol \cdot g^{-1}$. The adsorption test results showed that the adsorption kinetics of MB followed a pseudo-second-order model with a rate constant of 1.292 $g \cdot mg^{-1} \cdot min^{-1}$.

Keywords: CuO/GO composite, adsorption, methylene blue