ABSTRACT

Heavy metal contamination in wastewater poses a serious environmental problem due to its toxicity and persistence in aquatic ecosystems. This study aims to synthesize and evaluate the potential of Fe_3O_4–Clay composites as adsorbent materials for heavy metal removal. The composites were synthesized using an impregnation method with three sample variations: Sample 1 (5 gram bentonite and 5 gram KOH), Sample 2 (4.5 gram bentonite, 4.5 gram KOH, and 1 gram Fe_3O_4), and Sample 3 (4 gram bentonite, 2 gram KOH, and 4 gram Fe_3O_4). Material characterization was carried out using Fourier Transform Infrared Spectroscopy (FTIR) and Brunauer–Emmett–Teller (BET) analysis. FTIR results indicated the presence of Fe–O and Fe–O–Si bonds, confirming the formation of the composite. BET analysis showed a maximum specific surface area of 22.056 m^2/g, an average pore size of 41–49 nm, and a total pore volume of approximately 0.22 cm^3/g, indicating a mesoporous structure. These results demonstrate that increasing the Fe_3O_4 composition enhances the number of active sites and improves the adsorption potential of Fe_3O_4–Clay composites for heavy metal removal from wastewater.

Keywords: *Fe_3O_4–Clay, adsorption, surface area, heavy metals, wastewater*