

Title: Hydrogel synthesis: Incorporating hydrophobically modified graphite oxide with Mg₂Al LDH and alginate coating for evaluating multifarious adsorption utility

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Abstract: Addressing diverse water pollutants exposes limitations in specialized methods, requiring costly multi-approach solutions and facing broad acceptance challenges. This study confronts challenges through an in-depth exploration of synthesizing and characterizing the novel Alg[hGO/LDH] hydrogel. This hydrogel, composed of hydrophobically modified graphite oxide (hGO) and Mg₂Al layered double hydroxide (LDH), coated with alginate, is meticulously designed using a unique approach to incorporate diverse active sites for adsorbing contaminants within a single material. XRD analysis verifies the effective bonding of hGO to LDH, as indicated by the stepwise formation of the product. FTIR spectra underscore the incremental modification from graphite to Alg[hGO/LDH], revealing various exposed functional groups capable of binding through distinct attractive forces. N₂ adsorption/desorption isotherm indicates microporous characteristics, with a BET specific surface area 38.61 m² g⁻¹ and an average pore diameter 22.57 nm. At a temperature of 25 °C, Alg[hGO/LDH] showcases versatile pH-dependent adsorption behavior towards pollutants, including methylene blue, ibuprofen, naphthalene, arsenic, and lead with removal rates measured at 22.2 %, 20.6 %, 0.7 %, 19.1 %, and 99.9 %, respectively. Mechanistic insights into its sequential formation and adsorption processes highlight electrostatic, π - π interactions, and anion exchange processes. Alg[hGO/LDH] exhibits versatility, promising effectiveness in diverse component adsorption for environmental remediation applications.

Keywords: Water pollutants, Environmental remediation, Adsorption, Hydrogel, Microporous structure, PH-dependent adsorption, Methylene blue

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