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Adsorption of anionic dyes from aqueous solution using polyelectrolyte PDADMAC-modified-montmorillonite clay

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ABSTRACT

A novel polyelectrolyte poly diallyl-dimethyl-ammonium chloride (PDADMAC)-modified-montmorillonite was evaluated as low-cost adsorbent material to eliminate anionic dyes, namely congo red (CR) and methyl orange (MO), from the aqueous phases via batch adsorption experiments. The PDADMAC-modified-montmorillonite samples were characterized using X-ray diffraction, Fourier transform infrared, scanning electron microscopy, surface area measurement (Brunauer–Emmett–Teller method), zeta potential, and thermogravimetric analysis techniques. The sorption of anionic dyes on PDADMAC-modified-montmorillonite was studied. The experimental results demonstrated that the adsorption of anionic dye differs when varying pH and temperature values. In the presence of interfering anions (SO_4^{2-}, CO_3^{2-}, and HPO_4^{2-}), a decrease in the CR and MO adsorbed amounts were observed. These results highlight the pertinence of PDADMAC-modified-montmorillonite adsorbent for the removal of organic dyes from water contaminated. For both two anionic dyes, the investigations of sorption kinetics and isotherm model indicated that the adsorption kinetic was described better by the pseudo-first-order model, and the equilibrium data obtained were well-described by the Langmuir model. The removal efficiency of PDADMAC-modified-montmorillonite were beyond 90.7% and 69.2% of CR and MO dyes, respectively, showing that the PDADMAC-modified-montmorillonite can be utilized as an efficient adsorbent for anionic dye removal. The calculated thermodynamic parameters showed the spontaneous sorption of CR and MO on PDADMAC-modified-montmorillonite, and also its endothermic character.

Keywords: Dyes; Clay; Surfactant; Adsorption; Montmorillonite

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