Microwave-assisted preparation and characterization of organo-attapulgites and comparison for 1-naphthol removal: equilibrium, kinetic, and thermodynamic studies

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\textbf{ABSTRACT}

In this study, Na-attapulgite (Na-APT) was modified with octadecyl trimethyl ammonium chloride (OTMAC), sodium dodecyl sulfate (SDS), and the mixture of OTMAC and SDS using microwave-assisted technique. The prepared organo-attapulgites were characterized in detail. The combined analysis of characterizations indicated that surfactants were successfully introduced on the surfaces of attapulgite. A batch technique was adopted to investigate the removal efficiency of organo-attapulgites toward 1-naphthol under environmental conditions. The results showed that pseudo-second-order model and intraparticle diffusion model simulated the adsorption kinetic data better than that of pseudo-first-order model. The adsorption of 1-naphthol by organo-attapulgites fit reasonably well to Langmuir, Freundlich, and linear isothermal models. The negative values of $\Delta G^\circ$ and $\Delta H^\circ$ obtained from thermodynamic study indicated the spontaneous and exothermic nature of 1-naphthol adsorption on Na-APT and organo-attapulgites. Based on the experimental results, it could be deduced that the mechanism of 1-naphthol removal was a combination of surface adsorption and partitioning mechanism. The maximum adsorption capacity of organo-attapulgites for 1-naphthol was in the sequence of OTMAC/SDS-APT > OTMAC-APT > SDS-APT, which suggested that OTMAC/SDS-APT could be potentially used as a cost-effective material for the purification of actual organic contaminants-bearing effluents.

\textbf{Keywords:} Organo-attapulgite; 1-naphthol; Adsorption; Microwave-assisted technique; Removal mechanism

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