Intercalation and configurations of organic dye acridine orange in a high-charge montmorillonite as influenced by dye loading

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ABSTRACT

Cationic dyes have strong affinity for negatively charged particle surfaces. The uptake of cationic dyes by clay minerals was attributed to cation exchange. In this study, the mechanism of acridine orange (AO) interaction with a high-charge swelling clay and its interlayer configuration were studied by batch studies, Fourier transform infrared, derivative thermal gravity, and X-ray diffraction (XRD) analyses and assisted by molecular dynamic simulation. At lower loading levels up to 0.8 mmol/g of the clay mineral, the uptake of AO was mainly attributed to cation exchange. At higher AO uptake levels, AO molecular association into a horizontal bilayer would be anticipated in the interlayer of montmorillonite as deduced by the d-spacing expansion on XRD patterns and supported by molecular dynamic simulation. Both the external and internal sorption sites and higher AO adsorption capacity made montmorillonite a superior candidate for the removal of cationic dyes.

Keywords: Adsorption; Cation exchange; Clay minerals; Dye; Intercalation; Interlayer

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