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Efficient removal of cationic dyes from aqueous solutions by polydopamine functionalized NH_2-MIL-53(Al)

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ABSTRACT

Polydopamine (PDA) functionalized NH_2-MIL-53(Al) nanoparticles (NH_2-MIL-53(Al)@PDA NPs) were successfully prepared by a facile *in-situ* polymerization method for the first time and characterized by various methods, including transmission electron microscopy (TEM), scanning electron microscopy (SEM), Fourier transform infrared (FT-IR) spectroscopy, X-ray diffraction (XRD) analysis, and Brunauer-Emmett-Teller (BET) analysis. The prepared NH_2-MIL-53(Al)@PDA NPs were used to remove cationic dyes crystal violet (CV) and malachite green (MG) from aqueous solutions. The maximum removal efficiency of NH_2-MIL-53(Al)@PDA NPs for CV and MG reached 95.94% and 77.88% at pH 10.0 and 8.0, respectively. Compared with NH_2-MIL-53(Al), NH_2-MIL-53(Al)@PDA NPs showed better adsorption capacity and removal efficiency. The adsorption of cationic dyes on NH_2-MIL-53(Al)@PDA NPs might be attributed to hydrogen bonding, electrostatic, and π-π interactions. The results indicate that pseudo-second-order models and Freundlich isotherm are a better fit for CV and MG adsorption. Adsorption thermodynamic tests showed that the adsorption was spontaneous, irreversible, and endothermic. NH_2-MIL-53(Al)@PDA NPs can be used for five times with no loss in absorption efficiency.

Keywords: Metal-organic frameworks; NH_2-MIL-53(Al)@PDA; Adsorption; Cationic dyes

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