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Cr(III) Removal from Simulated Solution Using Hydrous Magnesium oxide Coated Fly Ash: Optimization by Response Surface Methodology (RSM)

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Abstract

Hydrous magnesium oxide coated fly ash (MFA) has environmental remediation potential by providing a substrate for the adsorption of aqueous Cr(III). Aqueous Cr(III) adsorption onto MFA was examined as a function of MFA dosage, pH and initial Cr(III) concentration with the Box-Behnken approach used for experimental design and optimization using response surface methodology (RSM). pH and dosage (dosage and concentration) have significant interactive effects on Cr(III) adsorption efficiency. Analysis of variance shows the response surface quadratic model is highly significant and can effectively predict the experimental outcomes. Cr(III) removal efficiency of 98% was obtained using optimized conditions of MFA dosage, pH and initial Cr(III) concentration of 1.57 g L^{-1}, 4.11 and 126 mg L^{-1}, respectively. Cr(III) adsorption onto MFA is mainly attributed to the interaction between Cr(III) and the functional group –OH of the hydrous magnesium oxide, in all probability caused by chemisorptions. The results of this study can conduce to reveal the interactions between Cr(III) pollutant and MFA characteristics, posing important implications for the cost-effective alternative adsorption technology in the treatment of heavy metal containing wastewater.

Keywords: Hydrous magnesium oxide; Fly ash; Cr(III) removal; Optimization; Response surface methodology (RSM)