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Adsorption behavior of tungstate on montmorillonite as a function of pH, ionic strength and competitive anion

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ABSTRACT

A better understanding of adsorption mechanism is vital for the effective reduction of tungsten mobility and potential human health risk such as its suspected link to the childhood leukemia clusters. This study investigated tungstate (WO_4^{2-}) adsorption characteristic onto montmorillonite under environmentally relevant solution properties such as the influence of reaction time, solution pH, initial concentration, the competitive anion (PO_4^{3-}), and ionic strength. The results of the adsorption isotherm studies suggested that both the Langmuir (R^2 = 0.9117) and Freundlich (R^2 = 0.9913) equations can be well consistent with WO_4^{2-} adsorption process and the maximal WO_4^{2-} adsorption capacity was 26.73 mmol kg^{-1}. The amount of WO_4^{2-} adsorbed onto montmorillonite strongly dependent on pH and slightly dependent on ionic strength. Specifically, WO_4^{2-} adsorption reached the maximum (17.41 mmol kg^{-1}) at pH 4.15, but becoming negligible (<10%) when pH increase above 9. PO_4^{3-} competed for adsorption sites on montmorillonite with WO_4^{2-}. The results of this study indicated that the adsorption mechanism of WO_4^{2-} onto montmorillonite involved ion exchange, inner-sphere surface complexation reaction, and electrostatic attraction. Collectively, our study will aid the understanding of tungsten fate and these results suggest that montmorillonite can be advantageous to the adsorption and recovery of tungsten from real wastewater.

Keywords: Montmorillonite; Tungstate; Adsorption

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