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Adsorption and Desorption of Heavy Metals onto Natural Clay Material: Influence of Initial pH

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Abstract:

The adsorptive capacity of natural clay materials towards adsorption of heavy metals as well as the heavy metals competitive adsorptive/desorptive selectivity sequences are greatly influenced by operating conditions. In this study, competitive adsorption of heavy metal ions (Cd, Cr, Cu, Pb and Zn) on natural clay was investigated in order to understand the influence of initial pH on the clay mineral adsorptive capacity and the heavy metals adsorption/desorption selectivity sequences. Batch adsorption and desorption experiments were performed at six different initial pH values (2, 4, 6, 8, 10 and 12). The amount of heavy metals removed at equilibrium in single and multi-component adsorption scenarios were analyzed and interpreted using distribution coefficients followed by selectivity sequence. The results indicated that the selectivity sequence of clay changed with pH for both Single Component (SC) and Multi-Component (MC) scenarios. The selectivity sequence of heavy metal ions on the adsorbent for the single component and multi-component scenarios were Cr>Pb>Cu>Cd>Zn and Cr>Cu>Pb>Cd>Zn, respectively while for multi-component desorption, the selectivity sequence was Cr<Cd<Cu<Pb<Zn. From the results, Pb ions became highest selective at pH 4 and 6 (SC scenario) but exchanged position with Cd ions in alkaline condition (pH 12). The initial pH plays a significant role in competitive adsorption and desorption of the heavy metals onto the clay mineral.