A Study on Selenium Oxyanions Adsorbed onto Iron/Manganese/Aluminum Oxides

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Abstract: Adsorption is one of the most important pathways for selenium (Se) infiltrating the solid deposits in supergene environment. In order to clarify the adsorption behavior of Se oxyanions and its influencing factors, we selected hematite, manganese dioxide and aluminum oxide as adsorbents, and applied batch experiments to research the effects of pH, Se concentration and contacting time on adsorption. Results show that the optimum pH range for attaining maximum adsorption should be 4–6. At pH = 5 and room temperature, the maximum selenite adsorptions of hematite, manganese oxide and aluminum oxide are approximately 1.62×10^{-3}, 0.33×10^{-3}, and 1.07×10^{-3}, respectively while the maximum selenate adsorption of hematite, manganese oxide and aluminum oxide are approximately 1.0×10^{-3}, 0.0×10^{-3}, and 0.55×10^{-3}, respectively. These adsorptions completely fit with the Langmuir isotherm and the stoichiometric adsorptions are close to the maximum adsorptions. The pseudo-first and pseudo-second order, Elvoich equations and intra-particle diffusion models were used to fit the experimental data, indicating that the pseudo-second-order kinetics model could best describe the adsorption behaviors. This result demonstrates that the adsorption process of SeO_3^{2-}/SeO_4^{2-} on Fe/Mn/Al oxide surface are complicated, which may involve surface physical adsorption and particle diffusion.

Keywords: iron/manganese/aluminum oxide; selenium oxyanion; equilibrium isotherm; kinetics