Modeling Adsorption-Desorption Processes of Cd on Montmorillonite

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Abstract: Adsorption-desorption of Cd to Ca montmorillonite (SAz-1) was studied at concentrations ranging from 44.5 to 266.8 μ*M*. An adsorption model was employed in the analysis of the data. The procedure consists of solving the electrostatic Gouy-Chapman equations and calculating adsorbed amounts of the cations as the sum of the cations residing in the double-layer region, and the cations chemically bound to the surface, in a closed system. The model also accounts explicitly for cation complexation in solution. The model yields good predictions for the adsorbed amounts of Cd, Ca and Mg, by employing binding coefficients from previous studies for the divalent cations and for Na, K and $CdCl^+$. The model calculations also yield good predictions for the apparent hysteresis observed in the adsorbed amounts of Cd after each of 3 cycles of desorption. The apparent hysteresis is explained by the reduction in the total concentrations of Ca and Mg in desorption cycles, and the corresponding increase in the magnitude of the surface potential. Our estimates indicate that adsorption of Cd is mostly to planar, rather than edge sites of the clay mineral.

Key Words: Cadmium • Cation Adsorption Model • Hysteresis • Montmorillonite

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