

Biogeochemistry of Manganese: Case study in Venarch mine, Iran

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Biogeochemical studies of manganese were done in the Venarch Mine located in Kahak city of Iran. As the high amount of manganese has poison effect on plants and destroys common plant communities, the area's flora is unique. At First, the flora's components were detected. Afterwards, plants grown on 4 important sites of the area including 2 main ore deposits (Chahe Piroozi, Gazanke Jalal) and 2 polluted sites like the leaching and damp places and soils corresponding to were sampled. The samples were analyzed by Atomic Absorption Spectroscopy method. Subsequently, biogeochemical data was processed by GIS and the correlation between plants and soils data was estimated by the interpolation method. Besides, the pattern of manganese distribution was modelled by the IDW method. As a result, the amount of manganese in plants accumulated more than 10 mg/g manganese (25 samples) showed a good spatial correlation with soils corresponding to, as well as the sites of ore deposits. However, the change of amount of manganese in other species (90 samples) did not show any logical correlation with soils and ore deposits.

U(VI) and Sr(II) speciation at the silica/water interface determined by second harmonic generation

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The surface-specific spectroscopy of second harmonic generation (SHG) was used to study the interactions of U (VI) and Sr (II) at the mineral/water interface. Through use of SHG, uranyl ion and Sr²⁺ adsorption was monitored at a buried fused silica/water interface, in real time, under flow conditions and in the presence of environmentally relevant background electrolyte concentrations. Free energies of binding were determined for both metals from SHG adsorption isotherms. The thermodynamic results are consistent with physisorption via hydrogen bonding for both uranyl species and Sr²⁺ at the silica/water interface at pH 7. The speciation of the metal cation adsorbates was determined through a free energy versus interfacial potential analysis, which revealed that the surface-active uranyl species are either neutral or univalent, cationic species. For the case of strontium, it was determined that interfacial Sr (II) exists in one of two distinct speciations depending on the background electrolyte concentration. At electrolyte concentrations below 10 mM, the Sr (II) adsorbed as the divalent cation, Sr²⁺. Once electrolyte concentrations exceeded 10 mM, strontium adsorbates were observed to become univalent. It is postulated that an electrolyte anion becomes incorporated into the hydration sphere of the Sr²⁺ when electrolyte concentrations exceed 10 mM, leading to a singly positive adsorbate of the form [Sr²⁺(H₂O)_nX⁻]⁺. Insofar as our experimental conditions model heterogeneous geochemical environments, the thermodynamic and speciation results serve as benchmarks for computer simulations of radionuclide pollutant mobility in the environment.