Antimony oxidation and adsorption reactions on synthetic manganite

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Antimony is emerging toxic contaminant in the environment. Manganite has been reported to be present in lakes and rivers in the temperate and subarctic zones of the world, and thus, it should play an important role in the geochemical cycling of elements in these areas. Oxidation and adsorption processes critically affect the mobility of antimony in the environment. Mineral such as manganese oxides appear to be important adsorbents or oxidants for Sb in soils and sediments. In this study, antimony oxidation and adsorption onto synthetic aqueous manganite (γ-MnOOH) was investigated comprehensively. The oxidation of Sb(III) by manganite occurred on a time scale of minutes and Sb(V) was released into the suspension as soon as the reaction begins. X-ray Absorption Near Edge Structure (XANES) analyses showed that the speciation of Sb adsorbed on manganite existed dominantly as Sb(V), suggesting that manganite works as a strong oxidant. The effects of temperature on the adsorption rates of Sb(V) was investigated. Thermodynamic parameters indicated that the adsorption of Sb(V) by manganite is an exthermin processes and is spontaneous at the specific temperatures investigated. A change in ionic strength from 0.001 to 0.1 M NaNO3 had little effects on the adsorption of Sb(V) onto manganite, indicating Sb(V) forms inner sphere complexes at the mineral surface. Anions such as phosphate, sulfate, silicate and carbonate, which possibly exist in natural water, were ineffective competitors with Sb(V) for sorption sites.

Keywords: antimony; oxidation; adsorption; manganite

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