GEOC: Division of Geochemistry

174 - Effects of adsorbed Cd(II) on the Mn(II)-catalyzed transformation of hexagonal birnessite

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Hao-Jie Cui[1,3], *hjcui@udel.edu, Donald Sparks*[2]

[1] Chinese Academy of Sciences, Institution of Urban Environment, Xiamen, China; [2] Interdisciplinary Sci Engr Lab, Univ of Delaware, Newark, Delaware, United States; [3] University of Delaware, Delaware Environmental Institute and Department of Plant and Soil Sciences, Newark, Delaware, United States

Abstract: Manganese oxides are important scavengers for heavy metals in natural environments. Electron transfer and atomic exchange between aqueous Mn(II) and Mn(III/VI) oxides induce dissolution and transformation that affects the fate and transport of heavy metals. In the present work, three hexagonal birnessites previously reacted with Cd(II) (Cd240-Bir, Cd120-Bir, and Cd60-Bir) were reacted with Mn(II) at pH 7 under anoxic conditions. The results indicated that the reaction with Mn(II) reached a steady state within 30 min. The adsorbed Cd(II) had a slight effect on the removal of Mn(II). The transformation of birnessites and the release of adsorbed Cd(II) increased with longer reaction time up to 6 days. The concentration of the released Cd(II) in the solution increased with an increase in Cd(II) in the birnessites and Mn(II) concentration. For the Cd240-Bir samples, no other manganese oxide formed after reacting with 0.2-0.8 mmol/L of Mn(II) for 6 days, and only a small quantity of hausmannite (Mn_3O_4) as a product resulted after reacting with 2 mmol/L of Mn(II). Increasing the concentration of Mn(II) to 4 mmol/L resulted in the birnessites transforming to feitknechtite (β-MnOOH). However, only Mn_3O_4 formed with the birnessites reacted with lower Cd(II) contents (Cd120-Bir and Cd60-Bir) after reaction with 0.8-4 mmol/L of Mn(II) for 6 days. These results indicated that Mn(II) could catalyze the transformation of birnessite and the adsorption of heavy metals would influence the transformation in natural environments.