

Inhibition of heterogeneous As(III) oxidation by hydrous Mn(IV) oxide by mineral surface alteration

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Heterogeneous oxidation of As(III) on the surface of manganese oxides has been well characterized; however, the surface chemistry of the oxidation reaction remains poorly characterized, particularly during the initial phase of the oxidation reaction. Our methodology uses a novel flow-through column system packed with hydrous manganese(IV) oxide (HMO) coated sand. A 1 mM As(III) solution is introduced into the column, and the oxidation and retention of As on the HMO mineral surface is followed in real-time, using quick-scanning X-ray absorption spectroscopy (Q-XAS). We found that initially, only As(V) is retained on the mineral surface. However, eventually, As(III) is also retained on the HMO mineral surface. The retention of As(III) on the mineral surface coincides with the appearance of As(III) in the column effluent. Ex situ analysis of the reacted HMO, using using HR-TEM, reveals the presence of an amorphous rind on the mineral surface, which may be responsible for As(III) retention, although the injection of 1 mM phosphate results in As(III) mobilization. Future studies will investigate As(III) oxidation by biogenic Mn(IV) oxides.

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