

Rigid immobilization of antimony(V) with hydrous ferric oxide (HFO) aging

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In this study, we investigated the behavior of Sb(V) during the transformation of poorly crystalline Fe(III) oxyhydroxides (two-line ferrihydrite) with various Sb/Fe molar ratios at pH 6.0. Both XRD and Fe EXAFS analyses confirmed that goethite and hematite are the primary transformation products of the ferrihydrite in the presence of Sb(V). The crystallization kinetics showed that the transformation rate with Sb(V) was approximately the same as that of the control (without Sb(V)), which indicates that the presence of Sb(V) does not influence the transformation rate to a noticeable extent. Throughout the transformation, Sb(V) dominantly partitioned in the solid phase and no desorption of Sb(V) was observed. Furthermore, Sb EXAFS analyses suggested that Sb(V) in the solid phase is structurally incorporated into crystalline goethite and/or hematite generated by the ferrihydrite transformation. Hence, Sb(V) transfers into the thermodynamically stable solids from the metastable ferrihydrite with aging, indicating a rigid immobilization of Sb(V). These findings are valuable for making predictions on the long-term fate of Sb associated with ferrihydrite in the environments.

Keywords: ferrihydrite, XAFS, antimony