

Arsenate partitioning from ferrihydrite to hematite: Spectroscopic evidence

SOUMYA DAS^{1,*}, JOSEPH ESSILFIE-DUGHAN¹ AND M. JIM HENDRY¹

¹Department of Geological Sciences, University of Saskatchewan, 114 Science Place, Saskatoon, Saskatchewan S7N 5E2, Canada

ABSTRACT

Despite the number of detailed studies on arsenate adsorption onto synthetic 2-line ferrihydrite carried out during the past few decades, questions remain regarding the fate of adsorbed arsenate during phase transformation of this poorly crystalline iron oxy-hydroxide. We assessed arsenate partitioning during this transformation by aging synthetic 2-line ferrihydrite with adsorbed arsenate (at an As/Fe molar ratio of ~0.017) for 7 days at 75 °C under highly alkaline conditions (pH ~10). X-ray diffraction patterns show that ~55% of the ferrihydrite converted almost entirely to hematite (with traces of goethite) after aging 7 days, accompanied by a ~54% loss of reactive surface area (BET). ICP-MS analyses indicate that despite this conversion and significant loss of surface area, the aqueous arsenate concentration decreased from ~1.48 to ~0.51 mg/L during the course of the experiment. XAS analyses suggest that the concentration of arsenate and its speciation are controlled by its incorporation into the hematite.

Keywords: Ferrihydrite, hematite, arsenic, structural incorporation