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Effect of Coexisting Ions on Adsorption of Arsenic by Metal Oxides

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Iron hydroxides and nano TiO_2 are commonly used adsorbents for removal of arsenic in water. Iron hydroxides also play an important role in controlling the fate and transport of arsenic in groundwater. Co-existing anions, such as phosphate, silicate, and bicarbonate could significantly affect the adsorption capacity of the adsorbents for arsenate and arsenite and increase their mobility in groundwater aquifers. Arsenate and arsenite interactions at the solid-water interface were investigated using electrophoretic mobility (EM) measurements, Fourier transform infrared (FTIR) spectroscopy, and extended X-ray absorption fine structure (EXAFS) spectroscopy. Electrochemical scanning tunneling microscopy (ECSTM) and in-situ flow cell ATR-FTIR were applied to investigate the interactions between As(III), As(V) and carbonate in water and at the solid-water interface. The experimental results suggested that arsenate and arsenite formed inner-sphere complexes with the hydroxide groups on the adsorbents. Arsenite and carbonate could form ternary surface complexes with the hydroxyl groups on iron hydroxide.