

## Surface speciation of sulfate at a water-ferrihydrate interface

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The concentrations of trace anion species including metalloids in natural water are much lower than those predicted by solubilities of solid phases containing these anion species. It is thought to be related to adsorption of those anions on the surface of an iron or aluminum oxides or hydroxides which are ubiquitously distributed in surface environment. The binding forms of ions on mineral surface are able to be divided into two categories. One is inner-sphere complex which adsorbs as chemical bonding directly to the metal-ion in surface. The other is outer-sphere complex which adsorbs to the surface hydroxyl electrostatically. These surface speciation are important considering the long-term behavior of toxic ion and the bioavailability of dissolved ion. In addition, the speciation influences the physical-chemical property of the mineral, such as solubility of nanosized mineral (Fukushi and Sato, 2005) and solubility rate of mineral (Blum and Lasaga, 1988).

Ferrihydrate is a low crystallinity ferric hydroxide widely distributed in soils and rivers. It is also thought to be an effective anion adsorbent substance because of its high-specific surface area and property of positively-charged surface in natural water. Sulfate ( $\text{SO}_4^{2-}$ ) is common anion in soils and rivers. It is reported that sulfate competes with phosphate, carbonate and organic acid, trace metal adsorption (Fukushi and Sverjensky, 2007). For this reason, adequate understanding of sulfate adsorption mechanisms is needed. The present study aim to reveal the surface speciation of sulfate at a water-ferrihydrate interface under various pH and ionic strength conditions by in-situ IR spectroscopic analysis (ATR-FTIR: Attenuated Total Reflection-Fourier Transform Infrared Spectroscopy) and surface complexation modeling (ETLM: Extended Triple Layer Modeling).