Adsorption and Ligand-Assisted FeOOH (Goethite) Dissolution by Aminocarboxylate Chelating Agents. (S02-stone145126-Oral)

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Abstract:

In order for extracellular chelating agents to solubilize Fe(III) (hydr)oxides, the following criteria must be met: 1. The chelating agent must adsorb. Amine groups structurally close to a carboxylate group strongly diminish adsorption (via hydrogen-bonding), while distal amine groups slightly diminish adsorption (via electrostatics). 2. The chelating agent must detach iron atoms from the surface. Chelate ring formation is necessary, which (unlike adsorption) is favored by a short distance between amine and carboxylate groups within the molecule. 3. The logK for iron-chelating agent complex formation must be high enough to maintain appreciable concentrations of iron in solution. 4. The iron-chelating agent complex must not re-adsorb to any appreciable extent. A chelating agent denticity less than the coordination number for iron enables metal-like ternary surface complexation; ligand-like surface complex formation is possible when the opposite is true. Structure-reactivity relationships have been developed using NTA, HEDTA, EDTA, CDTA, TMDTA, and EDDS. These findings provide a new perspective on phytosiderophore-assisted iron acquisition by

grasses.

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