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Speciation of Fe adsorbed on and incorporated into soil and aquatic bacteria: XAS structural study

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This work devoted to the interaction of important oligo-element and nutrient, iron, with major planktonic (cyanobacteria) and soil (rhizospheric *Pseudomonas aurefaciens*) microorganisms via structural study of metal adsorption on and incorporation into cells. Three typical cyanobacteria (*Synechococcus* sp., *Planothrix* sp. and *Gloeocapsa* sp.) were used both in assimilation (Fe³⁺-containing nutrient solution) and adsorption (Fe³⁺ and Fe²⁺ - containing inert electrolyte) experiments. Experimental details are presented elsewhere [1]. Our experiments demonstrated that Fe uptake during growth of exopolysaccharides (EPS) - producing and EPS-poor cultures yields octahedral oxygen environment of trivalent iron with no polymers of Fe-O-Fe structures even to pH 7 (*P. aurefaciens*) and 10.5 (cyanobacteria). Intracellular Fe storage in the form of Fe(III) phosphate is the most likely scavenging mechanism during growth at high concentration (10-100 mg/L of Fe(aq)). In case of Fe²⁺ or Fe³⁺ adsorption at pH = 5-8 and 2-6, respectively, mostly Fe(III) form isolated octahedra linked to carboxylate, and, probably, phosphoryl groups of the external surface layers. Our results strongly suggest that, in the presence of surface organic ligands, the oxidation of divalent iron does occur but the polymerization of formed Fe(III) oxyhydroxides is inhibited and the adsorbed iron present in the form of individual Fe atoms attached to organic moieties. This implies that Fe(III) adsorbed on the cell surface is potentially more bioavailable when follows from thermodynamic prediction on the equilibrium with Fe(III) solid oxyhydroxides.

[1] Pokrovsky O.S., Viers J., Emnova E.E. et al. *Geochim. Cosmochim. Acta* **72**, 1742-1757.