

Does Fe(II)-OM complexation promote or prevent microbial Fe(II) oxidation?

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Iron (Fe) influences the fate of nutrients, (in)organic contaminants, organic matter (OM), and many biogeochemical processes in the environment [1]. At neutral pH, Fe(II) is rapidly oxidized to Fe(III) either abiotically by O₂ or by microorganisms such as Fe(II)-oxidizing bacteria [2]. The cycling of Fe is strongly coupled to the cycling of OM which participate in a variety of processes, e.g. formation of water-soluble complexes with Fe, electron transfer reactions as electron shuttle, electron donor and/or acceptor, and coprecipitation of Fe oxyhydroxides with OM [1, 2]. Therefore, Fe-OM complexation is critical in regulating Fe solubility, bioavailability, and Fe(II)/Fe(III) redox reactions [1, 3]. However, we still do not fully understand if microbial Fe(II) oxidation is also influenced by Fe(II)-OM complexation. Thus, the goals of this research are to determine whether Fe(II)-OM complexation influence the kinetics and extent of microbial Fe(II) oxidation.

We used a combination of geochemical modeling and batch cell suspension experiments with representative strains including nitrate-reducing phototrophic and microaerophilic Fe(II)-oxidizers. Specifically, we compared the oxidation rates and extent of free Fe(II) with those of various Fe(II)-complexes, e.g. Fe(II)-EDTA, Fe(II)-humic acid and Fe(II)-fulvic acid complexes which were synthesised according to ratios determined in the Humic Ion-Binding Model VII [4] that allows complete complexation of Fe(II). We followed Fe(II) concentrations over time to determine the oxidation rates of Fe(II)-OM complexes and we also determined parameters such as nitrate consumption rates for nitrate-reducing Fe(II)-oxidizers and cell abundance. The results from this study will allow us to evaluate the impact of Fe(II)-OM complexation on Fe oxidation in the environment.

[1] Borch *et al.* (2010) *Environ. Sci. Technol.* **44**, 15-23. [2] Melton *et al.* (2014) *Nat. Rev. Microbiol.* **12**, 797-808 [3] Straub *et al.* (2001), *FEMS Microbiol Ecol.* **34**, 181-186 [4] Tipping *et al.* (2011) *Environ. Chem.* **8**, 225–235.