THE ROLE OF ORGANIC MATTER AND SILICA ON THE FORMATION AND STABILITY OF BIOGENIC IRON OXIDES (BIOS)

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Iron oxides and bacteria exert a significant control on the mobility and fate of various solutes, ranging from toxic metals (and metalloids) to nutrients[1]. Natural iron oxides contain several "impurities" that affect their surface area, mineralogy and ability to immobilze contaminants[2]. The exact role played by impurities, such as organic matter and silica, on the redox stability of BIOS and sorption capacity remain to be determined. This project involves the synthesis of Biogenic Iron Oxides (BIOS) with different concentrations of soluble alginate (as an analogue for bacterial exopolysaccharides) and silica and their mineralogical and physical characterization by X-Ray Diffraction (XRD) and scanning electron microscopy (SEM). Microbial reduction experiments of the various BIOS were performed with *Shewanella putrefaciens* CN32 under anoxic conditions.

Table 1. Percentage of reduced Fe and linear reduction rates for BIOS containing different molar ratios of organic matter to Fe(III) in hydrous Fe oxides (HFO).

Sample	Maximum Fe Reduced(%) /day	Reduction Rate (day^{-1})	R^2
HFO 0.00	1.9	0.026±0.10	0.998
Alginate HFO 0.03	2.29	0.027±0.001	0.953
Alginate HFO 0.04	3.81	0.039±0.001	0.941
Alginate HFO 0.05	2.1	0.018±0.001	0.969
Alginate HFO 0.06	1.28	0.013±0.005	0.966

Results indicate that the ratio of organic matter to Fe(III) in BIOS affects the reduction rate. In some instances, alginate binds to iron oxide particles and protects them from reduction in samples with an alginate/HFO > 0.05, whereas samples with ratios of 0.04 become more sensitive to reduction. In addition, preliminary results show an increase of the reduction rate of BIOS due to the presence of silica.

[1]: Warren and Haack, 2001. Earth Sci. Rev. 54, 261-320.
[2]: Fortin, et al.,1993. *Geochim. Cosmochim.* Acta, 57, 4391-4404.