

Interactive comment on “Reduction of ferrihydrite with adsorbed and coprecipitated organic matter: microbial reduction by *Geobacter bremensis* vs. abiotic reduction by Na-dithionite” by K. Eusterhues et al.

Anonymous Referee #1

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Iron oxide-organic matter interactions are important for the biogeochemical processes of iron and carbon cycling. Although existing studies suggest microorganisms use organic matter as electron shuttle to expedite iron reduction, it is likely that coating of organic matter on iron oxide surface or co-precipitation of organic matter with iron oxide can inhibit the iron reduction by preventing microbial access to mineral surface. This study was designed to examine the dissimilar effects of organic matter coating layer and co-precipitates on the abiotic/biotic reduction of iron. The results are interesting and potentially helpful in evaluating the iron geochemical processes in the presence

C2414

of organic matter. This reviewer found following concerns for the manuscript, before it can be published. The authors tried to compare the scenarios of surface coating of organic matter and co-precipitation of organic matter and iron. However, there are insufficient characterizations for complex produced through the two different ways. The physicochemical properties of two kinds of complex, including their XPS and surface areas, should be stated more clearly and used to interpret the iron reduction results.

Specific comments:

Line 65: What kind of certain conditions? Lines 108-112: More details about the synthesis process should be given. Line 196: How was the second derivative of FTIR obtained? Basic description should be added to the method part. Lines 184-201: Did authors analyze NMR and FTIR for iron oxide-sorbed and co-precipitated NOM? Under same concentration of organic matter, the chemical composition of NOM can be different for the sorbed and co-precipitated NOM. Lines 218-225 and Figure 2: XPS C/Fe ratio, is this atomic ratio or just signal ratio? It is better to convert X-axis to C/Fe ratio in bulk. Line 229 and Figure 3: Why did the reduction fraction decrease in control after 20 days? And in the control, the final reduction fraction is around 60-70%, with 30-40% of Fe resisting to microbial reduction. What is the mechanism for the reduction-resistance of Fe(III) in control samples? Lines 230-231: The initial reduction rates did not differ significantly from the control for sample with 44 and 98 mg/g C in the adsorption scheme. And the difference in the reduction degree is completely because of the drop of final point in the control system, which seems not reliable. This reviewer suggested only discussing reduction data within 20 days. Line 240: Did this have any relationships with potential difference in chemical composition of organic matter sorbed by or co-precipitated with iron oxide? Lines 262-265: This statement is somewhat contradictory to conclusion at lines 189-191. Lines 268-282: Perhaps partial of this discussion can be moved to the introduction part. Line 388: Such conclusion will be strong, if the authors compare two bacteria in their experiment.

C2415

C2416