Biogeosciences Discuss.,
https://doi.org/10.5194/bg-2019-308-RC2, 2019

Biogeosciences Discussions

Interactive comment on "Effects of extraction conditions on the redox properties of soil organic matter (SOM) and its ability to stimulate microbial iron(III) mineral reduction by electron shuttling" *by* Yuge Bai et al.

Anonymous Referee #2

Received and published: 12 December 2019

This paper compares how different extraction methods influence the composition of soil organic matter (SOM) derived from the process. They compared SOM extracted by neutral pH water and mediated by alkaline extraction followed by acid precipitation (the standard approach used to delineate soil humic and fulvic acids) under oxic and anoxic conditions. The authors determined carbon recovered, specific UV absorbance @ 254 nm (SUVA), and most importantly the exchangeable electron capacity (EEC) as well as electron accepting and donating capacities (EAC and EDC). The manuscript is well-organized, and easy to read (even though there are a couple of typos that spell

checker did not catch). The most important contribution, however, is the electrochemical analyses that were conducted, which makes this paper really unique. There are a few major issues that I have, and specific comments are below.

1. The SUVA data seems fine for the water extracted SOM and fall well within the range of values reported by others (e.g., Weishaar et al., 2003). However, the FA and HA alkaline extraction conducted anoxically were off the charts and many factors higher than the highest value reported by Weishaar et al., 2003. These numbers appear unrealistic and could be due to the presence of iron (both (II) and (III)) in the extracts that reached 3 mM. Given that Weishaar et al., reported iron interference (they use Fe(III) as an example, but noted that Fe(II) can also interfere) at levels of only a few mg/L (or 10's of μM) this could be a positive interference to their SUVA data. 2. There was only passing mention of the NMR and fluorescence data. Why wasn't this data more prominently discussed in the paper (as opposed to a glancing mention in the SI)? For example, how does the EEM data "confirm higher contents of aromatic carbon" (the explanation in the SI caption was inadequate)? Further, the relatively smaller differences in NMR determined aromaticity between anoxically extracted vs oxic extraction SOM is not reflected in the much larger (order of magnitude) spread observed for SUVA (see above). Further, the EEMs from Figure S2 look really odd and I suspect that this caused by the really high DOC levels used by the authors (100 mg/L!). At those levels inner-filter-effects will become dominant as the solution will be optically dense to the point where inner-filter corrections will likely no longer work. Typically, fluorescence EEMs are collected at much lower (nearly two orders of magnitude) DOC concentrations to minimize inner-filter-effects (see papers by Stedmon et al., in L and O). Thus, because the data is likely improperly collected I would simply eliminate it from the discussion. 3. I think the discussion regarding the comparison between Suwannee River reverse osmosis dissolved organic matter (DOM) to the fulvic acid fraction isolated by XAD-8 chromatography (as opposed to acid precipitation) does not add any value to the paper because you are basically comparing apples and oranges (i.e., SOM vs. aquatic DOM). The methods are totally different from alkaline and neutral extraction and there

are no mineral phases involved. The authors can delete the entire discussion and it will not affect the conclusions or the quality of this paper. 4. While the authors point to several studies demonstrating correlations between DOC and Fe(II) formed from the dissolution of iron oxides in batch incubation studies, evidence for this relationship has also been reported in benthic pore waters. See papers by Burdige (et al.,), Chin (et al.,), plus many others. I think showing that this phenomenon occurs in real aquatic systems strengthens the arguments put forth by the authors for this paper.

Interactive comment on Biogeosciences Discuss., https://doi.org/10.5194/bg-2019-308, 2019.