

Comment on soil-2021-146

Alexander Bonhage (Referee)

Referee comment on "Identification of thermal signature and quantification of charcoal in soil using differential scanning calorimetry and benzene polycarboxylic acid (BPCA) markers" by Brieuc Hardy et al., SOIL Discuss.,
<https://doi.org/10.5194/soil-2021-146-RC2>, 2022

This manuscript by Hardy et al. is a very fine addition to our knowledge regarding the use of the DSC method in soil science and the composition of SOM in RCH (or kiln) soils. The text is concise from title to conclusion and the figures are of very good quality and server their purpose ideally. The manuscript fits the scope of the journal well. However, I think the discussion can be revisited once more.

My knowledge regarding DSC is limited, but I have seen and studied quite a few kiln soils in the past, so my comments will be more general in nature. I will list them by line numbers in the following. I hope they can be used to improve the discussion of the results and methods.

59: The BPCA method is widely used in soil science, but it's also controversially discussed regarding its prediction quality for black carbon. There are several recent papers on this which are easily found. If it is not a specific indicator for BC, then this opens the question what is actually measured, especially in a very heterogeneous substrate like kiln soils.

70: The factor 2.27 is often used, and also often discussed critically, e.g. DOI:
[10.1016/j.orggeochem.2010.07.001](https://doi.org/10.1016/j.orggeochem.2010.07.001)

87. Minor point: not only western Europe, in the eastern parts as well. Also consider changing "former" to "mostly historical forest areas" or something similar.

135. So the DSC method is calibrated using charcoal pieces >1mm. All the kiln soils I saw were pitch black, often times with no or very little macroscopic charcoal pieces. What about fine charcoal dust and charcoal degradation products more humic in character, tar etc. Are they also detected by the DSC method at charcoal (>1mm) specific peaks?

Figure 1. Y axis unit inconsistent with the other figures

Figure 5c: could you show fresh and old charcoal overlaid?

Section 3.3 I can't see appendix 1 (?). This section could greatly benefit from a table showing TOC, DSC-charcoal, BPCA, BC concentrations! Maybe just average values to save space.

350: You only discuss the kilns on cropland soils here? What about the kiln sites in forests? Maybe I missed it. These kilns on cropland soils are somewhat of a novelty compared to other sites discussed in the literature, which are predominantly in "undisturbed" forests.

355. This is a very confident statement; I would be more cautious. Extra uncharred SOM

could easily be charcoal derived products not detected by BC quantification techniques. The difference between BC and TOC in kiln soils is sometimes very large (as you know best), depending on which techniques are used. This cannot easily be explained by the presence of extra uncharred SOM. I guess this is the wrong paper to discuss this issue. But maybe try to be more careful with these assumptions in writing.

366. If you use the BPCA method as a benchmark for BC then please discuss its potentially shortcomings also, not only in terms of the conversion factor(s).