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The effect of different chemical treatments, pyrolysis conditions and feedstocks on the redox properties of biochar.

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Pyrogenic carbonaceous materials can have a role in several biogeochemical redox reactions as electron transfer catalysts. Low N_2O emissions in biochar amended soils can be related to its ability to act as an "electron shuttle", facilitating the transport of electrons to soil denitrifying microorganisms. Modifying biochar redox properties could be an interesting approach to regulate this effect.

In this work we propose several methods for the development of biochars from slow pyrolysis with altered electrochemical properties. To improve its electron exchange capacity we aimed to:

1) Increase the number of redox active functional groups in biochar. Several pyrolysis conditions and chemical treatments (KOH, H_3PO_4 and H_2O_2) were tested.

2) Raise the fraction of redox active mineral in biochar. The presence of Fe and Mn-based minerals in biochar could also catalyze redox reactions in soil associated with the nitrogen cycle. Different additives ($FeCl_3$, $KMnO_4$ and clay) were combined with the feedstock before the pyrolysis process.

Results of their ability to modify biochar redox properties, measured by mediated electrochemical analysis, are presented. Additionally, we characterized biochars produced from different feedstocks to assess how their lignin, holocellulose and ash composition affects these properties. Analytical issues arising from the difficulty of measuring the electron exchange capacity of biochar will also be discussed.