Innovative techniques of nuclear magnetic resonance for assessment of physical and chemical properties of biochar

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Nuclear magnetic resonance (NMR) is one of the best techniques to evaluate structural properties of organic compounds. Nowadays techniques most used are liquid and solid state high resolution NMR spectroscopy, using magnetic fields >9 T. The first allows assessment of soluble compounds (in deuterated solvents) with high purity, the second can be applied on complex mixtures (for example biochar) when there are no solubility requirements. However, main disadvantage of solid state NMR spectroscopy is necessity to have hydrogen atoms in the closest proximity of carbon atoms that is needed to be observed. In addition, setting of NMR parameters is difficult to be achieved.

While analysis of systems with low level of hydrogen are time consuming and expensive, materials such as biochar provide spectra where few bands can be observed, thereby preventing any chemical differentiation

Among the others, nuclear magnetic resonance relaxometry with fast field cycling (FFC) setup, allows conformational comprehension of complex systems (e.g. biochar) although sensitivity and spectral resolution are decreased by application of low magnetic field strengths.

The aim of this study is to emphasize the possibility to use FFC NMR relaxometry to characterize biochars from thermo-chemical processes.