ANALYSIS OF TOTAL ORGANIC CARBON IN SOIL-BIOCHAR SYSTEMS

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Amending agricultural soils with biochar can contribute to negative carbon strategies when the resistance to oxidation of soil carbon is improved (avoided CO_2 emission) and plant growth is promoted (increased CO_2 fixation). The environmental stability and sequestering capacity of biochar is dependent on the chemical form of carbon and its physical location in the carbonaceous matrix. The addition of biochar in soil increases noticeably the stable carbon pool, while the effect on labile carbon, including polyaromatic structures, is less marked.[1] The fertilizing action can be lost if biochar is removed from the cultivated area due to physical processes (vertical transport, lateral export, slacking). Assessing the fate of carbon in the soil requires the use of suitable analytical methods that should be validated for the presence of biochar. While several studies have compared different methods (wet chemical, dry combustion, loss of ignition) for the determination of total organic carbon (TOC)[2], comparative studies for biochar treated soils are scant.[3]
The principal aim of this study was to compare dry combustion methods with a TOC analyser (Shimadzu) and a HCN analyser (ThermoFisher scientific) to determine TC, TOC and IC (inorganic carbon) in model soils with and without biochar. Air dried agriculture soils with low and high content of IC were mixed with biochar at 1 % wt. level. Biochar produced from an up-draft gasifier utilized in the PSR project for application in cultivated soils was considered along with two reference biochars. The TOC analyser operated at 900 °C for TC, IC was determined at 200 °C after acidification with aq. H_3PO_4; quantitation was performed by infrared detection of evolved CO_2 using glucose and sodium carbonate as calibration standard for TC and IC, respectively; TOC was calculated by difference. The HCN analyser was applied to the samples directly (TC) and after aq. HCl treatment (TOC) using GC-TCD detection and calibration with 2,5-bis(5-*tert*-butyl-2-benzoxazol-2-yl)thiophene. Obtained results of TC and TOC were compared with the expected values. The effect of sample pretreatment, carbonate content and biochar type on carbon concentrations was investigated. In addition, thermogravimetric analysis (TGA) was evaluated as a method to discriminate labile (humic-like) and stable (black carbon-ile) components of soil organic matter.

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