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Fourier-transform infrared spectroscopy for the assesment of soil organic carbon removal by superheated water: preliminary results

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Soil organic carbon (SOC) is key determinant of soil quality and thus can considerably affect ecosystem services, environmental and global climate changes. Consequently, characterization of SOC and its fractions is of an increasing interest. No standard method for assessment of SOC fractions was adopted. Subcritical water extraction (SCWE) provides great flexibility and could be used for the extraction of different organic compounds from soil as well as for the removal of different SOC fractions from soil. The purpose of this study was to assess the potential of the treatment with subcritical water (SCW), or superheated water, in combination with different catalysts to affect different SOC fractions and thus its spectral bands. Subcritical water treatment of soil samples was performed at 180°C and pressure of 40 bars, whilst three different catalysts were separately applied: titanium dioxide (TiO_2), cerium sulfate Ce (SO4)2 and zeolite. Fourier-transform infrared (FTIR) spectroscopy was used as known technique for SOC characterization. After the SCW treatment the efficiency of catalysts regarding the removal of SOC fractions was studied via spectral bands of treated soil samples. Soil treatment with SCW without catalyst caused most changes in the region of 3800-3000 nm (–OH) that corresponds to cellulose. The aromatic compounds (C=C groups) in the region of 1800-1550 nm that corresponds to stable SOC fractions (humic materials and lignin) was strongly affected by treatment with TiO_2. Aliphatic compounds in the region of 1500-1350 nm (C-H and C-O groups) were mostly affected by SCW in combination with zeolite, while SCW in combination with Ce(SO4)2 besides aliphatic region altered aromatic groups in lesser extent. Zeolite in combination with SCW was proved to be good tool for aliphatic (labile) SOC removal, while TiO_2 in combination with SCW was proved efficient for the removal of aromatic (stable) SOC fractions.