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Composition of organic matter fractions for explaining wettability of three forest soils

H. H. Gerke (1), R. H. Ellerbrock (1), J. Bachmann (2), M.-O. Goebel (2)

(1) Institut für Bodenlandschaftsforschung, Leibniz-Zentrum für Agrarlandschafts- und Landnutzungsforschung (ZALF) e.V., Müncheberg, (2) Institut für Bodenkunde, Universität Hannover, Germany (hgerke@zalf.de, Fax: +49-3343282280)

Soil organic matter (SOM) as solid or as film at mineral surfaces affects wetting properties in unsaturated soil. Soil OM mostly consists of a heterogeneous mixture of components with hydrophilic and hydrophobic functional groups. This paper analyzes relations of SOM to soil wettability by considering functional group compositions of differently soluble fractions. Forest soil samples from two loamy sand Cambisol profiles (locations Chorin and Steigerwald) and from a Podzol (Waldstein) were used to obtain water (SOM(W)) and sodium pyrophosphate (SOM(PY)) soluble SOM fractions. The hydrophobic (A) and hydrophilic (B) functional groups of bulk soil SOM and of the soluble fractions were evaluated using Transmission Fourier-transform infrared (FT-IR) spectroscopy. Advancing liquid-solid contact angles (CA) were de-termined by using the capillary rise method. For soil organic carbon (SOC) contents $<$10 g kg-1, wettability increased with SOC content while it decreased for SOC contents $>$10 g kg-1. Although hydrophilic groups in FT-IR spectra of SOM(W), SOM(PY), and bulk soil dominated (i.e., A/B ratios between 0.08 and 0.5), soil wettability was reduced (i.e., CA between 88° and 52°). Soil specific relations between CA and A/B ratios could be obtained after introducing rela-tively soil type independent factors, G. As exponential functions of the SOC/clay relation, the G-factors imitate the effectiveness of functional groups with respect to wettability. The results sug-gest that in addition to SOC content, the SOM composition may improve explanations of soil wettability if the spatial orientation of SOM functional groups at the SOM-mineral surface in the presence of sorption sites and polyvalent cations is considered.