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Modification of the functionality of soil biogeochemical interfaces: Impact of sorbed cation and temperature

Joerg Bachmann and Susanne K Woche
Institut of Soil Science, Leibniz Universität Hannover, Herrenhäuser Str. 2, 30419 Hannover, Germany

Soil as a porous 3-phase system is characterized by a tremendously high surface area to volume ratio. Complex interactions of physical, chemical and biological processes occur at biogeochemical interfaces generally formed in living media like soil. Along with electrostatic interactions, the interfacial properties (surface free energies) control wetting kinetics, physical status of adsorbed water films, flocculation, adsorption, and they are also a major contributor to the rheological properties of dispersions. To describe the surface properties in a mechanistic way it is crucial to understand complex biological, physical and hydraulical processes within a general mechanistic framework. Biogeochemical interfaces, on one hand, signicantly determine the relationship between the surface geochemistry of a pore domain and the micoorganism or plant life in that specific region. On the other hand, they determine additionally with the pore geometry (local pore diameter, turtuosity and connectivity) the hydraulic properties of the pore domain. However, until now no physically measurable surface property has been established to determine all aspects mentioned above with one set of parameters. One of the key physicochemical parameters for describing the interaction of water and colloids is the interfacial free energy which is basically measured through contact angle measurements. With respect to water repellency we will present approaches and problems related to the evaluation of soil wettability for a sandy topsoil and a peat soil. Hence, the first part of the study emphasizes a framework to determine the mixed hydrophilic-hydrophobic behavior of particle surfaces. Furthermore, the sensitivity of physical impact of frequently changing conditions in soil like cation composition of soil solution and temperature is analyzed. We conclude that the wettability of OM, quantified by the contact angle, links specifically the chemical structure of SOM with a bundle of physical soil properties which are important for biological as well as for physical processes in soil.