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Influence of pH on wetting kinetics of a pine forest soil

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Water repellent properties of organic matter significantly alter soil water dynamics. Various environmental factors control appearance and breakup of repellency in soil. Beside water content and temperature also pH exerts an influence on soil water repellency although investigations achieved partly ambiguous results; some found increasing repellency with increasing pH (Terashima et al. 2004; Duval et al. 2005), other with decreasing pH (Karnok et al. 1993; Roper 2005) and some found repellency maxima at intermediate pH and an increase with decreasing and with increasing pH (Bayer and Schaumann 2007; Diehl et al. 2010). The breakup of repellency may be observed via the time dependent sessile drop contact angle (TISED). With water contact time, soil-water contact angle decreases until complete wetting is reached. Diehl and Schaumann (2007) calculated the activation energy of the wetting process from the rate of sessile drop wetting obtained at different temperatures and draw conclusions on chemical or physical nature of repellency.

The present study aims at the influence of pH on the wetting kinetics of soil. Therefore, TISED of soil was determined as a function of pH and temperature. We used upper soil samples (0 – 10 cm) from a pine forest in the southwest of Germany (Rheinland-Pfalz). Samples were air-dried, sieved < 1.0 mm and pH was modified by NH3 and HCl gas (Diehl et al. 2010) and measured electrometrically in 0.01 M CaCl2 solution. TISED measurements (2007)were conducted at 10, 20 and 30 oC using OCA 15 Contact Angle Meter (Dataphysics, Germany) on three replications for each soil sample. Apparent work of adhesion was calculated, plotted vs. time and mathematically fitted using double exponential function. Rate constants of wetting were used to determine the activation energy by Arrhenius equation.

First results indicated that despite comparable initial contact angles, pH alteration strongly changed the wetting rate suggesting maximum wetting resistance at the natural pH of 4.3 and decreasing wetting resistance at lower and at higher pH. The poster will present further current results of the ongoing study and discuss the activation energy of the wetting process in dependence of artificially altered soil pH.

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