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The effect of pH modification on wetting kinetics of a naturally water repellent coniferous soil

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The interfacial dynamics of soil-water interactions are significantly affected by the hydrophobic properties of organic matter. The underlying mechanisms responsible for the development of soil water repellency (SWR) are still under discussion. Various environmental factors control the appearance and degree of SWR. The wetting of soil greatly depends on the physicochemical characteristics of soil surfaces which in turn depends on pH. In this contribution, we propose a mechanism for the change in SWR that is observed upon the artificial change in soil pH. Wetting kinetics were studied by the time dependent sessile drop measurements (TISED) of the contact angle, the work of spreading and the drop base diameter as time elapsed under controlled relative humidity. Modification of pH strongly affected the wetting kinetics, suggesting maximum wetting resistance at the control pH (3.60) and with decreased wetting resistance as pH was changed in either direction. The enhancement of the wetting kinetics by artificial modification of soil pH can be attributed to the chemical modification in organic materials coating soil particles based on the magnitude of spreading activation energy and the hydrophilic/hydrophobic moieties ratio of treated soil samples measured by (XPS & MIR spectroscopy). On the basis of our current state of knowledge, we propose that acid and base catalyzed hydrolysis-condensation reactions as dominant processes responsible for the chemical nature of SWR.