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Influence of pH and drying conditions on the wettability of soil samples

J. Bayer, G.E. Schaumann and J. Huraß

University of Technology Berlin, Institute of Environmental Technology, Dept. Environmental Chemistry, Germany (gabi.schaumann@tu-berlin.de)

The phenomenon of water repellency of soil has been recorded all over the world. The reduced water intake into hydrophobic soil modifies the nature of the soil and, therefore, hydrophobicity becomes an important environmental factor. It can lead to preferential flow and may be responsible for severe drying of water repellent spots. Heavy rainfalls can cause erosion on hydrophobic soils, and water repellency can be one reason for poor plant growth.

From the current state of knowledge, water repellency is determined by the location and different physical, chemical and biological parameters. A number of detailed studies have been conducted to understand the occurrence of water repellency and its relation sample properties, and there is high research demand to understand the development of the wettability in the course of changes of environmental conditions.

While many studies deal with the influence of water content on the wettability, only few studies concentrated on the influence of the drying and storage conditions. The possible relevance of the pH has been suggested in some studies and also needs further clarification.

The goal of this study was to characterize the impacts of soil pH and drying conditions on the wettability of soil samples from two urban sites. Water repellent and wettable samples have been subjected to drying and remoistening under varying conditions. Further, the wettability was determined as function of the pH.

The moisture content of the soil samples was identified to have an important influence on the wettability. But temperature and time of drying appeared even more relevant for the development of wettability. Closely-neighbored wettable and water repellent

soil samples from the same location revealed different development of the water repellency during drying. But wettable samples from different locations showed similarities as well as water repellent samples were comparable in their development of hydrophobicity. A thin water film with varying thickness in combination with variations in the orientation of hydrophilic functional groups is suggested to explain the findings of this study.

The pH was found to influence the wettability on one of the two urban location investigated in this study. Between pH 4.5 and 7 an increase of water repellency was found.

The results of this study emphasize once more that water repellency is a rather complex phenomenon, and slow processes (in the range of days, weeks or more) as well as fast processes are probably involved in wettability changes.