



Biofilm effect on hydraulic properties of unsaturated soils: experimental study and data analysis

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While it is well known that biofilm in saturated systems can cause significant reduction of the hydraulic conductivity, very limited attention has been given to the hydraulic properties under unsaturated conditions. Following preliminary experiments with a biofilm proxy and pore-network analysis, we use here direct measurements of soil hydraulic properties in substrates with real biofilms to investigate and quantify the biofilm effect on hydraulic properties of unsaturated soils, namely hydraulic conductivity function and retention curve. We show that biofilms can significantly alter the soil hydraulic properties under unsaturated conditions.

Measurements of the soil's unsaturated hydraulic conductivity function and water retention curve were performed by using the multi-step outflow and evaporation methods. The measurements with a longer duration (evaporation method) were conducted under refrigeration conditions to minimize microbial activity during the experiment. Data were analyzed by the standard simplified evaporation method and by inverse numerical simulation, using a flexible, but time-invariant, model of hydraulic properties. First results show that the hydraulic properties of the biofilm-affected soils differ from those of the clean soils. Those differences depend on the biofilm amount, growing conditions and substrate concentrations.