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Microplastic enhances water repellency of soils

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Soils are the largest sink of microplastic particles (MPP) in terrestrial ecosystems. However, there is little knowledge on the implication of MPP contaminating soils. In particular, we don't know how MPP move and, on the other hand, how they affect soil hydraulic properties and soil moisture dynamics.

Among the expected effects of MPP on soil hydraulic properties is the likelihood that MPP enhances soil water repellency. This emerges from (1) the MPP surface chemical properties as well as (2) their surface physical properties like size and shape. Here, we tested mixtures of MPP and a model porous media. The Sessile Drop Method was applied and apparent contact angles were measured. We are able to show enlarged contact angles with rising concentrations of MPP. Already in relatively low concentrations of MPP the contact angels exhibit a steep increase and are rapidly reaching areas of super-hydrophobicity. Furthermore, we provide the physical explanation of the apparent contact angles resulting from the three-phase contact line between solid composite surfaces, water and air. The considered modes of a droplet lying on a surface are Wenzel, Cassie-Baxter and Young. The goal here was to differentiate between the involved surfaces building up the apparent contact angle and to pin down the impact of MPP in these systems.

Thinking about the implications of these results, an increased water repellency alters soil hydraulic properties towards less water content resulting in a shift in the water retention curve. Less water in soils especially at sites of high MPP concentrations leads to a limitation of degradation of MPP by hydrolysis. Additionally, microorganisms themselves and their enzymes cannot migrate in the liquid phase towards the MPP even elongating the process of natural purification.