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Transport of Nanoplastic under groundwater aquifer flow and transport conditions

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In terrestrial environments soils are hypothesized sinks for plastic particles. Nonetheless, due to the existence of preferential flow paths as well as a variety of geochemical and microbiological processes, this sink may only be temporary. A vertical translocation from soils to groundwater aquifers eventually occurs along different pathways. In these conditions Nanoplastic transport characteristics are similar to colloidal transport behavior. Therby the magnitude of plastic transport is eventually governed by complex interplay between the particle with its surrounding media (particle-particle, particle-solvent, particle- porous media) masked by different hydro-geochemical and microbiological conditions. The physical entrapment of particles (straining) may be significant when the particle diameter exceeds 5% of the median grain size diameter. Below that size additional electrostatic, van der Waals or steric interaction become increasingly important.

We present a preliminary dataset on the interaction between Nano-sized Polystyrene (PS) with different surface coatings and a variety of common minerals occurring in groundwater aquifers under the presence of Natural Organic Matter (NOM). The reference aquifer material is based on the Danish subsurface structure of Quaternary and Miocene aquifer material, e.g. quartz, calcite and pyrite among others. In our study, batch scale interactions are up-scaled in column flow and transport experiments, simulating different groundwater aquifer flow conditions in the presence of selected minerals and NOM.

This aims to clarify transport behavior of plastic pollutant in the subsurface environment. Furthermore, it serves as guide in qualitatively assessing and quantifying the vulnerability of groundwater aquifers to Nanoplastic pollution.