EGU22-6608, updated on 16 Aug 2022
https://doi.org/10.5194/egusphere-egu22-6608
EGU General Assembly 2022

Transport of dynamically fragmented polystyrene (PS) microplastics through saturated porous media

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Insufficient information is available about the transport of fragmented microplastics in groundwater systems. To understand the transport processes, lab-scale column experiments were performed using fragmented microplastics. To mimic realistic microplastics present in the environment, polystyrene (PS) microspheres of diameter 3 and 10 µm were crushed dynamically into fragmented microplastics for injection. We examined the impacts of key physiochemical factors like concentration, soil grain size, flow velocity, ionic strength and straining. The detection and quantification of fragmented microplastics was carried out using solid-phase cytometry (SPC). We observed a high breakthrough of microplastics in coarse soils, and in fine soils, a lesser breakthrough of microplastics was observed because of straining phenomena and wedging of microplastics. Other influencing factors were: (i) greater flow velocity caused detachment and resulted in low attachment efficiency and (ii) ionic strength was found to have a smaller impact on microplastics transport due to their strong negative charge. Results and conclusions from the study provide a baseline of valuable information in order to better understand the mobility of small-sized fragmented microplastics through the soil-aquifer system.