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Titel

Microplastic in soils: Method development and application to Swiss floodplain soils

Abstract

The occurrence and toxicity of microplastics in aquatic systems is a hot topic in the environmental science community and beyond. Microplastics can have direct toxic effects to aquatic organisms because of their physical properties but also because they act as carrier for a number of toxic substances (BPA, heavy metals, hormone like substances etc.). However, there are no studies about the occurrence and environmental consequences of microplastics in soils. One reason for this lack of information might be analytical complications in soils compared to aquatic systems. We developed a method which allows the analysis of microplastics in soils in a relatively time and cost-effective way. The soils were sieved to 1 mm and extracted in NaCl (density 1.2 kg L⁻¹). The samples were density separated by centrifugation and the supernatant was treated with concentrated HNO₃ on a hotplate to digest organic matter, which was extracted together with the plastic. After digestion, the remaining sample was centrifuged for a second time, rinsed with ultrapure water over a 0.2 µm Anopore filter (Alumina based membrane) and finally analysed on a FTIR microscope in transmission mode. The recovery rate for microplastics was tested and was 97 % (particle size 0.5 mm – 1 mm). HNO₃ attacked PET and ABS but did not affect the other plastics. Because of blank issues with very small microplastics, only particles in the size range 150-1000 µm were analysed. The analysis allowed for the determination of particle size and the kind of plastic. The optical analysis of the filters showed that some mineral substance (probably clay minerals) were deposited together with the plastic on the filters. However, this does not affect FT-IR analyses. The method was applied to 29 Swiss floodplain soils, spread all-over Switzerland. The concentrations of microplastics were up to 55.5 mg Kg⁻¹. Together with microplastics, macroplastics and soil texture were analysed. There was no relationship between the concentration of microplastics and the size of the population living in the catchment of the respective rivers. There was also no relationship between microplastics and the grain size of the soil, indicating no simple relation between sedimentation of soil and microplastics. In the opposite correlation of macro- and microplastics indicate that microplastics form directly from fragmentation of bigger plastic pieces like e.g. waste material.