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Abundance and distribution of microplastics in water and sediments of the river Elbe, Germany

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Plastic pollution in the aquatic environment has gained worldwide attention in the last years. Microplastics have been investigated for over 45 years especially in the marine environment, but only in the past years research has also started to focus on freshwater environments. In the frame of the project about macro- and microplastics in German rivers, samples from 11 sites from the German part of the river Elbe were taken in order to study the plastic pollution in water and sediment, detect sinks of microplastics and better understand transport mechanisms.

The sediment samples were taken with a Van-Veen-grabber, the water samples from the Elbe with an Apstein plankton net (mesh size 150 µm) from the same location. The sediment samples were presorted with wet sieving, organic digestion and density separation and filtered on aluminium oxide filters. For the water samples, the organic matter was digested using a reagent composed of equal volumes of 10 M KOH and 30 % H₂O₂, then, the microplastic particles were isolated from remaining matrix by density floatation using 1.6 g/mL potassium formate solution and pressure filtration. Analysis was done by visual inspection, selected particles measured with Fourier-transform infrared spectroscopy and masses calculated with a pyrolysis GC-MS.

The results of the sediments of the Elbe reveal that tentative microplastic concentrations differed intensively between the different river compartments. Microplastics in the sediments were in average 600,000-fold higher than in the water samples (when referring to the same volume). The amount of particles also varies significantly between the sampling sites. In sediment samples, microplastic concentrations decreased downstream, in water samples, concentrations varied stronger. The form of the particles is also site specific. In two samples, more than 80% spheres were counted whereas the 6 locations downstream reveal an increase in fragments. Polymer distribution differed between the water and sediment phase with mostly PE and PP in the water samples and a more diverse distribution in the sediments.