

Microplastics in the river bottom sediment in the urban river of Mongolia

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The urban river takes many anthropogenic influences including plastic solid waste disposal, resulting in microplastic pollution in marine environment through their fragmentation processes. During their transportation, reaction of plastic debris with suspended solids in the river affect properties of plastic debris in their sizes, surfaces and specific density. Even in light plastics can be settled in the river bottom sediments. This study evaluates the dynamics of plastic debris from the composition of plastics in the river bottom sediments.

The study area was set along the Tuul River in Ulaanbaatar, which is the capital city of Mongolia. The sampling points were distributed from the upstream with low population density to just the downstream of the waste water treatment plant (WWTP) through the drain canal of city center. Sediments were directly collected from the depth of 5cm using a stainless steel shovel. After air-drying, samples were separated into three size fractions for further analyses. Each sediment fraction was digested with the mixture of peroxide and iron catalyst. Using sodium polytungstate solution as a density fractionation media, microplastics were separated from sediments. The number of plastics in a unit weight of sediment was counted using a digital micro scope and morphotypes of microplastics were also counted under the digital microscopic views. The chemical structure of plastics were also evaluated using micro-FTIR to evaluate the composition of the sedimentary microplastics.

The major morphotype of plastic was fibrous plastics of synthetic fibers. Other morphotypes of films, fragments and foams were also detected. However, the size range of fiber microplastics was specifically different from other three types. That has a broad range of size in the sediment. The form type plastics, which was the dominant plastic debris in this river, were less amount probably due to their specific density with its porous structure. Distribution of microplastics in the sediment size fractions was different depending on the location. The downstream of WWTP was occupied by microplastics in the coarse sediments different from other points where fine sediments collected much amount of microplastics. The water management in the urban area influences the distribution of plastic debris in the river bottom sediments. Poly-styrene and poly-ethylene with lower specific density than water were commonly found in the bottom sediments, indicating that changes in their surface with suspended solids increase their density to settle to the sediments.

Keywords: river bottom sediment, urban river, plastic debris, sedimentation