The microplastic dynamics between river surface water and sediment compartments

Dolgormaa Munkhbat*[1] and Kawahigashi Masayuki[1]

[1]Tokyo Metropolitan University [Tokyo] (TMU) – Minami Osawa, Hachioji shi, Tokyo, Japan

Abstract

Microplastics in the river system are distributed in various compartments such as surface water and bottom sediments under different river conditions. Missing microplastics in the river are likely to be compensated by deposits of plastic debris in the bottom sediment. However, it is not clear how floating microplastics tossed by the river flow reach the bottom sediment.
In August 2022 and 2023, we observed the occurrence of plastic in surface water and bottom sediment along an urban river from upstream to downstream. Our study aimed to monitor plastic transport in urban areas downstream and to evaluate the plastic transfer process between water and sediment compartments. Plastic samples were collected from surface water and sediment at nine sampling sites along the Tuul River, Mongolia. Surface water samples were collected using a plankton net, and river fluxes were determined by measuring river flowrates.

The composition of plastic debris in the Tuul River showed similarities between surface water and sediment in dominant plastic types (polyethylene and polypropylene), sizes (micro and meso), and shapes (films and fragments) in the 2022 sampling campaign. Moreover, we observed a significant correlation ($p > 0.05$) between the proportion of microplastics in water and sediment.
In August 2023, we found that the severe flooding in July promoted a significant increase in the number of plastics in surface water at each sampling site in 2023 (min-max: 1.5-539 item/m3) compared to 2022 (min-max: 0-288 item/m3). In contrast, plastic in sediment decreased drastically at all sampling sites in 2023 (min-max: 0-125 items/kg) compared to 2022 (min-max: 0-252 items/kg). Despite these drastic changes in the river system, the dominant polymer composition and plastic sizes did not change between the two years, suggesting that the flooding may have transferred microplastics residing in the sediment compartment to the surface water due to hydrological turbulence.

Keywords: River plastic, plastic transfer, polyethylene, polypropylene, flooding

*Speaker