Characterization, distribution and degradation of environmental plastics in inland river system of Mongolia

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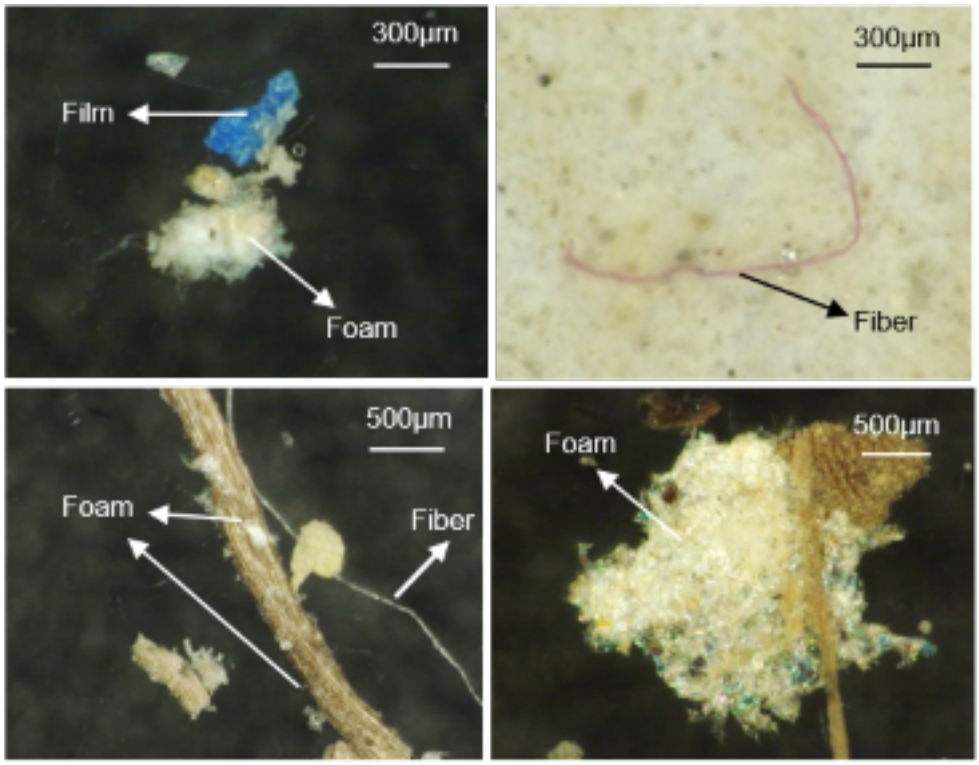
Marine plastic abundance and distribution have been reported toward increasing importance of their behavior as anthropogenic influences on aquatic environment. However, remains of plastics particularly in freshwater are largely unknown. Tributaries in the Selenga River system are important sources of fresh water in Central and Northern Mongolia, although the river system has been alarmed by various kinds of pollution because of growing population and increasing demand of land and resources. Evaluating fate of plastics in the river is vital to assess how the urban system affects plastic pollution in Selenga River. This study aimed to identify the fate of environmental plastics in the Selenga River system of Mongolia.
In 2017 and 2018, totally 18 sampling sites have been surveyed according to geographical locations from the capital city, Ulaanbaatar. Collected plastics were classified as their sizes (micro, meso, macro and mega) and materials such as films, foams, fragments and fibers. Visually sorted plastics identified by FTIR micro-spectroscopy to determine chemical characterization. Furthermore, a degradation index of collected plastics was examined using a ratio of two specific IR absorptions. Invisible microplastics (MP) attached onto the collected plastics were separated mainly from polystyrene foam (PSF), which was the most dominant environmental plastics in the research field. Characterization of the invisible MP was conducted using a digital microscope and an FTIR micro-spectroscopy.
Plastic films and foams were largely occupied in the collected plastics from the researched rivers. Surprisingly great amount of PSF were found in micro and meso size ranges. The results illustrate that on-site fragmentation and degradation of bulk PSF occurred in the research sites probably due to solar radiation and freeze-thaw cycles. A broad range of the degradation index was recorded in micro, meso and macro sized PSF, indicating that various stages of degradation occurred in the river environment. Apart from the other plastics types, PSF was considered as a carrier of invisible MP. A greater diversity of invisible MP types and numbers were found in a microscopic view using a digital microscope on the surface of PSF. Polyethylene (PE) and polystyrene (PS) were major components of the sorbed MP.
This study represents the first detailed examination of the distribution, types and degradation processes of plastics in the Mongolian river system. Environmental plastics were widespread litter in the investigated Mongolian river shores due to low-level of waste management with rapidly growing population and urbanization.

Keywords: Plastic debris, River shore, Mongolia, Degradation, Microplastics



Microscopic view of microplastics attached onto visible polystyrene foam (PSF).