Geophysical Research Abstracts
Vol. 21, EGU2019-6485, 2019
EGU General Assembly 2019

Behavior of plastic debris in Mongolian river system and characterization for aged microplastics

Batdulam Battulga (1), Masayuki Kawahigashi (2), and Bolormaa Oyuntsetseg (3)

(1) Tokyo Metropolitan University, Graduate school of Urban Environmental Sciences, Geography, Tokyo, Japan (battulga-batdulam@ed.tmu.ac.jp), (2) Tokyo Metropolitan University, Graduate school of Urban Environmental Sciences, Geography, Tokyo, Japan (kawahigashi-masayuki@tmu.ac.jp), (3) National University of Mongolia, School of Arts and Sciences, Chemistry, Ulaanbaatar, Mongolia (bolormaa@num.edu.mn)

Environmental plastics are now recognized as severe pollutants in the aquatic ecosystem. In the marine environment, plastic debris has been identified and quantified for the last several decades. Although the amount of land-based plastic debris in open water system is high through river transportation, their distribution and behavior are not well documented. It is important to focus on plastic distribution and its accumulation process along the inland rivers. Released plastic debris from our urban life can be distributed along the inland rivers depending on their physico-chemical properties derived from plastic origins. Diverse residential times of plastics differentiate their distribution and degradation. The present study highlights plastic debris distribution pathways, behavior and aging of microplastics driving in the Selenga River system which is the socio-economically and environmentally important river system in Mongolia. Totally 18 research sites along the Selenga River system have been surveyed in 2017 and 2018 to track their geographical distribution of environmental plastics accompanying with characterization of plastic debris and aging of microplastics. The number and sizes of plastic debris in a unit area was recorded at the research field and samples were collected to identify them. After cleaning of the samples with peroxide, the plastic materials were identified. Aging was also evaluated using micro FT-IR spectroscopy. The absorption ratio from the FT-IR spectroscopy was used to identify the aging presented as a carbonyl index (CI). Removed fractions by the cleaning treatment were also recovered for further characterization. The highest abundance of plastic debris was broken polystyrene foam (PSF), which is usually used for heat insulator and packaging. The plastic debris have significant correlation between their size fractions, suggesting that on-site fragmentation has been occurred without long distance trip. The analyzed PSF using micro FT-IR detected further smaller attached microplastics with microscopic sizes. Attached microplastics were observed from the PSF surface and it reached several tens items per piece of aged PSF across all surveyed locations. Major attached microscopic plastics were mainly consisting of polystyrene (PS) and polyethylene (PE) materials. The broad range of CI recorded in micro, meso and macro sized PSF indicate that various stages of degradation occurred in the river environment. In addition, organic matter adsorbed onto plastics (e.g. biofouling) has played a role as mediators for plastic interactions relevant to attaching mechanism of invisible microplastics onto PSF surface. The study proved that high number of invisible microplastics can be transported with visible size plastics, such as macro, meso, and micro plastics. Population density is the foremost reason of plastic accumulation in the river environment. Improper disposal of municipal waste is the major key drivers of plastic occurrence and distribution in the river catchment, and fragmentation is controlled under environmental conditions such as temperature change relating to freeze and thaw cycles.

Keywords: Plastic, Selenga River system, Polystyrene foam (PSF), Attached microplastic, Degradation, Carbonyl index