3　論文要旨

Thesis Abstract

A Study on the Proper Sampling Method for Microplastic Distributions in the Surface Freshwater : From Case Studies in Japan and Indonesia

河川の表層水におけるマイクロプラスチックの分布のための適切なサンプリング方法に関する研究:日本とインドネシアにおけるケーススタディから

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Microplastics are recently considered anthropogenic pollutants, and researchers have dealt with the issues in various study realms. One of the arguments to describe the microplastic pollution was which net pore size should be employed. Generated microplastic quantity differences, which are naturally caused by different net sizes, have been stated by many researchers, but how much specific plastic distribution is overlooked in large net sizes is still insufficient. Therefore, the present study demonstrated the differences of microplastic distributions qualitatively and quantitatively between 100 and 355 μm nets. A gradual increase in microplastic abundance toward small size was observed in the 100 μm net samples, whereas the 355 μm net had no specific size distribution. The cumulative probabilities relating to the minimum Feret diameter of film and fragment were divided into three parts. It implied 96.7% potential underestimation in the 355 μm net and 67.3% of potentially overlooked particle numbers in the 100 μm net. The film, fiber, and fragment with seven polymers were discovered by the 100 μm net, but the few shape and polymer types were revealed in the 355 μm net. In this respect, the 355 μm net could not represent tracing microplastic origins and presuming bioaccumulation potentialities. The median values of numerical and mass abundances were 12.5 particles/m^3 and 35.5 μg/m^3 respectively, in the 100 μm net, and 0.4 particles/m^3 and 0.5 μg/m^3 respectively, in the 355 μm net. Whereas the distribution tendency along the flow direction by the 355 μm net was affected by irregulars discovered in the sampling analysis step, the 100 μm net showed the highest abundances in the lower sampling station of the river adjacent to the urban. Additionally, the ranking of mass abundances in this

river comparing other Japanese rivers highlighted a remarkable difference at 27th in the 100 μm net and 9th in the 355 μm net.

The MPs pollutions in the surface water of the entire Citarum River, which plays a vital role in riparian people in West Java, Indonesia, were firstly studied with an FT-IR microscope for the shape, size, and polymer type of MPs. The MPs were collected in the wet season (St.1-6 in Mar. 2018, St.3-5, 3-a in Jan. 2020) by the Bulk water sampling method. Results showed that the MPs numbers decreased in 2020 due to the rainy events, the mean of 4.2 ± 2.6 (n = 6), and 2.8 ± 5.5 (n = 4) particles/20mL in 2018 and 2020. Notably, the tributary recorded the highest MPs number in 2020 with unknown pollutant sources. The upper area (Wagisagara, St.1) was anticipated pristine water, but the MPs pollution was shown, and the alkyd resin and PET were found in this area, unlike other stations in 2018. The Koyod (St.2), which had intensive textile industries, revealed high MPs pollution with a fiber in the 1000-5000 μm group. Additionally, the central part (Cisirung, St.3) of vast Bandung city showed heavy MPs pollution in 2018. The bioaccumulation of fishes inhabiting this river due to dominant PP (61%) and PE (17%) was concerned. Comparison with other studies indicated inadequate wastewater treatment systems affected the MPs abundance in this basin. It was concluded that the daily rain events and the different pollutant sources in each location resulted in various MPs abundance in this river.

In this present study, the 100 μm net revealed more specific distributions than 355 μm, but a suitable sampling method should be employed to describe microplastic distributions depending on the river characteristics and study purposes.