

Microplastic concentration in sediments of Tokyo Bay

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The amount of waste plastic spilt into the ocean between 1961 and 2017 is estimated at 21.4 million tons. It was considered about 47.4% of these plastics were degraded into plastic pieces (microplastics, as MPs) less than 5 mm in diameter (Lebreton et al., 2017). Matsuguma et al. (2017) have indicated in the previous study that 73% of missing MPs has been accumulated on the seabed as sediments

MPs in sediments are incorporated into lower ecosystems and expected to have some negative effects (e.g. Galloway et al., 2017). The impact of MPs is still unknown, and it is important to understand the status of MPs contamination to assess the impact of MPs properly. In particular, it is required to understand the actual conditions of MPs smaller than 350 μm . Therefore, in this study, we clarified the concentration of MPs smaller than 350 μm in the sediments of Tokyo Bay.

A survey was conducted on May 9th and 13th in 2019 by Tokyo University of Marine Science and Technology training vessel “Seiyo Maru” at three stations in the head of Tokyo Bay. The sediment was collected by Ekman barge-type sampler.

First, the sample was stirred thoroughly, and then 10 g of the sample was weighed. For density separation, the sodium iodide solution with density of 1.65 g / cm^3 added to the sample. Next, 20 ml 30% hydrogen peroxide was added to the sample, and the mixture was heated at 60 °C for 3 days to remove impurities. Finally, purely MPs were collected on a PTFE filter by vacuum filtration.

The sample was analyzed by FTIR-microscope (JASCO IRT-7200). The measured spectrum was compared with the spectrum of a standard plastic registered in advance (polyethylene, polypropylene, polystyrene, polyvinyl chloride, polyamide, polyethylene-terephthalate) to determine the composition of the particles in the sample. The size of the particles determined by FTIR to be MPs was measured by image analysis software Image J.

The detected MPs were approximately 100 pieces at each station. According to the dry weight measured from the water content, the concentration at each station was around 35 pieces / g-dry, which was higher than 1.8 to 5.3 pieces / g-dry in Tokyo Bay Canal (Matsuguma et al. 2017).

The types of MPs detected were about 27% polypropylene, 24.7% polyethylene, 12.3% polyamide 5.3% polyvinyl chloride, and 4% polystyrene.

About 72% of heavy MPs such as polyvinyl chloride was concentrated in Stn.2 located on the north side of Tokyo Bay. The average particle sizes of each measurement point were 40.1, 39.3, 31.1 μm . Besides, for light MPs such as polyethylene and polypropylene, the size of the particle less than 60 μm accounted for 50% or more of the whole quantity.

These results showed that heavy MPs, such as polystyrene and polyvinyl chloride, settled on the north side of Tokyo Bay. It was also showed that particles smaller than 60 μm dominated in light MPs. From this, it was clarified that heavy plastic can be settled rapidly after ingress the sea area.

Keywords: microplastic, sediment, Tokyo Bay