

Study on concentration of microplastics in surface water and sediments in Lake Biwa and Osaka Bay

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1. INTRODUCTION AND OBJECTIVE

In the environment, plastics become finer by physical decomposition. Microplastic refers to plastic less than 5 mm according to the definition of the National Oceanic and Atmospheric Administration (NOAA). In recent years, environmental contamination by microplastic has attracted attention, and there is concern about adverse effects on ecosystems. It was confirmed that it exists in the water environment around the world. However, the pollution situation of Lake Biwa and Osaka bay has not yet been elucidated. Therefore, the objective of this study are methods developing on collection, pretreatment, measurement and identification, and analyzing existence density, particle size and constituent components by this method, and aimed to understand the microplastic contamination situation in Lake Biwa and Osaka bay.

2. METHODS

From October to December of each year for two years 33 samples of surface water and 38 samples of sediment were collected in Lake Biwa, and 5 samples of surface water and 8 samples of sediment in Osaka Bay were collected. Plankton net (mesh size 315 μm) was used for collection of surface water samples. In addition, the volume of water filtered was obtained by a digital flow meter. An Ekman barge sediment collector was used to collect the sediment sample. Also, at the sampling site, the water quality was measured using multiple water quality meter, and ORP and electric conductivity of the sediment sample were measured. In the collected samples, contaminants such as sand and gravel, algae and plant debris are present, so in order to separate them from microplastic, decomposition of organic substances with H_2O_2 solution, separation by particle size using plankton net and sieve, separation by specific gravity using NaI solution were conducted. The separated sample was photographed with a biological microscope and stereomicroscope equipped with a digital camera, and the major axis diameter, the minor axis diameter, and the projected area of all the sample were measured. Finally, the compositional composition of the sample was elucidated using a Fourier transform infrared spectrophotometer (FT-IR).

3. RESULTS AND DISCUSSION

As a result, 1,319 microplastic debris were detected from 33 samples of surface water of Lake Biwa, of which 51% was polyethylene. The length of the average minor axis diameter was 824.0 μm . A total of 203 micro plastic samples were detected from 38 samples of sediment, 34% of which were poly hexadecyl acrylate which was not detected in the surface water. The length of the average minor axis diameter was 1,145.0 μm . Also, a total of 182 microplastics were detected from 5 samples of surface water in Osaka bay, 51% of which were polyethylene. The length of the average minor axis diameter was 1150.5 μm . A total of 64 microplastics were detected from 8 samples of the sediment, 61% of which were polyethylene. The length of the average minor axis diameter was 586.7 μm . Distribution results suggest that the drift density of microplastic in Lake Biwa may be influenced by gyre system. Regarding the deposition density of microplastic in Osaka bay, the density of the estuarial area tended to be higher than that inner area of the bay.