

Title of Research: 23-5-06

Ecotoxicological risk assessment of microplastics -as a model case of Osaka Bay-

Principal Investigator:

Yoshifumi Horie, PhD (Professor), Kobe University, Research Center for Inland Seas
5-1-1 Fukaeminami-machi, Higashinada-ku, Kobe 658-0022, JAPAN

Collaborators:

Hideo Okamura (Professor), Research Center for Inland Seas, Kobe University
Gomez Christopher (Professor), Graduate School of Maritime Sciences, Kobe University
Akira Ijiri (Professor), Graduate School of Maritime Sciences, Kobe University
Kazuyo Yamaji (Professor), Graduate School of Maritime Sciences, Kobe University
5-1-1 Fukaeminami-machi, Higashinada-ku, Kobe 658-0022, JAPAN

Summary of Research:

In the third year of this study, we focused on polypropylene particles, which were the most frequently detected microplastics in the surface waters of Osaka Bay during the first year of investigation. Virgin polypropylene particles were continuously exposed to medaka (*Oryzias latipes*) over a long period in order to evaluate their potential toxicity.

The exposure period lasted a total of 19 weeks and included three generations: the F0 generation (from 3 months after hatching for 3 weeks), the F1 generation (from immediately after fertilization for 14 weeks), and the F2 generation (from fertilization to hatching for 2 weeks). Continuous exposure was conducted throughout these generations. Seven endpoints were examined: (1) embryonic development, (2) growth, (3) secondary sexual characteristics, (4) histological observation of the gonads, (5) microplastic residues in the digestive tract, (6) reproduction, and (7) survival. The results showed no statistically significant differences between the exposure group and the control group for embryonic development, growth, secondary sexual characteristics, gonadal histology, reproduction, or survival. Even under long-term exposure to polypropylene particles at concentrations much higher than those found in the natural environment, no clear adverse effects were observed. These findings suggest that the toxicity of microplastics as particles alone is limited.

In addition, environmental samples were analyzed using pyrolysis gas chromatography-mass spectrometry (Py-GC/MS). The results revealed the presence of multiple types of microplastics in both sediments and surface waters in the coastal area of Osaka Bay. In the sediment samples, the polymer composition varied considerably among sampling locations. Only polyvinyl chloride (PVC) was detected around Wada Misaki, whereas polypropylene (PP) and PVC were detected around Tsubasa Port and Iwaya Port. In particular, relatively high concentrations of PVC, PP, and polyethylene terephthalate (PET) were detected around Iwaya Port. These results suggest that even polymers with a specific gravity lower than 1 may sink and accumulate in sediments due to processes such as the formation of attached materials and particle aggregation. In the surface water samples, several polymers including PP, PVC, polystyrene (PS), polymethyl methacrylate (PMMA), polyethylene (PE), and acrylonitrile butadiene styrene (ABS) were detected. Consistent with the results obtained in the first year using micro-FTIR analysis, PP was detected at many sampling locations.

Timeline:

March 2025 – February 2026

Topics:

Presented at the LRI annual research meeting of JCIA. August 29, 2025.

October 15-17, 2025 Presented at MARII Summit "Ecotoxicity of Microplastics Using Fish"

Publications: