Title of Research:

18_R05-01

Study on the contribution of microplastics to bioaccumulation and biological magnification towards fish

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Summary of Research:

The microplastics (MPs) are known to adsorb chemical substances and there is a concern about those chemicals may be taken more efficiently to organisms intermediated by MP and that biological concentration or biological magnification is accelerated. Our study will try to clarify whether the chemical substances adhered to MP are eluted, and absorbed / transferred / accumulated in the body of organisms.

In previous report, the concentration analysis of the PAHs which is adsorbed to MP, and uptaken and bioaccumulated by fish were conducted presuming that comparison of the applied dose and chemical concentration of fish meat calculates the accumulation factor. It was found by analyzing the 13 kinds of PAHs that the amount of chemical substances adsorbed varies depending on the type of MP and environmental conditions, and that the more hydrophobic the substance, the more difficult it is to desorb once it is adsorbed on the MP surface.From the result of examining the uptake of MP, medaka did not affected by MPs of all sizes and Daphnia did not affected by MPs with a diameter of 1 ㎛ or more. By using the fluorescent plastics, the MP beads were observed to accumulate in the gastrointestinal tract but not transferred to the outside of the gastrointestinal tract. Also, no translocation of MP from Daphnia to medaka was observed by feeding the Daphnia which had exposed (and taken) MP, to medaka.

There were difficulties to explain the presence or absence of the vector effect only by analyzing the chemical concentration accumulated in the body, we employed new method to detect whether the toxicity changes under the condition of coexistence of the MP and chemical, and to confirm the vector effect indirectly. As a result, in the closed experimental system, the presence of MP with sizes of uningested by living organisms reduced the concentration of chemical substances by adsorption, and the toxicity was mitigated. In the case of medaka, the toxic effect was mitigated even with the sizes of ingested MP and any harmful effect due to the vector effect were not confirmed. Only Daphnia exhibited adverse effects when the intakes were high, but it was due to intestinal obstruction by MP.

In conclusion, the vector effect of MP exists in the theory, though it is estimated that the amount of MP in the environment has no harmfulness in reality.

Timeline:

March 1, 2020 - February 28, 2021

Topics:

Oral presentation at JCIA LRI Annual Workshop 2020 “Study on the contribution of microplastics to bioaccumulation and biological magnification towards fish” (On-line, August 21st, 2020)

Publications:

1. Norihisa Tatarazako, ”Ecotoxicity of microplastics”, Society of Environmental Hormone,News Leter 23-2（2020）

2. Norihisa Tatarazako, ”Ecotoxicity of microplastics”, Microfiber lecture（Japan Chemical Fiber Association）, on web, 27/11/2020
3. Norihisa Tatarazako, Yukiyo Okazaki, Ecotoxicity of microplastics, The 22nd UK-Japan Annual Scientific Workshop,Research into Environmental Endocrine Disrupting Chemicals & Chemicals of Emerging Concern, on web, 27/10/2020