

Title of Research:

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The development of a model to evaluate the vector impacts of microplastics and to predict their effects under actual environmental conditions using this model

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Summary of Research:

To prove that the vector effect of MPs is caused by the adsorption and desorption of adsorbents by intestinal bile, we performed in vitro desorption tests using taurocholic acid for Ant, Phe, Nap, and CBs adsorbed MP. The results showed that Ant and Phe showed high adsorption and that taurocholic acid promoted desorption. However, Nap and CBs showed weak or no enhancement of desorption by taurocholic acid. The results of the in vitro desorption study were in agreement with the results of in vivo co-exposure studies of Ant, Phe, Nap, CBs and MP in medaka (Ant and Phe showed vector effects; Nap showed weak vector effects; CBs did not show any effects). The reason for this is considered to be the high-water solubility of Nap and the high Log Kow of CBs, which are difficult to elute from MP. The taurocholic acid concentration and its analogues were confirmed by LCMSMS analysis of medaka bile. Based on these results, the desorption test method using simulated intestinal fluid containing taurocholic acid as a substitute for bile is considered a useful approach for screening the elution of chemical substances adsorbed on MP. In the future, this screening method could be used to examine the elution of not only chemicals adsorbed on plastics, but also a wide variety of additives (plasticizers, antioxidants, stabilizers, etc.) to evaluate vector effects and their toxicity.

Timeline:

March 1, 2024- Feb28, 2025

Topics: "Construction of a Vector Effect Estimation Model for Microplastics and its Application to Prediction of Effects in the Real Environment - Elucidation of the Mechanism of Vector Effects" Yuji Oshima. LRI meeting. Aug23, 2024

Publications:

Al-Emran, M., Matsudera, M., Honda, M., Takai, Y., Lee, S., Uchida, Y., Qiu, X., Shimasaki, Y., Oshima, Y., 2024. Accumulation of chlorobenzenes in Japanese medaka (*Oryzias latipes*) co-exposed to 10- or 45- μ m polystyrene microplastics. 環境毒性学会誌 27, 73–86.

Al-Emran Md., Takai Y., Shimasaki Y., Oshima Y. Vector effect of polyethylene microplastics on accumulation of phenanthrene in Japanese Medaka, *Oryzias latipes*. Chemosphere (Preparing manuscript for submission)

Tokunaga M., Takai Y., Komatsu K., Al-Emran Md., Shimasaki Y., Oshima Y. Adsorption of polycyclic aromatic hydrocarbons on microplastics and their desorption in simulated intestinal fluids. Chemosphere (Preparing manuscript for submission)