



Title of Research:

19_D08-01 Elucidation of the formation mechanism of microplastics

Principal Investigator:

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Summary of Research:

The purpose of this study is to clarify the mechanisms by which secondary microplastics are generated from plastic products from the viewpoints of polymer science and polymer engineering. The study focused on analyzing microplastics (MP) in the environment and elucidating the mechanism of the miniaturization of the MP in the environment.

The use of deactivated SiO₂ as a diluent was effective in Py-APGC-MS measurements for pyrolysis analysis of plastics. An algorithm for analyzing MP in the environment was developed and its usefulness for analyzing unknown marine plastic samples was demonstrated.

Next, MP shapes recovered in the estuary were divided into pellets and flake fragments, with pellets recovered in greater numbers than flakes. In addition, crack patterns were observed in 13% of all PP pellets. Most of the spherical pellets showed an isotropic crackle pattern, indicating that these pellets were manufactured by hot cutting. In contrast, about 30% of the flakes developed parallel crack patterns, indicating the influence of molecular orientation during flow molding. In order to evaluate the mechanical collapsibility of the pellets, ball milling tests using glass beads were conducted, and it was found that the collapsibility can be evaluated by the actual MP surface degradation layer peeling off due to mechanical action.

Finally, a diamond disk grinder was installed and rotated in the flow path of the high-speed swirling airflow of the conventional jet mill system to increase the efficiency of accelerated MP formation. The PS elastomer was successfully milled to a fine particle size of approximately 5 μm in diameter using this improved jet mill system. It is expected that this improved jet mill can be used to grind any type of plastic into fine particles of a few microns in diameter, and is expected to be used as a standard MP for biotoxicity evaluation.

Timeline: March 2021-.

Topics:

Online presentation "Elucidation of the mechanism of microplastic formation" at the 2021LRI Research Report Meeting

Publications: Presentations: (Only the PI's presentation)

1) Shinichi Kuroda, "

Accelerated Production of Micro- and Nanoplastics Using Impact Pulverization", Academic Symposium on Marine Plastic Litter, March 3, 2021 (online)

2) Shinichi Kuroda, "Issues and Research Trends on Microplastics", Suga Weathering Webinar 2021, December 1, 2021 (online)