

Title of Research: 25-5-04

Development of a comprehensive risk screening method for substances in recycled-plastic materials using quantitative non-target analysis

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Summary of Research:

From the perspective of the circular economy, the use of recycled plastics is expected to increase rapidly in the coming years. Recycled plastics may contain a wide variety of chemical substances, including additives originating from the raw materials as well as unintentionally formed by-products generated during recycling processes. In the case of post-consumer materials, it is also expected that unpredictable chemicals may be present. Non-targeted analysis is a powerful approach for comprehensively detecting chemical substances. However, quantitative evaluation of identified compounds generally requires the development of individual analytical methods for each compound, similar to conventional targeted analysis. Method development typically requires authentic standards, but it is unlikely that standards are commercially available for all substances detected by non-targeted analysis, particularly for unintentionally generated by-products. In addition, developing analytical methods for each compound individually is difficult from both time and economic perspectives. In this study, a comprehensive risk screening method for chemical substances derived from recycled plastics is developed by combining quantitative non-targeted analysis (qNTA) using post-column reaction gas chromatography with dual detection by mass spectrometry and flame ionization detection (GC-MS/PR-FID) with toxicity prediction approaches.

Timeline:

March 2025 – February 2026

Topics:

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

Publications:

Sota Sakai, Masahiro Tokumura, Takeshi Enomoto, Kouichi Tatsu, Naohide Shinohara, Takeshi Fujimoto, Noe Koto, Satomi Morizumi, Masakazu Makino, "Development of a Risk Screening Method for Chemical Substances in Recycled Plastic Feedstock Based on qNTA Using Waste Fishing Nets as a Case Study," 2025 Annual Meeting of the Society of Indoor Environment, Kokura, Japan, December 2025 【Recipient of the Conference Chair's Encouragement Award】

Sota Sakai, Masahiro Tokumura, Takeshi Enomoto, Kouichi Tatsu, Naohide Shinohara, Takeshi Fujimoto, Noe Koto, Satomi Morizumi, Masakazu Makino, "Development of a Quality Evaluation Scheme for Recycled Plastic Feedstock Toward a Safe and Secure Circular Economy," 2025 Annual Meeting of the Society for Environmental Science, Hiroshima, Japan, September 2025.

Masahiro Tokumura, Sota Sakai, Takeshi Enomoto, Kouichi Tatsu, Naohide Shinohara, Masakazu Makino, "Environmental Risk Screening of Recycled Plastics Using a Quantitative Non-Targeted Analytical Approach", 12th IWA International Symposium on Waste Management Problems in Agro-Industries—AGRO'2025, Istanbul, Turkey, September 2025.

Sota Sakai, Masahiro Tokumura, Takeshi Enomoto, Kouichi Tatsu, Naohide Shinohara, Takeshi Fujimoto, Noe Koto, Masakazu Makino, "Quality Evaluation Scheme for Fishing Nets Toward Plastic Recycling Based on qNTA," The 4th Joint Conference on Environmental Chemical Substances, Yamagata, Japan, July 2025 【Recipient of the American Chemical Society Award】