Abstract

1. Avoiding Land-based Plastic Pollution, including Microplastics: International Context and Domestic Measures

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Abstract

At the UNEA 5 this year, it was decided to start a negotiation for developing an international legally binding instrument to end plastic pollution. In advance of this, Japan proposed the Osaka Blue Ocean Vision at the G20 in 2019 aiming to reduce additional pollution by marine plastic litter to zero by 2050, and has been collecting data and scientific knowledge through monitoring of marine plastic litter, while also assessing biological-ecosystem impacts from plastics, including microplastics. Since the enforcement of the Act on Promotion of Resource Circulation for Plastics this year, we have also been taking measures to reduce plastic pollution through its entire lifecycle: from design to manufacturing and discharge. Measures to raise public awareness, including Local Blue Ocean Vision, have also been taken up.

The outflow of marine plastic litter into the ocean, including microplastics, is an urgent issue. We will continue working on countermeasures to contribute to our reputation as a leading country tackling the 3Rs and waste management.

Keywords: marine plastic litter, microplastics, plastic pollution, resource circulation
Abstract

The plastic issue is not only a waste issue, but also symbolic in that it requires our efforts to address global warming and environmental conservation. Plastics are required to strike a balance between being easy-to-use materials that are indispensable to our daily lives and being difficult-to-decompose materials that have an environmental impact because they are made from fossil resources. Moreover, while there are great expectations for recycling, novel recycling concepts will be required as a next step. Looking at the recent trend of intellectual property in major countries, the focus of technological development is on pretreatment technologies. Emphasis is being placed on developing pretreatment techniques such as shredding, sorting, washing, and drying after bulk recovery rather than recovering the fractionated material. The foreign petroleum and petrochemical industries are beginning to make large investments in chemical recycling. In addition, biomass waste has massive potential as a raw material for biomass plastics, and technical development of biodegradable plastics is remarkable. From the perspective of the carbon cycle, there are some extremely high expectations for converting raw materials to recycled materials and biomass. In order to make further progress, collaboration and integration of arterial and venous industries will be effective approaches.

Keywords: plastic circulation, chemical recycling, bioplastic, integration of arterial and venous industries
3. Understanding Microplastic Generation to Improve Plastic Pollution Prevention Measures

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Abstract

Marine plastic pollution is currently one of the most pressing environmental issues. Global and domestic mappings of plastic losses to the environment throughout the plastics value chain have been developed to help decide the priority of interventions, such as reduce, substitute, and recycle. These losses have been estimated based on data available in the plastics industry and scientific literature and include information on activity, emission factors, transport routes to the environment, and removal rates at wastewater treatment plants. However, several potential losses during the plastic lifecycle and the link between plastic loss to the environment and subsequent release to the ocean remain to be clarified. Further research in these areas is, therefore, needed to provide better estimates of actual plastic losses. This manuscript introduces background, results, and future directions with regard to our research into microplastic generation and release during mechanical recycling, weathering degradation of plastics on the beach, and the effects of plastic additives on weathering processes. We hope that our research activities will lead to a better understanding of microplastic generation during the plastic lifecycle and to better loss estimates for the development of improved measures to prevent marine plastic pollution.

Keywords: marine plastic pollution, microplastic, fragmentation, weathering degradation, plastic additives
4. Measurement of Microplastics

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Abstract

Microplastic pollution is attracting worldwide attention. Although much research is being carried out, the details of the actual situation are not yet clear. It is said that about 80% of the world’s marine plastic waste is generated from the land area and in order to take further measures, all related parties from the inland to the coast and the ocean must work together to control its generation and create standardized laws.

This paper introduces some of the Guidelines for Harmonizing Ocean Surface Microplastic Monitoring Methods, a simple in-house detection method for detecting fibrous MPs and analysis of persistent organic pollutants contained in plastics.

Keywords: microplastic, measurement, Guidelines for Harmonizing Ocean Surface Microplastic Monitoring Methods, simple method, chemical analysis
5. Microplastics from Landfill Sites and Municipal Solid Waste Incinerators via Wastewater

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Abstract

This report summarizes the concentration, shape, composition, particle size, and removal behavior of microplastics (MPs) in leachate from landfills and in various incineration wastewaters from municipal solid waste incinerators (MSWIs).

First, the number of MPs in raw water in leachate from landfills in Japan was 0.00023~0.00039 particles/L, which was about 1/105 of that found in direct landfills in overseas countries. The reason for this is assumed to be that Japan mainly landfills incineration residues. The microbial degradation of plastics in direct landfill sites may inversely lead to the generation of MPs. Surface runoff was identified as an emission pathway other than leachate and needs to be investigated.

For MSWIs, the report outlines the wide variety of wastewater types and treatment methods and summarizes a survey of eight MSWIs in Japan. The results showed that plant wastewater, wastewater from wet scrubber and wastewater from other facilities were found to contain MPs ranging from 0.0234 to 0.69 particles/L (median: 0.1 particles/L). Ultimately, MPs in wastewater are removed at a high level, mainly by sand filtration, to a concentration of 0.00667 to 0.00167 particles/L.

Finally, in order to expand from concentration data to an estimate of emissions inventory, a questionnaire survey of wastewater discharges and discharge destinations is needed.

Key words: landfill leachate, wastewater from wet scrubber, methane fermentation residue, sand filtration, inventory

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Abstract

Plastic litter is present in oceans throughout the entire world and has developed into a problem of global proportions. Here we review the comprehensive risk profile of plastic litter in the oceans. This study focuses on an outline for profiling the sources of plastic emissions into the ocean by verification of the environmental impacts of plastics, the environmental fate of fragmented microplastics, and the quantitative risk assessment framework. The review indicates that the essential problem regarding plastic litter is the collection and management of large plastic waste, while the issue of intentional use of microplastics subject to REACH restrictions is a limited contribution overall. Large plastic waste is also the culprit behind the accidental ingestion of plastics by marine life, while the current concentration of microplastics in the environment does not seem to affect marine organisms. It is reported that more than 98% of microplastics in domestic wastewater can be trapped by wastewater treatment processes. In the future, it will be necessary to conduct activities aimed at reducing plastic waste through strong collaborations between industries, academia, and government.

Keywords: source profile assessment, risk management, risk assessment, risk comparison, regulatory science
Abstract

Since 2005, the tire industry as TIP (Tire Industry Project) has supported research into the potential human health and environmental impacts of tires throughout their lifecycle. Tire and road wear particles (TRWP) are tiny particles that are produced by the proper friction between tires and the road surface, often referred to as abrasion. The studies TIP has sponsored to-date have found it unlikely that TRWP pose a significant risk to human health or the environment. However, TIP continues to engage in researching ways to improve scientific understanding of the potential risks associated with TRWP.

Keywords: tire and road wear particles, tire particle, environment, human health
8. ISO Standardization Related to Bio-plastics

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Abstract

The paper explains ISO standardizations related to (marine) biodegradability of bioplastics, biobased microplastic fibers, and recycling processes for plastics. These ISO were discussed and published in ISO/TC 61/SC 14: ISO Sub-committee, SC14 (Environmental aspects) of Technical Committee, TC61 (Plastics). Twelve ISO standards related to marine biodegradation were published and are currently under discussion; three of these were proposed by Japan. Nine ISO standards related to microplastics and fibers were also published and under discussion; one of these was proposed by Japan. Four ISO standards related to plastics recycling were published and under discussion; one of these was proposed by Japan. In addition, the paper outlines promotion of market expansion for these products using ISO standards, such as the certification system.

Keywords: bioplastics, biodegradable plastics, bio-based plastics, microplastics, recycling