## Abstract

**[Project Information]**

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| Project Title : | Model and Scenario Formation of Plastic Recycling System Based on Regional Characteristics |
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| Project Period (FY) : | 2022-2024 |
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| Keywords : | Plastic composition analysis, Reuse and recycling “visualization”, Household and business waste, Collection and recycling system |

**[Abstract]**

The objective of this study is to build a model of a wide-area or cross-organizational resource circulation system for plastics in regions with three different urban characteristics and collection and recycling systems, and to evaluate and analyze scenarios leading to the goal of 100% reuse and recycling in 2035. The issues that each region will address step by step according to its regional characteristics and challenges were clarified.

In the first sub-theme, "Research on collection systems by governments and regions and the possibility of resident cooperation," questionnaire surveys and analyses were conducted on residents of multiple municipalities. It was clarified that there was a desire for higher collection frequency and more accessible collection points for plastic containers and packaging. There was a covariance between social capital and information, and correlated variables were extracted (Hayabuchi *et al.*,2024). It was demonstrated that when recycled resin products are returned to the community as daily necessities, it becomes easier to get a sense of realization and reward for recycling, and the effect of improving residents' cooperation in sorting was verified. In order to increase the frequency of use of administrative drop-off schemes, it is effective to select locations that are close and easily accessible, and to actively and regularly disseminate information in municipalities with large populations.

In the second sub-theme, "Research on the establishment of collection and local processing systems by private businesses," the actual statuses of waste household plastic products through regular collection (door-to-door collection and station collection) and drop-off schemes were

investigated. It was clarified that while polypropylene, which is easy to recycle, accounts for about 50% of the weight of plastic products, composite resin products with different materials are often generated. Although improvement of sorting technology is necessary, it was shown that effective resource recovery is possible if drop-off schemes are used in combination (Suzuki *et al.*,2024).

The characteristics of waste plastics generated at multiple commercial facilities were investigated. Furthermore, pelletizing processing and physical property evaluation provided useful knowledge for promoting material recycling in the future. A framework for evaluating the efforts of businesses was developed based on the circularity matrix. It was shown that a collection model in which a single business or multiple businesses work together to collect, sort, store, distribute, and share information on recyclable materials in an integrated manner improves the recycling rate and resource quality, reduces costs, and ensures traceability (Kikusawa *et al.*,2024). It was shown that it is realistic to introduce minimum common specifications for products with the same use, such as uniformity of materials, labeling specifications, and general shapes, so as not to impede recycling.

In the third sub-theme, "Research on modeling of optimal social systems," presented a method for constructing detailed processing flows that reflect the composition ratios of different resins by integrating various flows such as household, business, and private sector collection. In particular, a method was presented for estimating the volume and composition at each processing stage based on existing statistics and surveys and organized in a format that allows comparison between regions.

The break-even point was analyzed from the perspective of business profitability for advanced mechanical sorting technology aimed at improving sorting accuracy. Furthermore, an analysis of the effects of regional expansion, taking into account collection and transportation distances and population size, showed that regional expansion is more effective than individual operations in terms of collection efficiency, processing costs, and $CO_2$ reduction effects (Kawagoe *et al.*,2024). For smaller municipalities, the economic and environmental benefits of establishing a regional processing system are significant, and useful information was provided for considering the framework of the optimal circulation system in the future, including regional expansion.

**[References]**

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