An Interim Report on the Pilot Project for Recycling Urban Mined Plastics

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INTRODUCTION

Towards the global target of 2050, a number of companies have committed to making their packaging from recyclables, reducing the amount of virgin petroleum plastic used. As the efforts of global corporations to perform circular economy expands, the demand for recycled materials is expected to boost in the coming years.

While Japan boasts a high energy recovery rate (74 %), the rate of material recycling is particularly low (20 %) comparing to other OECD countries (OECD, 2017). Whereas the recycled resources mainly supplied from factories where a stable quantity and quality of recyclables are obtained, low volume and high variety post-consumer recycled (PCR) materials in a city also needs to be focused. In spite of that the total amount of plastic emission from the municipal and commercial sector in Japan is 4.29 million tons, which is comparable to that from industrial sector (4.62 million tons), 66 % of recycled plastic is from the industrial sector (Plastic Waste Management Institute, 2020).

Therefore, it becomes increasingly important to identify where and what PCR plastics are disposed of to facilitate the effective collection of urban mined waste plastics and to guarantee a stable supply to the corporations seeking PCR contents. In order to identify the quantity and quality of PCR plastics in a city, it is effective to trace resource circulation using digital technology.

For this purpose, a pilot project has been carried out in a shopping mall in Fukuoka City. The project consists of two tasks. The first is to visualize urban plastics by collecting the data on where, when and what plastics are generated on an IoT platform. The second is to identify the types and grades of plastics collected and make sure the market needs.

As a whole, the project aims at identifying the potential supply of urban mined plastics and the market needs of PCR plastics (Fig. 1). In this paper, however, the focus is solely on the results of the second task.

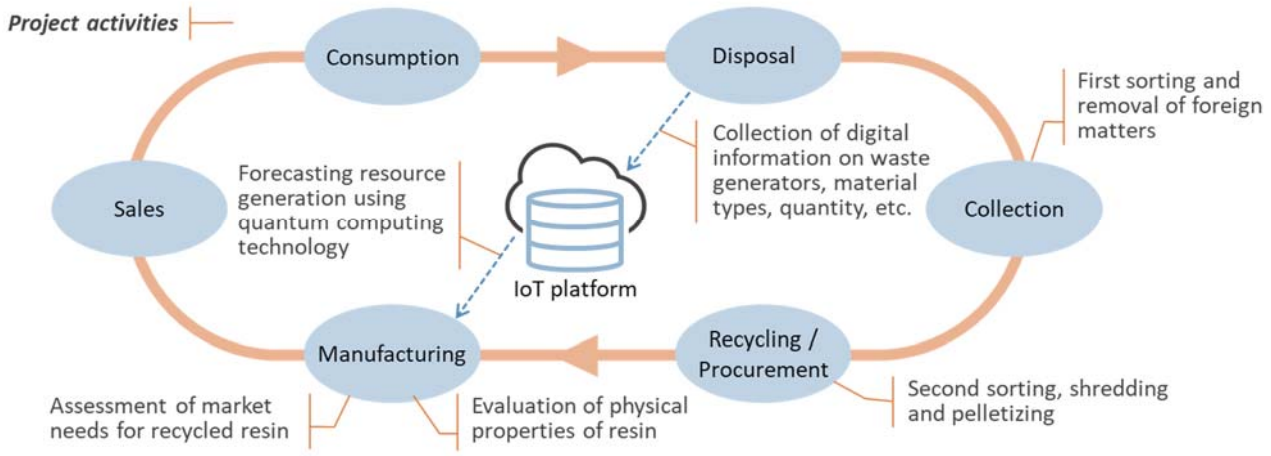

Figure 1 Structure of pilot project

MATERIALS AND METHODS

Waste plastics films collected at the targeted shopping mall were the mixture of different types of plastics. After visual inspection and identification using Raman spectroscopy, Linear Low Density Polyethylene (L-LDPE), High Density Polyethylene (HDPE) and PP were observed at a ratio of 6:1:3. As samples, 100 kg of L-LDPE films and 100kg of the mixture (no segregation) were collected. The samples were pelletized, being filtered through a screen mesh with size of 200 mesh, which is fine enough for plastic film production.

The photo below shows [I] reference sample (not from this project), [II] L-LDPE and [III] the blend of L-LDPE, HDPE and PP. The sample II and III have slightly brownish color (sample III is darker) comparing to the reference sample, factory-derived resin. Blackish spots and small cracks are observed only in sample III. With the physical property assessment, Melt Mass-Flow Rate (MFR) of the sample II is low enough (1.07-1.26 g/10-min) for blow molding, which is used to form hollow plastic objects including bottles.

Photo 1 Pellet samples

PRELIMINARY RESULTS AND DISCUSSION

The results demonstrated that the PCR plastics collected at a shopping mall could be alternative materials to virgin resources through appropriate sorting and processing. Currently, used plastic films are roughly segregated and mixed with different types of plastics and foreign matters, and that ends up being sent for thermal recycling. The stores with large volume waste emissions in Fukuoka City including the target shopping mall are responsible for over 8,000 tons of plastic waste every year (Fukuoka City, 2018). Proper sorting of plastic films together with material unification upstream will have a significant impact on material recycling.

CONCLUSION

This study aims at matching the potential supply of PCR plastics and the market needs, and enhancing the material recycling. Although market research needs to be further advanced, the results of the physical property evaluation suggest the recyclability of urban mined plastics. With IoT technology, it will be possible to secure the volume, improve collection efficiency, and upcycle the urban mined plastics into the existing supply chain.

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