Material Composition Survey of Plastic Waste from Households in Japan

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INTRODUCTION

It is estimated that at least 8 million tons of plastics flow into the oceans annually (Jambeck et al., 2015). From the viewpoint of marine pollution, greenhouse gas emissions, and other environmental burdens, plastic waste is of significant concern (Ellen MacArthur Foundation, 2016). Various plastic materials such as PE, PP, and PET, were used for the packaging, containers, and products based on their required functions including durability, heat resistance, flexibility etc. Although there were some previous studies focused on material composition of waste plastic containers and packaging (Van Eygen et al., 2018), further study considering material composition based on plastic items is needed for the development of resource circulation strategy for plastics. Therefore, this study aimed to investigate the material composition of plastic waste from households.

MATERIALS AND METHODS

Household waste composition survey

Material composition was investigated via a household waste composition survey conducted in Kyoto during November 11-22, 2019. Household waste from three regions (A, B and C regions), disposed as 1) combustible waste, 2) plastic containers and packaging (C&P). Although PET bottles was also source separated in Kyoto City, it was excluded because its material is obvious. Among 1,060 kg of plastic waste samples, approximately 250 kg was investigated. Similar study was repeated again for Region C during November 19- December 2, 2020.

Table 1 Details of samples investigated in 2019

		Material notations		Identification by AOTF		
		Amounts of sample investigated	Amounts identified	Amounts of sample investigated	Amounts identified	Unknown
Region A	Combustible	33.2 kg	19.9 kg	-	-	-
	Plastic C&P	55.1 kg	27.0 kg	22.5 kg	18.8 kg	3.7 kg
Region B	Combustible	39.6 kg	22.2 kg	-	-	-
	Plastic C&P	39.3 kg	21.8 kg	-	-	-
Region C	Combustible	32.7 kg	19.0 kg			
	Plastic C&P	54.0 kg	29.0 kg	21.5 kg	15.9 kg	5.6 kg
合計	―	253.9 kg	139.0 kg	44.1 kg	34.8 kg	9.3 kg

Material composition survey

Plastic waste was categorized into 17 items based on their shape and intended usage. First, material was identified by the material notations on the labels. If there were no material notations, AOTF (Acousto-Optic Tunable Filter) was used for material identification. It should note that AOTF was applied for plastic C&P at A and C regions. Categorization of plastic materials considered were PE, PP, PS, EPS, PET, PVC, ABS, other plastics (such as PVDC and EVOH), and non-plastics. Table 1 summarized the details of samples investigated and identified results in 2019.

RESULTS AND DISCUSSION

Approximately 58% and 53% (weight basis) of plastic was identified by material notations for combustible waste and plastic C&P, respectively. Via AOTF, totally 85% of materials were identified. Figure 1 showed the material composition of each plastic item from households, which was adjusted by the amounts of combustible waste and plastic C&P generated at Kyoto City in 2018. Two dominant materials, PE and PP accounted for 43% and 25%, respectively followed by 14% of PET. It was found that 76.0% of PE and 70.4% of PP were contained in combustible waste while 42.9% of PS, 48.6% of EPS, and 42.9% of PET were in plastic C&P. It implied that most PE and PP materials, which was suitable for material recycling, were incinerated. PE, PP, and PET fractions in the annual investigation by Ministry of the Environment, Japan (MOEJ, 2017) accounted for 38%, 25%, and 10% while those in EU accounted for 53%, 20%, and 17%, respectively (Van Eygen et al., 2018). PE and PET fractions in our study were slightly higher than those by MOEJ. Our investigation continued in 2020 showed that PE fraction reduced from 43% to 31%. It might be because the amounts of shopping bags were reduced due to the charge for plastic shopping bags since July 2020.

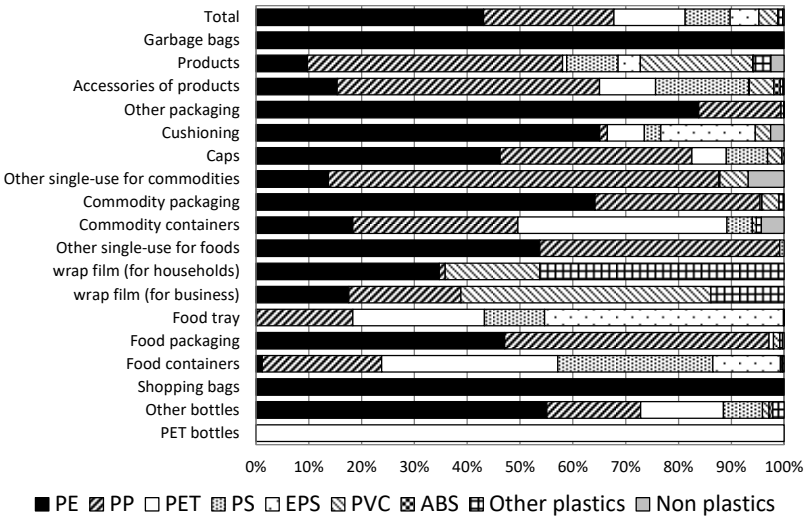

Figure 1 Material composition of plastic waste from households

CONCLUSION

This study investigated material composition of plastic waste from households. Promoting plastic resource circulation, not only items but also their materials need to be considered. System analysis is needed to develop 3R and renewable measures.

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