Recycling practices and material flow of PET waste in South Korea

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INTRODUCTION

PET bottles made of PET resins are easier to transport and handle than other packaging containers, so it was first used as a container for carbonated beverages in the United States in 1977 and has been used worldwide(Korea Packaging Recycling Cooperative, 2017). However, there are not only problems that it is at the center of marine waste, but also problems such as environmental pollution, resource depletion, and greenhouse gas emissions caused by improper treatment.

In order to establish an appropriate treatment and recycling policy for such PET, it is first necessary to analyze the material flow of PET. However, in South Korea, research on quantitative flow of PET is insufficient due to the lack of related statistics and information. Therefore, in this study, material flow analysis from generation of waste PET to collection/selection, recycling, and final treatment was conducted. In addition, using the Waste Reduction Model(WARM) (US EPA, 2016) methodology developed by the U.S. EPA was used to calculate the GHG reduction potential through PET recycling.

MATERIALS AND METHODS

Material Flow Analysis of PET in South Korea

In this study, statistical data from the Korea Ministry of Environment (Korea MOE) and the Korea Environment Corporation(KECO) were used. Data difficult to obtain statistics were inferred through existing statistical data and research reports. Due to the nature of PET bottles products, it was assumed that all domestic sales in 2018 are discharged in 2018.

Greenhouse gas reduction potentials by recycling

WARM developed by the US EPA(Environmental Protection Agency) was used to calculate the amount of greenhouse gas reduction. WARM models PET recycling in a closed loop, meaning that when these plastics are recovered and recycled, they are recycled back into the same products(EPA, 2016). Table 1 shows greenhouse gas emission factors according to the PET treatment method of WARM.

Table 1 GHG emission factors according to the PET treatment method of WARM(Unit: tCO_2eq/ton)

Category	Reuse	Recycle	Combustion	Landfill
Emission Factors	-2.00	-1.02	1.12	0.02

RESULTS AND DISCUSSION

Material flow of PET bottles by life cycle

The results of the 2018 PET bottles material flow analysis conducted in this study are shown in Figure 1.

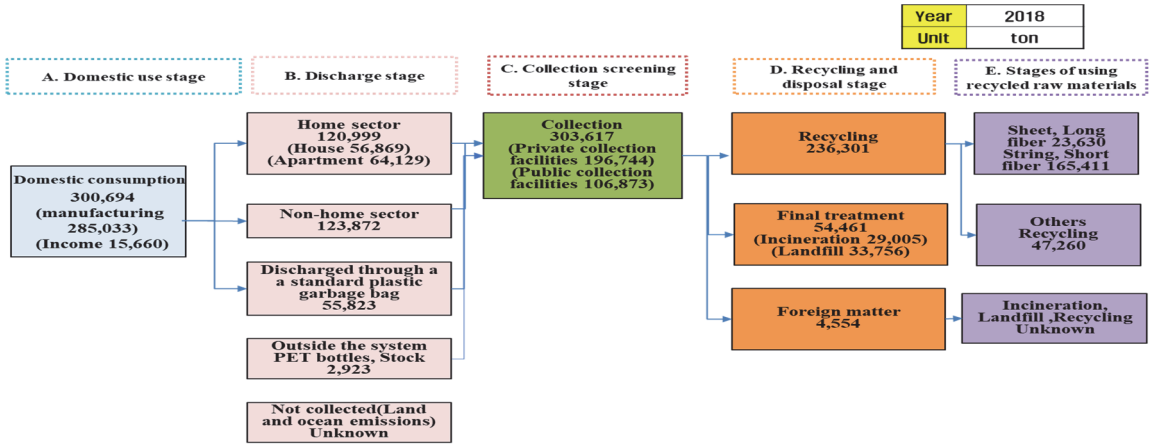

Figure 1 Material flow of PET bottles in South Korea 2018

Greenhouse gas reduction and saving by WARM

In 2018, 236 thousand ton were recycled, and 240 thousand tCO_2eq/ton of greenhouse gas emissions was reduced. Figure 2 shows the amount of greenhouse gas reduction by recycling PET bottles from 2010 to 2018.

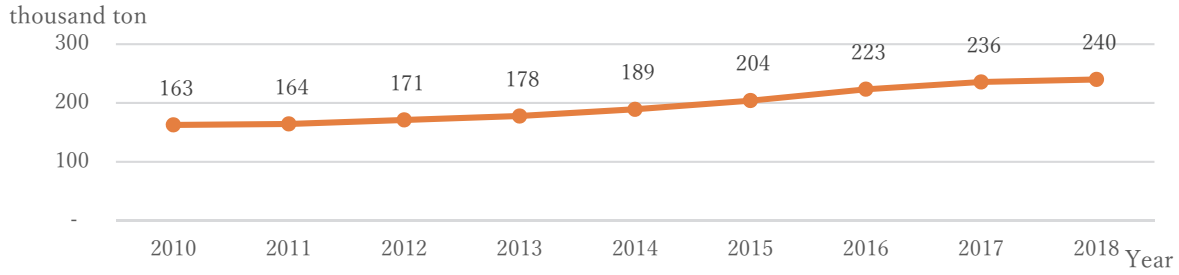

Figure 2 The amount of greenhouse gas reduction by recycling PET bottles from 2010 to 2018

CONCLUSION

In this study, material flow analysis from generation of waste PET bottles to final treatment was performed, and based on the results, using WARM proved the necessity of recycling in terms of GHG reduction by quantifying and evaluating the potential amount of GHG reduction resulting from PET bottles recycling. As a result, in 2018, by recycling PET bottles in Korea, 240 thousand tons of greenhouse gases were reduced, and a total of 1,768 thousand ton of greenhouse gases were reduced from 2010 to 2018. However, in order to derive more meaningful data and results, the amount of recycling according to each recycling method is required, and data on not only PET bottles but also others PET resin materials are required. Through future research, the greenhouse gas reduction factor derived according to the situation in Korea should be developed.

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