

# Screening survey of plastics used in WEEE for conversion to secondary raw materials

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## INTRODUCTION

In Japan, resource recycling for automobiles and home appliances, among other types of plastic resins, has been promoted within the framework of recycling law. On the other hand, the types of plastics used in small domestic appliances in Japan (Japanese SDA), for which local governments are responsible and are not clearly defined in the law, have not been clarified and recycling has not progressed.

Therefore, in this study, we conducted a screening survey of plastics in used Japanese SDA discharged as general waste to clarify the actual status of plastics used in Japanese SDA.

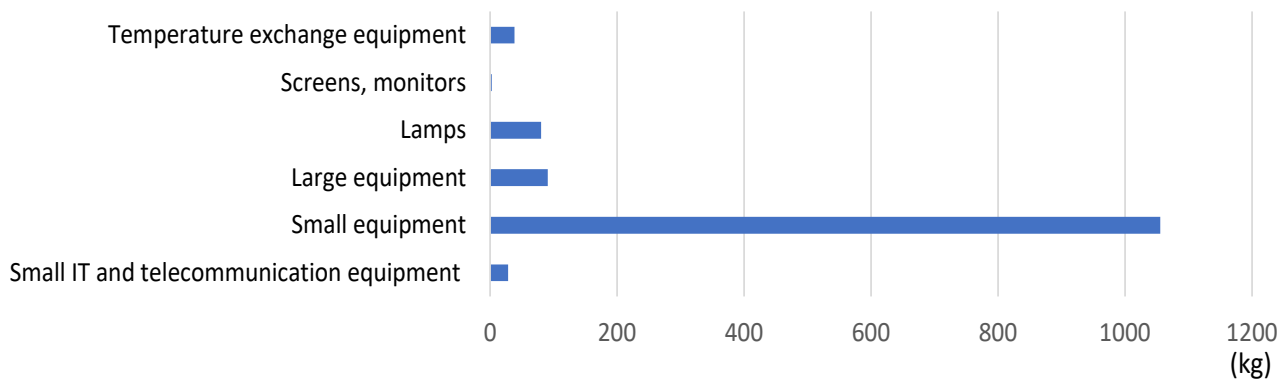
## MATERIALS AND METHODS

Plastic samples (n = 71) were taken from small household appliances (1296 kg) collected from city B in prefecture A (collected in October and November 2020). First, we classified the collected small household appliances according to the categories of the EU WEEE Directive. The WEEE (II) Directive is an amendment to the WEEE (I) Directive (Directive 2002/96/EC), but the scope of application of the WEEE (II) Directive changed from 10 product groups in Annex I to 6 product groups in Annex III from August 15, 2018. It is worth noting that the Japanese SDAs are all WEEE except for four items. (refrigerator, CRT/LCD, air conditioner, washing machine). Then, a screening study was carried out using a hand-held plastic analyzer (Polymax, TSI Incorporated, US) to qualitatively clarify the types of plastics collected. Furthermore, scanning electron microscopy (SEM-EDX, TM4000Plus, Hitachi High-Technologies Corporation, Japan, Energy dispersive X-ray spectroscopy, AztecOne, Oxford Instruments, UK) was used to study the elemental compositions of the plastics.

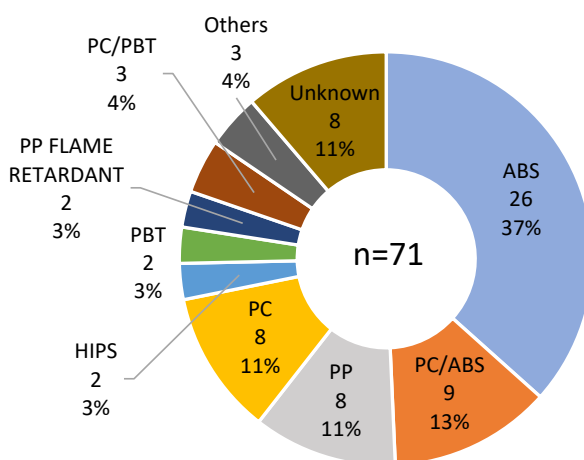
## RESULTS AND DISCUSSION

Figure 1 shows the results of the classification of the collected Japanese SDA in the categories defined by the EU WEEE Directive. Small appliances (No.6 of WEEE) accounted for the majority of the tested samples. Small equipment (no external dimension > 50 cm): 1055 kg, 81 %, Temperature exchange equipment (Cat.1); 38 kg, Screens, monitors, and equipment containing screens (Cat.2) having a surface greater than 100 cm<sup>2</sup>; 3 kg, Lamps (Cat.3); 80 kg, Large equipment (Cat.4; any external dimension more than 50 cm); 91 kg, Small IT and telecommunication equipment (Cat.6; no external dimension more than 50 cm); 28 kg.

Figure 2 shows the results of a screening study of plastics (n = 71) retrieved from the small equipment collected using a handheld plastic analyzer. The results show that ABS and PC/ABS accounted for 50 % of the total. Other materials, such as PP and PC, accounted for 8 % each. Flame retardants were present in 3 % of samples.



**Figure 1 Classification results according to EU WEEE Directive**



**Figure 2 Types of plastics in used small appliances collected in this study**

Flame retardants should be removed from the recycling system to facilitate the recycling of plastics. Although only 3 % of the products detected flame retardant content in the plastics analyzer, SEM-EDX analysis showed that several products contained chlorine, bromine, and phosphorus, which could be used as flame retardants. Some of the items found to contain bromine were also found to contain antimony.

## CONCLUSION

In this research, we conducted a screening study of the plastics found in widely used Japanese SDA. The results show that there was no significant variation in the samples collected for this study. The presence of additives such as flame retardants cannot be ignored as a limiting factor in the recycling of plastics and the promotion of secondary resources. In particular, halogens are a cause of corrosion in recycling facilities and equipment, thus it is important to develop separation technologies and systems. A future goal is to produce a quantitative analysis.

## ACKNOWLEDGEMENT

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## REFERENCES

Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (recast), 2018