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EPR대상품목 확대에 따른 B시 생활계폐기물 중심의 회수율과 재활용 확대를 위한 현안조사 연구

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A Study on Research of Pending Issues for Recovery and Recycling Expansion of Domestic Waste in B City According to EPR Target Extension

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요 약

본 연구에 있어서 현 EPR제도의 확대 품목의 부족성 및 문제점을 파악하기 위하여 B시의 소, 중, 대규모 별 아파트의 현장조사를 통하여 실질적인 발생량과 원단위를 파악하고 통계자료에 나타나지 않는 품목들을 예측하여 그에 따른 결과값으로 현재 이루어지는 재활용 분리수거의 문제점을 비교하고 분석하였으며 이를 뒷받침하기 위하여 B시에 거주하는 전문가 및 전문분야 학생 137명을 대상으로 EPR제도 품목 및 인식여부에 대한 설문조사를 실시하여 일반적으로 사람들 인식에 부족한 EPR제도 품목의 필요성 및 현 재활용 분리배출의 시스템의 오류를 지적하였고 향후 원활하고 지향적인 시스템 구축을 위한 해결 방안을 모색하였다.

주제어 : EPR, 원단위, 재활용 폐기물, 발생량

Abstract

Realization of zero waste society, which includes reduction, recycling and reuse of waste, has been a huge issue in Korea recently, and many experts are proposing various improvement plans in the establishment of political system. In particular, the current EPR system is partially agreed on its external achievement, but many problems are arising from the enforcement of the system. Therefore, flexible revisions and modifications on recycling policy are necessary. In order to understand the insufficiency and problem of the expansion of items in current EPR system, this study examined the actual generation and basic unit in small, medium and large-scale apartment complexes in B City and predicted the items that do not appear in the statistics to compare and analyze the problems in current recycling based on their result value; a survey was conducted on 137 experts and students of relevant major that live in B City on the items of EPR system and their perceptions to indicate the error in the necessity of items in EPR system that are generally underperceived by people and the error of current recycling system, and solution plans were sought to establish smooth future system.

Key words : EPR, Basic Unit, Recycling of waste, Generation

1. Introduction

Not only in Korea that needs to import major commodities from overseas due to lack of natural resources, saving resources and promotion of recycling have long become an object of concern for the entire humanity. Therefore, this probably is the reason why all countries are reinforcing organizations for recycling and focusing on development of different systems and techniques while slimming down and simplifying organizations and systems.[1]

As a part of such efforts, Germany, France, the United Kingdom, leading countries of Western Europe have been implementing advanced system including various market mechanisms for the invigoration and promotion of waste recycling, and either recently adopted EPR (Extended Producer Responsibility) system or are trying to adopt it.[2] In Korea as well, consumers and local governments have been taking the lead in waste sorting and recycling, producers have merely remained at a passive position such as making deposit payment, displaying limitations in construction resource-circulating society, and therefore, EPR system has been effect for 2 years to break away from such limitations. When implementing EPR system, it would be significant to examine the outcome on the intention to promote recycling when producers with relatively favorable position in reduction of waste and recycling are taking the lead in recycling system. In addition, serious discussions on any problems arising in such implementation and improvements for such problems are demanded.[3]

There have been fragmentary analyses and discussion by item until now, but a systematic analysis at an academic level has lacked. Therefore, by examining the outcome, problems and demanded improvements until now, this study is to provide necessary data for the settlement, development and expansion of this system.[4]

2. Content and Scope of Study

2.1. Content of Study
In order to estimate the substance and type of research target for waste recycling, waste paint, waste oil, waste medication and pesticides were examined. To prepare effective management plan of selected items, the waste classification, collection and transportation system in B City was studied. An improvement plan in collection system of selected substances (waste point, waste medication, pesticide, etc.) was to be prepared for the efficiency of classification and collection system of the recyclables.[5,6] This study selected 10 small, medium and large-scale apartment complex in 16 districts of B city, investigated recyclable waste amount per item and calculated the basic unit; and it predicted the generation of items that are omitted in the recyclable waste statistics of B City due to waste processing. Also, it attempted to seek foregoing direction of system and improvements by presenting the problems following it. In addition, by conducting a survey on 137 experts and students studying in the relevant area about the minor processes of current recycling, their perception on EPR system and items in it and problems of waste sorting and disposal, the study tried to come to the result that can present the problems of current system regarding EPR items, perception on various items and the directionality of recycling disposals.

2.2. Scope of Study
Through the field investigations at small, medium and large-scale apartment complexes in each district of B City, the waste generation by complex size was obtained and the systematic differences and waste disposal status by the complex size were investigated, which are presented Fig. 1 ~ 3.

Figure 1 presents the status of recyclable disposal occurring at small apartment complexes in B City, in which the number of households in small-scale apartment complex was set between 100-500 households. Small apartment complexes with less population was limited in the items of recyclable waste in their recycling system, and because of that, the recovery of recyclable waste was not smooth, resulting in low total recovery rate.

Figure 2 displays the status of medium-scale apartment complexes in B City. Apartment complexes with 1000-2000 households were selected, and their EPR items were extended than small-scale complexes, resulting in

(a) Paper Items

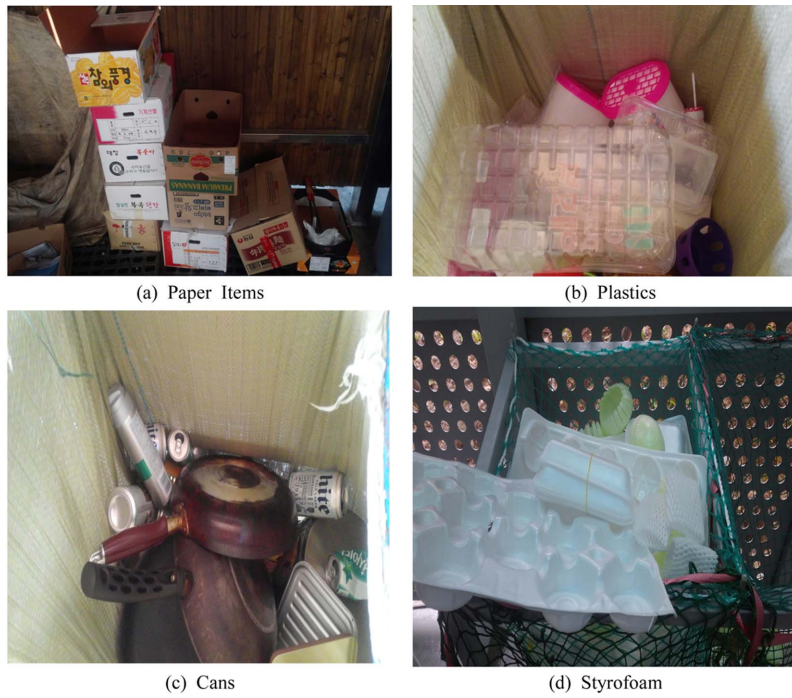(b) Plastics

(c) Cans

(d) Styrofoam

Fig. 1. Field investigation of small-scale apartment complex in B City.

(a) Paper Items

(b) Plastics

(c) Cans

(d) Styrofoam

Fig. 2. Field investigation of medium-scale apartment complex in B City.

(a) Paper Items

(b) Plastics

(c) Cans

(d) Styrofoam

Fig. 3. Field investigation of large-scale apartment complex in B City.

smooth waste sorting and disposal and high total recyclable waste processing efficiency.

Figure 3 displays the status of large-scale apartment complexes in B City, which included apartment complexes with over 2000 households. In large-scale complexes, the recycling welfare status was well-furnished, and due to high population, the amount of waste disposal is significantly higher than smaller complexes. However, with more variety in EPR items and higher level of welfare, large-scale apartment complexes displayed smooth waste processing and higher recovery rate, as well as total recyclable recovery amount.

In small-scale apartment complexes, the number of recycling items were smaller than large-scale complexes, generating much more waste in comparison with the population.

When the kind of recycling items is diverse and more sophisticated sorting and disposal occur, waste can be more efficiently process and total recyclable recovery amount would increase, despite the large size and large amount of waste.

3. Results and Discussion

3.1. Generation and basic unit per item and comparison of generation and prediction by small, medium and large-scale apartment complexes in B City

According to the total generation statistics of B City, the daily recyclable waste generation in B City is as follows: Paper 636.1 t (Basic unit 0.18 kg/day), Glass bottles 161.8 t (Basic unit 0.045 kg/day), Can 63.2 t (Basic unit 0.018kg/day), Synthetic resin 26.5t (Basic unit 0.0075 kg/day), Plastic 99 t (Basic unit 0.028 kg/day), metal 148 t (Basic unit 0.042 kg/day), battery 0.1 t (Basic unit 0.0003 kg/day), and fluorescent lamp 1.7 t (Basic unit 0.0005 kg/day).[7]

The statistics only presented generation statistics on the typical recycling items such as paper, glass bottle, can, synthetic resin, plastic and metal, but the statistics on paper carton, yogurt bottle, PET bottle, vinyl and styrofoam, which are all recycling objects as per EPR system, are not stated on the statistical data. This implies insignificant recovery rate by the recycling company or

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Table 1. Basic units of small, medium, large-scale apartment complexes in 16 districts of B City

Section	B City		Large	Medium	Small
	Generation (t/day)	Basic Unit (kg/day)	The Average Intensity (kg/day)	The Average Intensity (kg/day)	The Average Intensity (kg/day)
Paper Items	636.1	0.18	0.140	0.150	0.151
Cocurrent Glass	161.8	0.045	0.015	0.048	0.037
Cans	63.2	0.018	0.014	0.01	0.015
Synthetic Resins	26.5	0.0075	-	-	-
Plastics	99.0	0.028	0.022	0.090	0.032
Scrap Flow	148.0	0.042	-	-	-
Cartons	-	-	0.027	0.019	0.004
Yogurt Bottles	-	-	0.001	0.004	0.002
PET Bottles	-	-	0.016	0.041	0.011
Plastic Packaging	-	-	0.065	0.06	0.01
Styrofoam	-	-	0.009	0.006	0.002
The Batteries	0.1	0.0003	0.002	0.0008	0.0005
Waste Fluorescent Lamps	1.7	0.0005	0.006	0.007	0.001

intermediary company in the process of each district or within the apartment complex. Also, in assessing recycle processing item, problems in calculation of generation of other items and processing arose through the omission in statistics of detailed recycling items.

Also, more specific recyclable collection system needs to be established through the extension plan of recyclable item by district, and recycling disposal management performance should be systemized through accurate calculation of recycling amount per district accordingly. A plan to increase total recyclable waste recovery in B City can be prepared through quarterly performance assessment based on statements issued from the district office to private recycling collectors according to their monthly recovery amount, and more efficient plan for waste processing can be presented.

For the extension of EPR items and problem improvement, the generation of recycling items that are not stated B City's statistics due to recycling companies was investigated through field sample study and actual condition survey at small, medium and large-scale apartment complexes (10 complexes) in B City, and

such results are presented in Table 1. The daily recyclable generation in small, medium and large-scale apartment complexes is as follows: paper 3436.10 kg (basic unit 0.147 kg/day), glass bottle 764.64 kg (basic unit 0.030 kg/day), can 240.76 kg (basic unit 0.013 kg/day), plastic 1426.48 kg (basic unit 0.041 kg/day), paper carton 446.98 kg (basic unit 0.016 kg/day), yogurt bottle 61.98 kg (basic unit 0.002 kg/day), PET bottle 641.68 kg (basic unit 0.02 kg/day), vinyl 1196.57 kg (basic unit 0.045 kg/day), styrofoam 143.57 kg (basic unit 0.006 kg/day), battery 31.38 kg (basic unit 0.001 kg/day), and fluorescent lamp 132.99 kg (basic unit 0.001 kg/day).

As a result of comparative analysis of statistical data of field sample survey and statistical data of B City, segmentation of recycling items is enforced in each complex but is not entered in the figures, and problems arose in calculating the total generation. Results of prediction is displayed in Table 2, in which the basic units per item in small, medium and large-scale apartment complexes was calculated based on their generation and compared with the total basic unit of B City; the generation of items omitted from the statistical data was

Table 2. Prediction of basic unit per recycling item at small, medium, large-scale apartment complexes

Section	Prediction amount	
	Basic Unit (kg/day)	Generation (t/day)
Paper Items	0.147	3.4361
Cocurrent Glass	0.030	0.76464
Cans	0.013	0.24076
Synthetic Resins	-	-
Plastics	0.041	0.1426
Scrap Flow	-	-
Cartons	0.016	0.4469
Yogurt Bottles	0.002	0.0619
PET Bottles	0.02	0.6416
Plastic Packaging	0.045	1.1965
Styrofoam	0.006	0.1437
The Batteries	0.001	0.0318
Waste Fluorescent Lamps	0.005	0.1329

predicted and improvements were required in processing and recovery. Instillation of a new understanding on environment is needed through the extension of EPR items and invigoration of recycling campaigns, which would contribute to resource saving, prevention of environmental pollution and increase in recycling significantly.
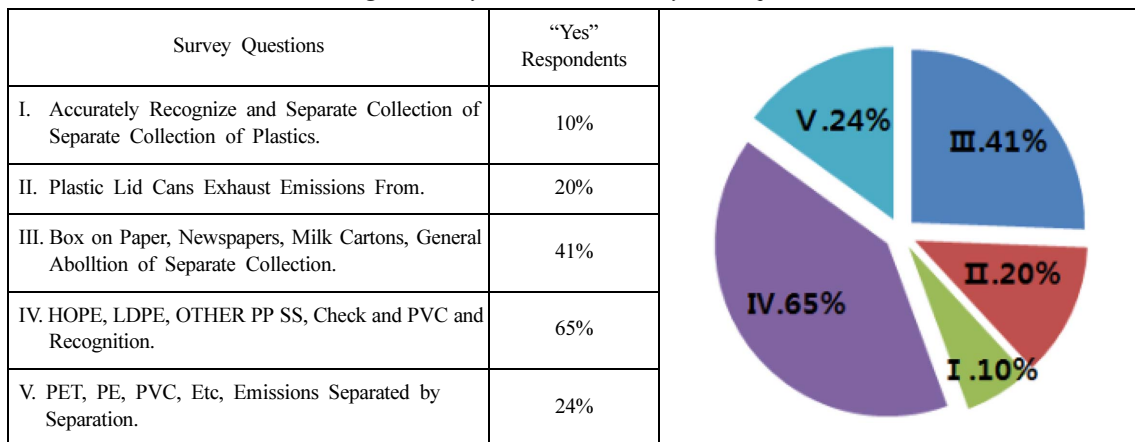
3.2. Survey about EPR system extension on experts and students of relevant major in B City

The survey conducted in this study targeted 137 experts and students of relevant major to study their perception on EPR system and understand errors and problems of current recycling disposal system, which is presented in Fig. 4.

In the first question, 41% of participants responded "yes" to sorted disposal of paper, box, newspaper, milk carton and general waste paper, displaying low result value. Participants that responded "yes" to the question on sorted disposal of aluminum lid and plastic lid accounted for only 20%, which was a significantly low result value, and participants that responded "yes" to the question on correct identification and sorting of synthetic resin accounted for only 10%, implying that synthetic resin products were not being properly sorted and disposed. Despite the fact that this survey was conducted on experts and students majoring in the area that both have higher understanding of EPR system and waste sorting, since recycling is a group activity but not an individual one, more detailed recycling could not happen due to the recycling system and items defined by the group.

65% of participants responded "yes" to the question about the product logo or signs for indications such as HOPE, LDPE, OTHER PP PS and PVC and whether they had prior knowledge on them or not, which was

Fig. 4. Survey results conducted by 137 experts.

Survey Questions	"Yes" Respondents	
I. Accurately Recognize and Separate Collection of Separate Collection of Plastics.	10%	
II. Plastic Lid Cans Exhaust Emissions From.	20%	
III. Box on Paper, Newspapers, Milk Cartons, General Abolltion of Separate Collection.	41%	
IV. HOPE, LDPE, OTHER PP SS, Check and PVC and Recognition.	65%	
V. PET, PE, PVC, Etc, Emissions Separated by Separation.	24%	

a higher result value than waste sorting and disposal, and such result indicates that although people have understanding, smooth disposal is not happening due to the systematic error or problem in waste disposal process.

24% of participants responded "yes" to the question asking whether they dispose PET, PE and PVC items separately, displaying lower result compared to their level of understanding. The survey implies that the experts and students of relevant major with higher level of understanding than regular citizens were making mistakes in recyclable disposing process due to the nature of recycling system, which the method for smooth and efficient waste processing can be presented and the plan to increase total recyclable recovery in B City can be sought.

4. Conclusions

This study examined the problems that occur due to Korea's current recycling system, EPR system, and insufficient items in such system, and in order to assess the performance of EPR system, the total generation, generation per EPR item and their basic unit in B City were calculated to find out the perception on EPR system. Following results were obtained.

1. The daily recycling waste generation in B City is as follows: paper 636.1 t (basic unit 0.18 kg/day), glass bottle 161.8 t (basic unit 0.045 kg/day), can 63.2 t (basic unit 0.018 kg/day), synthetic resin 26.5 t (basic unit 0.0075 kg/day), plastic 99 t (basic unit 0.028 kg/day), metal 148 t (basic unit 0.042 kg/day), battery 0.1 t (basic unit 0.0003 kg/day), and fluorescent lamp 1.7 t (basic unit 0.0005kg/day).

2. Statistics of B City only displayed generation statistics on representative recycling items, but did not include EPR recycling items such as paper carton, yogurt bottle, PET bottle, vinyl and styrofoam; the generation and basic unit of omitted items at selected small, medium and large-scale apartment complexes were calculated and predictions were made, which presented 0.023 kg/day in small-scale, 0.040 kg/day in medium-scale, and 0.028 kg/day large-scale apartment complexes.

3. As a result of survey on the perception on EPR

system and the items in current EPR system given to experts and students of relevant major, they had the knowledge of items on EPR system but proper waste sorting could not occur due to the nature of recycling, which is done by the group in one location that limits the recycling items.

4. People's knowledge on current recycling system was high but proper recycling was not happening in the disposal process. Instillation of a new understanding of environment is needed through the extension of EPR items and invigoration of recycling campaign of waste resource, which would lead to resource saving, prevention of environmental pollution and increase in recycling due to decreased waste.

Acknowledgement

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하 상 안

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學會誌 投稿 安內

種　　類	內　　　　　容
論　　說	提案, 意見, 批判, 時評
展望, 解說	現況과 將來의 견해, 研究 技術의 綜合解說, Review
技 術 報 告	實際的인 試驗, 調査의 報告
技術, 行政情報	價値있는 技術, 行政情報를 간결히 解說하고, comment를 붙인다.
見 聞 記	國際會義의 報告, 國內外의 研究 幾關의 見學記 등
書　　評	
談 話 室	會員相互의 情報交換, 會員 自由스러운 말, 隋霜 등
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