Practical Environmental Education on Kyoto Koka Women's College Department of Contemporary Life Design

— 2nd Report, Influence of Garbage Box Design on Wastes Sorting Ratio —

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Abstract

In order to reduce wastes generated and to build a recycling-based society, it becomes an problem to recycle waste as resource by thorough separation rather than to generate waste as waste. Then, in order to solve this problem, the student of Kyoto Koka Women's University, the Ukyo-ku administration, the Ukyo inhabitants of a ward, Kyoto City Environmental Policy Bureau, etc. work in close coordination to (1) improve in wastes-sorting ratio by a new design of garbage box (improve of present pictogram), and further, (2) aim at contributing to town management so that it comes to be called "Eco-town Ukyo!"As a result, by improving pictogram of the garbage box and further installing the display expediting separation in garbage entrance slot and the ceiling portion, wastes-sorting ratio of public garbage box currently installed in the Kyoto Arashiyama was able to be improved about 10%. This result suggest that it is one of the factors where pictogram of the newly created trash brought emitter of wastes environmentally-conscious mind (eco-mind), and raised the wastes accuracy of sorting. Furthermore, pictogram which the woman students designed will be adopted as entire public garbage box Kyoto City because of its achievements on wastes-sorting ratio.

I Introduction

The Ministry of the Environment released the results of an investigation of discharge / processing situation of the wastes in the 2009 fiscal year. According to the results, the total volume of wastes was 46,250,000 tons, decreased by 3.9% compared to the previous fiscal year and the quantity of waste disposed of per day per person was 994 grams, decreased by 3.8%, both of which decreased from the previous fiscal year. Final disposal amount was 5,070,000 tons, becoming 8.3% of decrease, and the recycling rate was a slight increase from 20.3% in the last fiscal year to 20.5%. The total volumes of wastes of 46,250,000 tons in the 2009 fiscal year are equivalent to the size of 124 Tokyo Domes. Total volumes of waste decreased continuously from 54,830,000 tons in the fiscal 2000, and were less than 53,100,000 tons made into the bases line in the 1997 fiscal year for five consecutive years. Moreover, the total wastes by patterns were made up of 30,180,000 tons of household-related wastes, 13,280,000 tons of office-related wastes and 2,790,000 tons of group collections, as such, the household-related wastes account for about 65%. In addition, household-related wastes are slightly lower rate of reduction compared with enterprise-related wastes [1]. Thus, total wastes amounts are decreasing. However, the percentage of reductions is low and household-related wastes account for more than half of total volumes of waste. Such a discharge tendency of garbage is the evidence in which the tendency in the 20th century of mass productions and mass consumptions were still remained. Mass productions and mass consumptions cause depletion of resources, and we are faced with this problem at current 21st

century. In order to solve this problem, it becomes an issue to recycle wastes as resources by thorough separation rather than to generate waste as waste. Then, we paid our attention to designs of a garbage box as a means of this improvement aiming at improvements of wastes-sorting ratio.

II Adoption of support program for the Ukyo town management

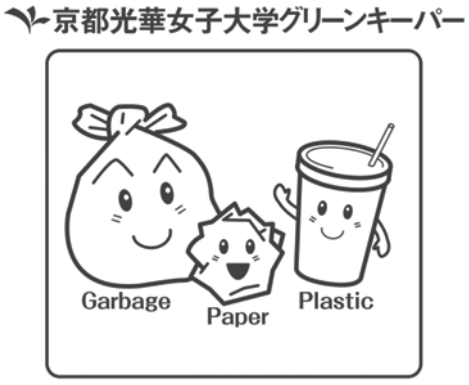
Now, about 700 sets of public garbage box are installed in Kyoto city [2]. These public garbage box are set in sightseeing areas, downtown areas, parks and business districts. Characters, such as "regular garbage" and "resource garbage" are written on the public garbage box. If it can change into the new design to encourage sortingis from the design of characters only, wastes-sorting ratio may improve. However, in order to change the design of public garbage box, it is necessary to obtain authorization of Kyoto City Environmental Policy Bureau. Moreover, it also becomes essential to carry out in collaboration with a citizen. Then, we subscribed for Support program for the Ukyo town management [3] and undertook the business to propose. In addition, Ukyo-ku is a district where our university is located.

The title of the business to propose is "Eco-town Ukyo created by women students and citizens."With the support of Ukyo Eco City Station (jurisdiction of Kyoto City Environmental Policy Bureau), we, Kyoto Koka Women's University environmental volunteer circle "Green Keeper", and the Ukyo ward residents jointly devise the seal (pictogram), attaching to a garbage box on the street, and investigate the effect of devised pictogram to wastes-sorting ratio. Moreover, as for offerings of Ukyo ward residents, using university website and citizens newspaper and from the elderly to children were participated.

Pictogram was devised in Kyoto Koka Women's University. How design is processed in cooperation with Green Keeper and the Ukyo ward residents is shown in Fig.1 Although many designs were devised, it was narrowed down to single design by discussions. The design adopted in this project is shown in Fig. 2. Woman-like tenderness and a rich sentiment are felt for this design.

Fig. 1 Photograph showing of creating new design pictograms of garbage box by Kyoto Ukyo Ward people and Green Keeper members.

(a) Regular garbage



(b) Resource garbage

Fig. 2 Pictograms designed by Kyoto Ukyo Ward people and Green Keeper members.

III The survey on wastes-sorting ratio in Kyoto Arashiyama

The survey on wastes-sorting ratio at this time was conducted in Kyoto Arashiyama, a famous tourist destination. Fig.3 shows photograph showing of survey on wastes-sorting watio.

Fig. 3 Photograph showing of survey on wastes-sorting ratio at Arashiyama by Kyoto Ukyo Ward people and Green Keeper members.

The wastes-sorting ratio of regular garbage box and resource garbage box was calculated by following formulas (1) and (2), respectively.

$$R_{regular}\ (\%) = \frac{M_{total} - M_{resource}}{M_{total}} \times 100 \quad (1)$$

$$R_{resource}\ (\%) = \frac{M_{total} - M_{regular}}{M_{total}} \times 100 \quad (2)$$

Here, $R_{regular}$ (%) is waste-sorting ratio of regular garbage box, $R_{resource}$ is waste-sorting ratio of resource garbage box. M_{total} (kg) is the weight of the whale garbage, $M_{regular}$ (kg) is the weight of the regular garbage only. $M_{resource}$ (kg) is the weight of the resource garbage only. Spring balance was used for wastes weigh measurement. Measurement was probed by a total of 10 sets of 8 regular garbage boxes and two resource garbage boxes. As shown in Fig. 4, A1, A2 and B1 and B2 are regular garbage boxes, and only regular garbage box is installed in area A and area B. C1and C2, and D1and D2 are regular garbage boxes. However, C3 and D3 are resource garbage boxes and, as for area C and area D, both regular garbage boxes and resource garbage boxes are installed. Survey carried out on pictogram 7 times

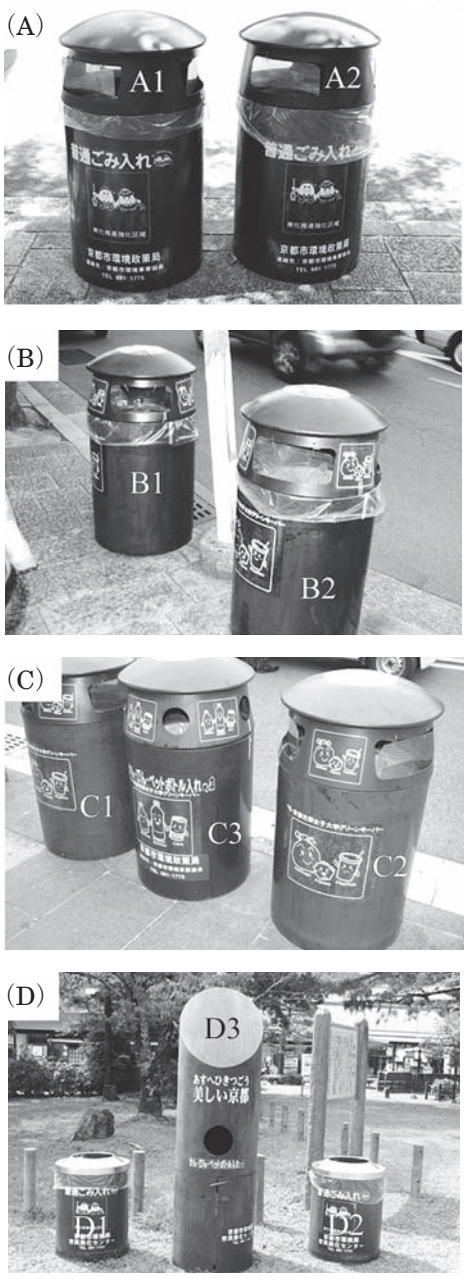


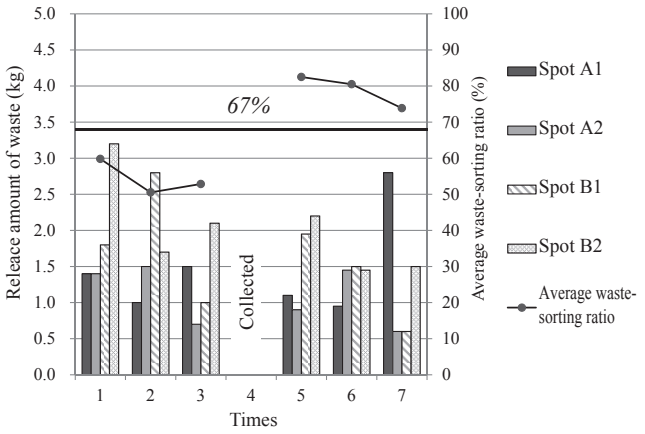
Fig. 4 Surveying spot of waste-sorting ratio. At A1, A2 and B1, B2, only regular garbage boxes are placed. At C1, C2 and D1, D2, both regular and resource garbage boxes are placed. C3 and D3 are resource garbage boxes.

before improvement from Aug. 25, 2010 to Sep. 18, 2010 and 7 times after improvement from Oct. 22, 2010 to Dec. 4, 2010), a total of 14 times.

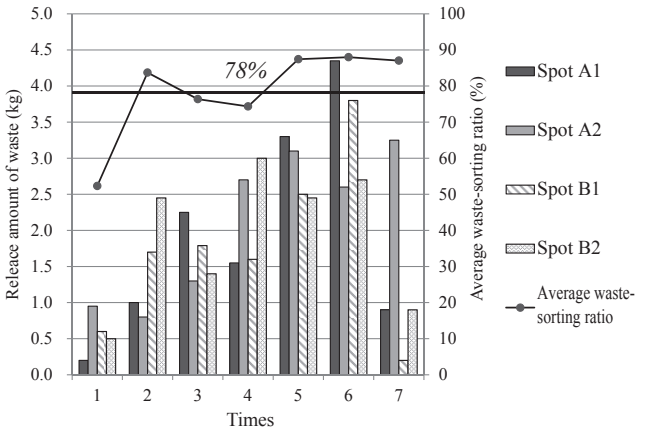
Fig. 5 shows an effect of pictogram on regular garbage boxes A1, A2 and B1, B2 wastes-sorting ratio which are installed in Kyoto Arashiyama. In the area surveyed, only regular garbage boxes are installed, resource garbage boxes are not installed. Number of the measurement is appeared on a

horizontal axis, and total amounts of each garbage box and each average of wastes-sorting ratio are appeared on a vertical axis. (a) is the result of normal state (before improvement) and (b) is the result of a new design (after improvement). By change of pictogram, the wastes-sorting ratio is improving from 67% to 78%. The result shows that wastes-sorting ratio has improved by improving pictogram. In addition, it is shown that the 4th time of (a) was not able to be measured since wastes were picked up before measurement. Moreover, like the 1st time of (b), the reason when there are low amounts of discharge of garbage, wastes-sorting ratio becomes low shows that contamination of modest resource garbage affects wastes-sorting ratio greatly.

Fig.6 shows regular garbage boxes C1 and C2 and effects of pictogram to the wastes-sorting ratio of C1 and C2. As shown in Fig. 4, as for this area detectable for measurement, not only regular garbage boxes but resource garbage boxes (C3, D3) are installed. (a) is the result of normal state (before improvement) and (b) is the result of a new design (after improvement). By change of pictogram, wastes-sorting ratio is improving from 80% to 94%. The result shows that the wastes-sorting ratio has improved by improving pictogram. Moreover, when compared wastes-sorting ratio of regular garbage boxes alone installed as shown in Fig.5 with both regular garbage boxes and resource garbage boxes installed in Fig.6, the latter shows higher wastes-sorting ratio. However, in spite of installing two kinds of garbage boxes, wastes-sorting ratio is not

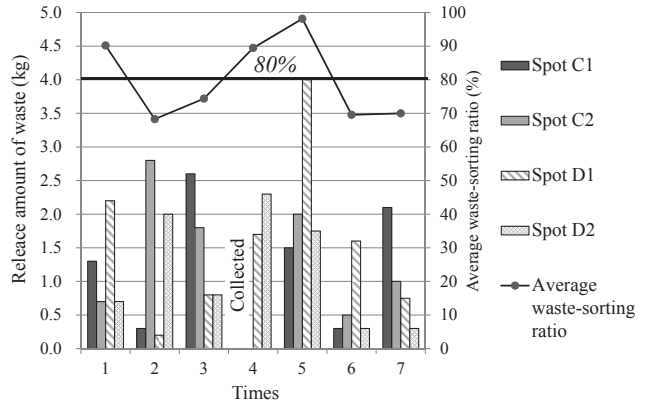


(a) Waste-sorting ratio of conventional design garbage boxes

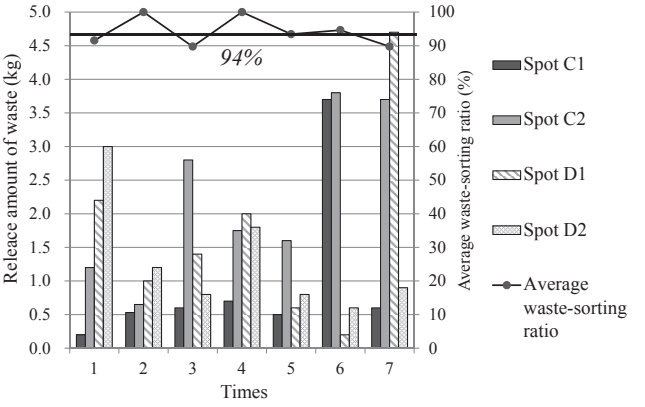


(b) Waste-sorting ratio of improved design garbage boxes

Fig. 5 Influence of garbage box design on wastes-sorting ratio of regular garbage. Only regular garbage boxes are placed at surveying spot A1, A2 and B1, B2 in Kyoto Arashiyama.



(a) Waste-sorting ratio of conventional design garbage boxes



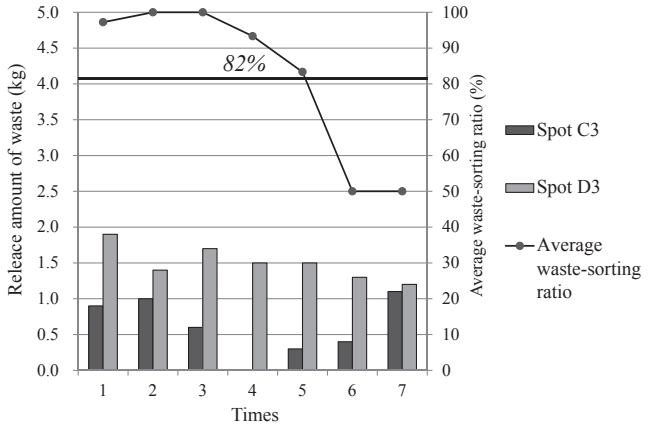
(b) Waste-sorting ratio of improved design garbage boxes

Fig. 6 Influence of garbage box design on wastes-sorting ratio of regular garbage. Both regular and resource garbage boxes are placed at surveying spot C1, C2 and D1, D2 in Kyoto Arashiyama.

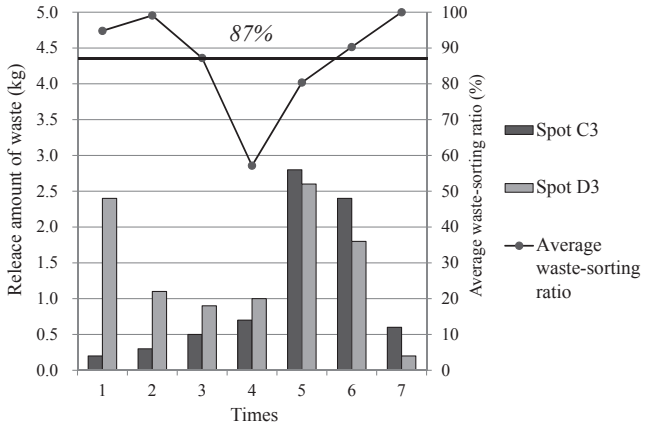
100%. One of the reasons why this slight mixing of resource to garbage boxes could happen is that garbage is thrown away by foreign tourists. Tourists from all over the world visit Kyoto Arashiyama in which the garbage boxes are installed. Proliferation of Chinese and Korean tourists is especially conspicuous in recent years [4]. Since the design of pictogram proposed this time is only English, if Chinese and Hangeul are added, wastes-sorting ratio may improve.

The effect of pictogram to wastes-sorting ratio of resource garbage boxes C3 and D3 is shown in Fig. 7. As shown in Fig.4, this area surveyed has been installed not only resource garbage boxes but regular garbage boxes (C1, C2, and C1, C2). (a) is the result of normal state (before improvement) and (b) is the result of a new design (after improvement). By change of pictogram, the wastes-sorting ratio is improving from 82% to 87%. The result shows that the wastes-sorting ratio has improved by improving pictogram. Moreover, since wastes-sorting ratio of resource garbage boxes have little amount of resource garbage, change of wastes-sorting ratio is large. For example, when ten of 10g PET bottle per bottle were thrown away, the whole PET bottle weighs 100g. In the case where a package of household garbage which contains 100g garbage is dumped there, wastes-sorting ratio will become 50%. In order to improve the accuracy of measurement of wastes-sorting ratio, it is necessary to increase the number of measurement and deals with data statistically.

Fig. 8 shows that the example of a lot of garbage seen when a survey conducted on wastes-sorting ratio in the Kyoto Arashiyama. (a) is Fireworks cinder. Since wastes-sorting ratio survey was conducted in summer, it was able to check such garbage. The person who did fireworks at the riverside is considered to have laid garbage by the public garbage boxes, without bringing waste home. (b) is unused hardcover books. Such unused books were discarded in large quantities. Probably, bookstores disposed of books that are remaindered at bookstores. (c) is the household garbage. By type of waste dumped, this household garbage is the largest group. Most of this household garbage was firmly tied with grocery bags. The container of tableware washing detergent other than kitchen wastes, the disposable diaper after use, etc. were contained in grocery bags. On some occasions, the expired food in large quantities was discarded like (d) and (e). Since the same kind of food is thrown away, the neighboring supermarket probably discarded them. (f) is an empty bottle of a nutrition supplement drinks. The empty bottles of the same kinds were thrown away in large quantities. Although these empty bottles were thrown away into resource garbage boxes, they must be clearly

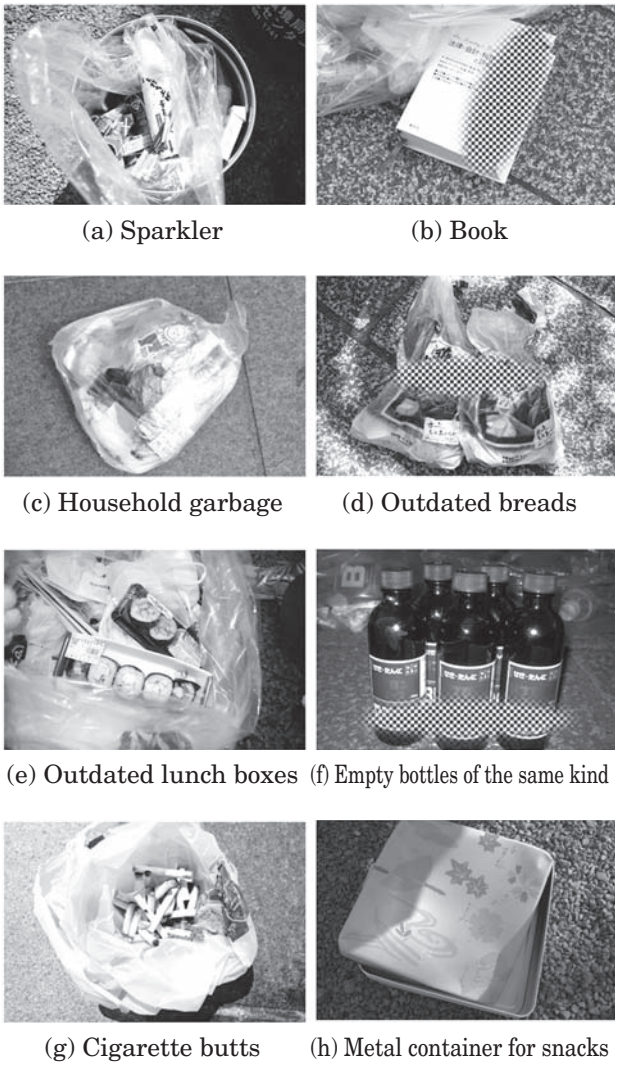


(a) Waste-sorting ratio of conventional design garbage boxes



(b) Waste-sorting ratio of improved design garbage boxes

Fig. 7 Influence of garbage box design on wastes-sorting ratio of resource garbage. Both regular and resource garbage boxes are placed at surveying spot C3 and D3 in Kyoto Arashiyama.



(a) Sparkler (b) Book

(c) Household garbage (d) Outdated breads

(e) Outdated lunch boxes (f) Empty bottles of the same kind

(g) Cigarette butts (h) Metal container for snacks

Fig. 8 The kinds of wastes thrown away in public garbage boxes placed in Kyoto Arashiyama.

discarded from a home. As shown in Fig. (f), stuffing into bags, PET bottles, and cans, cigarette butts were discarded more often. This is most likely to household garbage and garbage especially generated in a car. Cigarette butts may cause a fire and a fatal disaster with so many old traditional temples in Kyoto Arashiyama. Many cans of the sweets for souvenirs etc. were thrown away like (g). Such waste was dumped regardless of change of pictogram. Moreover, since the same maker's bottles and foods were thrown away repeatedly, it is likely to be discarded by the same individual. In order to solve these problems, it will be necessary to control severely with thorough surveillance and the regulation.

IV The pictogram of public garbage boxes in the entire Kyoto City will be improved.

As mentioned above, wastes-sorting ratio has been able to be improved by about 10% through improving the design of pictogram. This result suggests that the pictogram designed by women college students and the Ukyo citizens engenders the environment-conscious mind (eco-mind) to the heart of waste generators..

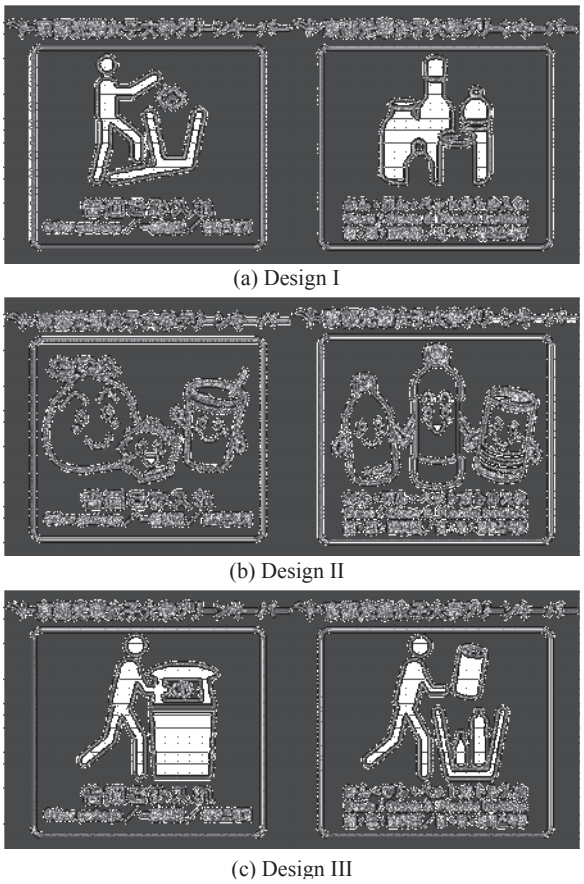
In order to expand such an effort, Kyoto Koka Women's University environmental volunteer circle "Green Keeper" will cooperate with Kyoto City Environmental Policy Bureau and pictogram which Green Keeper designed will be applied to about 700 public garbage boxes in the entire Kyoto City. However, it remains unclear whether pictogram shown in Fig. 2 is the most effective design or not. Then, Green Keeper will develop some more designs and survey on the impact of the new design for wastes-sorting ratio. The design of newly devised pictogram is shown in Fig.9. Design I (a) and III (c) are new designs, and design II (b) is the conventional one. However, in addition to Japanese and English, Chinese and Korean are written. Moreover, the design (left side) of regular garbage boxes show the first two characters "KY" of Kyoto.

The survey on wastes-sorting ratio was conducted for a total of 14 sets (8 sets of regular garbage boxes E1-1 and 6 sets of resource garbage boxes E2-J2 installed between Karasuma-Sanjo and Karasuma Oiike and Karasuma- Oiike and Kawaramachi Oiike near Kyoto City Hall. Regarding E1, E2, F1, and F2 to J1 and J2, regular garbage boxes and resource garbage boxes are installed together. Regarding K1 and L, only regular garbage boxes are installed. Fig. 10 shows wastes-sorting ratio of regular garbage boxes E1-L1. As shown in (a), wastes-sorting ratio had already reached to 96% before redesign. As shown in (b), as for design I, wastes-sorting ratio was 94%. As shown in (c), as for design II, wastes-sorting ratio was 95%. As for the

design III of (d), the wastes-sorting ratio was 96%. As such, since wastes-sorting ratio before redesign was high enough, in spite of having improved the design, the ratio was not able to be raised.

Fig.11 shows the wastes-sorting ratio of resource garbage boxes E2-L2. Fig.12 shows the wastes-sorting ratio of regular garbage boxes K1 and L1. As well as wastes-sorting ratio of regular garbage box shown in Fig. 10, in spite of having improved a garbage box design, the significant improvement in the wastes-sorting ratio was not confirmed.

As shown in Fig.13, in the survey on wastes-sorting ratio conducted in front of Kyoto City Hall, disposal of the household garbage was seen frequently. This household garbage occupied more than half of total wastes. In this survey, since this household garbage was classified mostly and discarded, the wastes-sorting ratio stands at high. However, since the household garbage is not allowed to bring in, the new measures are needed to prevent this.



(a) Design I

(b) Design II

(c) Design III

Fig. 9 New design of pictogram to improve waste-sorting ratio furthermore. Right: for resource garbage box, left: for regular garbage box.

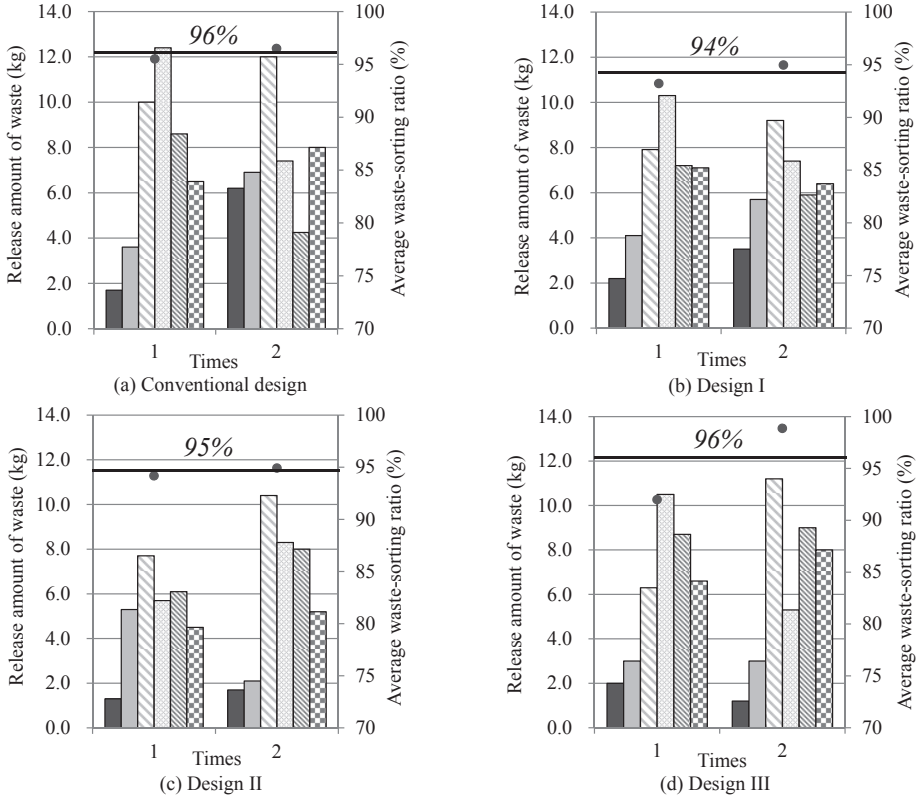


Fig. 10 Difference of waste-sorting ratio of regular garbage boxes on the proposed design I, II, III. Both regular and resource garbage boxes are placed at surveying spot E1, F1, G1, H1, I1 and J1 near Kyoto City Hall. E1: ■ , F1: ▒ , G1: ▨ , H1: ▩ , I1: ▧ , J1: ▣ and average waste-sorting ratio: ● .

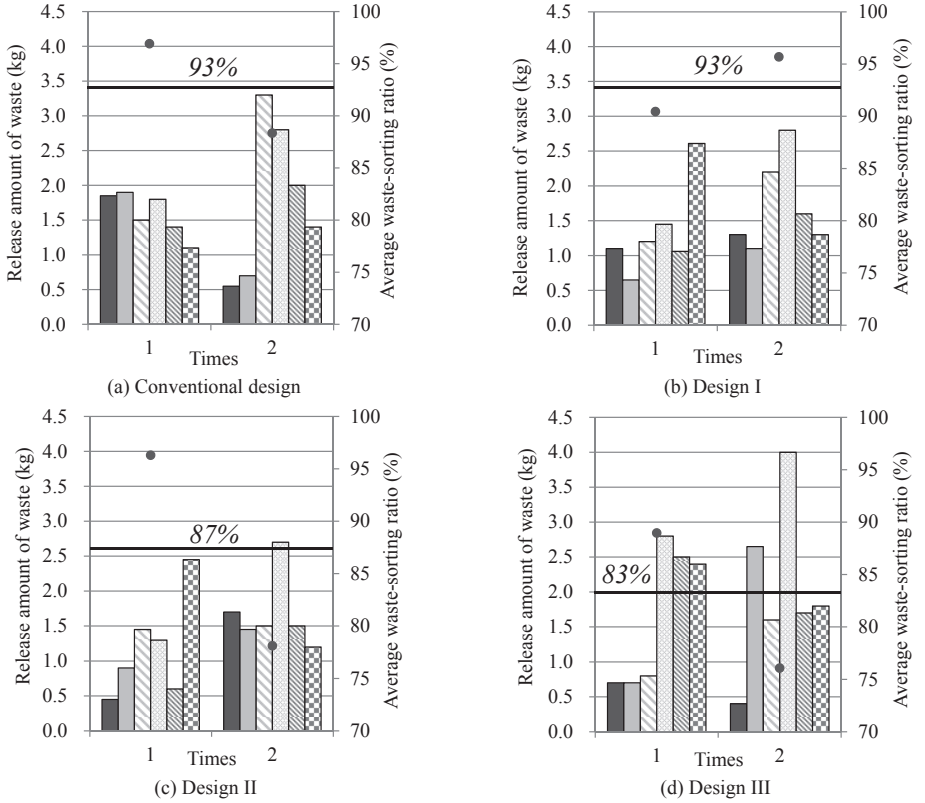


Fig. 11 Difference of waste-sorting ratio of resource garbage boxes on the proposed design I, II, III. Both regular and resource garbage boxes are placed at surveying spot E2, F2, G2, H2, I2 and J2 near Kyoto City Hall. E2: ■, F2: ■, G2: ■, H2: ■, I2: ■, J2: ■ and average waste-sorting ratio: ● .

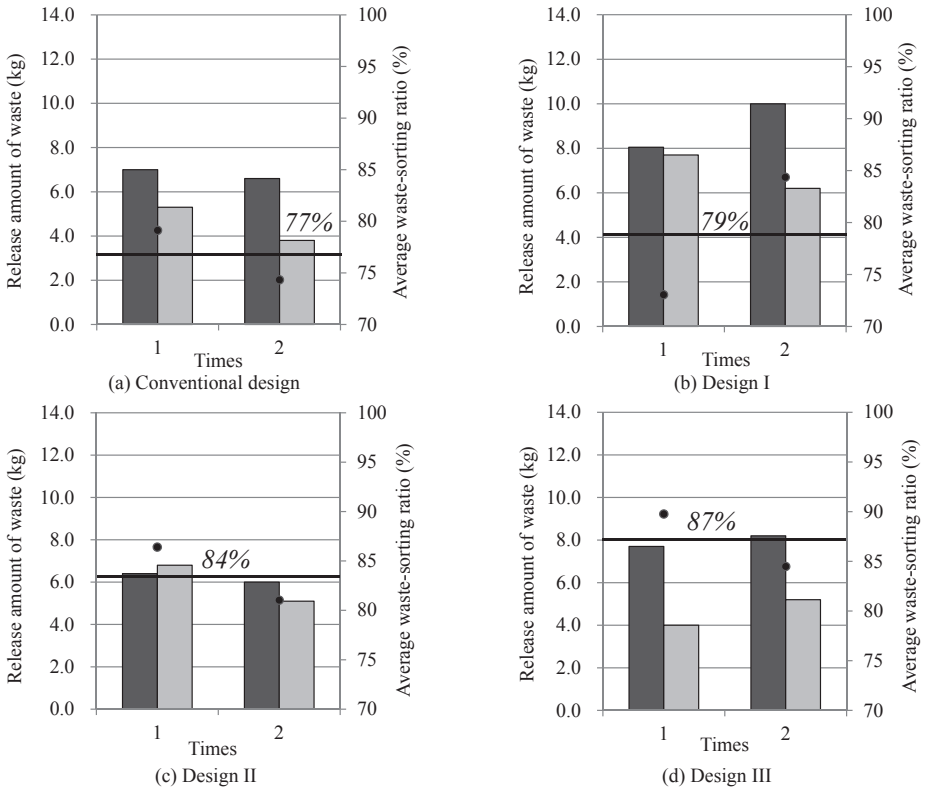


Fig. 12 Difference of waste-sorting ratio of resource garbage boxes on the proposed design I, II, III. Only regular garbage boxes are placed at surveying spot K1 and L1 near Kyoto City Hall. K1: ■, L1: ■ and average waste-sorting ratio: ● .

Fig. 13 Photograph showing of scattered household garbage. At surveying spots in front of Kyoto City Hall, household garbage was remarkable.

V Summary

This wastes-sorting survey was conducted in Kyoto Arashiyama, famous for tourist spots, and in front of Kyoto City Hall located at business districts. Although the wastes-sorting ratio has been improved by making the design of pictogram new in the Kyoto Arashiyama, significant improvement was not recognized at the place in front of Kyoto City Hall. The difference in the wastes-sorting ratio is considered to be contributed to the difference of place where the wastes-sorting ratio was measured. In the case of tourist spots, wastes-sorting ratio was able to be improved by improved designs because waste generators are scarcely the same person each time. However, in the case of business districts, the measures to prevent carrying in the household garbage rather than improvements of wastes-sorting ratio are needed since the same individual has discarded the household garbage habitually.

Acknowledgments

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