

COMPARATIVE ANALYSIS OF HOUSEHOLD WASTE COMPOSITION IN THE DIFFERENT DISTRICTS OF STOCKHOLM

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ABSTRACT

Separating household waste into fractions at the place where it was generated is one of the most popular methods of collection household waste in most European countries. In 1994 a producer responsibility ordinance for packaging was introduced in Sweden. This ordinance mandates householders to sort out packaging waste, clean the waste and sort different package materials – paper, plastic, glass and metal in assigned recycling bins. Household's participation is mandatory but in practice it is rarely controlled and enforced. In our study we have focused our interest on seeing the composition of the "trash bags", theoretically the rest of the waste after household sorting. The aim of the study was to identify the main fractions of household "trash bags" and the difference in the fraction among 3 different districts in Stockholm, which have practically analogous facilities for separate collection of household waste but rather different socioeconomically characteristics. The chosen districts were located: one in the downtown and two in the suburb districts, one of which has a big multicultural characteristic due to the big amount of emigrants living there.

The results of the study show that the biggest fraction from the composition analyses is organic fraction. This fraction is varying from 48% in the multicultural suburban district to 34% in the downtown. These results show the big opportunity for implementation the separate organic waste collection spatially in the suburban areas of Stockholm. The amount of packaging material in the "trash bags" still composes around 28-50%. The composition of the packaging material differs in the 3 districts.

Keywords: Pick-analysis; household waste; composition.

INTRODUCTION

Around 4.485.600 tons of household waste are produced in Sweden each year [1]. Divided over the population, each Swedish resident produces 480,2 kg of waste per year. 49,2 % of household waste is recovered either by material recycling or by biological treatment, 48,4 percent treated through incineration with energy recovery and 1,4 percent goes to landfill [1]. Environmental policy requires that waste shall be treated in such a way that the maximal environmental and social benefits are achieved. All parties participate in this work from producers to householders. In 1994 a producer responsibility ordinance for packaging was introduced in Sweden [2,3,4,5]. This ordinance requires that the producers of packaging materials provide a collection system. The producers' system includes approximately 6000 unmanned recycling stations (drop-off stations) for packaging and paper that are located around the country [1]. The collection system is formed in consultation with both producers and local authorities. The recycling stations have separate bins for newspaper and various packaging material. Several municipalities have implemented curbside collection for single-family dwelling or property close collection for apartment blocks dwelling.

In case of householders this ordinance mandates them to sort out packaging waste from other waste, clean the waste, make use of the collection systems that producers provide, and finally sort different packaging material in recycling bins. Household's participation is mandatory but in reality it

is rarely controlled and enforced. Nevertheless official statistics show that households in Sweden recycle substantial amounts of packaging materials [6].

In our study we have focused our interest on seeing the composition of the “trash bags”, theoretically the rest of the waste after household sorting. The aim of the study was to identify the main fractions of household “trash bags” and the difference in the fraction among 3 different districts in Stockholm, which have practically analogous facilities for separate collection of household waste but rather different socioeconomically characteristics.

METHOD AND MATERIAL

A general fraction analysis of “trash bags” was done using official data from Traffic Office in Stockholm City Municipality. Data from three fraction analysis of “trash bags” in three municipalities of Stockholm where chosen for this work:

- Apartment building area downtown, Normalm
- Apartment building suburban area, Hågsten
- Apartment building suburban area, Rinkeby-Kista

All three areas have property close collection of packaging material and paper within 150 m. “Trash bags” collection is also property close but can differ within the municipality and between the chosen municipalities from refuse sacks in the apartment building to underground tanks or containers within 100 m from the household. The collection of trash is weekly pickup in all three municipalities. However, socioeconomically characteristics of the areas are rather different.

The fraction analysis of “trash bags” has been performed indoor by the variety of waste from the “trash bags” sorted manually and divided to the predetermined fractions. The pick-analyses were conducted in accordance with the manual RVF Development [7].

The analysis was conducted over three days in October, by Furumo Irebrand Waste Consultant AB. The waste was collected twice a day from the refuse sacks, underground tanks and containers, wrapped in garbage bags by householders. To obtain statistically representative results, the goal was to sort about 300 kg per day from each area, resulting in a total of around 900 kg of “trash bags” for each area.

All the collected waste was sorted manually and separately for three areas into the 15 agreed fractions and later weighted. Weights were obtained for each fraction of material using two different digitally calibrated scales. One scale can weigh up to 300 kg and had an accuracy of 100 g and a smaller one with an accuracy of 1 g was used for weights below 2 kg.

Socio-economical characteristics of sampling areas

For this work three municipalities of Stockholm were chosen, one in the downtown of Stockholm (Normalm) and two in the suburban areas (Hågsten in the south-west of Stockholm and Rinkeby-Kista in the north-west of Stockholm).

Socio-economical characteristics of these three municipalities rather differ. There are a big number of residents with foreign origin in the Rinkiby-Kista municipality, 77% from the all population of the area (Figure 1). The majority of them have non European origin. While in Hågsten and Normalm residents with faring origin account less than 20% and half of them coming from Europe.

The income parameter show that Hågsten and Normalm are high income areas, while Rinkiby-Kista is low income one (Figure 2). The education level is high in the Hågsten and Normalm. There is small number of people with only elementary school education and majority have high school education, 60% of population in Hågsten and more than 60% in Normalm. While in Rinkiby-Kista the number of people with high school education only 30% and majority have elementary and secondary school level (Figure 3).

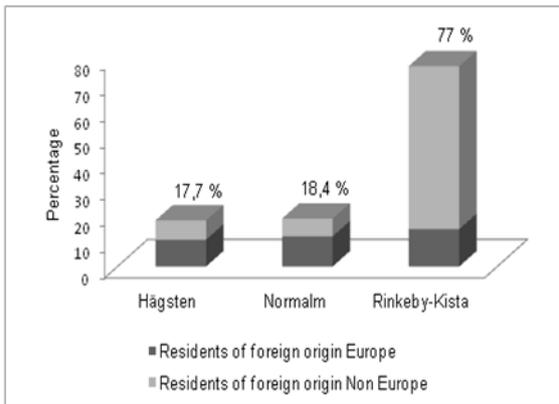


Figure 1. Residents of foreign origin (Source: USK, 2010).

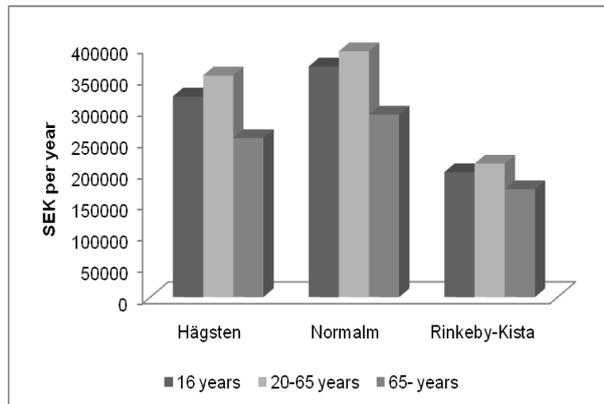


Figure 2. Income (Source: USK, 2010).

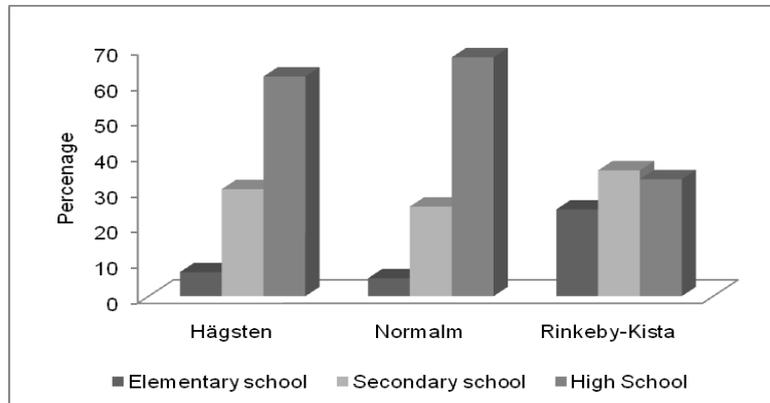


Figure 3. Educational level 25-64 years old (Source: USK, 2010).

RESULTS AND DISCUSSION

Around 900 kg of “trash bags” for each of the three areas was analyzed. The results from the downtown area of Normalm are presented in the Figure 4.

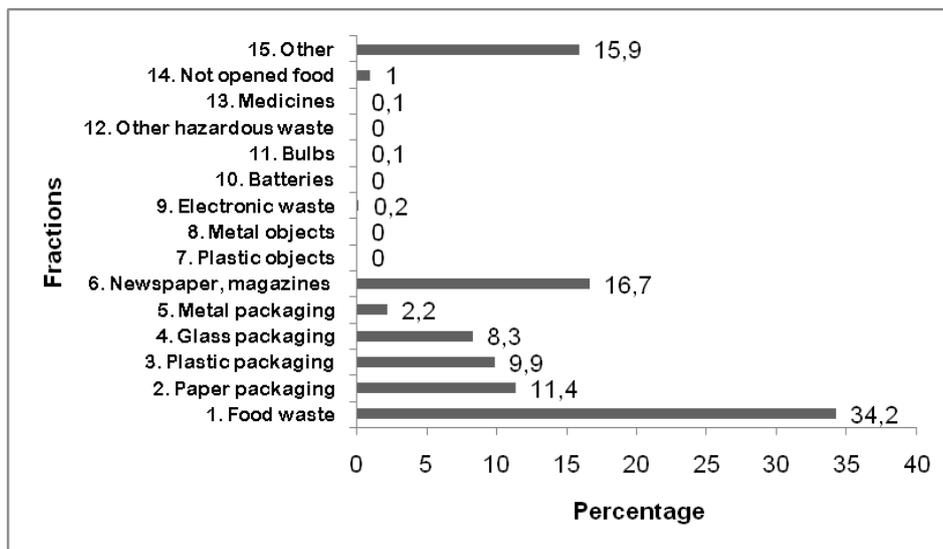


Figure 4. Composition analyses of the “trash bags”, Normalm, Stockholm.

According to the figure 4 the biggest percentage account food waste, 34,2% from the all amount of analyzed waste. We can see that all packaging material with newspaper and magazine still have almost 50% of the “trash bags”. The biggest fraction from this material is newspaper and magazine 16,7%, later going paper packaging 11,4%, plastic 9,9%, glass and metal packaging finishes this group of material.

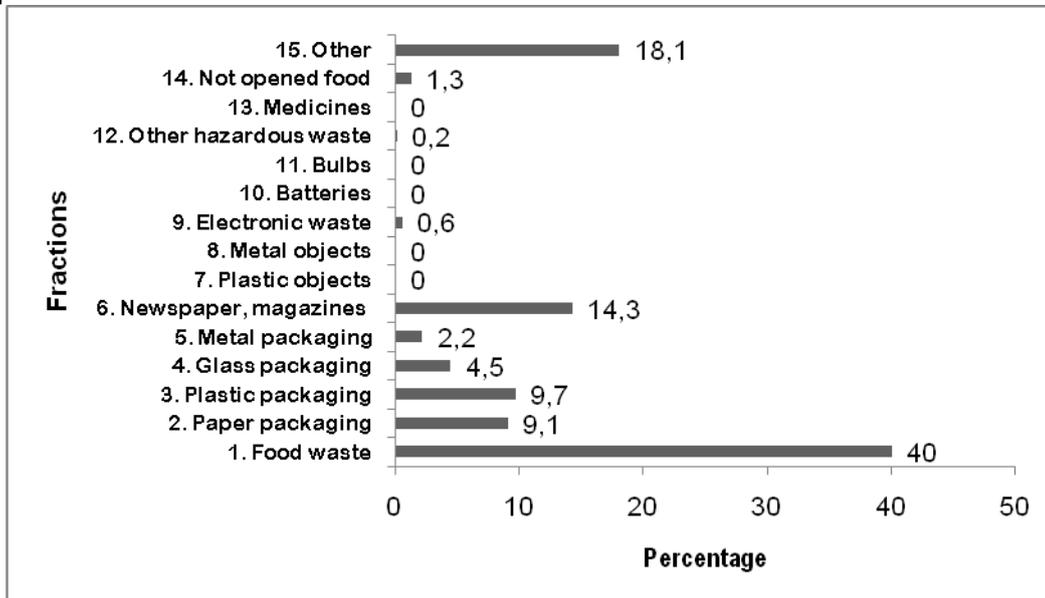


Figure 5. Composition analyses of the “trash bags”, Högsten, Stockholm.

In suburban area of Högsten we can see similar trends in the fraction analyses (Figure 5). The biggest fraction is food waste, which even more than in Normalm and account 40%. The packaging material with newspaper accounted around 40% of “trash bags” waste. The leader here as in Normalm is newspaper 14,3 percent, later going plastic packaging 9,7 %, paper packaging 9,1 % and glass with metal packaging finishing this group of material. It can be noticed that amount of glass packaging is two times less than in the downtown of Normalm.

In multicultural suburban area of Rinkiby-Kista the amount of food waste increased to 48 percent and as in two previous areas account the biggest percentage from the all 15 fractions (Figure 6).

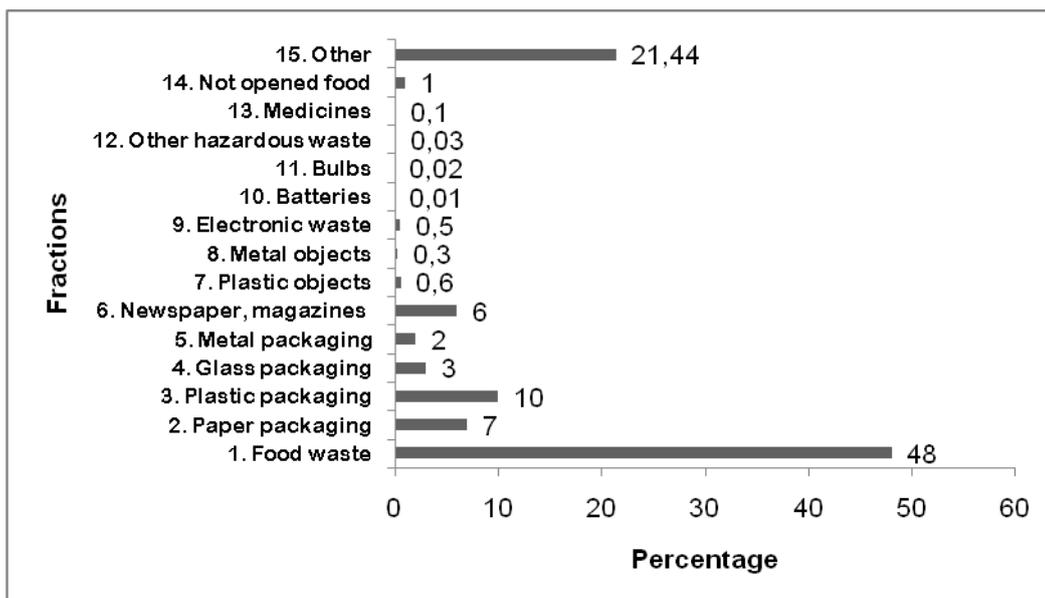


Figure 6. Composition analyses of the “trash bags”, Rinkiby-Kista, Stockholm.

The percent of packaging material together with newspaper is rather less than in the the two previous area and account 28%. The biggest decrease in this group of material was found in the fraction of newspaper and magazines, this can be explained by better recycling or just by less use of newspapers by population in this area, due to the problems with language.

The amount of glass packaging is also decreased (3%) compare with the downtown area of Normalm (8,3%) and have similar results as in other suburban area Högsten (4,5%).

Fractions of hazardous, electronic waste and medicine waste in all three areas account very small percentage, however in the area of Rinkiby-Kista this small percentage is a little bigger, that show the necessity of more educational and informational work concerning the hazardous waste in the areas of big population with different cultural background. However the amount of packaging material and newspaper in this area is visually smaller compared with the other two areas. This can be explained by better separating the waste or using products with less packaging. In the multicultural area of Rinkiby-Kista is traditionally popular to buy food products in the street vegetable market or in the national shops where the amount of product is rather bigger in the package than in the supermarket.

CONCLUSIONS

The key findings of the analysis were as follow:

- The biggest amount of "trash bags" account fraction of food waste, that show the potential for the separate collection of organic waste and as the result reduction of waste in the "trash bags". The fraction of food waste increase in the suburban areas and in the area with lower income and education characteristics.
- The group of main recyclable materials (newspaper, packaging of metal, glass, plastic and paper) still remains rather big amount of "trash bag", from 50% in the high income downtown to 28% in the lower income multicultural suburban area with 40% in the middle in the high income suburban area.
- Fraction of newspaper remains the biggest amount in the group of recyclable materials in the downtown and high income suburban areas.
- Fraction of glass packaging two times bigger in the downtown area comparing with suburban areas.

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