

Household Solid Waste Characteristics and Management in Low Cost Apartment in Petaling Jaya, Selangor

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ABSTRACT: Knowledge of solid waste generation and composition is necessary for an accurate decision making in the management strategy of urban waste. The objective of this study is to characterise the generation of waste and identify the problems arise from improper solid waste management to public health. This study also verifies the relationship of socio-economic status and lifestyles that influence the amount of waste generated. A total of 360 solid waste samples were collected over six weeks from 60 households in Gasing Indah Apartment and were hand sorted and classified into eight weighted fractions. A questionnaire was distributed among the respondents and analyzed using SPSS. Results show that average solid waste per household in the study area is 1.70 kg, and 0.34 kg/person/day. The major fractions were: organic waste (43.5%), plastic (25.2%) and paper (22.7%) respectively. From the linear regression, the explanatory variables show that family size and lifestyle factors, particularly the eating habits and dining out activity of resident, contribute significantly to variations in the generation of residential waste in the study area ($p < 0.05$, R of 0.625). As for the solid waste problems that arise, most respondents feel uncomfortable with nuisances such as broken facilities, aesthetic value, and overflow of waste. Respondents have the probability of being exposed to harmful vector borne diseases due to the presence of habitats for vectors such as rodents, flies, cockroaches and mosquitoes.

Keywords: household solid waste, characterization, management

Introduction

Knowledge of solid waste composition is necessary for an effective management of urban solid waste (McDougal et al., 2002; Zeng et al., 2005). Inappropriate solid waste operation, storage, collection and disposal practices entail environmental and public health risks (World Resources Institute 1996). Decision making in solid waste management (SWM) requires a sound understanding of the composition and the processes that determine the generation of waste (Acurio et al. 1997). Special attention should be paid to the waste generation sources since the characteristics and composition of the waste are source dependent (Tchobanoglous et al., 1996).

In Malaysia, the amount of waste generated is increasing from year to year as a result of rapid population growth and escalating urbanization and industrialization in many municipalities. The average amount of municipal solid waste generated in Malaysia in 2003 was 0.5–0.8 kg/person/day

with 1.7 kg/person/day in major cities (Kathirvale et al., 2003). Major urban areas such as Kuala Lumpur, Petaling Jaya, and Penang are projected to have a huge increase in solid waste (Agamuthu, 2001). The amounts and composition of solid waste generated are affected by factors, including socio-economic development of the area, degree of industrialization, and climate. Generally, the greater the economic prosperity and the higher degree of urbanization, the greater the amount of solid waste produced (Hassan et al., 2001).

The objectives of this study are (i) to identify and measure the amount of household waste generated (ii) to study the relationship between socio-economic status and life style with waste generated (iii) to identify the problems encountered related to improper solid waste management.

Methodology

Study area

The study was conducted at a low cost apartment residential area, Gasing Indah which is an 8-blocks flat. This residential area was governed by Petaling Jaya City Council (MBPJ). The consortium responsible for solid waste management at this locality is Alam Flora Sdn. Bhd.

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TABLE 1- Solid waste composition at selected urban area in Malaysia (Source: Kathirvale S. *et al.*, 2003)

	Kuala Terengganu	Petaling Jaya	Johor Bahru	Klang
Paper	15.0	23.6	19.0	27.5
Plastics/ rubber	3.5	9.4	12.0	7.7
Food	66	48.3	45	44
Glass/ Ceramic	1.0	4.0	3.0	2.6
Metal	5.0	6.0	9.0	5.1
Wood	3.0	4.9	7.0	10.1
Textiles	1.0	4.0	5.0	2.9
Miscellaneous	5.5	-	-	0.1
Total	100	100	100	100

Questionnaire, sampling and characterisation of the sample

A structured questionnaire was designed to collect the household level data on socioeconomic status and daily solid waste traits. The questionnaire also included a number of attitudinal questions aimed at examining the households’ awareness and attitudes toward the problem of urban solid waste management. Data were also collected through direct observations and interviews with household members, the officer of city council and waste management company.

Plastic bags of similar size with respondent’s code were supplied to each household to place their residential wastes during the distribution of questionnaire. Collected wastes from each household within the poly bag were weighed and recorded. Then the wastes within each bag were segregated and each hand-segregated item was weighed separately and recorded. The same procedure was conducted each day for each of the 60 households for 6 weeks.

Data collection and analysis

A statistical computer package, SPSS was used to analyze the results of the study. Attributes in the study include gender, age, education, marital status, income, family size, as well as eating habits and home-cooking activities.

The waste generation is usually represented by waste generation rate – the quantity of waste generated per person per day (kg/day/capita). In this study, wastes amount is measured using the average daily waste generated by the family (which is obtained by dividing the total sample of wastes from individual unit), by the number of days the amount being collected by the respondents:

$$\text{Average daily weight per household (kg)} = \frac{\text{Total Weight of Wastes}}{\text{Number of days the wastes collected}}$$

Results and Discussion

The results of this study are discussed from three aspects: (1) characterization of the waste generated, (2) correlation between socioeconomic and lifestyle with waste generation and (3) problem encountered with improper solid waste management.

Characterisation of the solid waste generated

Solid waste generation rates give an estimation of the amount of waste created by residences over a certain period of time. Note that waste generation includes all materials discarded, whether or not they are later recycled or disposed in a landfill. The waste generation rates for residential activities can be used to estimate the impact of new developments on the local waste stream.

TABLE 2- Total of solid waste composition generated by household

	Total waste generated (Kg)	Percent
Food	267.06	43.5
Paper	139.51	22.7
Plastics	154.65	25.2
Glass	16.62	2.6
Metal	13.02	2.1
Aluminium	6.56	1.2
Textile	5.83	0.9
Others	11.23	1.8
TOTAL	614.48	100

Based on the results obtained, the total weight of household generated was 614.48 kg. The average generation rate among residents was 1.7047 kg for every household per day and 0.34 kg/capita/day. The highest composition of waste generated was food waste (43.5%, 267.06 kg) followed by plastics (25.2%, 154.65 kg), paper (22.7%, 139.51 kg, glass (2.6%, 16.62 kg), metal (2.1%, 13.02 kg.), aluminium (1.2%, 6.56 kg) textile (0.9%, 5.83 kg) and others (1.8%, 11.23 kg).

Waste generated as per household per day or per capita per day in this study was found to be lower if it was compared to the previous data from Agamuthu (2001) for waste generation rate in Petaling Jaya of 2.76 kg/household/day and 0.49 kg/capita/day at low cost or low income residential setting. Our results are also comparative low when compared to averaged value for a Malaysian of 0.95 kg of wastes per capita per day. It is important to note that this figure is solely based on the household wastes at home and should not be mistakenly compared to the overall municipal wastes (which include yard and bulky wastes).

Examination on the solid waste composition found that organic waste or food waste, paper, plastics, glass, metal, aluminium, and textile represent the major constituents of the residential solid waste generated. This was also agreed with the findings by Agamuthu (2001) and Badruddin (2004) that solid wastes in Malaysia were mainly household wastes, followed by paper, and plastics. The average composition was also compared with the previous study conducted by Sivapalan *et al.* (2003) for the generation of solid waste in Petaling Jaya. There was a considerable amount of food waste that can be a concern, but the amount of organic content found in the present study was lesser compared to previous report (Sivapalan *et al.*, 2003). In general, organic waste formed the higher composition for most studies conducted previously. This is due to the fact that food waste or organic wastes were released during all stages of preparation and post consumption.

Plastics were the second higher composition generated by household. Through observation and sampling activity, plastic types include soft drink containers, detergent bottles, food wrappings, ice cream boxes and others are recyclable. The increase in the amount of plastics at the end of the month was observed and this can be explained by the fact that September was a fasting month for Muslim during the time of our study where people tend to buy ready-to-eat food from stalls set up during the fasting month. This finding was also supported by Agamuthu (2001) that composition of waste can be influenced by seasonal factors.

Hazardous wastes, which can lead to an adverse health and environmental effects, were also found in the household waste generated during our study. These include fluorescent tubes, batteries, cosmetics, nappies (disposable diapers), electronic waste (e.g. hand phone charger) and vehicle spare part.

Relationship between socioeconomic and lifestyle with solid waste generation

The generation of waste was found to be positively correlated with family size ($r = 0.511$, $p < 0.05$). In other words, families with more individuals generate a larger quantity of solid waste per day (FIG. 1).

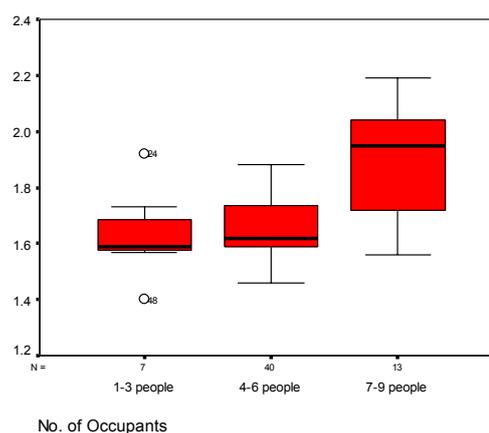


FIG. 1- Correlation between waste generation rates with number of occupants

Our results show that the weight of wastes increases correspondingly to the size of the family and the frequency of home cooking activity. This result was however, in contrast to the findings of Abu Qdais *et al.* (1996) who observed a poor relationship between the numbers of persons living in the property with the rate of waste generation. Linear regression analysis was conducted. All insignificant determinant variables were omitted, leaving behind only three attributes; cook at home, dine out activity and family-size. This finding partly agrees with Sabarinah (1997), that lifestyle can be a factor on the amount of wastes generated by households.

Dine out activity among household has also contributed to the amount of waste generated. Other personal factors such as age, gender, income, and marital status, education level and occupational were excluded in the analysis since these variables did not contribute much to the amount of wastes generated.

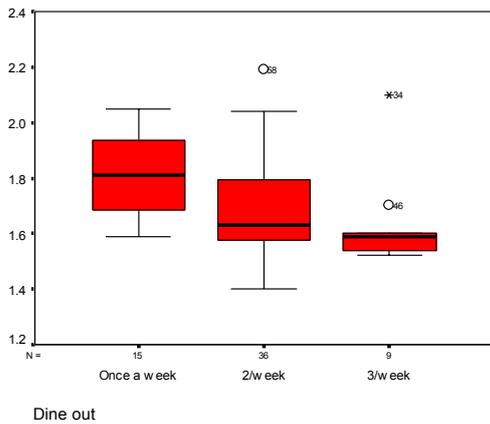


FIG. 2- Correlation between waste generation rate with dine out activity

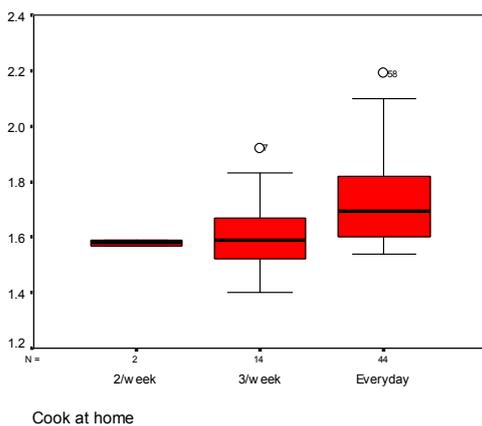


FIG. 3- Correlation between waste generation rate and cook at home activity

Problems due to improper solid waste management

The handling and separation, storage and processing of solid wastes at the source before collection is the second of the six functional elements in the solid waste management system (Siong, 2005). This process is a critical step in the

management of residential solid waste because it contributes significant impact to public health and affects the sequence of steps in the management of solid waste. Davis A. Cornwell (1998) reported that environmental factors were the most important determinant in areas of waste storage and disposal because these functions represent prolonged exposure of waste to environment.

This study focused more on problems arises from communal storage site (FIG. 4). Note that communal storage is a large container that is located outdoors in a collection point. Waste is taken from the household to the collection point by the householder and these large containers are emptied mechanically using collection vehicles equipped with unloading mechanisms.

Household wastes in these communal containers consisted of food waste, paper, glass, plastic or metal containers, garden wastes and animal dung. Among all, food waste preceded other wastes. During decomposition, food waste produces an unpleasant smell. This was also supported by Davis A. Cornwell (1998) that garbage decomposes rapidly particularly in warm weather and quickly produce disagreeable odours. Thus, improper scheduled of waste collector can create nuisance to community.

The frequency of waste collection in the study area was 3 times a week (Monday, Wednesday and Friday). Based on the researcher’s observation, the subcontractor often failed to collect the waste at the scheduled time. This delay leads to the amount of waste being increased day by day until the communal storage was overloaded. Consequently, the household would put their waste on the floor nearby it or discard into dumpsite leading to waste being scattered near the communal storage and created unsightly conditions.

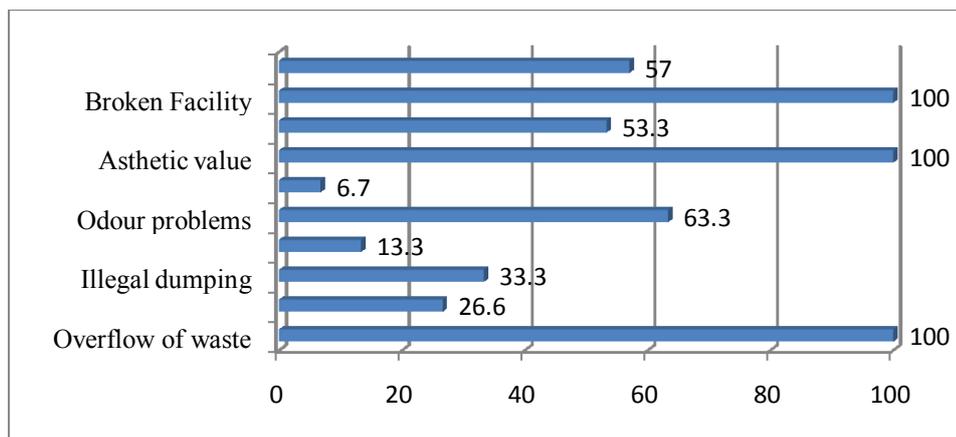


FIG. 4- Problems faced by the community at the collection stora

Possible health risk

Many human diseases are linked to the improper solid waste management (Tchobanoglous 1999). Our observation during the period of study found that several containers were possible breeding habitat for mosquito including flowerpot, tyres, cans and pails (TABLE 3). According to Kamau (2000), empty bottles, tyres, plastic cups and other receptacles that litter the landscape were significantly contributing to mosquito related diseases. In addition, the data from the City Council has shown that flowerpot was the highest potential breeding for mosquito followed by cans container, tires, plastic container, water tank and flushing toilet.

TABLE 3- Potential breeding site for mosquito

Location of potential breeding site (container)	Amount
Flowerpot	4
Tyres	3
Plastic container	3
Pail	1
Others	1

Infrequent collection and rapid decomposition of waste provide an attractive feeding and breeding site for flies, rats, cockroach and other scavengers (Sunil, 2005). From the observation, six burrows were encountered around the storage area and food stall near the residential area.

Similar to mosquito and rodent, flies and cockroach-related problems tend to arise when there is food source. Flies are attracted to waste or unsanitary condition (Sabesan, 2001). They breed in close association with man, in human and animal waste. They can carry various diseases, including cholera, diarrhea, typhoid and dysentery. Houseflies are mechanical carrier of disease, which means that they do not bite as mosquitoes do (Pan America Health Organization 2002); therefore, germs or pathogens are picked up by houseflies and carried to human food. Resident who lives near the communal storage therefore can be the group at risk.

Conclusion

The characterization of solid waste is the first step in the planning of an integrated waste management in a local authority. Knowing the composition of the waste allows for defining the strategies for separation, collection and frequency of collection for recycling. Besides, it is important to maintain

the facility provided for the collection of waste in order to avoid any nuisances in future.

The purpose of solid waste study at household level is to measure the amount of waste generated by household and to break down this aspect into its basic components and characteristics, and predicts the possible health problems. It can also help us to understand the influence of socio-economic status and lifestyle on solid waste generation. Our results conclude that amount of organic waste is still the highest followed by plastics and paper. The eating habits and family size of the residents of the study area, on the other hand, can influence the household weight significantly.

Problems which are related to solid waste management persist in low cost residential area. The facilities provided are not properly maintained and thus create repeated problems to the community. Therefore, accentuation of environmental and health aspects in solid waste management should be emphasised to make sure that community can live without intimidated by the surrounding factors.

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