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Study of household solid waste generation and composition in Medan City, Indonesia; a case study in Medan Labuhan and Medan Tuntungan

H Khair^{1,2}, D D S Mutia² and T Matsumoto¹

¹Graduate Programs in Environmental Systems, Graduate School of Environmental Engineering, The University of Kitakyushu, 1-1, Hibikino, Wakamatsu, Kitakyushu, Fukuoka, 808-0135, Japan

²Department of Environmental Engineering, Faculty of Engineering, Universitas Sumatera Utara, Medan, Sumatera Utara, 20155 Indonesia

Email: hafizhul@usu.ac.id

Abstract. This study aims to estimate solid waste generation and its composition of households in Medan City. Medan Labuhan and Medan Tuntungan sub-districts were selected as study area. Data of this study was collected in 2017. The estimation of waste generation was conducted based on Indonesian standard SNI 19-3964-1994. The study found that the household solid waste generation in Medan Labuhan generated 0.233 kg/person/day of solid waste and 0.254 kg/person/day in Medan Tuntungan. The result in composition revealed three main fractions they are 45.2- 52.3% of organic waste, followed by 19.5-23.7% of plastic, 12.5-13.1% of paper and other fraction such as wood, glass, textile, and metal. This study showed a potential of recyclable materials in the composition of household waste. It is necessary to initiate minimizing of waste generation, reusing, separating, and recycling waste.

1. Introduction

In some cities in Indonesia, the available data on waste generation is still challenging. In terms of waste management planning, comprehensive and reliable data about waste generation and composition are absolutely required. Un-managing solid waste will lead to human and environmental issues. Meanwhile, managing solid waste properly will improve the living condition. Thus, it is a priority to plan carefully the effective solid waste management.

Several studies proposed the concept of the integrated solid waste management system. Integrated solid waste management was defined as the selection and application of suitable techniques, technologies, and management approach to achieve specific objectives and goals [1]. Citizens in developed countries are dropping their waste at a specific location, time and waste categories. Public participation, awareness, and corporation are the main keys to success in solid waste management. Public participation is a necessary part to make the people aware of active participation in the system. Without public participation, it may be difficult to make city cleaner and may also become less effective in the use of cost resource.

Currently, the household solid waste in Medan city is managed by the municipality. Waste generated in the household are disposed of as a mixed waste into a plastic bag before taken to pick up point for the daily collection. There is no separation or sorting at sources. The municipality takes the household solid waste directly to the landfill. However, some households try to separate the recyclable



materials such as plastics, cans, bottles, and metal; and sell it to private recycling agents. The recycling agents sell the recyclable waste to recycling companies.

Medan, located at Sumatera island, is one of a big city in Indonesia, consist of 21 sub-district. Approximately 2.4 million people inhabit the city. The objective of this paper was to assess the generation and composition of household solid waste in Medan city, especially in Medan Labuhan sub-district and Medan Tuntungan sub-district. The study areas are located in southern and northern of Medan city. The areas represent the suburban area of Medan city. The data are obtained from sampling, sorting and analyzing household solid waste.

2. Methodology

Sample collection and measurement of solid waste generation and its composition were referred to the Indonesian National Standard SNI 19-3964-1994, Method of Collecting and Measurement of Samples and Composition of Urban Wastes. Waste generation and composition were measured in eight days. Solid waste generation was calculated through load count analysis method, which calculates the total of waste collection every day [2]. Two sub-districts of Medan City were selected as areas of study, which are Medan Labuhan and Medan Tuntungan. Based on SNI 19-3964-1994, the sample collections were based on income level: high, medium and low income. The total number of the sample in Medan Labuhan is 56 households, consist of 14 units of high income, 17 units of medium income and 25 units of low income. Meanwhile, 41 households were selected in Medan Tuntungan, consist of 10 units of high income, 12 units of medium income and 19 units of low income.

The composition of wastes was gathered by sorting into 11 fractions and analyzed their weight and percentage. The fractions include organics, paper, plastics, wood and yard waste, textile, rubber, glass, metal and miscellaneous. Sample collection was conducted on July 22-30, 2017.

3. Result and discussion

On the average, the rate of household solid waste generation was 0.233 kg/person/day for Medan Labuhan and 0.254 kg/person/day in Medan Tuntungan. These areas generated 0.244 kg/person/day. This study found that low economic activity generated more waste than high economic activity. This result is slightly different if compared with another study. A study in Tampan sub-district, Pekanbaru city found that the highest income generated more waste, following by medium and low income [3]. Another study in Bukittinggi city also showed the same pattern [4]. Table 1 shows the amount of household solid waste generated in different income levels.

Table 1. Household solid waste generation.

Income level	Waste generation (kg/person/day)	
	Medan Labuhan	Medan Tuntungan
High income	0.205	0.215
Middle income	0.239	0.232
Low income	0.254	0.316
Average	0.233	0.254

The largest fractions of household solid waste in Medan Labuhan and Medan Tuntungan were organic with 52.3% and 45.2% of household solid waste, this waste comes from food waste. The second largest fraction was plastic, 19.5% of household solid waste in Medan Labuhan and 23.7% of household solid waste in Medan Tuntungan. This number means that the consumption of plastics was high, including plastic packaging, PET bottle, and another form. Paper fraction contributes about 12.5% of household solid waste in Medan Labuhan and 13.1% of household solid waste in Medan Tuntungan. The rest of fraction were wood and yard waste, textile, glass, metal and miscellaneous. The result of the household solid waste compositions is shown in table 2.

Table 2. Solid waste composition.

Composition	Medan Labuhan	Medan Tuntungan
	%	%
Organic	52.3	45.2
Paper	12.5	13.1
Plastic	19.5	23.7
Wood and yard waste	1.1	2.4
Textile	2.4	2.1
Rubber	0	0
Glass	2.8	3.1
Metal	3.1	3.5
Misc.	6.3	6.9

Table 2 shows that household solid waste has an inorganic potential recovery. It can reduce the volume of waste dumped to landfill. Several options to recovery are by attaching the material recovery facility or encouraging separating activity in the areas. The biodegradable waste goes to the composting center. The material fraction can be recovered and composted using the activities such as paper, plastic, glass, metal and organic waste. It can reduce up to 90.2% of waste disposal to landfill.

4. Conclusions

This study revealed the rate of household solid waste and composition in two areas: Medan Labuhan and Medan Tuntungan. These areas are representing the condition of the suburban area. This study also provides the opportunity way to reduce solid waste. The three mains recyclable/reusable fractions are plastic, paper and metal. The composition data also provide the potential of the biodegradable fraction; mainly coming from food waste. Using this data, the municipality may plan the effective and efficient solid waste management and bring to the cleaner city.

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