



Household Solid Waste Management and Composition in Bekasi, Indonesia

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Abstract

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BACKGROUND: Waste is any substance that is discarded after primary use or is worthless, defective, and of no use, and it is a serious problem in several countries. The largest composition of waste in Indonesia today is food waste. In this country, waste management is still carried out using the landfill method. Therefore, the increase in waste generation will have a very serious impact on the environment. The impact can lead to global warming, acid rain, depletion of the ozone layer, etc.

AIM: This research aims to summarize the generation and composition of household solid waste.

METHODS: The method used is a quantitative approach using surveys and field observations. The data were collected by measuring the generation and composition of waste, as well as through interviews. The research sample amounted to 100, comprising three households.

RESULTS: The results showed that food waste was the most commonly generated waste at 66%. Therefore, the role of mothers in the daily handling of food ingredients in the family is very important as it contributes to daily food waste.

CONCLUSION: There is still a lack of public awareness in managing household scale food waste.

Introduction

Waste is waste material that is discarded by humans, usually due to a perceived lack of utility. The term rarely encompasses bodily waste products, purely liquid or gaseous wastes, or toxic waste products. Therefore, it is commonly sorted and classified into both organic and inorganic, biodegradable or non-biodegradable kinds of material suitable for specific kinds of disposal. Waste is one dilemma facing many cities in the world. With the increase in population and activities, the volume of waste also increased. Therefore, waste management is not cheap because the land used is getting wider. Waste is harmful to health and the environment if not handled properly [1].

According to Law no. 18 of 2008 concerning waste management, waste is the residue of daily human activities or natural processes in solid or semi-solid form as organic and inorganic, biodegradable and non-biodegradable substances, which are useless and disposed of in the environment. Increasing people's purchasing power for raw materials and technological products businesses or activities that support the economic growth of a region, also contributes to the

number of people and quantity and quality of waste generated.

At present, cities around the world produce about 1.3 billion tons of waste per year. This volume is expected to increase to 2.2 billion tons by 2025. Waste generation rates will double over the next few decades in low-income countries. The growth rate of urban waste is influenced by economic development, industrialization, community behavior, and local climate. The higher the economic development and urbanization, the greater the amount of solid waste generated. Income levels and urbanization are highly correlated with an increase in the amount of waste generated. Urban communities generate about twice as much waste as rural communities [2].

Until now, waste management in Indonesia's cities has not achieved optimal results. There are still many challenges encountered in implementing waste management, both economic, sociocultural, and technological constraints. The problem of waste management in urban areas is very serious due to the complexity of the problems that arise and the high population density. Therefore, waste management is often a priority in urban areas.

Indonesia is one of the tourist destinations for people from different countries, which influences the cities to experience growth in the economic sector. It is characterized by the continuous rise of various restaurants, cafes, fast food outlets, and other eateries. This has the potential to generate an enormous amount of waste in this sector, especially food waste. According to the Food and Agriculture Organization, food waste is a waste generated during food production and after-meal activities associated with the behavior of sellers and consumers. The problem of food waste worldwide is becoming a particular concern that should be addressed within the framework of environmental sustainability [3].

Food waste has become an important global problem in the world. The issue is also included in Sustainable Development Goals (SDGs) No. 12 related to responsible consumption and production. SDGs No. 12 also places specific targets on waste reduction to halve the amount of global food waste per capita at retail and consumer levels by 2030 and reduces food losses along production chains and supply. Food waste that is not managed properly can also hurt human health. The process of decomposition of food waste will produce methane and H₂S gas, which is toxic to the body. Another indirect effect is that vector-borne diseases increase food waste. This vector likes to live in places that are dirty, damp, and smell-like leftovers. This rotting food residue is also a source of food for vectors, which then cause certain diseases such as gastrointestinal (stomach) diseases, plague, and others [4].

Food waste occurs at all levels of the food supply chain, with most of the sources originating from households, which represent the main endpoint that generates food waste throughout the food supply chain, influenced by a complex set of household management behaviors. FOA showed that food waste is associated with consumer or community behavioral issues. Subsequently, food waste in households is often the result of poor shopping planning, over-buying, ignorance of the label (used before) on the back of the package, poor food stock management or storage, preparing too much food, and not knowing how to use leftovers in other recipes instead of throwing them away [5].

In Indonesia, food waste is not given special attention, although it has great potential if managed properly. However, only a few research focused on food waste. Therefore, it is necessary to consider different research related to the behavior of an individual with food waste behavior and food waste management experiments carried out by many countries with different experiences to be applied in Indonesia [5]. Bekasi is a developing city with trade, services, and industry. This city strives to create a clean, healthy, safe, and comfortable environment to achieve progressive Bekasi. In addition, sustainable waste management has started in the city of Bekasi, including through the development of maggot cultivation.

Research Methods

The research design uses quantitative with several stages such as surveys, data collection, data processing, and analysis. The minimum sample size for the RW 01 waste bank was 100 households (KK) using the purposive sampling technique. Then, the household solid waste (HSW) generation was calculated once due to limited conditions in the community that does not permit the collection and sorting of waste. Meanwhile, the identification of the characteristics of household waste is based on SNI 19-2454-2002, which comprises organic waste, paper, wood, cloth, rubber, plastic, metal, glass, etc. The data collected were field observation data, which in this case were obtained after field testing as waste occurrence and composition data, and interviews with the waste bank manager on waste management. Data analysis using univariate analysis describes the proportion of the waste generated in the household, which will be presented as graphs, pies, or tables.

Results

The generation of waste is directly proportional to the waste generated from each household, which comprises organic and inorganic waste. This is appropriate with SNI 19-2454-2002 which comprises organic waste, paper, wood, cloth, rubber, plastic, metal, glass, etc. The following tables are the characteristics of the respondents:

Table 1 shows that the majority of respondents are female compared to the male, which is 85%. The age of the majority of respondents is over >40 years with a total of 73%. The education of the majority is high school about 54%. The occupation of the highest respondents differs with a total of 84%, from civil servants, private employees, entrepreneurs, and services. Regarding the income of the household, there are still many respondents who have income <IDR 4,800,000.

Table 1: Characteristics of respondents

No.	Variable	Category	N	Percentage
1	Gender	Male	15	15
		Female	85	85
2	Age	≤40 years	27	27
		>40 years	73	73
3	Number of family members	≤3 members	37	37
		>3 members	63	63
4	Education	Unschooling	3	3
		Elementary	15	15
		Junior high school	16	16
		Senior high school	54	54
		Associate degree	6	6
		Bachelor degree	5	5
5	Occupation	Master degree	1	1
		Civil servant	2	2
		Private employees	2	2
		Entrepreneurs	10	10
		Service	2	2
		Others	84	84
6	Household income	<IDR 4,800,000	63	63
		≥IDR 4,800,000	37	37

Figure 1 shows that the highest proportion of HSW composition is food waste at 66%, while the proportion of inorganic waste is 34%. The following is the result of household waste generation based on SNI 19-2454-2002, consisting of organic waste, paper, wood, cloth, rubber, plastic, metal, glass, etc.

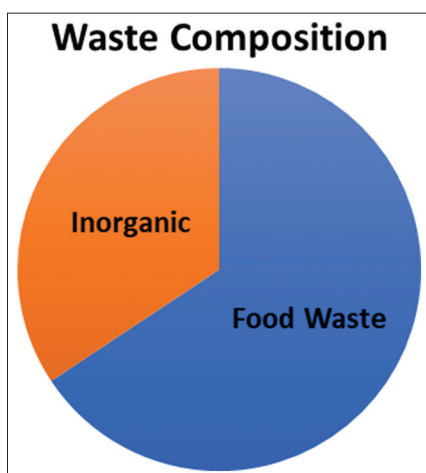


Figure 1: Pie chart of garbage composition

Table 2 shows that the highest household waste generation is food waste at 261.60 kg (82.67%), while inorganic waste generation is plastic waste at 27.89 kg (8.81%), paper at 15.52 kg (4.9%), others at 4.57 kg (1.44%), a glass of 4.43 kg (1.4%), and wood of 2.43 kg (0.77%). Regarding rubber, cloth, and metal, no waste was generated from household activities.

Table 2: Composition of household waste based on the Indonesian National Standard (SNI)

Waste composition	Weight (kg)	Percentage
Leftovers	261.60	82.67
Paper	15.52	4.90
Wood	2.43	0.77
Cloth	0	0
Rubber	0	0
Plastic	27.89	8.81
Metal	0	0
Glass	4.43	1.40
Others	4.57	1.44
Total	316.44	100

Discussion

Based on Figure 1, the results show that the composition of food waste has the largest percentage (66%) compared to inorganic waste (34%). Research by Sedek and Hakami (2015) stated that the generation of organic waste has the highest proportion of 48% compared to the generation of plastic, paper, glass, cloth, and other waste. Meanwhile, Table 2 shows that the composition of the waste produced is 82.67% food waste, 4.90% paper, 0.77% wood, 0% wood, rubber, and metal, 8.81% plastic, and glass 1.40%. Therefore, the waste generated is dominated by food waste [6]. Based on this information, the overriding problem is that there

are still many people engaging in food waste behavior. Therefore, given that food waste is considered an important issue, efforts are needed to reduce food waste.

The decision-maker for the consumption of groceries in the family is the mother. About 90% of respondents answered that the mother is the decision-maker for the consumption of food in the family. An individual who considers leaving food is a bad behavior can be viewed as an individual who cares about the wasted food. Feelings of guilt become one motivation to reduce food waste [7]. Many researches in the developing countries have shown that financial considerations are one motivation for people to reduce food waste [8], [9], [10].

Considering and paying attention to the existence of environmental impacts of food waste is less important according to consumer concerns [11]. Amirudin and Gim (2019) stated that individuals' behavior is influenced by environmental conditions [10]. In Korea and other developed countries, environmental concerns will reduce food waste. However, increasing environmental awareness is motivated by the existence of a food waste management system [12]. Food waste is also associated with feelings of emotion (Radzymińska, Jakubowska, and Staniewska, 2016; Waitt and Phillips, 2015), hate (Waitt and Phillips, 2015), and frustration and anxiety from some consumers (Graham-Rowe *et al.*, 2014) [13], [14], [15].

Meal planning habits are important in influencing the incidence of food waste [16]. However, households are considered to underestimate the generation of food waste [7]. In this case, precautionary suggestions for reducing food waste include storing, cooking, and dealing with leftovers and wasted food. Storage for each type of food has a different way of handling. In addition, proper food preparation can make it easier to get the food you want, and therefore, nothing is hidden and forgotten. However, most consumers do not implement storage strategies to extend food shelf life [16]. Cooking in large quantities can cause too much food residue, and therefore, good cooking skills can help reduce the amount of food waste. This can increase the portion estimate as needed [16] and reduce the potential for non-essential food waste. Handling and disposal of leftovers from one serving are due to oversupply. Not everyone wants to eat leftovers because considering the sustainability of food waste or food safety if it is still consumed. Using leftovers as ingredients to create new food menus are considered more difficult and time-consuming [16]. This leads to leftover food going to landfills, although it can reduce the possibility of increased food waste in households if reused.

The village of Magajaya Bekasi already has a waste bank that can be used as a container for waste disposal. Waste management uses the maggot cultivation system (Black Soldier Fly), in which household and organic waste can be transformed.

However, based on the results of interviews with the community, it was reported that 53 (53%) respondents never recycle packaging and 46 (46%) respondents never recycle organic waste.

Food waste has potential and can be disposed of by recycling. According to Abdelradi (2018) who conducted research in Cairo, respondents who supported recycling activities can reduce the generation of food waste [17]. This differs from Amirudin and Gim (2019) who stated that recycling activities and preventive measures have no relationship between and their environmental value [10]. Environmental values have no impact on environmentally conscious behavior. This shows that recycling practices and precautions do not reduce the generation of food waste [18].

Conclusion

The average amount of waste generated in a household was 4.2 L/person/day. The composition of most waste is food waste at 82.67%. The lack of public awareness of food processing planning in the family, as well as waste sorting and community cooperation with waste management (waste bank), is an obstacle. Garbage transportation facilities, containers for maggots, and garbage collection have been very supportive, but this is still difficult due to the lack of commitment and information in managing waste, especially food waste.

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