Municipal solid waste composition in final disposal area of Serang City Banten Province

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Abstract. This research aims to identify the percentage of the mass fraction of the entire waste component and composition of municipal solid waste in final disposal area which is reflects the pattern of consumption of Serang City residents in its contribution to produce waste. The study was conducted in the area of TPA Cilowong, Serang City. The research used experimental method. The techniques of data analysis are measurement of water content, observation, and deep interview. This study found that the composition of solid waste was identified according to their characteristics, which are organic waste, plastic, paper, Styrofoam, textiles, wood, glass, and pieces. The results show that the composition of urban waste is related to people's lifestyles and economic growth of Serang City. Organic waste such as leaves, leftover vegetables, leftover fruits, and food scraps are most found in Cilowong final disposal area. While the amount of inorganic waste most collected is plastic waste. This condition illustrates that the current tendency of the people of Serang city to use various plastics such as plastic bags or plastic food packages to meet their daily needs up to 37%.

1. Introduction
Waste is the material that is left and is not desired in the production process, or the result of waste from humans or nature. According to the Law of the Republic of Indonesia No.18 of 2008 concerning Waste Management, waste is the residue of human daily activities and/or solid natural processes. Whereas according to SNI 19-2454-2002 concerning Procedures for Urban Waste Processing Operational Engineering, waste is defined as solid waste consisting of organic and non-organic materials which are deemed useless and must be managed so as not to endanger the environment and protect development investment [1].

The average generation of municipal solid waste in Indonesia contains about 70% garbage, is about 2.5 liters per capita per day. The increasing of population growth and various activities in big cities like Jakarta, Surabaya, Bandung, Makassar, etc. tend resulted in the increase of waste generation [2]. The average waste generation and composition are influenced by various factors such as population activities including waste management systems, technology, season and time, population density, population habits, socioeconomic level and geography [3].

In municipal waste management in Indonesia, the source of municipal waste is divided into: 1) Settlement or household and the like. 2) Market. 3) Commercial activities such as shops. 4) Office activities. 5) Hotels and restaurants. 6) Activities from institutions such as industries, hospitals, to garbage that are similar to settlement waste. 7) Sweeping the road. 8) Parks.
Data regarding generation, composition, and characteristics of waste are very supportive in developing a solid waste management system in an area. The data must be available so that an alternative solid waste management system can be prepared. For developing countries and tropical climates such as Indonesia, the factor of the season is very large influence on the weight of waste. In addition, the weight of waste is also strongly influenced by other socio-cultural factors. Therefore, it is advisable to evaluate waste generation several times in one year [4]. The objective of research is to identify the percentage of the mass fraction of the entire waste component and composition of municipal solid waste in final disposal area which is reflects the pattern of consumption of Serang City residents in its contribution to produce waste. The study was conducted in the area of TPA Cilowong, Serang City.

2. **Methodology of research**

The waste component sample in this study was taken from the Cilowong landfill (TPA), which is located in Taktakan District, Serang City. The production of waste in final disposal area per day reaches 500-600 M³ with the arrival time of approximately 100 garbage trucks per day with a load capacity of 5-6 M³ per truck. The collection of waste sample data is on the garbage from the vehicle of the newly arrived garbage truck and is taken down in the landfill, considering that the waste sample does not experience much change due to compaction, leaching and recycling activities [5]. Then the garbage is put into a plastic waste measuring 75 x 75 cm² or about 50L. The waste then undergoes sorting based on the characteristics of the waste. Each waste component is weighed so as to produce a mass fraction of the waste component. The municipal solid waste sampling is carried out for 8 (eight) days with the procedure of taking garbage samples referring to SNI 19-3964-1994.

2.1. **The stages of waste sampling**

The stages of waste sampling are carried out as follows:

- Samples of solid waste are taken from trucks (garbage transport vehicles) that have just arrived or come down (scheduled)
- Take pile of solid waste from the truck to form a new pile, spread over plastic sheeting, take a sample of approximately 500 Liter (100kg)
- Put it in a 50L (75x75) cm² plastic bag container.
- Label the date and day
- Samples of initial waste weighed (kg). Record in the worksheet.
- Garbage is sorted according to its constituent components. Sorting is done to determine the composition of municipal waste.
- Each component of the waste is weighed both wet weight and dry weight.
- There will be parts that are difficult to identify such as ash and other missing parts, so it can be stated as "and others". Record the composition of the waste in the worksheet.

2.2. **The measurement of moisture content**

By knowing the moisture content in the waste, we can find out how much potential waste is as an alternative to fossil fuels. Moisture levels are determined by calculating the loss of weight of the waste sample before and after heated. The process of heating or drying is done naturally with a temperature of 30°C.

**Working steps:**

- Sort the waste from TPA based on the waste characteristics.
- Weigh waste samples per category, set as wet weight (a).
- Perform the drying process for approximately 2 (two) weeks in open air.
- Weigh back samples of dried waste per category, set as dry weight (b).
- And record the results.
- Calculation of moisture content in waste:
Moisture Content = 100% - % Moisture ................................. (2)

3. Experimental results

Figure 1 shows the highest to the lowest amount of garbage obtained based on the components of Serang municipal waste for eight days of collecting and sorting of waste samples from the Cilowong landfill.

![Figure 1. Municipal solid waste composition.](image)

Experimental results show the composition of measurement waste. After collecting and analyzing the solid waste samples collected and analyzed, there are 8 (eight) types of solid waste identified according to their characteristics. Those are organic waste, plastic, paper, Styrofoam, textiles, wood, glass, and pieces. The picture depicts that metal and rubber waste in random sampling are not found. This is due to the metal and rubber waste has previously been taken by collectors when the garbage is in a temporary disposal area (TPS). The result also shows that the composition of urban waste is related to people's lifestyles and economic growth of Serang City. Organic waste such as leaves, leftover vegetables, leftover fruits, and food scraps are most found in Cilowong final disposal area. While the amount of inorganic waste most collected is plastic waste. This condition illustrates that the current tendency of the people of Serang city to use various plastics such as plastic bags or plastic food packages to meet their daily needs up to 37%, shown in Figure 1.

![Figure 2. The reduction of water content between dry solid waste and wet solid waste.](image)
Figure 2 describes the graph of reduction of mass fraction of waste water content before drying (wet weight) and after drying (dry weight). The drying process is carried out for two weeks in open water. Based on the drying process the water content is significantly decreasing. This decline can improve waste performance as an alternative energy substitute for fossil fuels.

![Percentage of Moisture Lost Content of Municipal Solid Waste in Serang City](image)

**Figure 3.** The percentage of moisture lost content.

The drying process in Figure 3 shows that the percentage of moisture lost content above 40% is plastic, wood, papers, textile, and pieces. Variations in waste components (physical waste) and chemical elements contained in it will affect the potential of waste as an alternative energy substitute for Fossil Fuels by utilizing municipal solid waste from the source of Cilowong disposal area and become a preliminary study for next stages.

4. Conclusion

The pattern of the volume of Serang municipal waste reflects the consumption pattern of the Serang city community itself. The organic solid waste of Serang city is sourced from food scraps. While the inorganic waste is mostly sourced from the use of plastic such as plastic bags and plastic food packaging. Environmental mitigation efforts by reprocessing plastic waste as a new renewable energy source can be done so that waste problems can be reduced. The finding is the initial reference for further research related to the feasibility of plastic waste as an alternative energy substitute for fossil fuels.

References

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