

Waste reduction potential in samtama program implementation (study case: rt 10/rw 03 cempaka putih timur)

Yemima Marnalita Hasibuan^{1*}, Filson Maratur Hasibuan¹

¹Environmental Engineering, Engineering Program, President University Bekasi, 17530, Indonesia

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Abstract. Waste is one of the big problems often faced by metropolitan cities like DKI Jakarta. The Jakarta Environment Agency's research stated that DKI Jakarta produces 7500-tons of waste per day with 60.5% coming from residential. Therefore, the DKI Jakarta government initiated the Sampah Tanggung Jawab Bersama (SAMTAMA) to mobilize residential people to manage waste from its source at certain locations as a pilot, one of locations is RT 10 / RW 03 Cempaka Putih Timur. RT 10 / RW 03 Cempaka Putih Timur is the RT that is considered optimal in implement the SAMTAMA program. Based on this, the objectives of this study are to find the existing condition of SAMTAMA program and to measure the waste generation, composition, and reduction potential in the implementation of SAMTAMA program. The method implemented in measuring using SNI 19-3964-1994 which is carried out for 8 consecutive days. Waste composition is classified based on SNI 19-3964-1995, supplemented with components of B3 waste and diapers. The results of the analysis show that the average of waste generation is 14.99 kg/day where the treated waste is 11.36 kg/day and the untreated or residual waste is 3.63 kg/day with the largest composition is food waste with 10.66 kg/day (71%). With SAMTAMA Program implementation, the waste potential reduction can reach 0.019 kg/day/person.

* Corresponding author: mimahsb20@gmail.com

1 Introduction

Waste management in metropolitan cities faces many problems because the amount of waste is getting bigger [1]. In addition, this also occurs because waste management still uses the old paradigm that relies on collection, transportation, and disposal activities. According to DLH DKI Jakarta, If there is no suitable system for waste management, it will require a lot of budget from time to time and more landfill location.

DKI Jakarta is a city with a dense population. According to Attachment to the Decree of the Head of the Sanitation Office No. 334 2013, DKI Jakarta produce organic waste in the biggest number as many as 53.75% in their research in 2011 like Figure 1 below.

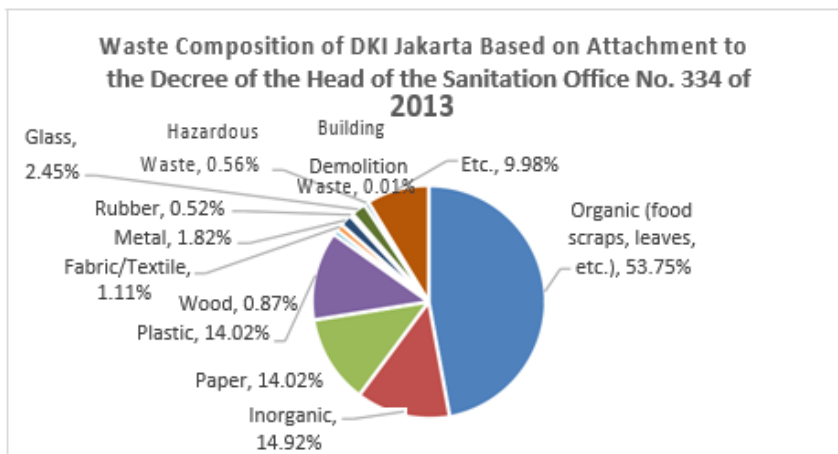


Fig 1. Waste Composition of DKI Jakarta Based on Attachment to the Decree of the Head of the Sanitation Office No. 334 of 2013

Beside of that, according to DKI Jakarta Environment Agency in Official Portal of Integrated Waste Management Unit, Jakarta produces 7452.6 tons of waste per person where 60.5% from domestic waste in 2018 [2]. If it still using the old paradigm, TPST Bantargebang which is a DKI Jakarta waste shelter is threatened to be unable to dispose of waste again in 2022 [3].

The waste management paradigm that relies on the final approach should be abandoned and replaced with a new paradigm of waste management. To change

this paradigm, the DKI Jakarta government has created a household waste management program called the Sampah Tanggung Jawab Bersama (SAMTAMA) where waste management is carried out from its source so that all parties have an awareness to the waste.

SAMTAMA is a movement / social branding of waste management to reduce the waste by changing the mindset of people about waste. To run the SAMTAMA Program, the government give some socializations to representatives of each RW in DKI Jakarta about increasing the awareness to the waste by bring them to TPST Bantargebang. Beside of that, the government teaches them how to do 3R (Reduce, Reuse, and Recycle) to the waste so that they have skills to manage their waste well. In addition, the government still in progress to make the regulation about SAMTAMA Program so that the program could be sustain.

At present, the SAMTAMA program has been implemented in Jakarta's RW with 22 RWs as the pilots. One RW that is considered optimal in running the SAMTAMA program is RW 03 Cempaka Putih Timur. This RW has developed a waste bank, composter barrel, and maggot BSF cultivation to reduce plastic waste and food waste.

To improve the SAMTAMA program to be applied to all locations of DKI Jakarta, it needs optimization based on waste generation, waste composition, and reduction potential. Therefore, this study examines waste generation and composition based on SNI 19-3964-1994 about "Urban Waste Generation and Composition Measurement Methods" in residual waste generated by RT 10 / RW 03 Cempaka Putih Timur which is considered optimal in conduct the SAMTAMA program.

2 Method

2.1 Determination of Research Location

The determination of the location is based on direct observation and the ease of information access about the condition of the location. The research location is RT

10 / RW 03 Cempaka Putih Timur, Jakarta Pusat, where the RT 10 location has 70 housing units with a population of 218 people.

Some considerations in the selection of study locations are, RT 10 / RW 03 Cempaka Putih Timur is one of the SAMTAMA pilot programs that is considered to be running optimal, this is evidenced by the reduced amount of waste. In addition, RT 10 / RW 03 Cempaka Putih Timur is a location where the data needed for research is easily obtained and accessed.

However, not all houses in RT 10 / RW 03 Cempaka Putih Timur apply the SAMTAMA program. Only 10 housing units that have a total population of 38 people are considered optimal and consistent in carrying out this program. Therefore, 10 houses that were considered optimal and consistent in carrying out the SAMTAMA program were taken as the sample of this study to determine the waste generation, waste composition, and waste reduction potential.

2.2 Environmental Aspects Data Collection

This research requires an appropriate and accurate method to obtain representative data. The data needed in this research are primary data and secondary data.

Primary data can be obtained from research and direct observation of the field. In this research, the measurement that has conducted are Waste generation, Waste composition, and reduction potential in RT 10/RW 03 Cempaka Putih Timur.

Secondary data is needed to support primary data. Secondary data were obtained from government agencies namely DLH DKI Jakarta, RW, and RT. Secondary data needed in this study are:

- a. Total population of RT 10 / RW 03 Cempaka Putih Timur.
- b. Total treated waste of composter barrels, maggot BSF, and waste banks.

2.2.1 Waste Generation

Waste generation is the amount of waste that generates from the people. Since SAMTAMA management program had been implemented, to calculate the waste

generation, the amount of residual waste and treated waste must be added up. Residual waste is waste from the people that is not treated by SAMTAMA program, while treated waste is waste from the people that is treated by SAMTAMA program.

The method of sampling the residual waste generation is done by collecting residual waste from 10 housing units used as samples and weighing every day for 8 days based on SNI 19-3964-1994. The collection process is carried out by taking out waste from sources that have been contained.

After that, the residual waste that has been collected is weighed to calculate the total weight of the residual waste produced each day so that the resulting waste generation is expressed in kg/day. The equipment needed is a hanging scale with a scale of ± 100 kg, a waste measuring tub with dimensions of 20 cm x 20 cm x 100 cm with a weight of 5 kg, and a measurement form.

Then the amount of treated waste obtained from data that has been recorded by head of RT 10 Cempaka Putih Timur.

To determine the waste generation, this research using Equation 1 [4].

$$\text{Waste Generation} = \text{Average of residue waste} + \text{Average Treated Waste} \quad (1)$$

2.2.2 Waste Composition

The method used in accordance with SNI 19-3964-1994 [5]. Waste is taken to the measurement location provided and then separated according to its composition.

Plastic bags are needed to store sorted waste before weighing. To weighing the waste, it needs a hanging scale with a scale of ± 100 kg and measurement form. The residue waste composition has classified based on SNI 19-3964-1995 [6], namely: food waste, wood and foliage, paper, textile, rubber, plastic, metal, and glass. However, in its implementation usually has 9 and 10 components namely hazardous waste and diapers [7].

The calculation of the composition of urban waste can be seen in the Equation 2 as follows.

$$\text{Waste Generation} = \frac{\text{Weight of each type of waste (kg)}}{\text{Weight total of all waste (kg)}} \times 100\% \quad (2)$$

2.2.3 Reduction Potential

To determine the percentage of reduction potential and reduction potential per person of waste in this program, the research using this Equation 3 [8] and 4:

$$\% \text{Reduction Rate} = \frac{\text{Waste weight managed (kg)}}{\text{Total of waste generation (kg)}} \times 100\% \quad (3)$$

$$\text{Reduction Rate} = \frac{\text{Waste weight managed (kg)}}{\text{Total of waste generation (kg)}} / \text{Total residents} \quad (4)$$

3 Results and Discussion

3.1 Waste Management in RT 10/RW 03 Cempaka Putih Timur

RT 10/RW 03 Cempaka Putih Timur classified as the household that run the SAMTAMA program optimally. This is indicated by the waste management that has been provided. At present, RT 10 / RW 03 Cempaka Putih Timur has 1 (one) waste bank, 6 (six) composter barrels, maggot BSF cultivation that is active to reduce plastic bottle, glass bottles, and organic waste. The waste management can be seen in Figure 2:

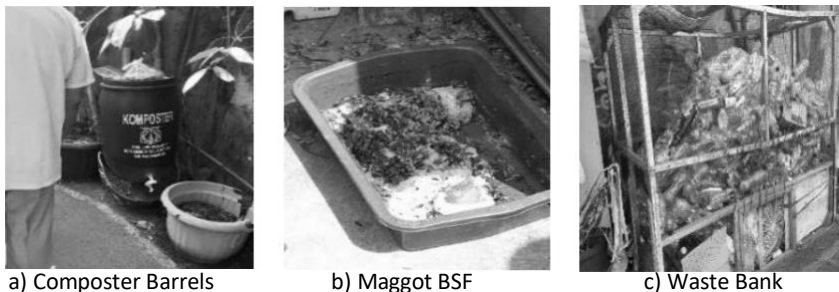


Fig 2. Waste Management in RT 10/RW 03 Cempaka Putih Timur

Then for residual waste that cannot be treated will be transported by the transporter using a cart every 03.00 WIB or 09.00 WIB to be taken to a temporary disposal site.

3.2 Waste Generation

Waste generation generated by each house generally has a different amount. This caused by the number of waste components produced by each house can be different and the number of occupants of each house can be different [9]. The number of waste generation can be different also because of the consumption patterns of the people followed by changes in people's lifestyles [10].

By using the SNI 19-3964-1994 method, the rate of residual waste generation of 10 houses with 38 residents in RT 10 / RW 03 Cempaka Putih Timur measured for 8 consecutive days after implement the SAMTAMA Program obtained results as Table 1.

Table 1. The Rate of Residual Waste Generation of 10 Houses of RT 10/RW 03 Cempaka Putih Timur.

No.	Day	Residual Waste Generation (kg)
1	Thursday	3.19
2	Friday	2.25
3	Saturday	3.81
4	Sunday	5.01
5	Monday	5.11
6	Tuesday	2.66
7	Wednesday	3.43
8	Thursday	3.60
Total (kg)		29.06
Average (kg/day)		3.63

Based on the data that has been recorded for 8 consecutive days (October 31st – November 7th 2019), the data of treated waste can be seen in Table 2. However, due to the waste bank data recorded once a month from head of RT 10 Cempaka Putih Timur document. To get the number in kg/day in the waste bank

can be found by the number of bottle plastic waste deposits in a month divided by the number of days in a month. The waste bank data used in Table 2 is October 2019 data.

Table 2. Waste Reduction by SAMTAMA Program Implementation

Day	Waste Bank (kg)	Composter (kg)	Maggot BSF (kg)
1	1.86	8.21	2.72
2	1.86	6.57	3.19
3	1.86	4.01	3.41
4	1.86	10.98	2.67
5	1.86	7.73	2.92
6	1.86	4.93	3.42
7	1.86	5.27	2.42
8	1.86	5.59	2.02
Average (kg/day)	1.86	6.66	2.84
Total Average (kg/day)		11.36	

By using the Equation 3, it can be found that the waste generation of 10 houses in RT 10/RW 03 Cempaka Putih Timur is 14.99 kg/day. Then, if it is made in the form of a graph like Figure 3, it can be shown that the largest waste generation is generated on Sunday in the amount of 20.52 kg and Monday in the amount of 17.62 kg. This is because the previous day, Saturday and Sunday, is not a working day, which means that people spend more time at home. This shows the number of occupants or residents influences the amount of waste generated. After RT 10/RW 03 Cempaka Putih Timur implement the SAMTAMA Program, residual waste generation during sampling time can be seen in Figure 3 in red bar. Based on the graph, SAMTAMA has a potential reduction around 11.36 kg/day.

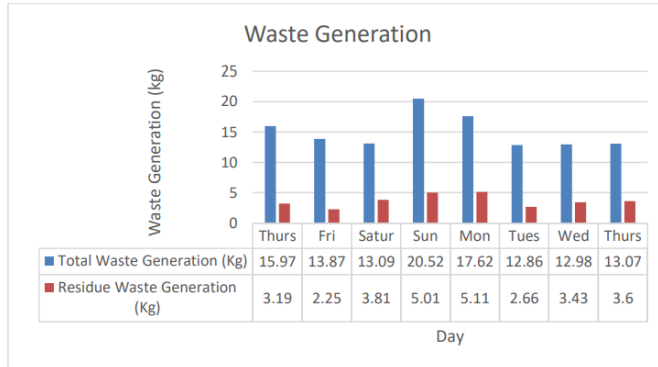


Fig 3. Waste Generation of 10 Houses of RT 10/ RW 03 Cempaka Putih Timur Graph

3.3 Waste Composition

Not only the generation of waste that can differ in the amount from each source, but the composition of waste is also the same [11]. If there is no SAMTAMA Program, the waste composition of 10 houses of RT 10/RW 03 Cempaka Putih Timur can be found as a graph in Figure 4 in blue bar. After they implement the SAMTAMA Program, the residual waste composition will be seen as Figure 4 in red bar below by using SNI 19-3964-1994.

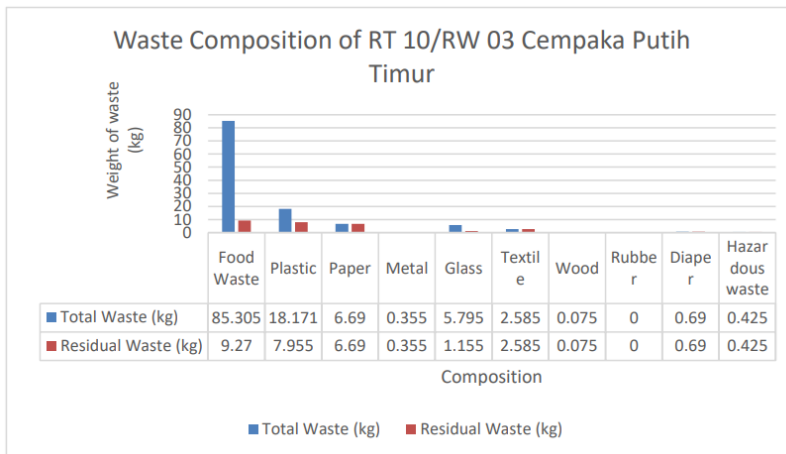


Fig 4. Waste Composition of 10 Houses in RT 10/RW 03 Cempaka Putih Timur Graph

From the measurement results, it can be seen that the composition of the largest waste generated by these 10 houses is food waste. This number can show

the kind of people's life patterns are sampled because the simpler lifestyle of the people, more organic waste can be produced [7].

3.4 Reduction Potential

SAMTAMA program was implemented to reduce the waste generation in temporary waste disposal. Waste management facilities provided by RT 10 / RW 03 Cempaka Putih Timur in running the SAMTAMA program to reduce waste generations are waste bank, composter barrels, and maggot BSF. Waste bank is for treating plastic bottles and glass bottles. Meanwhile composter barrels and maggot BSF are for treating organic waste in the form of foliage and food waste.

According to comparison of waste reduction based on waste composition in RT 10/RW 03 Cempaka Putih Timur, the SAMTAMA program able to reduce food waste until 89%, plastic waste until 56%, and glass waste until 80%. The comparison can be seen in this Table 3.

Table 3. Waste Reduction Percentage Based on Waste Composition

Waste Composition	Total Waste (kg)	Residual Waste (kg)	Total Reduction (kg)	Reduction Percentage (%)
Food Waste	85.305	9.27	76.035	89%
Plastic	18.171	7.955	10.216	56%
Paper	6.69	6.69	0	0%
Metal	0.355	0.355	0	0%
Glass	5.795	1.155	4.64	80%
Textile	2.585	2.585	0	0%
Wood	0.075	0.075	0	0%
Rubber	0	0	0	0%
Diaper	0.69	0.69	0	0%
Hazardous waste	0.425	0.425	0	0%

The waste reduction rate can be found by using Equation 3. Table 4 shows the rate of reduction rate resulted.

Table 4. Waste Reduction Rate of SAMTAMA Program
in RT 10/RW 03 Cempaka Putih Timur

Total Treated Waste (kg/day)	Total Waste Generation (kg/day)	Reduction Rate (%)
11.36	14.99	75.78%

From the calculation, it results the reduction rate in SAMTAMA program implementation as 75.78% for 10 houses in RT 10/RW 03 Cempaka Putih Timur. The percentage means the reduction potential of SAMTAMA program implementation by using equation 4 with the total number of residents is 38 people will be reduced 0.019 kg/person/day of waste to TPST Bantargebang. If it is projected to RT 10, RW 03, and DKI Jakarta levels, the waste reduction potential to TPST Bantargebang can be seen in Table 5.

Table 5. Waste Reduction Potential of Each Level

Level	Total Population	Reduction Potential
RT 10	218 people*	4142 kg/day
RW 03	3,649 people**	69331 kg/day
DKI Jakarta	10,500,000 people***	199500 kg/day

*) : RT 10 population data of 2018 from head of RT 10.

**) : RW 03 population data of 2018 from village office of RW 03.

***) : DKI Jakarta population data of 2018 from BAPPENAS.

This number shows that the role of the SAMTAMA program in reducing waste capacity in TPST Bantargebang is still low because based on data of DKI Jakarta Environment Agency in Official Portal of Integrated Waste Management Unit, Jakarta produces 7452.6 tons/day where 60.5% obtained from domestic waste [2]. It means total of waste domestic from DKI Jakarta in TPST Bantargebang is 4508.823 tons/day. Based on that total, waste reduction rate of SAMTAMA program only 4.42%. But there is a gap for this case because of the different of waste generation number between 38 people and 10,500,000 people.

Besides that, because the research assumes the all people have the same number of reduction potential.

Not only DKI Jakarta that has household-waste waste management, Surabaya that have population as 2,874,699 people in 2017 according BPS Jawa Timur also. The facilities of waste management that provided in Surabaya are composter, recycling, and waste bank [12]. In 2017, the data show that Surabaya able to reduce their waste with the management into 16.81% [12]. If the waste reduction potential of SAMTAMA program compared to Surabaya waste management, SAMTAMA program should reduce the waste until 61.39 %.

4 Conclusions

The existing waste management condition of SAMTAMA program in RT 10/ RW 03 Cempaka Putih Timur is having 1 waste bank, 6 composter barrels, maggot BSF cultivation that is active to reduce plastic bottle, glass bottles, and organic waste. Beside of that, they have an organizational structure in RW level consisting of supervisors, main coordinators, companion, composter coordinator, waste bank coordinators, person in charge in composter, person in charge in waste sorting, waste recording, and waste transportation.

Based on waste generation, waste composition, and waste reductional potential analysis, it can be concluded that:

- The total waste generation of 10 houses in RT 10/RW 03 Cempaka Putih Timur is 14.99 kg/day.
- The residual (untreated) waste generation of 10 houses in RT 10/RW 03 Cempaka Putih Timur is 3.63 kg/day.
- The largest waste composition of 10 houses in RT 10/RW 03 Cempaka Putih Timur is food waste.
- The potential reduction of the waste management is 0.019 kg/day/person.

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