WASTE GENERATION AND COMPOSITION IN KARAWANG REGENCY

Nurcholis Salman*, Anan Iskandar, Estin Noviyanti, Melly Mellyanawaty

Environmental Engineering Program, University of Muhammadiyah Tasikmalaya, Indonesia

Abstract

Sources of waste in Karawang Regency come from various activities of residents who are concentrated in locations such as residential, commercial, social facilities and public facilities. Each source of waste has characteristics for the generation, composition and characteristics of the resulting waste. In general, the source of waste is divided into household (domestic) and non-household (non-domestic). It is known that the generation of waste for the domestic sector of households is 2.93 L/person/day or 0.42 Kg/person/ day. But when viewed from the economic level, high income housing has the highest generation of 3.27 L/person/day. This is because differences in economic level and lifestyle affect the consumption level of the residents of the House. The higher the level of community life, the greater the waste generation. Based on the calculation results, it is known that the value of waste generation of each facility is different. This is because each facility has different activities. Shops have the highest generation of 3.78 L/person/day, followed by markets and roads as much as 1.55 L/m^2/day and 1.12 L/ m^2/day. This indicates that the activity of the store produces more waste than the market and the street. When reviewing the waste generation of Karawang Regency, the generation is greater than the domestic sector alone. The result of one area of Karawang Regency showed the waste generation is 0.56 Kg/person/day or 4.06 L/person/day.

Keywords: *Karawang Regency, waste generation, waste composition*

Introduction

The increasing population, the advancement of the Times, and human activities are very diverse resulting in increased waste generation in various regions, especially the district or city. Waste that is not managed properly will lead to various problems such as environmental problems, and health problems (Kiswandayani et al., 2016), (Abubakar, 2017). Therefore, an adequate waste management system is needed.

Regencies or cities are currently experiencing rapid growth and development that requires the provision of better and adequate urban infrastructure. In this regard, the government has issued several basic policies related to urban development efforts. One of the efforts made is to improve the service performance of the waste sector in a sustainable manner.

Karawang regency, West Java province has a problem of low levels of infrastructure services and basic facilities of the environment, especially with regard to solid service. These problems are caused by rapid population growth in Karawang Regency, increasing diversity of human activities, many industrial sectors, low waste budget, and still low awareness and participation of the community to participate in waste management. The rapid rate of population growth, especially in urban areas, has a very serious impact on reducing the carrying capacity of the environment. Based on data from the

*)Corresponding Author:
E-mail: nurcholissalman@umtas.ac.id

Received: 11 February 2024
Revised : 27 February 2024
Accepted: 3 March 2024
DOI: 10.23969/jcbeem.v8i1.12620

Central Statistics Agency (BPS) of Karawang Regency, the average growth rate of the population of Karawang Regency from 2020 to 2022 is ± 1.49%. Along with the increase in population, it will certainly increase consumption behavior which will have an impact on increasing waste generation that can pollute the environment. The increase in waste generation causes the greater volume of waste generation that must be managed.

Karawang Regency waste sources come from domestic and non-domestic waste sources. Based on data from the Karawang Regency Environment Office in 2023, the coverage of waste services in Karawang Regency is only 56% (3.93% reduction and 51.69% handling). However, Karawang Regency has a target of achieving 85% by 2023.

The low number of waste service coverage in Karawang Regency accompanied by the high number of waste generated is certainly a special concern for all sectors, especially from the government sector, stakeholders and the community. Seeing the conditions mentioned above, waste management must be carried out in a planned and integrated manner.

Research Methodology

Research Methodology Research location and time performed on 6 districts in Karawang Regency. The district is divided into the Central City area represented by West Karawang District, East Karawang District, Klari District and Cikampek District and the periphery area represented by Lemahabang District and Rengasdengklok District. The study was carried out for 8 days in January 2023.

Stages of research 1. Study of literature 2. Secondary data collection 3. Dissemination of 4. Primary data collection, in the form of the number of samples of domestic waste Karawang divided by the income level of the population. The number of waste samples is based on SNI method 19-3964-1994. 5. Testing of waste samples, which are carried out in the field by weight and volume of waste, specific gravity of waste, compaction factors and composition of waste and biological characteristics of waste.. 6. Data processing, in the form of analysis of generation, composition and characteristics of domestic waste. 7. Based on the calculations obtained the number of garbage samples taken from each house in Karawang Regency is 220 the number of garbage samples, divided into domestic garbage samples 145 samples and 75 samples for non-domestic 8. Determination of the location of garbage sampling is done using stratified random sampling method. Chart 1 shows the waste sampling locations and the number of samples.

Table 1. Collection location and number of waste samples

District	Sample Number	
	Domestic	Non Domestic
Urban Area		
1. District of Karawang Barat;	34	15
2. District of Karawang Timur;	22	13
3. District of Klari;	36	17
4. District of Rengasdengklok;	20	11
Non Urban		
1. District of Cikampek;	22	12
2. District of Lemahabang;	11	6

Survey and assessment of sources of Generation, Composition and characteristics of the litter

The survey and assessment of sources of generation, composition and characteristics were carried out in accordance with the procedures stated in SNI 19-3964-1995 and SNI M 36-1991-03 on the method of taking and measuring samples of Generation and composition of urban waste or the latest SNI.

1. Waste generation Data

Waste generation is the quantity of waste produced from waste sources. Waste generation is expressed in units of volume or units of weight. In the calculation of domestic waste generation, waste sources are divided into two

sources of household waste and non-household waste sources. The units to be used for waste generation from household sources are kg/person/day and liter/person/day.

2. Waste composition Data

The composition of waste is a description of the various types of waste produced by human activities. The composition of waste is generally expressed in percent by weight or percent by volume of organic waste and various types of inorganic waste. The calculation of the composition of this waste is used to determine the appropriate and efficient treatment to be applied in the waste management system.

In this work, the composition of the waste is sorted based on the type of waste commonly found in waste sources. In sorting, the waste will be divided into eight categories and then classified again specifically. Sorting categories of waste composition can be seen in Table 2.

Table 2. Waste Category (SNI 19-3964-1994)

No.	Category	Type
1	Organic waste	Food and plant waste
2	Plastic	Bottle plastic (PET), crackle bags, PP, PE, OPP, HDPE scraps, PS, and other types of plastic
3	Paper and cardboard	Newspaper, HVS paper, tetrapack, cardboard, cardboard, food wrap and the like
4	Rubber and leather	Rubber, leather and the like
5	Cloth	Used rags, rags and the like
6	Metal	Aluminum and iron cans
7	Glass and ceramics	Glass, glass bottles, glass chips, ceramics, ceramic containers and ceramic chips
8	Hazardous waste	Pampers files, used sanitary napkins, used medicine wrappers, medical waste, used batteries, used lamps, electronic waste and the like
9	Residue	Waste that is not available and is difficult to use or recycle

3. Data on waste characteristics

Apart from waste composition, other data related to waste management planning is data on waste characteristics. The waste characteristic data that will be displayed in this work includes physical and chemical characteristics. These characteristic data vary greatly depending on the components contained in the waste. Analysis of the characteristics of this waste is needed to determine processing facilities, recycling potential and planning final disposal facilities. In this work the physical characteristics measured are density, water content, volatile content, ash content and heating value. Meanwhile, chemical characteristics include c-organic, total nitrogen, total kjeldahl and c/n ratio. The steps for taking and measuring samples of waste generation and composition can be seen in Figure 1.

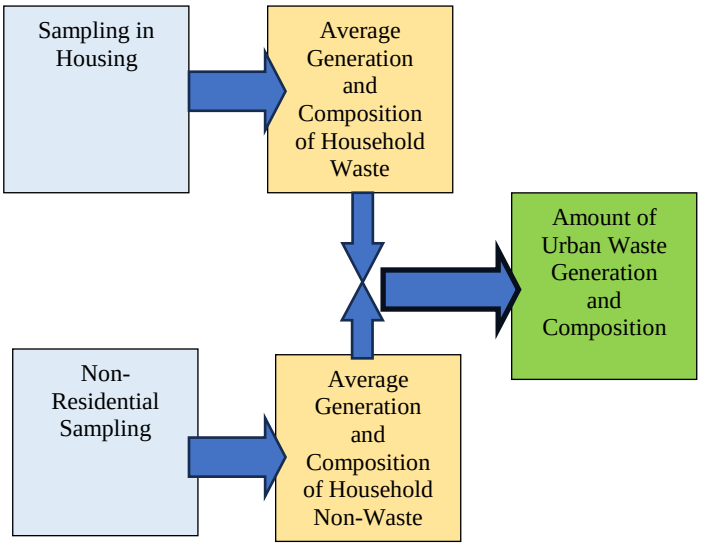

Figure 1. Steps for collecting and measuring samples of waste generation

Socio-Economic, Cultural And Public Health Conditions

The population and growth rate of Karawang Regency in each sub-district can be seen in Table 3.

The percentage of population and population density per square km in each sub-district of Karawang Regency can be seen in Table 4.

Table 3. Number of Population and Population Growth Rate of Karawang Regency (Karawang Regency in Figures, 2023)

No.	Subdistrict	Population	Population Growth Rate 2021–2022 (%)
1.	Pangkalan	41,900	1.53
2.	Tegalwaru	40,000	1.40
3.	Ciampel	45,140	1.23
4.	Telukjambe Timur	135,360	0.66
5.	Telukjambe Barat	56,880	1.36
6.	Klari	204,790	2.38
7.	Cikampek	122,220	1.20
8.	Purwasari	83,750	2.42
9.	Tirtamulya	51,290	1.31
10.	Jatisari	82,480	1.22
11.	Banyusari	57,390	1.07
12.	Kotabaru	141,260	1.47
13.	Cilamaya Wetan	81,580	0.76
14.	Cilamaya Kulon	67,420	1.09
15.	Lemahabang	67,440	0.96
16.	Telagasari	70,710	1.43
17.	Majalaya	80,430	5.13
18.	Karawang Timur	159,800	2.61
19.	Karawang Barat	166,860	0.69
20.	Rawamerta	55,340	1.16
21.	Tempuran	66,470	1.14
22.	Kutawaluya	62,160	1.30
23.	Rengasdengklok	118,620	1.15
24.	Jayakerta	68,930	1.26
25.	Pedes	80,840	1.27
26.	Cilebar	46,100	1.39
27.	Cibuaya	54,430	1.03
28.	Tirtajaya	71,760	1.32
29.	Batujaya	82,230	0.83
30.	Pakisjaya	41,680	1.18
Karawang Regency		**2,505,250**	**1.49**

Table 4. Population Percentage and Population Density of Karawang Regency (Karawang Regency in Figures, 2023)

No.	Subdistrict	Percentage of Population (%)	Population Density (per sqkm)
1.	Pangkalan	1.67	401.98
2.	Tegalwaru	1.60	375.00
3.	Ciampel	1.80	393.43
4.	Telukjambe Timur	5.40	2,956.43
5.	Telukjambe Barat	2.27	809.52
6.	Klari	8.17	2,586.87
7.	Cikampek	4.88	3,290.92
8.	Purwasari	3.34	2,508.90
9.	Tirtamulya	2.05	1,106.21
10.	Jatisari	3.29	1,463.08
11.	Banyusari	2.29	1,041.38
12.	Kotabaru	5.64	4,123.15
13.	Cilamaya Wetan	3.26	1,037.01
14.	Cilamaya Kulon	2.69	986.95
15.	Lemahabang	2.69	1,256.94
16.	Telagasari	2.82	1,340.93
17.	Majalaya	3.21	2,102.18
18.	Karawang Timur	6.38	5,044.35
19.	Karawang Barat	6.66	4,200.66
20.	Rawamerta	2.21	1,097.91
21.	Tempuran	2.65	713.57
22.	Kutawaluya	2.48	1,133.00
23.	Rengasdengklok	4.73	3,044.90
24.	Jayakerta	2.75	1,570.16
25.	Pedes	3.23	1,232.93
26.	Cilebar	1.84	629.00
27.	Cibuaya	2.17	458.90
28.	Tirtajaya	2.86	698.48
29.	Batujaya	3.28	1,101.50
30.	Pakisjaya	1.66	612.20
Karawang Regency		**100.00**	**1,286.76**

Results and Discussion

The discussion of the results of this research is only focused on the waste generation produced during the 8 (eight) days of sampling and the composition of the waste.

Domestic Waste Generation

Waste generation is the quantity of waste produced by a waste source. Waste generation can be expressed in volume units or weight units.

Table 5. Domestic Waste Generation

Category	Waste Volume	Unit	Waste Weight	Unit
High Income	3.27	L/ person/ day	0.53	Kg/person/ day
Middle Income	2.95	L/ person/ day	0.43	Kg/person/ day
Low Income	2.58	L/ person/ day	0.32	Kg/person/ day
Total	**2.93**	L/ person/ day	**0.42**	Kg/person/ day

From the calculation results, it is known that waste generation for the domestic household sector is 2.93 l/person/day or 0.42 l/person/day. However, if we look at the economic level, high income housing has the highest generation, namely 3.27 liters/person/day. This is because differences in economic levels and lifestyles influence the consumption levels of the residents of the house. The higher a community's level of living, the greater the waste generation.

Non-Domestic Waste Generation

Based on the sampling results, the amount of non-domestic waste generation obtained is as follows.

Table 6. Non-Domestic Waste Generation

Category	Waste Volume (L/ person/ day)	Waste Weight (Kg/ person/ day)
Shops	3.78	0.31
School	0.08	0.001
Office	0.38	0.04
Market	1.55	0.19
Road	1.12	0.09
Hotel	0.09	0.0076
Restaurant	0.93	0.40
Hospital / Community Health Center	1.45	0.11
Public facilities	0.80	0.09

From the calculation results, it is known that the waste generation value for each facility is different. This is because each facility has different activities. Shops had the highest generation at 3.78 liters/person/day, followed by markets and roads at 1.55 liters/m2/day and 1.12 liters/m2/day. This indicates that shop activities produce more waste than markets and roads.

The Emergence of One District Area

the generation in the Karawang Regency area, the generation is greater than in the domestic sector alone. The incidence of one area of Karawang Regency can be seen in Table 7.

Table 7. Generation per Capita in Karawang Regency

Karawang Regency waste generation	Unit
0.56	Kg/person/day
4.06	L/person/day

It can be seen that Karawang Regency's waste generation tends to be more but lighter. This could be because the waste generation survey was carried out during the dry season, where the waste produced tends to have a low water content so the wet weight will be smaller. Apart from that, a lot of waste was also found in the form of cardboard, piles of plastic and other dry inorganic waste.

Per Capita generation will be used to project the total waste generation in one Karawang Regency area based on sub-districts. The generation of one Karawang Regency area is obtained by multiplying the generation per capita by the existing population. The incidence for one area of Karawang Regency can be seen in the following Table 8.

Table 8. Generation of Karawang Regency (kg/day)

No	Subdistrict	Total population	Generation (kg/day)
1	Karawang Timur	161,300	89,944
2	Karawang Barat	168,500	93,959
3	Telukjambe Timur	136,667	76,209
4	Telukjambe Barat	57,367	31,989
5	Klari	206,767	115,298
6	Pangkalan	42,333	23,606
7	Ciampel	45,567	25,409
8	Tegalwaru	40,400	22,528
9	Rengasdengklok	119,800	66,803
10	Tirtajaya	72,433	40,390

No	Subdistrict	Total population	Generation (kg/day)
11	Jayakerta	69,600	38,811
12	Batujaya	83,033	46,301
13	Pakisjaya	42,033	23,439
14	Kutawaluya	62,733	34,981
15	Pedes	81,633	45,520
16	Cibuaya	54,967	30,651
17	Cikampek	123,433	68,829
18	Purwasari	84,533	47,137
19	Kotabaru	142,633	79,535
20	Jatisari	83,233	46,413
21	Tirtamulya	51,733	28,847
22	Banyusari	57,867	32,268
23	Cilamaya Wetan	82,333	45,911
24	Cilamaya Kulon	68,067	37,956
25	Lemahabang	68,067	37,956
26	Telagasari	71,400	39,814
27	Majalaya	81,200	45,279
28	Rawamerta	55,867	31,153
29	Cilebar	46,567	25,967
30	Tempuran	67,067	37,398
	Total	2,529,133	1,410,301

Composition

Waste composition is a description of the various types of waste produced by human activities. Waste composition is generally expressed in % by weight or % by volume of organic waste and various types of inorganic waste. This waste composition calculation is used to determine appropriate and efficient processing to be implemented in the waste management system.

Waste is sorted based on the type of waste generally found at waste sources and also refers to SNI 3694-1994. The following is a grouping of the specified waste composition.

1. Composition of Domestic Waste

Based on the survey results of waste generation and composition, the domestic sector waste composition in mass percent is obtained as follows in Fig. 2.

It can be seen that the composition of domestic waste is dominated by organic at 45.5%. This organic waste can be used to make compost through TPST (integrated waste management) facilities which have a waste composter and a Waste Recycling Unit. Organic waste is always in dominant in domestic waste (Setiawan et al., 2011). .For inorganic waste such as paper and plastic, looking at the recycling potential, it can be utilized through TPS3R (3R integrated waste management) facilities or Waste Banks and also TPST (Rachman et al., 2016).

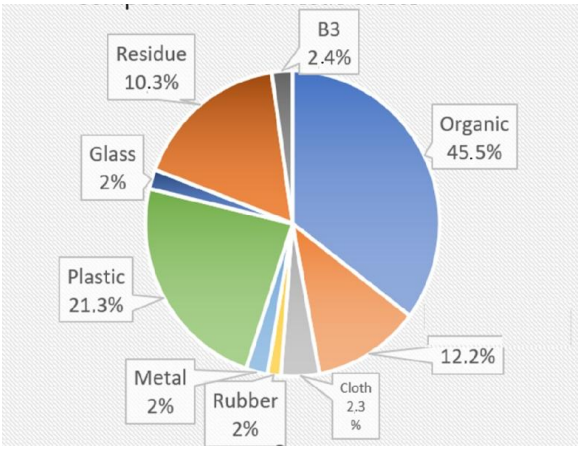

Figure 2. Composition of Domestic Waste

2. Composition of Non-Domestic Waste

Based on the survey results of waste generation and composition, the composition of non-domestic sector waste in mass percent is obtained as follows in Fig. 3.

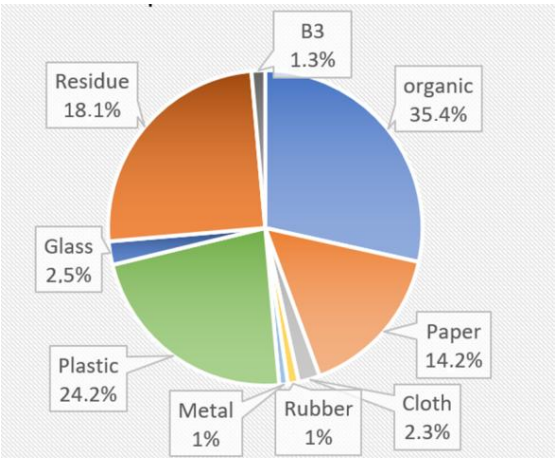

Figure 3. Composition of Non-Domestic Waste

It can be seen that the composition of non-domestic waste is dominated by organic at 35.4%. This high level of organic waste

indicates that the type of non-domestic waste is not much different from domestic waste. This organic waste can be used to make compost through the Waste Processing Unit facility with maggot cultivation and/or TPST which can also process organic waste. For inorganic waste such as paper and plastic, looking at the recycling potential, it can be utilized through TPS3R or Waste Bank and TPST facilities (Hidayah et al., 2021) (Yustiani and Abror, 2019). The local community must be involved in the 3R program for handling the waste from the source (Yustiani et al., 2019). This program includes recycle activities in the local community (Sumantri et al, 2015), (Adisanjaya et al., 2018).

Conclusions

The sampling results showed that the average volume of waste generation was 0.56 Kg/person/day or 4.06 L/person/day. The generation of waste in Karawang district per day is 1,410,301 kg/day or 1,410 tons/day. The composition of organic waste remains the largest, namely for domestic at 45.5% and non-domestic at 35.4%.

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