

Predictive analysis of waste generation at the Babussalam Islamic Boarding School, Pekanbaru City

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ABSTRACT

Babussalam Islamic Boarding School is an Islamic educational institution that has education levels ranging from kindergarten, elementary school, junior high school, and high school with a population of students, teachers, and employees in the Islamic Boarding School of Babussalam which is 2248 people. A large population with an area available produces waste generation (organic, paper, and plastic). Research has been conducted related to the generation of waste generated in the Babussalam Islamic Boarding School and the predictions for the next five years. Measurement methods and data calculations use SNI 19-3964-1994. Total solid waste generation in Pesantren Babussalam is 0.3746 kg/person with an average of 0.042 kg/person. The total volume of solid waste generation in Pesantren Babussalam is 98.338 liter/person with an average of 1.37 liter/person. The average composition of organic waste is 0.1392 kg/person with a percentage of 37%. The average composition of waste paper is 0.1374 kg/person with a percentage of 36%. The average composition of plastic waste is 0.1042 kg/person with a percentage of 27%. Waste generation in 2024 is predicted to increase by 35.33371 kg/year, with a total generation in 2024 of 176.668 tons.

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1. INTRODUCTION

Based on SNI No. 19-3964-1994, schools/educational facilities are included in non-residential criteria. According to the Ministry of Environment in 2017, schools/educational institutions are one of the sources of national waste with 4% of the total national waste [1-3]. The Babussalam Pekanbaru Islamic Boarding School is an Islamic educational institution managed by the Syekh Abdul Wahab Rokan Foundation and is currently led by Syekh Haji Ismail Royan [4, 5]. Garbage at the Babussalam Islamic Boarding School is collected daily and piled up at the temporary disposal site. The collected rubbish is transported by rubbish van three times a week to the Muara Fajar landfill [6-8]. Based on the explanation above, initial research was carried out on the amount of waste and to find out the predicted amount of waste produced by the Babussalam Islamic Boarding School in 2024. The composition of the waste taken in this research was organic, paper, and plastic.

Waste is all that arises from human and animal activities, usually in the form of solids that are considered useless or no longer desired [9-11]. Waste generation is the volume of waste or weight of waste produced from types of waste sources (residential, commercial, construction and demolition offices, industry, and agriculture) in a certain area per unit of time [12-15]. Based on SNI 19-2454-2002, waste generation is the amount of waste arising from the community in units of volume and weight per person per day, building area, and road length [16-20]. Waste composition is a description of each component contained in waste and its distribution. The most frequently used grouping of waste is based on its composition, for example, expressed as weight (%) or volume (%) of paper, wood, leather, rubber, plastic, metal, glass, cloth, food, and other waste [21-25]. This research aims to

calculate and predict the generation of waste (organic, paper, and plastic) produced in the Babussalam Islamic Boarding School environment for 5 years.

2. RESEARCH METHODS

2.1. Tools and Tool Functions

The tools used in this research are a 40-liter plastic bag that functions as a bag for collecting waste, a 500-liter styrofoam box that functions as a volume measuring box, a scale that functions as a waste mass measure, a shovel that functions as a waste mover, and gloves which are used as hand wraps.

2.2. Sampling

Prepare trash bags labeled with the name of the building; Collect and transport plastic bags filled with rubbish; Weighing the empty mass of the measuring box (M_k); Pouring waste into the measuring box; Step three times on the measuring box by lifting it to a height of 20 cm then dropping it to the ground; Weighing the waste and measuring box then weighing the total mass of waste (M_{tp}) per day; Measuring length (p), width (l), waste height (t); Calculating total waste volume (V_{st}); Weighing the mass of composite waste per day (M_{sk}) using plastic bags.

2.3. Data Analysis

Comparing total organic waste, paper waste, and plastic waste; What is the density of organic waste, paper waste, and plastic waste in each Babussalam Islamic Boarding School building; What is the waste generation (mass and volume) from organic waste, paper waste, and plastic waste in each Babussalam Islamic Boarding School building; What is the percentage composition of organic waste, paper waste, and plastic waste in each Babussalam Islamic Boarding School building; How is organic waste, paper waste, and plastic waste generated in each Babussalam Islamic Boarding School building; What is the composition of organic waste, paper waste and plastic waste in each Babussalam Islamic Boarding School building; What is the prediction of total waste at the Babussalam Islamic Boarding School.

3. RESULTS AND DISCUSSIONS

In this research, the waste produced by the Babussalam Islamic Boarding School is separated based on composition, namely organic, paper, and plastic. The number of students, teachers, and employees and the total population at the Babussalam Islamic Boarding School are in Table 1.

Table 1. Data on students, teachers, and employees for 2019.

Building	Building population (People)	
	Number of students	Number of teachers and employees
Kindergarten	60	12
Elementary school	483	59
Junior high school	459	59
Senior high school	306	34
Boys' dormitory	347	1
Girls' dormitory	418	1
Foundation office	-	9
Total	2248	

3.1. Mass and Volume Waste Generation

The total mass waste generation per day produced by the Babussalam Islamic Boarding School is 0.3746 kg/person/day. The highest average mass waste generation per day at the Foundation Office is 0.1806 kg/person/day with an average total mass waste per day of 1.6 kg and a population of 9 people. The high level of paper waste is obtained from administrative activities and leftover food packaging which still contains food residue. Minimum mass waste generation is found in mosques. The average mass waste generation per day is 0.0021 kg/m²/day. This is also due to the average total

mass of waste produced is 2 kg with a mosque area of 947 m². Total volume waste generation and total mass generation have several differences in buildings. This is because the shape and size of the waste for each unit are different. If we look at it as a whole, based on the volume waste generation graph, that is, the smaller the population/area, the greater the volume of waste generated per person. The higher the population or area, the smaller the waste generated. The smaller the population or area, the greater the waste generated. Graphs of mass and volume waste generation can be seen in Figure 1 and Figure 2.

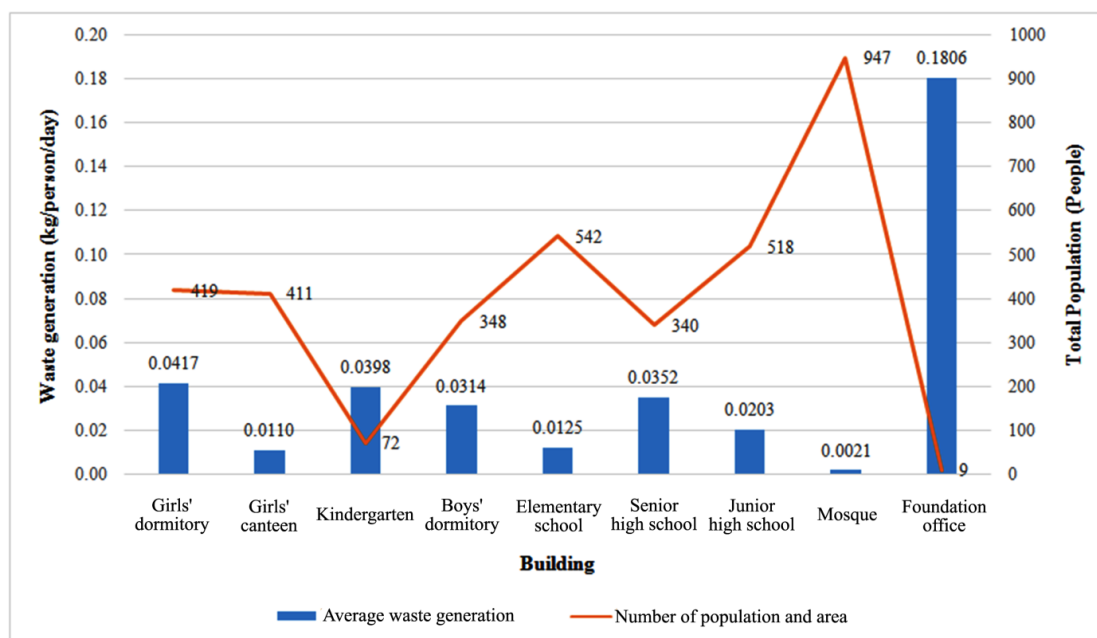


Figure 1. Mass waste generation in each Babussalam Islamic Boarding School building.



Figure 2. Volume of waste generation in each Babussalam Islamic Boarding School building.

3.2. Generation of Composite Waste

Based on the results of measuring the average mass of the waste composition, Babussalam Islamic Boarding School produces 25.39 kg of organic waste, 19.63 kg of paper, and 23.88 kg of

plastic. The maximum waste generation per the composition of the Babussalam Islamic Boarding School is an organic waste of 0.1392 kg/person/day at 37%. The generation of paper waste is 0.1374 kg/person/day with a percentage of 36%. Organic waste generation is the minimum waste at the Babussalam Islamic Boarding School of 0.1042 kg/person/day with a percentage of 27%. Based on the graph, it can be seen that the composition of organic waste is greater than other waste. This happens because the Babussalam Islamic Boarding School is an educational facility that provides accommodation for middle and high school students and is surrounded by lots of trees. The large number of trees and implementing a boarding system has resulted in more and more leaf litter and food waste being produced by the Babussalam Islamic Boarding School. The graph of waste generation by composition can be seen in Figure 3, 4, and 5.

3.3. Prediction of Total Waste Generation at Babussalam Islamic Boarding School in 2024

The predicted results of waste generation in 2024 Babussalam Islamic Boarding School will produce 176.6855 tons. If processing is not carried out, waste will accumulate and become a problem. Organic waste management can be done using the biopore method. The bio pore method is the creation of water absorption holes by placing organic waste into them. This technique does not require a lot of space and is quite effective in processing organic waste apart from making it into compost.

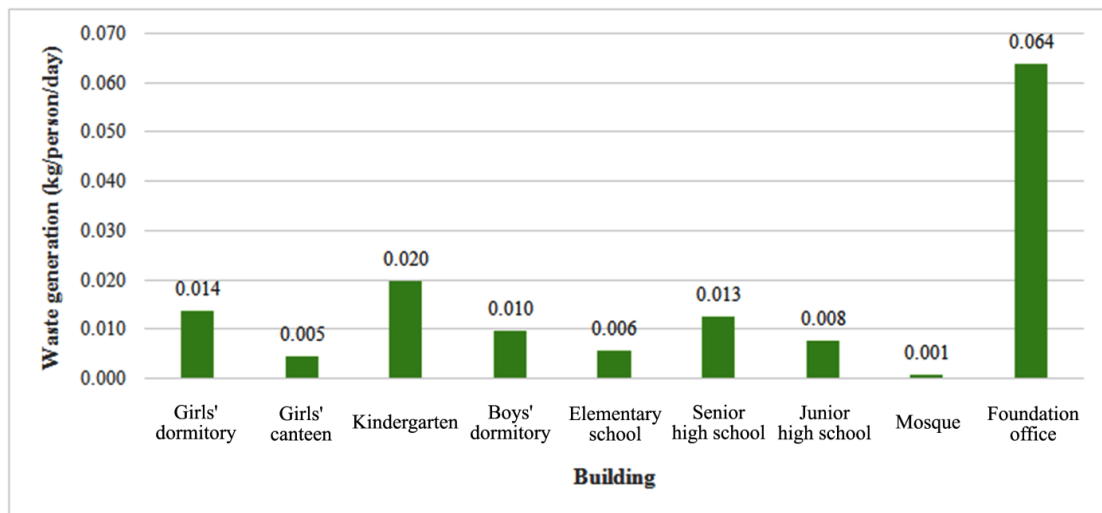


Figure 3. Generation of organic waste.

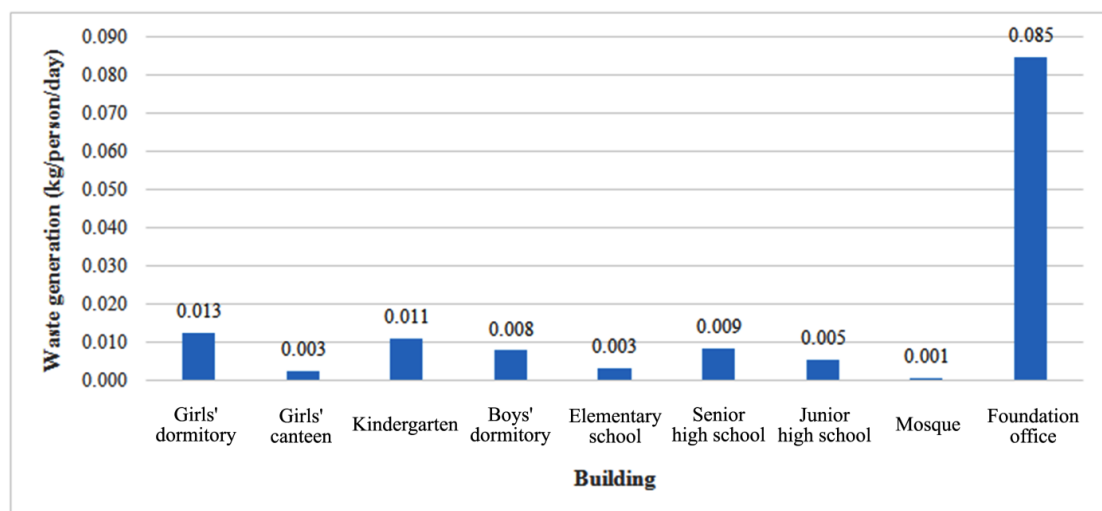


Figure 4. Generation of paper waste.

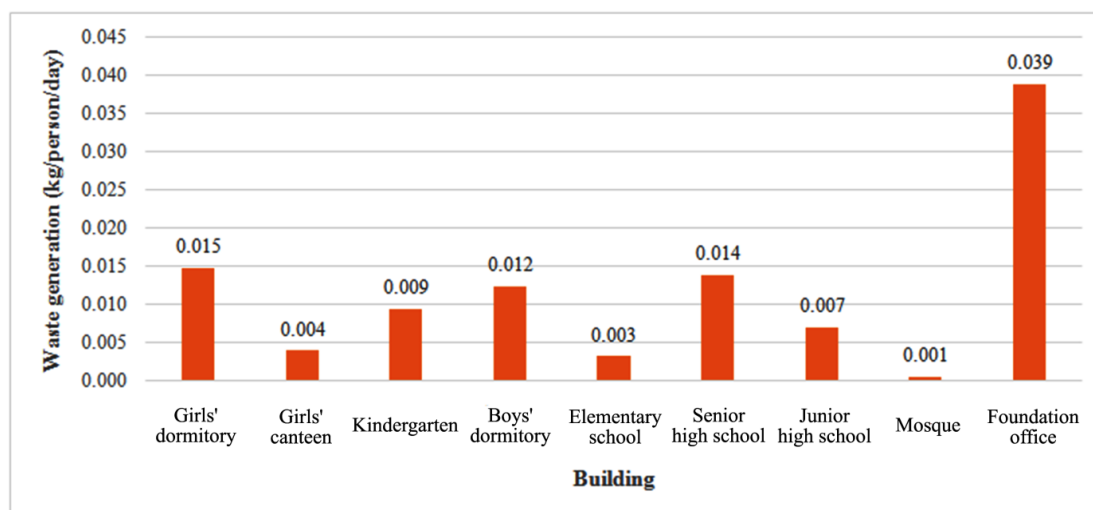


Figure 5. Generation of plastic waste.

4. CONCLUSION

Based on the results of calculations and data analysis that have been carried out, the conclusion obtained is that the total mass waste generation at the Babussalam Islamic Boarding School is 0.3746 kg/person with an average of 0.042 kg/person; the total volume of waste generation at the Babussalam Islamic Boarding School was obtained at 98,383 liters/person with an average of 1.37 liters/person; the average composition of organic waste is 0.1392 kg/person with a percentage of 37%; the average composition of paper waste is 0.1374 kg/person with a percentage of 36%; the average composition of plastic waste is 0.1042 kg/person with a percentage of 27%; waste generation in 2024 is predicted to increase by 35.3371 kg/year, with total generation in 2024 amounting to 176.6855 tons.

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