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Determining Composter Needs Based on the Production Time of Compost Made from Household Organic Waste (Case Study of Syamsul Falah Islamic Boarding School)

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ABSTRACT: *Compost production from household organic waste is one of the solutions in reducing the volume of waste while producing environmentally friendly products that are beneficial for soil fertility. This study aims to determine the number of composter needs based on the optimal compost production time with household organic waste raw materials at the Syamsul Falah Islamic Boarding School. The methods used include collecting data on the type and amount of organic waste based on SNI-19-3964-1994, setting up a composter with a 5% variation of EM4 bioactivator; 10%; 15%; 25%; 40%, and the measurement of the time it takes for the compost to mature. The results show that the time of compost production is influenced by factors such as temperature and the ratio of compost materials. So that the composter needed based on the effectiveness of compost production is 23 composter units. This amount is based on the volume of household waste generation for seven consecutive days which is 0.086 m³, the volume of composter used is 0.0188 m³, and the effective time of compost production using a 40% variation of EM4 with a time of five weeks. This finding is expected to be a guide in the management of organic waste in the environment of Islamic boarding schools and similar communities.*

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I. INTRODUCTION

Household organic waste management is one of the important issues in an effort to maintain environmental cleanliness and reduce the burden on landfills. Organic waste, which includes food scraps, leaves, and other organic matter, has great potential to be processed into useful compost as a natural fertilizer. Unfortunately, many household organic waste is still thrown away, causing an increase in the volume of waste in landfills and causing environmental problems such as greenhouse gas emissions and groundwater pollution (Rahman et al., 2019).Composting is one of the effective solutions to process organic waste. This process not only reduces the volume of waste thrown into landfills, but also produces compost that can be used to improve soil fertility. The effectiveness of composting is greatly influenced by various factors, including the type of raw material, environmental conditions, and the use of appropriate composting technology (Nair et al., 2020).At the Syamsul Falah Islamic Boarding School, TerongTawah Village, there is no adequate waste management system other than incineration. Waste incineration produces dioxins that are harmful to health and the environment. Therefore, alternative solutions that are more environmentally friendly are needed, one of which is the construction of an Integrated Waste Management Site (TPST) which includes composting facilities (Yasir & Saputra, 2021).

So far, the Islamic Boarding School has used the land at the back as a garbage collection place to be burned, thus causing disruption to the learning process. One of the programs that is expected to reduce waste problems is to build an Integrated Waste Processing Site (TPST) at the Syamsul Falah Islamic Boarding School. According to Law No. 18 of 2008, TPST is a place where waste collection, sorting, reuse, recycling, and final processing are carried out. TPST is expected to change the waste management system to be decentralized, namely the management system in the upstream area (Cahya et al., 2017).The Syamsul Falah Islamic Boarding School Foundation has an area of about 90 acres with a total of approximately 500 students under the auspices of PAUD, TPQ, SMP, and Madrasah Diniyah institutions. Waste as an item that can still be used should not be treated as a disgusting item. To reduce the volume of existing waste and not harm the environment, waste must be able to be used as raw materials or other useful materials. Organic waste can be processed into compost using composting techniques. Composter is a tool used to help bacteria decompose various organic materials in the form of waste into compost (Desy, et al., 2018).

This study aims to determine the need for the number of composters based on the time of compost

production with household organic waste raw materials. The research method used is direct observation and measurement of the volume of organic waste produced by households in the Syamsul Falah Islamic Boarding School. The results of this study are expected to provide a clear picture of the need for composters to support composting programs at the household level and reduce the burden of waste in landfills.

Figure 1. Portrait of the study site (Source: Doc, 2022)

II. STUDIES OF METHOD

This study uses observation and direct measurement methods at the Syamsul Falah Islamic Boarding School. The first step is to measure waste generation using a tool as shown in figure 2. Where the waste generation measurement method refers to SNI 19-3964-1994 concerning waste generation measurement methods.

Figure 2. Tools to measure waste generation

The next step is to prepare and carry out the composting process. The composter used in this study is a 25 kg used paint can as shown in figure 3.

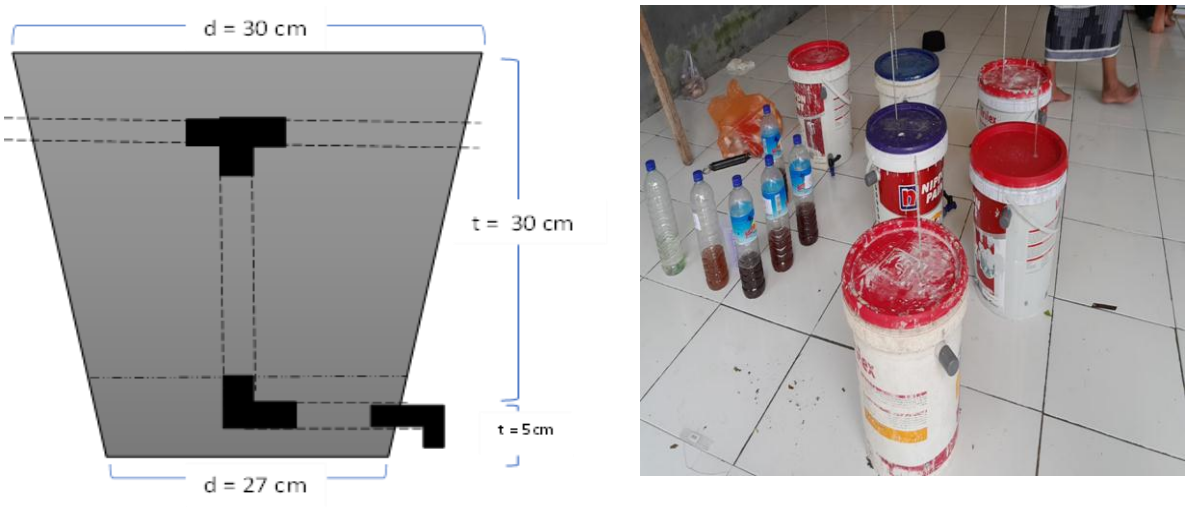

Figure 3. Design and composter used

From the figure 3 the composter is equipped with a thermometer to monitor the temperature of the composter. After the waste generation data was collected, compost production was carried out using EM4 treatment variations. The purpose of this stage is to determine the effectiveness of compost production, so that the need for composter at the Syamsul Falah Islamic Boarding School can be determined. After all the data is collected, analysis and discussion are carried out which include the volume of waste generation, the effectiveness of compost production, and the determination of composter needs based on the results of compost production.

III. RESULTS AND DISCUSSION

The results of measuring waste generation for seven consecutive days obtained a total waste weight of 172 kg. In more detail, it can be seen in table 1 which shows the total weight and volume of waste generated each day.And the composition of the waste is shown in table 2.

Table 1. Waste generation at Syamsul Falah Islamic Boarding School

No	Hari/Tanggal	Total Berat Sampah (Kg/hari)	Total Volume Sampah (m^3/hari)
1	Selasa, 7 Maret 2023	25 Kg	0,208 m^3
2	Rabu, 8 Maret 2023	22 Kg	0,167 m^3
3	Kamis, 9 Maret 2023	20 Kg	0,189 m^3
4	Jumat, 10 Maret 2023	28 Kg	0,250 m^3
5	Sabtu, 11 Maret 2023	23 Kg	0,196 m^3
6	Minggu, 12 Maret 2023	25 Kg	0,250 m^3
7	Senin, 13 Maret 2023	29 Kg	0,250 m^3
Jumlah		172 Kg	1,51 m^3
Rata-rata perhari		24,5 Kg	0,215 m^3

Table 2. Composition of waste at Syamsul Falah Islamic Boarding School

NO	Hari/Tanggal	Jenis-jenis Sampah			
		Organik		Non organik (Kg)	Total (Kg)
		Daun (Kg)	Rumah Tangga (Kg)		
1	Selasa, 7 Maret 2023	12 kg	6 kg	7 kg	25 kg
2	Rabu, 8 Maret 2023	8 kg	6 kg	7 kg	21 kg
3	Kamis, 9 Maret 2023	8,5 kg	6 kg	6,5 kg	21 kg
4	Jum'at, 10 Maret 2023	10 kg	8 kg	10 kg	28 kg

5	Sabtu, 11 Maret 2023	11 kg	4 kg	8 kg	23 kg
6	Minggu, 12 Maret 2023	9 kg	7 kg	9 kg	25 kg
7	Senin, 13 Maret 2023	10 kg	9 kg	10 kg	29 kg
Jumlah Total		68,5 kg	46 kg	57,5 kg	172 kg
Rata-rata perhari		9,78 kg	6,57 kg	8,21 kg	24,57 kg

The most appropriate technique to control organic waste is to decompose it into compost because it is very effective and has economic value and is environmentally friendly. In this research on the compost production process, we use the standard reference of SNI 19-7030-2004 regarding compost and waste specifications. Household waste that has been separated per day is separated into six parts according to the specified EM4 variation, then cut into 2-3cm sizes. After the waste is small, it is then mixed with EM4 which has been mixed with water and then put into the composter.Table 3 is the result of observation for 6 weeks with varying bioactivators.

Table 3. Observation of the Compost Production Process at the Syamsul Falah Islamic Boarding School

Hari Tanggal	Variasi EM4 terhadapsuhukomposter					
	0%	5%	10%	15%	25%	40%
Minggupertama, 13 Maret 2023	32˚C	31˚C	30˚C	32˚C	31˚C	32˚C
Minggukedua, 20 Maret 2023	32˚C	32˚C	31˚C	33˚C	33˚C	35˚C
Minggueketiga, 27 Maret 2023	34˚C	34˚C	33˚C	35˚C	36˚C	40˚C
Minggukeempat, 3 April 2023	36˚C	36˚C	35˚C	38˚C	39˚C	37˚C
Minggukelima, 10 April 2023	38˚C	38˚C	37˚C	36˚C	35˚C	31˚C
Minggukeenam, 17 April 2023	39˚C	40˚C	40˚C	33˚C	31˚C	31˚C

From table 3, it can be seen that the temperature that occurs in organic waste compost is always changing, where on the first day it has increased on average until the third week, some even until the fourth and fifth weeks are still increasing, which indicates that the decomposition process has started to run because a number of bacteria have changed the organic content into simpler materials that are easily absorbed by plants. Furthermore, in the following days, the temperature decreases because the organic matter to be decomposed has begun to decrease and begins to shrink.

The results of the observation of the compost production process in table 3 are then depicted in the form of a graph of the relationship between the temperature and the variation of EM4 on compost production. Figure 4 shows the temperature variation in the composting process at the Syamsul Falah Islamic Boarding School for six weeks with a varying percentage of EM4. Each line represents a variation of EM4 which helps visualize how the temperature changes over time for each variation.

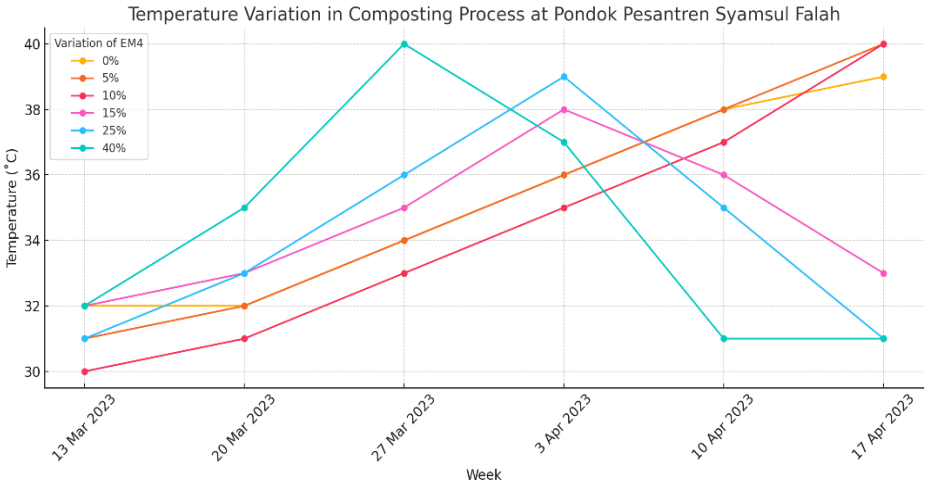

Figure 4. Weekly development of compost production temperature

The need for composters can be estimated if data on the effectiveness of compost production has been obtained. In this study, the most effective composting time was to use a 40% EM variation with a composting

time of 5 weeks.To find out the composter needs, the following calculations can be made: Total Volume of Household Waste Generation (Vtts) = 0.086 m3 Effective time of composting (t) = 5 weeks Composter volume (Vk) = 0.0188 m3 Then composter needs (N) = (Vtts/Vk) x t = (0.086 / 0.0188) x 5 = 5.375 x 5 = 22.87 ≈ 23 Composters.

So, the recommendation given so that the problem of household waste at the Syamsul Falah Islamic Boarding School can be overcome or processed into compost effectively, a minimum of 23 composters are needed, namely one composter equivalent to a paint bucket containing 20 L.

IV. CONCLUSION

Based on the total volume of household waste generation for seven consecutive days, which is 0.086 m3, with the volume of composter used is 0.0188 m3 and the effective time of compost production using a variation of 40% EM4 which takes five weeks, so that the results of calculating the need for composter needed are obtained as many as a minimum of 23 composters.

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