Available online at: http://e-jurnal.lppmunsera.org/index.php/parahita
Wikrama Parahita: Jurnal Pengabdian Masyarakat
p-ISSN 2599-0020, e-ISSN 2599-0012

Assistance in Compost and POC Production at SD Muhammadiyah 4, Samarinda, East Kalimantan

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Article Information

Article history

Received: August 13, 2024
Revised: March 18, 2025
Accepted: May 12, 2025

Keywords: Compos; Organic; POC; Treatment; Solid Waste

Abstract

The waste problem is a global challenge that is faced daily, including in Indonesia. Organic waste that is not appropriately managed can hurt the environment. One effective solution is to process organic waste into compost and liquid organic fertilizer (POC). This activity aims to practice organic waste processing methods through training for students and teachers at SD Muhammadiyah 4, Samarinda, East Kalimantan. The methods used are Project-Based Learning (PBL), which includes socialization to increase environmental awareness and training in practical composting and POC. The parameters measured include temperature and pH to monitor the composting and fermentation processes. The results of the activity showed that the participants were able to process organic waste into fertilizer well. Compost has an acidic pH (4-6) because lime is not added during the composting process. POC has a pH of 4, indicating effective fermentation activity. The temperature at POC ranged from 26°C to 28°C, with the highest temperature on day 12 indicating maximum degradation. This service activity increases participants' understanding and skills regarding organic waste processing. This activity also encourages schools to actively manage waste independently, creating a cleaner and more sustainable environment.

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INTRODUCTION

Waste is a daily problem for human life. It is due to the production of waste that occurs every day (Hayat & Zayadi, 2018; Lestari *et al*., 2018). The increase in population increases the volume of waste, especially household waste. It is also in line with the increase in waste types and characteristics, which are becoming increasingly diverse (Andriyanto *et al*., 2023). Education about waste management and processing provides understanding to the community, which can influence their behavior to live clean and healthy (Pramaningsih *et al*., 2024).

In Indonesia, waste management is contained in Law Number 18 of 2008, which requires environmental communities to minimize and overcome waste problems through environmentally friendly ways. One of the alternatives in an environmentally friendly waste management strategy is through the Waste Bank Program. Waste can be divided into inorganic waste and organic waste, and Organic waste is waste that microorganisms can decompose, while inorganic waste is waste made from non-biological materials that takes a long time to decompose (Sutrisno & Priyambada, 2020). Household activities produce a lot of organic waste (Mardwita *et al*., 2019). The amount of organic waste has the highest percentage compared to other types of waste (Wahyuni *et al*., 2019).

Compost fertilizer is a fertilizer derived from the decomposition of organic matter by microorganisms (Eliana *et al*., 2019). Organic compost fertilizer is an environmentally friendly fertilizer with various benefits, such as increasing soil fertility, acting as a soil aggregate stabilizer, a source of nutrients for soil and plants, and increasing land productivity in the long term (Puspadewi *et al*., 2016). Activities carried out by Suprapto *et al*. (2017) resulted in increased public awareness in managing their environment from household waste into compost and liquid compost. Compost from waste can be used for ornamental

DOI: https://dx.doi.org/10.30656/jpmwp.v9i1.9243

plants in a ratio of 1:1, while vegetable plants add compost produced from waste, which must be followed by inorganic fertilizers (Siswati *et al*., 2020). Organic waste is biodegradable, easily decomposed by microorganisms into simpler compounds. The fermentation process of organic fertilizer with EM4 can increase the content of plant nutrients N, P, and C (Teddy *et al*., 2023). Processing waste into compost has multiple benefits, namely the community can process waste appropriately and increase the selling value of waste that has been converted into compost (Anwar *et al*., 2019).

The problem of organic waste management in the school environment is an urgent issue due to the lack of understanding and skills in processing waste into useful products. Organic waste allowed to accumulate can cause odors, pollute the environment, and increase health risks. Therefore, this service is carried out to provide education and training to students and teachers, so that they are able to manage organic waste independently by producing compost and Liquid Organic Fertilizer (POC), while supporting the formation of environmental awareness from an early age.

Through the Community Service team, Muhammadiyah University of East Kalimantan processed household waste for students of SD Muhammadiyah 4 Samarinda City into compost. The goal is to practice organic waste processing methods through training so that students can no longer litter and properly handle waste. This activity can be used to provide students with knowledge about waste management and processing.

MATERIALS AND METHODS

This service activity is designed to overcome organic waste management problems in the school environment. The problems, solutions and planned outputs of this service activity are presented in Table 1.

Table 1. Problems, solutions, and outputs

Problem	Solution	Output
Organic waste in schools from shade trees has the potential to be made into compost and Liquid Organic Fertilizer (POC), not burned.	Through education and training programs that aim to increase the capacity of participants to manage organic waste effectively,	Increased environmental awareness, participants' ability to practice composting and POC, and creating a cleaner and more sustainable school environment.

The method used is Project-Based Learning (PBL) with the following stages.

1. Socialization and Training
   The initial stage was socialization to students and teachers of SD Muhammadiyah 4, Samarinda. This activity aimed to increase environmental awareness and provide an understanding of the adverse effects of unmanaged organic waste and the benefits of processing it into compost and POC. Participants were given materials on the basics of organic waste processing, the composting process, and fermentation for POC. The explanation included the materials used, the tools needed, and the basic principles of organic waste management.
2. Composting Practice
   Participants were trained to practice composting using simple methods. Steps include sorting organic waste, shredding, layer preparation, and moisture regulation. During the process, participants monitor the temperature and pH to optimize the process.
3. Practice of Making Liquid Organic Fertilizer (POC)
   Participants were taught how to make POC by utilizing liquid organic waste, such as fruit or vegetable scraps, which were fermented using microbial activators. The fermentation process is monitored regularly by measuring temperature and pH until the POC is ready.

Time and Place

The activity was carried out for 1 month, from May 1 to May 31, at SD Muhammadiyah 4 Samarinda, East Kalimantan.

Tools and Materials

The tools for making composter are a paint bucket, glue gun, electric drill, water faucet, spraying, stirring rod, large knife, EM4, Molasses, sealed bucket, 1000 ml beaker glass, and organic waste.

Procedure

1. Making a composter with the Pile Bucket Method.
   The steps in making a composter with the stacked bucket method are as follows:
   a. Prepare the tools and materials that we will use.
   b. Then take two buckets of used paint.
   c. One bucket, then we make a hole on the bottom side of the bucket for the faucet installation.
   d. Then we install this faucet to harvest the liquid organic fertilizer (POC).
   e. Then, we take one more bucket and make a hole at the bottom of the bucket.
   f. After that, drill the bucket to make small holes for the leachate from the composting process.

DOI: https://dx.doi.org/10.30656/jpmwp.v9i1.9243

g. We can put it together into a stacking bucket if it is all.

2. How to Make Bioactivator
   The steps for making a bioactivator are as follows:
   a. Prepare a bucket for mixing EM4 and molasses.
   b. Prepare water according to what we want to make using a beaker or glass.
   c. Then put it in the bucket.
   d. Also, prepare the same EM4 according to the water we take and measure it with a measuring cup.
   e. Then put it in the bucket that already has water.
   f. Put enough molasses into the bucket that already contains water and EM4. Then stir until smooth.
   g. If it is flat, then cover it tightly and let it stand for 1 night.
   h. For the manufacture of EM4 bioactivator, the ratio is 1: 50 so 1 liter of EM4 is added to 50 liters of water.
3. How Compost Fertilizer Works
   Prepare the organic waste that we will use.
   a. Then, chop the existing organic waste. The function of this chopping is to facilitate the degradation process or the process of decay by bacteria.
   b. The waste that was chopped earlier is then put into the composter. In the process of entering this waste, the bioactivator is sprayed so that it can be evenly mixed with the waste.
   c. After inputting everything, close the bucket, and then ferment for 1 month.
   d. When entering new waste into the bucket, we must respray the bioactivator.
   e. But every 1 week we have to check the pH and humidity of the compost we make. So within 1 month of fermentation, we check every 1 week to control the composting process.
   f. If it has been 1 month of the fermentation process, we can mix the compost we made with good soil, then let it sit for 7 days in this process. We can spray the biocatalyst so that the process is faster. After that, the compost fertilizer is ready to use. We can harvest the leachate water as liquid organic fertilizer (POC).
4. How POC Making Works
   Household waste is put into the composter / top bucket, then leachate from the fermentation of organic waste drops into the bucket below. The fermentation process to produce liquid fertilizer takes approximately 1-2 weeks, depending on the amount of household waste entered. The result of this fermentation produces Organic Liquid Fertilizer (POC). POC is ready to be used as a liquid fertilizer. Before application, mix the POC with water in a ratio of 1:10 to 1:20. Spray to plants or apply directly to the soil.

RESULTS AND DISCUSSION

Compost results from the fermentation or decomposition of organic materials such as plants, animals, or organic waste. Compost can be made from materials that are very easy to find around our environment. Compost, or humus, is the residue of degraded waste and living things that have undergone weathering; its shape has changed, like soil, and it has no odor.

The composting process begins with preparing the tools and materials to be used (Fig. 1). Prepare the organic waste that will be put into the composter for fermentation. Waste must first be chopped into small sizes. It aims to accelerate the degradation process of microorganisms. The process of chopping the waste and putting the waste into the composter along with molasses and EM4 (Fig. 2).

Fig. 1. Preparation of tools and materials

Fig. 2. Shredding process and putting waste into the composter

Waste that has entered the composter is allowed to stand for 1 month, with temperature and humidity monitored and checked every week. The fermentation process is as shown in Fig. 3. Temperature and humidity monitoring using a soil tester (Fig. 4). It can be seen that the waste has turned into compost that is ready to be used for fertilizer and POC. In addition to producing compost in the bottom bucket, POC is collected from waste degradation, which can be used as a liquid fertilizer.

DOI: https://dx.doi.org/10.30656/jpmwp.v9i1.9243

Fig. 3. Fermentation process

Fig. 4. Finished compost and POC

Composting starts from the decomposition of waste until the destruction of waste. Compost occurs when it is blackish in color, held in no clumps, or has no odor. The color of the POC is red because the waste used is fruit waste, which is dominant in red color, namely watermelon and dragon fruit. Measure pH and temperature in compost, and POC is carried out continuously to see the level of degradation and maturity of compost and POC. To make this compost, use two composters. The results of pH and POC temperature measurements in Composter 1 are presented in Table 2, and in Composter 2 in Table 3.

Table 2. Results of pH and temperature of POC composter 1

Day	pH	Temperature (°C)
Day 1	-	-
Day 7	4	27
Day 12	4	28
Day 18	4	27
Day 25	4	27.5
Day 33	4	26.6

Table 3. Results of pH and temperature of POC composter 2

Day	pH	Temperature (°C)
Day 1	-	-
Day 7	4	28
Day 12	4	28
Day 18	4	27
Day 25	4	27.3
Day 33	4	26.5

Based on the results obtained (Table 2) in POC fertilizer in both composters, the pH is relatively the same, and the temperature is different (Table 3). The temperature will increase in line with decomposition activity and then decrease to room temperature if the decomposition process has been completed (Simanungkalit *et al*., 2006).

pH measurement was also carried out on the compost in composters 1 and 2. pH was measured to see the acidity of the compost, which can affect the performance of bacteria in the degradation process. The pH measurement results of compost in composter one are presented in Table 4, and composter 2 in Table 5. The pH of compost in composter 1 and 2 has a difference, but not too far. pH in compost degradation will drop to acidic if it is necessary to add lime as a pH neutralizer. It is done if the pH is very acidic, but in this service, no lime is added because the pH is still in the 5-6 range.

Table 4. The pH results of compost in composter 1

Day	pH
Day 1	-
Day 7	-
Day 12	5.9
Day 18	5.4
Day 25	4.1
Day 33	5.6

Table 5. The pH results of compost in composter 2

Day	pH
Day 1	-
Day 7	4
Day 12	6.1
Day 18	6.2
Day 25	6.9
Day 33	6.8

The acidity level in the composting process is an important factor in the composting process. This pH change indicates the activity of microorganisms in degrading organic matter; a decrease in pH value during composting in the early stages is caused by the activity of microorganisms that produce organic and reducing acids and ammonium ions (NH4) (Ismayana *et al*., 2012). Microorganisms are activators to accelerate waste degradation to compost (Bachtiar *et al*., 2019). While the temperature increase began to decline after day 7, the degradation process began to decline due to the reduction of organic carbon material that decomposes into CO2 gas, water, and heat. The compost temperature will stabilize to room temperature, indicating that the organic carbon degradation process is complete and the composting process is almost complete (Nurkhasanah *et al*., 2021). The overall results of this community service regarding

DOI: https://dx.doi.org/10.30656/jpmwp.v9i1.9243

initial conditions, interventions, and changes in conditions to measure the level of success carried out are presented in Table 6.

Table 6. Results of changes from community service implementation

Initial Condition	Intervention	Change
Organic waste at school is not processed into compost and Liquid Organic Fertilizer (POC)	Practice of making compost and POC with a composter	Participants are able to practice making compost and POC at school.

CONCLUSION

Making compost and Liquid Organic Fertilizer (POC) using a stacked bucket composter produces POC with an acidic pH of 4-6, indicating effective fermentation activity. This pH is suitable for plants that are tolerant of acidic conditions, increasing the availability of nutrients in the soil. This system is efficient in processing household organic waste and producing potential natural fertilizers. However, its use needs to be adjusted according to the type of plants and soil conditions for optimal results. However, this activity has limitations, including the fact that the testing of compost and POC results only covers pH and temperature without involving further analysis, such as nutrient content and its impact on plant growth. The follow-up activity to address the limitations of the initial activities is to measure the nutrient content of compost and POC and apply them to plants in the school environment.

ACKNOWLEDGEMENTS

We want to express our gratitude to the Higher Education Research and Development Council (Diktilitbang), Muhammadiyah Central Leadership, through the Muhammadiyah National Research Grant Batch VII Community Service scheme within the organization with Contract No. 0258.097/I.3/D/2024.

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