

Conference Paper

## Organic Waste Treatment Optimization Design Planning Using Simultaneous Composting Technology with EM4 and MOL at Universitas Pembangunan Nasional “Veteran” Jawa Timur

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### ABSTRACT

Universitas Pembangunan Nasional “Veteran” Jawa Timur is one of the public facilities that produces solid waste, including organic waste, inorganic, and hazardous waste. Waste that can be immediately utilized is organic waste consisting of food waste and leaves and twigs. Therefore, appropriate technology is needed to process organic waste into more useful goods and as a better management alternative through community service. One of the alternatives for processing waste is recycling it into compost using Simultaneous Composting Technology with EM4 and MOL. The main target of this community service is to reduce waste and utilize university waste with appropriate technology for regional coverage and national coverage in the future. The method of this community service is to separate waste between organic and non-organic, selected organic waste is cut by a hammer mill, and then other waste from the canteen activity is made Local Microorganisms (MOLs) as the decaying medium in the composite production of the organic garbage processing device reactor. As a result, this community service has been running smoothly and well. The results of this community service have a positive impact through the use of organic waste into compost which can be utilized by the internal campus and generate economic value.

*Keywords: Campus, organic waste, simultaneous composting, technology*

### Introduction

Waste is the residue of an undertaking or activity (Menteri Lingkungan Hidup Dan Kehutanan Republik Indonesia, 2021). In a city, colleges become one of the highest garbage producers (Fadhilah et al., 2011). The waste generated from the college sector is solid waste (MSW). Solid waste is garbage consisting of everyday items disposed of by society. Solid waste includes all substances or objects disposed of, such as packaging products, grass pieces, furniture, clothing materials, bottles/glasses, food waste, electrical equipment, newspapers, paint, batteries, etc. Integrated waste management is waste management with six stages of activity: collection, disposal, reuse, recycling, treatment, and final waste processing (Fahmi, 2021). The characteristics of garbage are mainly solid waste, which is vital to know for the proper waste management of the collection stage, the choice of means of transportation, energy transformation, and recovery, the recovery of reusable materials, as well as the proper design, application of routes and optimal disposal methods. The monthly amount of Municipal Solid Waste is influenced by the number of people or activities performed in a particular area.

#### How to cite:

Hidayah, E. N. et al. (2024). Organic waste treatment optimization design planning using simultaneous composting technology with EM4 and MOL at Universitas Pembangunan Nasional “Veteran” Jawa Timur. *8<sup>th</sup> International Seminar of Research Month 2023*. NST Proceedings. pages 106-111. doi: 10.11594/nstp.2024.4118

The problem of garbage management, especially in developing countries such as Indonesia, is a serious problem that remains an unsolved challenge (Rahim, 2020). It is due to rapid and uncontrolled urbanization and industrialization, weak environmental laws, inadequate funding, and the main waste disposal routes ending in land storage. The situation of Garbage Management in Indonesia is similar to what is expected in various universities, especially at the point of lack of understanding of garbage differences, which are critical factors in determining the level of effectiveness and efficiency in garbage management. It is vital to analyze the nature and composition of the MSW produced and evaluate the efficiency and effectiveness of waste management policies and practices in the campus environment.

The standard for waste disposal site (TPST) and waste management includes 5 points: disposal, collection, transportation, processing, and final processing (BSILHK, 2022). Of these five points, the Universitas Pembangunan Nasional "Veteran" Jawa Timur has not met the disposal and final treatment stage.

To overcome this problem, in this community service, simultaneous composter technology was designed using microbial additives such as EM4 (Effective Microorganisms 4) and MOL (Local Microorganisms) as a step to optimize the final processing of organic waste processing in the Universitas Pembangunan Nasional "Veteran" Jawa Timur campus environment.

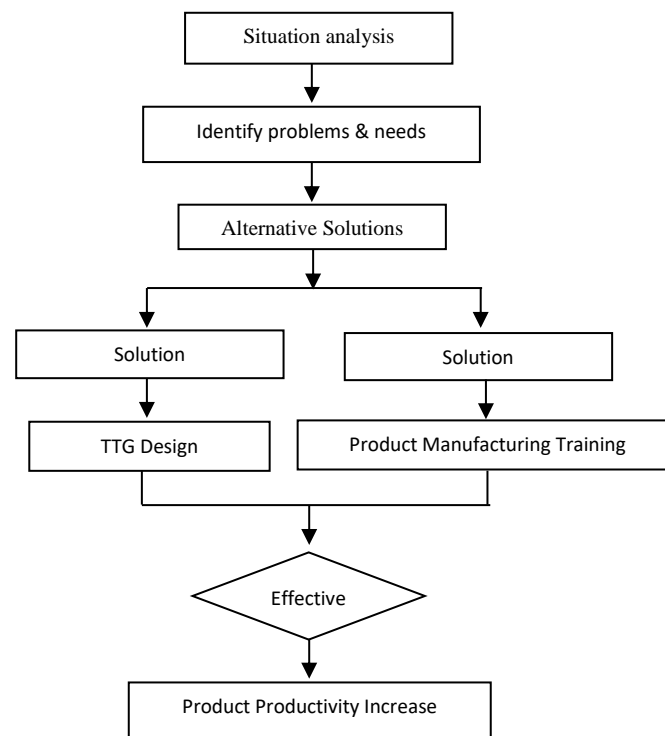
The composting method is used to produce compost that can serve as fertilizer and enhance the strength of soil structures. The composting process is also used to accelerate the decomposition of organic material with the support of microorganisms (Imelda et al., 2022). EM4 is an additive that contains microorganisms capable of decomposing various organic components, such as cellulose, starches, sugars, proteins, and fats, mainly involving *Lactobacillus* sp. (Hidayati et al., 2022). MOL (Micro Organism Local) is a group of microorganisms that are generally bred and play an important role in the concept of zero waste as an initiation in the manufacture of organic compost. MOL contains various types of microorganisms, including *Azotobacter* sp., *Lactobacillus* sp., yeast, photosynthetic bacteria, and fungi responsible for decomposing organic compounds (Hadi, 2019). According to research carried out by (Fatma & Yasril, 2021), there is a difference in the average effectiveness of EM4 and MOL activators that can be observed through measurements of temperature, humidity, and pH.

Based on the introduction above, this community service is dedicated to reducing organic waste in the campus environment of the National University of Development "Veteran" East Java through appropriate technology for simultaneous composting with EM4 and MOL so that the existence of these activities can increase the use of organic garbage that is more effective and efficient for plants inside the campus or generate economic value.

## **Material and Methods**

### **Methods**

The main target of this community service is to reduce organic waste and utilize university waste with appropriate technology (TTG) simultan composting. Waste is separated between organic and non-organic. Selected organic waste is cut by hammer mill, then other waste from the canteen activity is made Local Microorganisms (MOLs) as the decaying medium in the composite production of the organic garbage processing device reactor. Next, the mechanism of dedication is as follows:

**Tools**

Equipment used between:

1. Power
2. Roll
3. Iron Plate (for building a mall)
4. Scissors
5. Mixing baking
6. Drive wheel
7. Dynamo
8. Driver pipe

**Material**

The materials used include:

1. Fiber
2. Resin
3. Talc powder
4. Iron Plate
5. Catalyst
6. Mirror Glass
7. Thinner
8. Coloring Pigment
9. MOL
10. EM4
11. Rice water
12. Salt

**Results and Discussion*****Waste composition analysis***

In Universitas Pembangunan Nasional “Veteran” Jawa Timur, Some sanitary officers are very responsive and cultural to environmental management activities such as collecting garbage daily to collect at specific containers. However, this collection process is a barrier because there is a lack of good in the processing process. It could affect the composition process. To do that, we must make modern garbage disposal equipment that suits our needs.

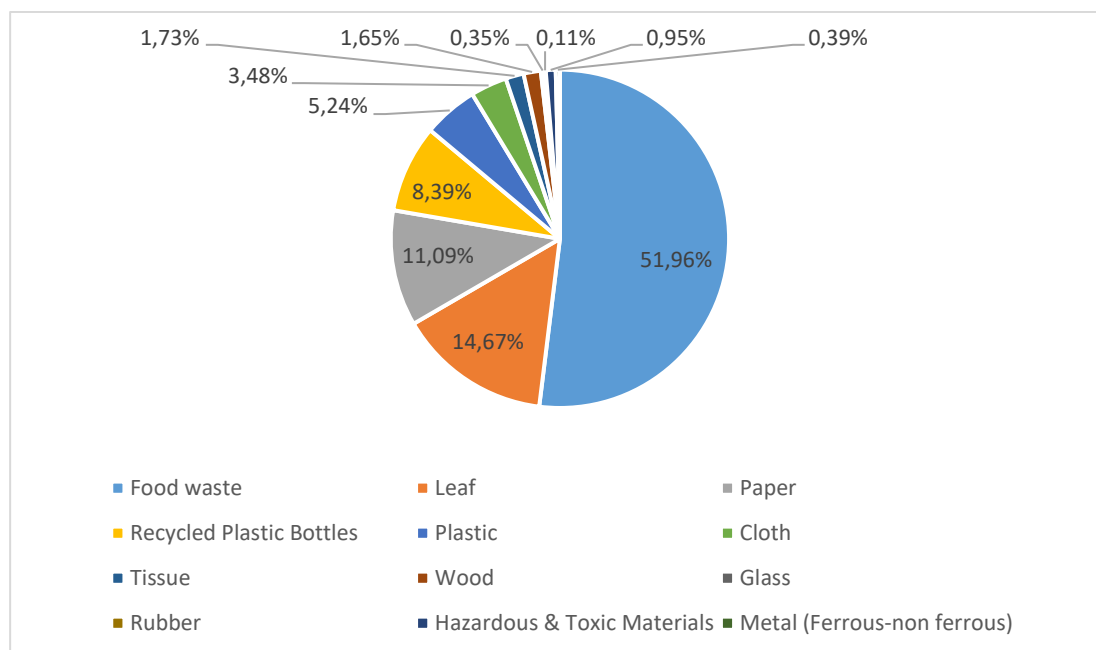


Figure 1. Percentage of waste composition from campus activities at UPN "Veteran" Jawa Timur  
Source: Mufidah (2020)

From Figure 1 above, it is known that 51.96% comes from organic waste. Garbage collection activities from cleaning staff are carried out once a day with the volume of waste as illustrated Figure 2.



Figure 2. (a) Pan Granulator (b) Sieve (c) Hammer mill

In processing devices such as Figure 2, there is still a lack of waste handling. It requires a waste technology tool that works simultaneously in the waste processing used for compost fertilizers. Of the two above activity situations, the waste generally comes from organic garbage moons and the waste disposal device technology is not significant. So, the potential made organic compound fertilizer is highly possible with the method of aid MOL in the formation of fertilizers.

### **Appropriate technology planning**

Appropriate Technology Planning (TTG) for campus begins with identifying the need for the waste processing technology to be used. Some of the attributes and functions the UPNVJT requires will be scaled priority (Abdullah, 2020).

From these attributes, technical specifications on the design of the tool. From the technical specification, some design concepts and estimates of the cost of manufacture. The concepts that have been developed are then discussed with the UPNVJT garbage managers for selection. Evaluation and improvement of concepts can occur due to difficulty and cost of manufacture. These are the selected concepts that will be applied to the tool design. The method of making this simultaneous composting can be seen in the scheme Figure 3:

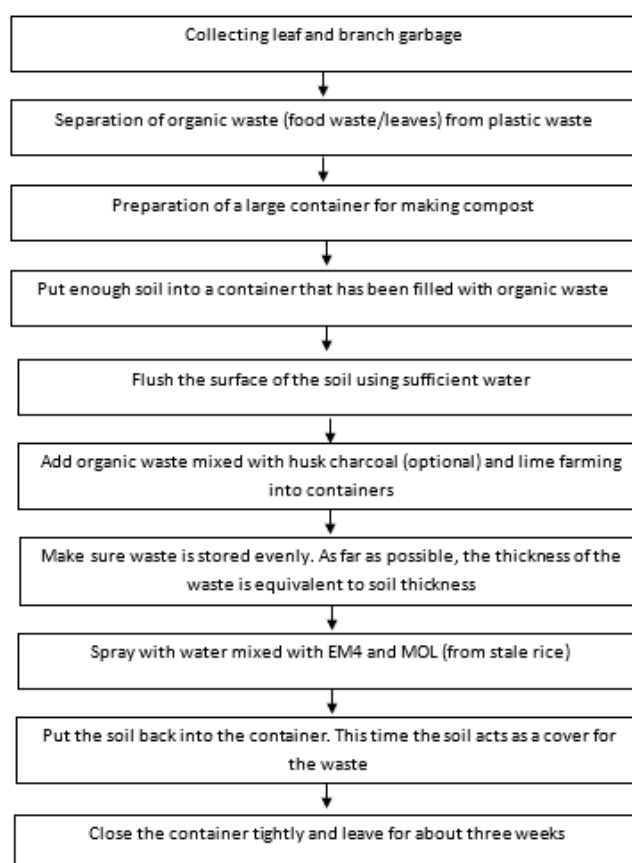


Figure 3. Stages of the process of creating Simultan Composting Technology

Figure 3 explains the collection of organic waste according to the guidelines management of making compost from leaf waste scattered around the yard campus, in accordance with Undang-Undang No.18 Tahun 2008 in managemet waste.

### **Prototype**

The prototype that will be used in this community sevice can be seen in Figure 4 as follows. Figure 4. shows that the residue of wasted rice is collected with the release of banana leaves to grow the mushroom next week by adding salt and rice water to become MOL (Local Microorganism). After becoming MOL within 3 weeks, the mol is poured into the organic garbage mixer reactor, disassembling the waste into organic fertilizer.

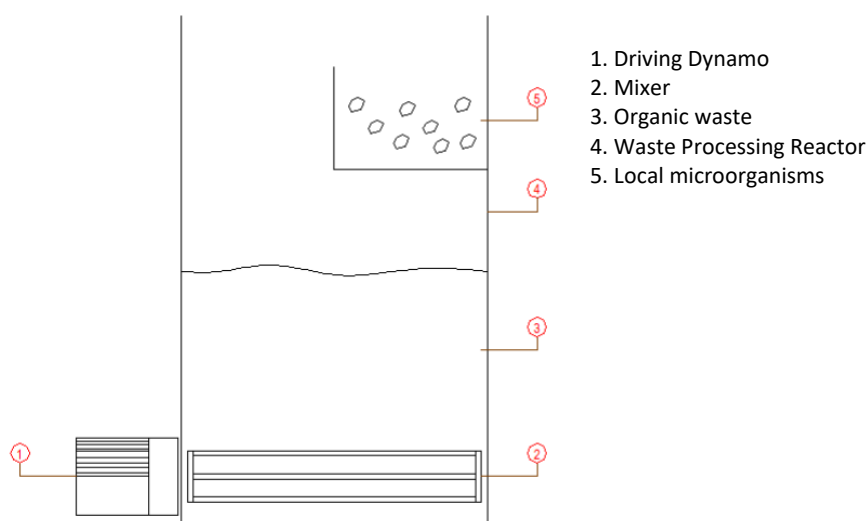


Figure 4. Prototype simultan composting for processing organic waste

### Conclusion

The results of this community service is able to achieve the goals of community service activities by implementing the concept of handling campus organic waste through simultaneous composting technology with EM4 and MOL. The results of this community service have a positive impact through the use of organic waste into compost which can be utilized by the internal campus and generate economic value.

### Acknowledgment

This work was supported by UPN "Veteran" Jawa Timur. Therefore, we as the community service team would like to thank the UPN "Veteran" Jawa Timur, especially the parties involved, namely lecturers, students, campus cleaners and canteen residents in carrying out this service activity.

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