Takakura Model Waste Composting Performance Analysis

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Abstract. Composting with the conventional method takes a long time so it is less effective to overcome the problem of accumulation of organic waste. Therefore, it is necessary to find another method or method of composting that is more effective to overcome this problem. Currently, it has been found EM4 (effective microorganime 4) by Prof. Teruo Higa from Japan's Ryukyus University. This EM4 solution contains fermenting microorganisms and can work effectively in accelerating the composting process compared to conventional methods. According to Mirwan's research in the journal Environmental Engineering Vol. 04 No.01 which uses aeration and cow dung with the final result of C/N quality compost of 4.144. However, from these studies, the quality of the compost formed for the C/N ratio parameter has not met the C/N ratio standard according to the SNI 7763:2018. Therefore, the aim of this research is to analyze the performance of composting from organic waste using EM4 and cow dung using the takakura method with sieve diameters of 3 mm, 4 mm and 5 mm. In this way, it is hoped that the composting process can run more effectively and produce quality products. The results of the study on the effectiveness of compost processing with a sieve diameter of 3 mm with composting time of 15 days, yielded Organic C of 31.12%. Macro Nutrients (N + P2O5 + K2O) 4.51%. C/N 20.49. And the average pH was 6.6–7.3. The results of the study on the effectiveness of compost processing with a sieve diameter of 4 mm with composting time of 15 days, yielded Organic C 31.12%. Macro Nutrients (N + P2O5 + K2O) 5,46%, C/N 20. And the average pH was 6.6–7. The results of the study on the effectiveness of compost processing with a sieve diameter of 5 mm with composting time of 15 days. Yielded Organic C 31.05%, Macro Nutrients (N + P2O5 + K2O) 6 .56%. And the average pH was 6.6–8. The quality of the compost in this study complied with SNI 7763:2018. Leachate as much as 4 l on a sieve diameter of 3 mm, a sieve diameter of 4 mm as much as 5.5 L and 6.5 L in a diameter of 5 mm. Days compared to the composting time of 20 days and 25 days. Leachate produced from the composting process needs to be analyzed to determine the quality of Nitrogen, Phosphorus and Potassium (NPK) leachate, so that leachate can be used as liquid fertilizer.

Keywords: Organic Waste · Compost · EM4 · Cow Manure · Takakura

1 Introduction

The Takakura method is a composting method using a basket. This basket is called the community as a magic basket because of its very good ability to process organic waste.

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Takakura magic basket is a tool for composting organic waste for household scale, with a practical shape, clean and odorless, so it is very safe to use at home. Takakura model composting is an aerobic composting process, where air is needed as an important intake in the growth process of microorganisms that decompose waste into compost. The process is to put organic waste (ideally chopped organic waste) into the basket every day and then control the temperature by stirring and sprinkling water. In this study, organic waste used vegetable waste from household activities and from unsold vegetable waste from traditional markets and mixed with cow dung and bioactivator used EM4 solution which contains fermenting microorganisms and can work effectively in increasing the effectiveness of the composting process performance, and minimizing the risk of process failure.

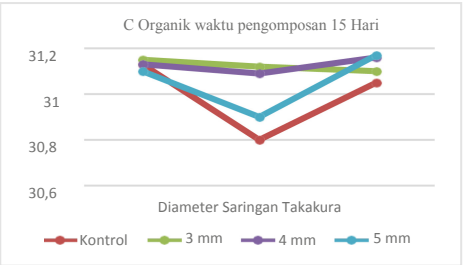
2 Research Methods

This study is an experiment to determine the effectiveness of composting using the Takukara method with sieve diameters of 3 mm, 4 mm, and 5 mm.to determine the quality of compost (C, Macro Nutrients (N + P2O5 + K2O), pH, and C/N ratio) in the ratio of 24 kg organic waste, 330 ml EM4 4% and 9 kg cow dung. The research variable consists of 2 types of variables, namely the independent variable or the independent variable and the dependent variable or the dependent variable. The independent variable consisted of the Takakura composter. With variations in composting time and diameter of the Takakura tool hole and the dependent variable is: the quality of the compost formed (N, P, K, C, C/N, and pH) according to SNI 7763:2018. Research Time This research was carried out from June to November 2021 at the Tanjungkarang Environmental Health Department Laboratory.

3 Results and Discussion

The results of measurements and observations on the takakura method of composting for 15 days. With diameter 3 mm, 4 mm and 5 mm sieves showed that the compost parameters (organic C, Macro Nutrients (N + P2O5 + K2O), and C/N Ratio) can be seen in the picture and narrative as follows:

1. Analysis of organic C, at the time of composting 15 days using the Takakura method with sieve diameters of 3 mm, 4 mm and 5 mm



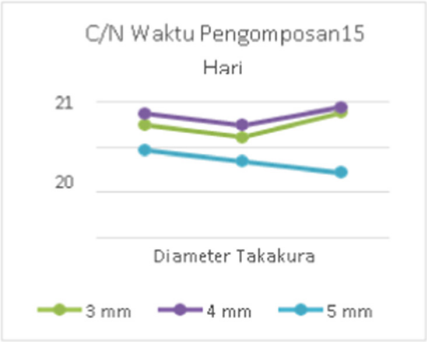
In Fig. 1, the composting process using the Takakura method with sieve diameters of 3 mm, 4 mm and 5 mm, with a composting time of 15 days, the highest organic C content was found in the 5 mm sieve diameter and the lowest was 31.17 and 30.8 in the control. This is because organic carbon compounds are used as an energy source for microorganisms and then carbon is lost as CO2, so the value in the control is low. In the sample with a filter size of 5 mm, the organic carbon value is still high due to the increasing nitrogen content, the number of microorganisms in the sample will also increase, but in this case it causes less food availability for microorganisms for metabolism. When compared with the quality standard of SNI 7763:2018.

2. Analysis of Macro Nutrients (N + P2O5 + K2O), at 15 days composting using the Takakura method with sieve diameters of 3 mm, 4 mm and 5 mm

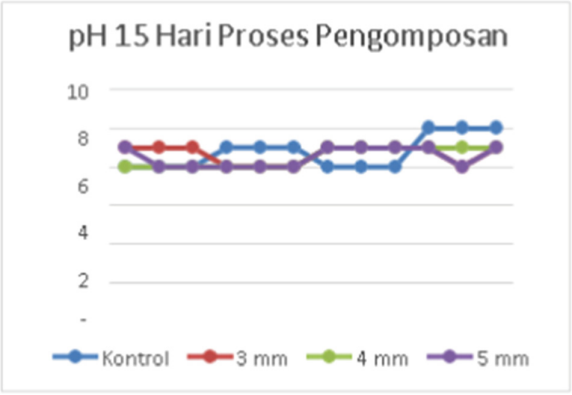
Macro nutrients are nutrients contained in compost in large quantities. The role of organic matter on the availability of nutrients in the soil is inseparable from the mineralization process which is the final stage of the organic matter reform process. In Fig. 2, it is found that the macronutrient content (N + P2O5 + K2O) on a 15-day examination is in the range (4.54–6, 64%) and the highest NPK content is in a filter with a diameter of 5 mm, based on SNI 7763:2018 the NPK value contained in the 15-day inspection compost is still in accordance with the standard, namely the NPK value of at least 2%.

3. Analysis of the C/N Ratio at the time of composting 15 days using the Takakura method with sieve diameters of 3 mm, 4 mm and 5 mm

According to SNI 7763:2018 the standard C/N ratio in compost is a maximum of 25. Based on the standard in Fig. 3, the C/N ratio on a 15-day compost inspection meets the requirements, namely a sieve with a diameter of 3 mm has a C/N ratio ranging from (14 .36–14.64), the diameter of the 4 mm sieve ranges from (19.47–19.85), and the 5 mm sieve has a C/N ratio of (15.73–15.97). This study shows that the ratio obtained from composting with the Takakura method for 15 days still meets the standard C/N ratio in SNI 7763:2018. (National Standardization Agency, 2018).



4. 15 Day Compost pH Analysis In the composting process, the control group and the treatment group in the first measurement had a low pH or tended to be acidic.



Based on Fig. 10, it can be seen that the average compost pH in the control group composting process did not change significantly. The pH results in the control group were found to be relatively low or acidic in the overall measurement due to the process of formation of organic acids and causing mold growth in the compost. (Larasati et al., 2019) At the beginning of composting, the pH obtained was between 6–8, in this case the pH was still within the standard limits of SNI 7763:2018 which was used as a pH parameter for solid compost, which ranged from 4–9. (National Standardization Agency, 2018).

5. Leachate Analysis

Based on the results of the study, the average leachate (Leachate) in each treatment was 4 L sieve 3 mm in average, 4 mm sieve diameter averaged 5.5 L and 5 mm sieve diameter averaged 6.5 L In general, leachate consists of chemical compounds resulting

from the decomposition of waste and water that enters the waste generation. Leachate (leachate) contains microbes and various kinds of minerals needed for bacterial growth.

In addition to containing high concentrations of organic elements, leachate also contains metal elements such as Zn and Hg. The type of leachate content composition is influenced by many factors such as the type and age of the waste, the type of water that passes through the landfill, land and climate factors, hydrogeological conditions, the depth of the landfill, the slope of the soil where the landfill is placed and the soil cover factor [13].

4 Conclusion

The effectiveness of compost processing with a sieve diameter of 3 mm with a composting time of 15 days, resulted in 31.12% Organic C. Macro Nutrients (N + P2O5 + K2O) 4.51%. C/N 20.49. And the average pH is 6.6–7.3. The effectiveness of compost processing with a sieve diameter of 4 mm with a composting time of 15 days, yielded 31.12% Organic C, Macro Nutrients (N + P2O5 + K2O) 5.46%. C/N 20.7. And the average pH is 6.6–7. The effectiveness of compost processing with a filter diameter of 5 mm with a composting time of 15 days, Organic C 31.05%, Macro Nutrients (N + P2O5 + K2O) 6.56 C/N 19.68, and an average pH of 6.6–8. The average leachate produced by the composting process using the Takakura method with a 3 mm sieve diameter is 4 L, a 4 mm sieve diameter is 5.5 L and a 5 mm sieve diameter is 6.5 L. The leachate produced from the composting process needs to be analyzed to determine quality of Nitrogen, Phosphorus and Potassium (NPK) leachate, so that leachate can be used as liquid fertilizer.

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