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Differences in C/N ratio of organic waste compost due to variation of aeration rate and composting time using aerated static pile method in Cahaya Kencana Landfill, Banjar District, South Kalimantan

Rizqi Puteri Mahyudin*[1], Yuni Safaria Dwi Lestari[2]

[1]*Department of Environmental Engineering, Faculty of Engineering, University of Lambung Mangkurat University, Banjarbaru, South Kalimantan, Indonesia*

[2]*Postgraduate Programme Natural Resources and Environmental Management, University of Lambung Mangkurat, Banjarbaru, South Kalimantan, Indonesia*

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Abstract

The study aims to analyze the differences in the C/N ratio of leaf organic waste compost due to variations in aeration rate and composting time using the aerated static pile method. One pile of compost weighs 40kg with a ratio of 2:1:1 (fresh leaves: cow manure: sawdust). The height of the compost used is 55 cm with a width of 100 cm. Variation of aeration rate used is 0.5, 0.7L/min.Kg with open windrow control. C/N ratio analysis is done weekly. The results showed that the best aeration rate variation was 0.7L/min.Kg because it produced the lowest C/N ratio, namely 14.7. Statistical test results stated that there was no difference in the C/N ratio of leaf organic waste compost due to variations in aeration rate and composting time.

* **Corresponding Author:** Rizqi Puteri Mahyudin ✉ rizqiputeri@ulm.ac.id

Introduction

The Final Processing Site (TPA) for Cahaya Kencana waste is located in Padang Panjang Village or Lihung Village, Karang Intan District, Banjar Regency, South Kalimantan Province. There are several efforts in the final processing of waste at the Cahaya Kencana landfill, namely the operation of landfilling with sanitary landfills, composting and waste banks. Composting at the Cahaya Kencana landfill uses the main ingredient, namely organic waste in the form of leaves obtained from cooperation with the Banjar Regency PLN, the Banjar Regency cleaning service and the surrounding community (Mahyudin *et al.*, 2018).

The composting method carried out at Cahaya Kencana TPA uses the open windrow method. Where in the open windrow method is characterized by frequent reversal processes that are carried out to regulate air circulation in the compost. However, the use of the open windrow method has several drawbacks, including the need for large areas of land, a large amount of equipment and a larger number of workers.

The research results of Mahyudin *et al.* (2018) showed that the variations in the aeration rate used were 0.4, 0.5 and 0.6L/minute.kg. The most optimal treatment for the composting process using the aerated static pile method is aeration of 0.6L/minute.kg. The variation of aeration used in this study is 0.5L/min.kg (Cahyani *et al.*, 2013; Mahyudin, 2018) and 0.7L/min.kg. The rate of aeration increases the reduction in the total weight of the compost mixture. The water content tends to increase with composting time. Therefore, in this study compost processing will be carried out with variations in the rate of aeration using the aerated static pile composting method at Cahaya Kencana TPA.

Material and methods

The aim of the study was to determine the effect of aeration rate and composting time on reducing the C/N ratio in the composting process using the Aerated static pile method which is made from fresh leaf waste found in Cahaya Kencana Landfill in Banjar Regency South Kalimantan, water, sawdust and cow dung. The piles will be built with a width of 1 m, a length of 1m and a height of 0.55m for a total of 40kg. This research carried out in the field using a completely randomized with the treatment of variations in the rate of aeration, namely: 0.5 ; 0.7L/min. Kg. While the composting method in the control without using aeration.

The research variables used are:

1. Independent variable (composting time and aeration rate)

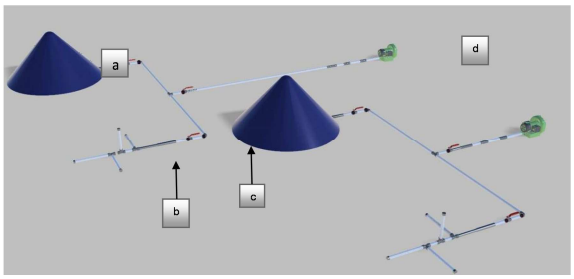
1) Without aeration as a control (abbreviated as C)

2) By providing an aeration rate of 0.5L/min.Kg (abbreviated as B)

3) By providing an aeration rate of 0.7L/min.Kg (abbreviated as A)

2. The dependent variable in this study is the C/N ratio observation variable.

The compost materials used are fresh leaf waste with additional ingredients such as sawdust, water and cow manure. The piles are 1m wide, 1m long and 0.55m high with each pile weighing 40kg with a ratio of 2:1:1 (fresh leaves : cow manure : sawdust). This research was conducted in the field using a Completely Randomized Design (CRD) with the treatment of varying aeration rates, namely: 0.5; 0.7L/min.Kg. While the composting method in the control is open windrow. Parameters observed were temperature, pH and humidity every day. C/N ratio analysis every 7 days.



a. Compost pile
b. Horizontal dan vertical pipe
c. Faucet
d. Blower

Compost can be said to be mature if the C/N ratio complies with Indonesian National Standard SNI: 19-7030-2004. Analysis of carbon to nitrogen ratio data

uses a 95% level of confidence so that the probability value used is 5% (sig. A = 0.05). Data analysis used statistics in the form of a completely randomized design with a factorial pattern with a linear additive model using software in the form of SPSS (Statistical Product and Service Solutions) Version 16. First, a normality test was performed to determine whether the data was normally distributed (sig> 0.05). If the data is normally distributed, the next step is to carry out a homogeneity test, a homogenity test is carried out to find out whether the data has homogeneous variance (sig > 0.05). If the data is normally distributed and has a homogeneous variant, the next test is a two-way ANOVA test to find out whether it is significant (sig <0.05), if it is proven to be significant then proceed with a comparison test of treatment mean values using the LSD (Least Significance Different) test.

Result

The results of the compost produced when the compost is ripe it has a shapealmost the same physical at each variation of aeration rate. The color of the compost produced using the ASP method and without aeration is almost the same, namely brownish black in color, does not smell rotten or smells earthy, the resulting texture still looks like sawdust but the particle size is between 0.55-25mm, and the temperature of the compost is mature. All variation of compost has complied with Indonesia National Standard 19-7030 2004 Specification of Compost from Domestic Organic Waste.

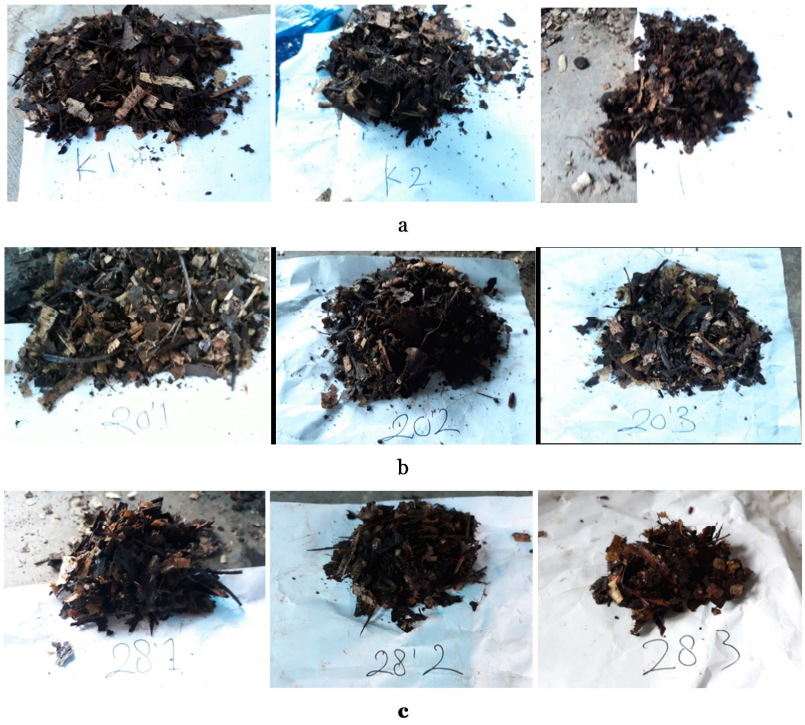


Fig. 1. Mature compost (a) control (no aeration), (b) aeration rate 0.5L/min.kg, (c) aeration rate 0.7L/min.kg.

The following is a graph of changes in compost moisture content with the aeration treatment of 0.5L/min.Kg, 0.7L/min.Kg and control can be seen in Fig. 2.

Measurement of the value of the C/N ratio in this study was carried out every 7 days for 5 weeks in the laboratory. Graph of C/N ratio of compost with aeration treatment 0.4 ; 0.5 ; 0.6L/min.Kg can be seen in Fig. 4.

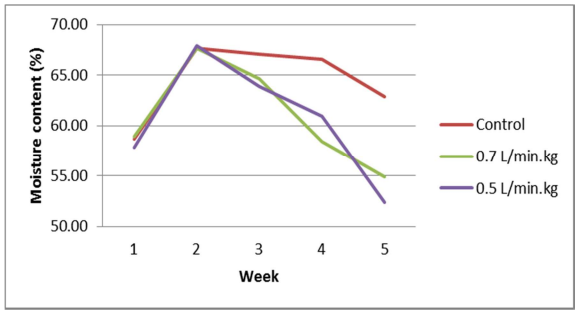


Fig. 2. Compost moisture content

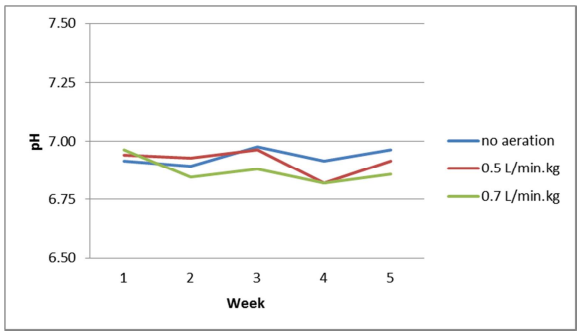


Fig. 3. Compost pH.

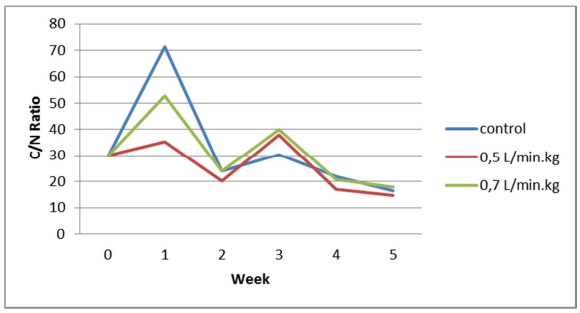


Fig. 4. C/N ratio value.

Table 1. Results of analysis C/N ratio each week.

Week	C/N Ratio without aeration (control variation)	C/N Ratio 0.5L/min.kg eaeration rate	C/N Ratio 0.7L/min.kg eaeration rate
0	30.0	30.0	30.0
1	71.2	52.9	35.3
2	23.9	23.9	20.3
3	30.3	40.0	37.8
4	22.0	20.9	16.9
5	16.3	17.8	14.7

Based on fig. 1 can seen that the lowest C/N ratio from third variation rate given aeration indicated by aeration rate 0.7L/min.kg ie of 14.7. If compared to with control it can be concluded that the resulting compost from ASP methods have lower C/N ratio. All variations already fulfil criteria in accordance with SNI 19-7030-2004.

Discussion

Moisture Content and pH

Moisture content affects the temperature and rate of compost decomposition in organic waste composting. The optimum water content is 60% (Kurnia *et al.*, 2017). The results of observing the water content in the control in the first week amounted to 58.67%, then increased to the second week. In the second week the water content increased due to the addition of water. Observations in the second week to the third week have increased. The increased water content causes the pores of the compost to become closed resulting in an increase in carbon so that the C/N ratio increases, this is in line with research conducted (Ratna *et al.*, 2017). The water content in the fourth and fifth weeks decreased, causing the C/N ratio to decrease.The results of observing temperature changes in the different treatments of the ASP composting method with different aeration variations showed differences in temperature increase. The highest temperature on the first day was at the aeration rate of 0.7L/min.kg, then in the first to fifth week the highest temperature was given 0.5L/min.kg aeration of 38.17°C and the lowest temperature was given 0.7 L aeration /min.kg of 28,33°C.

To see the difference between the variations, a two-way ANOVA test was carried out. The highest C/N ratio value is 127.71 and the lowest is 13.40. The results significancy value of the normality test is 0.087 (sig 0.087 > 0.05), which means that Ho is accepted as normally distributed data. Then a homogeneity test is carried out to find out whether the data is the same or not. The results of the homogeneity test showed that Ho was accepted (sig 0.576 > 0.05), which can be interpreted as homogeneous data. The c/n ratio data tested did not fluctuate and had the same distribution. The data owned by the group category is the difference in each control treatment, the aeration rate is 0.5L/min.kg and 0.7L/min.kg, each treatment has 15 data with a total of 45. In the week category it is divided into 5 weeks with data every week there are 9 data and a total of 45 data. The two way ANOVA test aims to find out the difference in C/N ratio due to variations in aeration rate and composting time. The two way ANOVA test in the group showed a value (sig 0.238 > 0.05), which means that Ho was rejected, there was no difference in the C/N ratio due to variations in the aeration rate. In the week group category, the value (sig 0.000 <0.05) of Ho is accepted, which means that there is a difference in the C/N ratio due to the length of composting time. The value obtained from the group and week is (sig 0.505 > 0.05) Ho is rejected. It can be concluded that there is no

significant difference in the C/N ratio due to variations in aeration rate and composting time.

From the research conducted, it was found that there is a relationship between variations in the rate of aeration and fluctuations in values at temperature, pH and C/N ratio. The variation of the aeration rate that produces the highest temperature during the composting process is the aeration rate of 0.5L/min.kg. Whereas for pH fluctuations there was not much difference and more or less all treatments had the same pH value. The increase in temperature is influenced by the microbes that are present in the pile during the composting process, especially in the mesophilic and thermophilic phases, while fluctuations in the pH value are affected by organic matter which decomposes to produce acids which will lower the pH while those that produce ammonia will increase the pH in the initial phase. However, mature compost has a pH that is close to neutral, this is the same as the pH of mature compost in this study (Agastirani, 2011). From the research results it can be concluded that a decrease in pH value will be in line with an increase in temperature (Syafrudin & Zaman, 2007). Then for humidity when the humidity is high the temperature will rise then the humidity decreases and so on. For the value of the C/N ratio of variations in the aeration rate of 0.5L/min.kg, 0.7L/min.kg and the control given, it can be concluded that there is no significant difference between the variation in the aeration rate and the value of the C/N ratio. because the temperature, pH, and pH values did not have a significant difference. The variations in aeration rate and control had a decrease in temperature in the fifth week, which meant that the compost had matured and occurred in all variations in aeration rate and control.

Conclusion

There is no significant difference in the C/N ratio due to variations in the aeration rate and composting time. The variation of the aeration rate that produces the highest temperature during the composting process is the aeration rate of 0.5L/min.kg.

Recommendation(S)

Further research is needed on the composting process using the aerated static pile method. Can use different ranges of aeration rates, widths and heights of piles and material compositions.

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