Comparative analysis of composting with ecoenzymes and bioactivator MOL based on parameters of pH, temperature, and water content

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Abstract. Composting is a process of decomposition of organic matter by various microorganisms that help process of overhauling organic matter, resulting in changes in both structure and texture. Composting occurs naturally with a long process, bioactive ingredients such as bioactivator MOL and ecoenzym are needed. Bioactivator MOL and ecoenzyme are microorganisms made from natural ingredients such as fruits and vegetables and as a medium for developing microorganisms that can accelerate the composting process. The purpose of this study is to analyze the comparison of composting between the addition of ecoenzymes and mole bioactivator based on the parameters of pH, temperature, and water content. Study carriedout for one year using the experimental method. Samples in the form of organic waste with the addition of bioactivator MOL and ecoenzyme stored in wooden storage. The results to be achieved from this research are the effectiveness level of the addition bioactivator MOL and econzym in organic composting, as well as providing solutions from various existing composting methods.

1 Introduction

Compost is a type of organic fertilizer that comes from from organic ingredients that have been experienced decomposition by decomposing microorganisms and work as a soil nutrient supplier [1]. Fertilizers may be made up of one or more essential nutrients, and this serves as a means of fertilizer classification. The fertilizers that contain only one of the major elements are called single, simple, or straight fertilizers. Those that contain two or more major elements and trace elements are categorized as mixed or compound fertilizers [2]. Nitrogen, phosphorus, and potassium (NPK) are the major nutrients required by plants. Although micronutrients are also necessary for normal development in plants, higher concentration leads to toxicity.

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Solid waste disposal activity is a continuous activity. Population increase, rapid urbanization, booming economy, and the rise in the standard of living in developing countries have greatly accelerated the rate, amount, and quality of the municipal solid waste generation [3]. Therefore, a solid waste management system is needed. Management of urban solid waste has some difficulties in collecting the solid wastes and finding a safe area to dispose them. Composting is needed to reduce its volume. Composting is a biological process.

Composting is a special process, because of the raw material, and the place, although the method can be done by anyone and wherever. Compost is organic material that is decomposed in a place that is protected from the sun and rain, the humidity is regulated by watering when it is too dry. Factors that influence composting are C/N of raw materials, type and size of raw materials, aeration, humidity, temperature, microorganisms, and activator. Theplace of composting process might be digging soil, container or surface of the soil.

One of the key factors indicating that composting works quickly is the water content. Water content has a critical role in composting engineering because the decomposition of organic matter depends on the availability of water content. Moisture content is an important key in the composting process. Therefore, the product is less stable than compost. Easy-degradable organic compounds, such as organic acids produced during fermentation, can increase the proportion of active microorganisms in soils [4, 5]. The importance of water contentas an important factor in the maturity and quality of compost.

In addition, the higher the temperature, the more oxygen consumption and the faster the decomposition process. An increase in temperature can occur rapidly in a compost heap. Temperatures ranging from 30°–60°C indicate rapid composting activity. and also the optimum pH for the composting process ranges from 6.5 to 7.5. The composting process will cause changes in organic matter and the pH of the material itself. The pH of mature compost is usually close to neutral.

2 Research Methodology

2.1 Preparation Stage

Before doing the composting process, did the process of making MOL bioactivator. The process ofmaking the bioactivator MOL is carried out with the following steps:

1) Prepare ingredients such as organic waste, brown sugar, 2 liters of coconut water, and 8 liters of rice water.
2) Mix the ingredients then stir until smooth
3) Put the ingredients that have been mixed into a bucket and then tightly closed, fermentation is carried out for 2 weeks. The finished bioactivator MOL is characterized by a strong alcohol smell.

2.2 Implementation Stage

The composting process is carried out by mixing materials and adding bioactivator MOL and ecoenzymes. The ready sample is placed in wooden storage and covered with plastic until tightly. 3 samples were made which were given different treatments, 1 control sample, 1 sample with the addition of a mole bioactivator, and 1 sample with the addition of ecoenzymes. The composting process is carried out for 1 month. The process of turning the sample is carried out once every 3 days and watering is carried out if the compost is too dry. After the waste has undergone the composting process and turned into compost, an analysis of the pH, temperature, and moisture content of the compost is carried out. Sample testing was observed every 3 days. According to SNI 19-7030-2004, the finished compost has a

temperature according to the temperature of the groundwater, has a blackish color, a soil-like texture, smells like soil, and the pH is in the range of 6.80-7.49.

3 Result and Discussion

3.1 Temperature Analysis

Temperature measurements were carried out for 21 days. Observation of temperature in this study serves to see the difference in the speed of composting to differences in water content. Temperature measurement is done by inserting a thermometer as deep as half the height of the compost. The following is a graphic image of the compost temperature during the study.

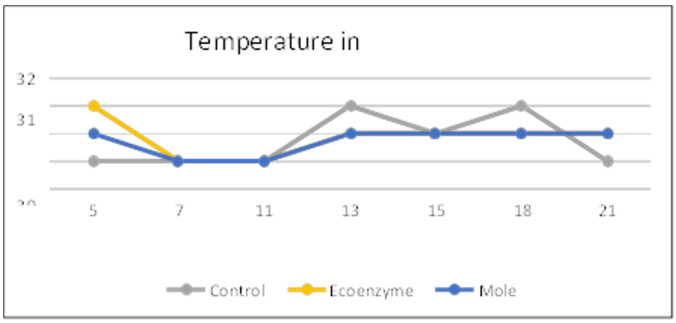


Fig. 1. Graph of temperature in composting using ecoenzyme and mol.

From Figure 1, it can be seen the difference in temperature of each treatment. The highest temperature achieved by the compost was 31°C, which was achieved by the control treatment on the 13th and 18th day and eco-enzyme on the 5th day. As for the mole treatment, the highest temperature was 30°C on the 5th day and the 13th to the 21st day. In this study, the effect of water content on the temperature of the compost was not very visible because the temperature obtained was constant in the range of 29-31°C.

3.2 The pH Analysis

The pH measurement was carried out for 21 days. Observation of pH was carried out to describe the stages of composting and compost maturity. The pH measurement was carried out using a pH meter. The following is a graphic image of the pH of the compost during the study.

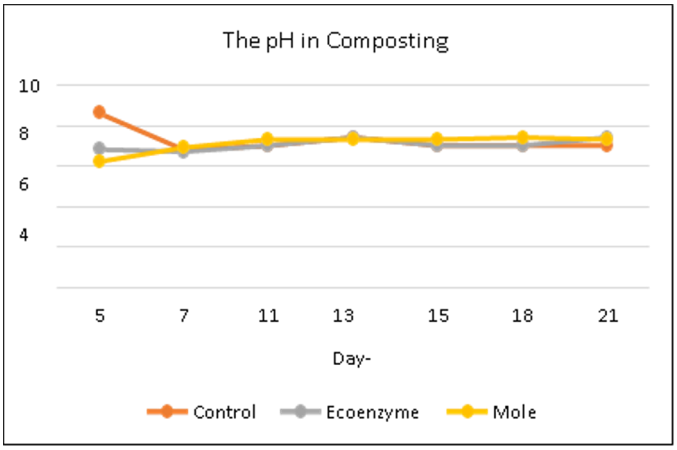


Fig. 2. Graph of pH in composting using ecoenzyme and mol.

Based on the graph above, it can be seen that there is no significant difference in pH values in the three treatments, so it can be concluded that there is no relationship between differences in humidity and pH. The pH of each treatment ranged from 6.7-8.6. The pH is increasing because there has been the formation of ammonia. On the 13th day, the pH in the three treatments had become neutral. This happens because the nitrogen decomposition has been reduced.

3.3 Analysis of Moisture Content of Composting Using Bioactivator (Mol and Ecoenzyme)

Moisture content is an important key in the composting process. This happens when the moisture content is too low or high, it will reduce the efficiency of the composting process [6]. The optimal moisture content is 45% - 55% [7]. If the moisture content exceeds 60% then the air volume is reduced, odor will be generated (due to anaerobic conditions), and decomposition is slowed down. One of the problems of compost moisture content is the reduced moisture content of the compost pile during the composting process, therefore it is necessary to add water and stir [8].

Research measurement of moisture content is carried out every 2-4 days with stirring before taking samples. The purpose of mixing is to homogenize the components in the compost. The research was conducted to compare the use type bioactivator mol or ecoenzyme which is more optimally used in composting.

Table 1. Results of moisture content test using an ecoenzyme.

Date	Moisture Content (%)
31 May 2022	86,78
2 June 2022	86,63
6 June 2022	70,81
8 June 2022	69,28
10 June 2022	69,98
13 June 2022	26,58
16 June 2022	27,47

Table 1. indicates that the change in moisture content from the data taken has decreased significantly. This is because the amount of waste that has been decomposed decreases and the heat is released. So, it affects the moisture content in the waste decreased.

Table 2. Results of moisture content test using a mol (local microorganism).

Date	Moisture Content (%)
31 May 2022	80.86
2 June 2022	77.4
6 June 2022	66.41
8 June 2022	42.06
10 June 2022	60.94
13 June 2022	47.01
16 June 2022	40.99

Table 2. indicates that the trend of moisture content using mol bioactivator insignificant decrease. The decrease that occurs looks more stable than the use of ecoenzyme bioactivator.

Table 3. Results of moisture content test on control sample.

Date	Moisture Content (%)
31 May 2022	92.04
2 June 2022	67.27
6 June 2022	71.85
8 June 2022	65.05
10 June 2022	61.17
13 June 2022	63.49
16 June 2022	35.9

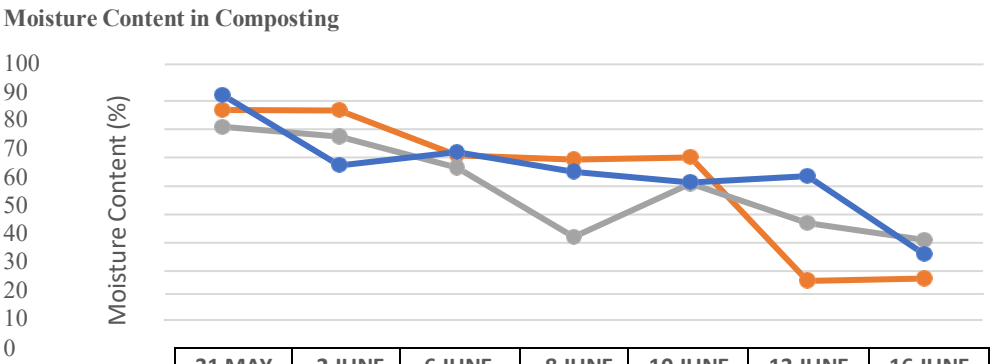
Table 3. indicates that the change in moisture content without bioactivator can be seen that the waste still has a high moisture content and has the lowest level at the last sampling.

3.4 Comparison Of Moisture Content in Composting Using Ecoenzyme and Mol

Ecoenzyme and mol are bioactivators that are useful for accelerating the decomposition process of waste in the composting process. The natural composting process takes a long time, approximately six to twelve months, dependingon the composition of the ingredients. To speed up the degradation process,a test of adding a bioactivator was carriedout to make compost from household organic waste.

From Figure 3. it can be seen that the ratio of the highest initial moisture content comes from waste without the addition of a bioactivator, then the second highest with the addition of mol, and the last from the addition of ecoenzyme. While the lowest moisture content comes from the addition of ecoenzyme in the second last sample taken. From the test results of adding mol bioactivator and ecoenzyme and comparing with the control sample, it can be seen that the moisture content of composting using mol as a bioactivator is more optimal than using ecoenzyme. This is due to the optimum moisture content for aerobic composting is 45-55%. If less than 45% causes composting takes place slowly, but if more than 55% causes nutrients to be leached and the volume of air in the compost is reduced. As a result, the activity of microorganisms decreases and Anaerobic fermentation will occur, so that give off

a bad smell. Another consequence is that if the compost pile is too moist, the process of decomposition will be inhibited. This is because the moisture content will cover the air cavity in the pile. Lack of oxygen causes aerobic micro-organisms to die and be replaced by anaerobic microorganisms.



	31 MAY 2022	2 JUNE 2022	6 JUNE 2022	8 JUNE 2022	10 JUNE 2022	13 JUNE 2022	16 JUNE 2022
Ecoenzyme	86.78	86.63	70.81	69.28	69.98	26.58	27.47
Mol	80.86	77.4	66.41	42.06	60.94	47.01	40.99
Control	92.04	67.27	71.85	65.05	61.17	63.49	35.9

Fig. 3. Graph of moisture content in composting using ecoenzyme and mol.

4 Conclusion

Based on the results of the analysis and discussion, it can be concluded that on the temperature analysis, the effect of water content on the temperature of the compost was not very visible because the temperature obtained was constant in the range of 29-31°C. On the pH analysis, there is no significant difference in pH values in the three treatments (Control, Eco enzyme, and Mole) and there is no relationship between differences in humidity and pH. The pH of each treatment ranged from 6.7-8.6. On the other hand, it can be seen that the moisture content of composting using mol as a bioactivator is more optimal than using the eco enzyme. This is due to the optimum moisture content for aerobic composting is 45-55%.

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