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Quality of Biocompost Resulting from Biopore Holes Based on Light Intensity and Acidity Degree (pH)

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Abstracts

The use of chemical fertilizers that are not balanced with the provision of organic fertilizers can damage the soil. Chemical fertilizers can also damage the balance of nutrients in the soil and lower soil pH. Therefore, organic fertilizers are needed to help restore soil fertility and LRB as a medium for composting organic fertilizers. The biopore infiltration hole (LRB) is "activated" by providing organic waste. This waste will be used as a source of energy for soil organisms to carry out their activities through the decomposition process. This decomposed waste is known as compost. Compost is a term for man-made organic fertilizer made from the decomposition process of the remains of living things (plants or animals). The investigation of this study was to determine the quality of compost based on light intensity and acidity (pH) from the results of biopore infiltration holes (LRB) as well as good physical properties of compost. This type of research is an experimental research. Good quality compost has low resistance. The pH value of the compost in samples A,B,D,E is 6.5-7.5 so it is neutral, while the pH of the compost sample C is 8.5 is alkaline. The intensity of the light is high. The results of the lowest light intensity in the compost from this study were leaf compost + sawdust + EM4 of 990 lux, fermented in LRB for 2 weeks. Meanwhile, the highest light intensity value was found in the compost of raw material leaves which were fermented for 1 month at 1017 lux. So the greater the value of light intensity in the compost, the better quality it has, because it can improve soil fertility.

Keywords: Biocompost, Degree of Acidity (pH), Light Intensity, LRB

1. Introduction

Waste is unwanted residual material after the end of a process. Garbage is defined by humans according to the degree of use [1]. The amount of waste generated in an area is proportional to the population in a certain area. The greater the population or the level of consumption of goods, the greater the amount of waste produced. Garbage is one of the biggest problems that have not been managed by the community properly.

Garbage is referred to as solid waste. Garbage usually consists of organic and inorganic materials. Organic waste is all waste that can be decomposed, such as leaves, stems, food waste, and livestock manure. Organic waste can be processed into biocompost. Meanwhile, inorganic waste is waste that cannot be destroyed or decomposed, such as plastic and glass. This inorganic waste cannot be processed into compost [2].

Biocompost is the end result of decomposition or fermentation of piles of organic waste originating from plants, plants or from animals. Organic waste consists of sawdust, leaves, straw, municipal waste, yard waste and so on. Organic matter from municipal waste and other agricultural wastes in large quantities. The waste cannot be used directly for biocompost. In order to become biocompost, waste must first be decomposed [3].

Biocompost is like a multi-vitamin for agricultural soil. Biocompost is useful for increasing soil fertility and stimulating healthy roots, improving soil structure by increasing soil organic matter content, thereby increasing the soil's ability to retain soil water content. Soil fertility is the potential of the soil to provide nutrients in sufficient and balanced quantities to ensure optimum plant growth and production. Nutrient requirements needed by plants for growth and production are determined by the ability of the soil to provide nutrients for plants and cannot always be met. Soil microbial activity that is beneficial to plants can be increased by adding biocompost (Rachman Sutanto, 2002).

In addition to the garbage problem, there is the problem of clogging of water in the ditch due to the large number of leaves falling into the ditch. Blockage of water in gutters can cause flooding. Thus, it is necessary to do a countermeasure to implement efforts to reduce waste and make biocompost and tools to loosen and fertilize the soil. This service is carried out for the sake of creating a generation that cares about the environment, trying to manage the environment as well as possible and to overcome the occurrence of flooding.

In order to overcome the problem of clogged water in the sewers so as not to cause flooding, we use LRB (Biopore Infiltration Hole) technology. Biopore infiltration hole technology (LRB), was developed based on the principle of maintaining the health of soil ecosystems to support the existence of biodiversity in the soil by the availability of sufficient water, air, and food sources (organic matter). LRB is made by digging a small hole deep with soil about 15 cm in diameter and about 80 cm deep.

Based on the problems experienced at this time, the researchers conducted research related to composting using LRB (Biopore Infiltration Hole) technology. The research conducted by the researcher is in line with the research conducted by Sri Widyastuti (2013) with the title "Comparison of Waste Types Against the Length of Composting Time in Biopore Infiltration Holes" [4].

2. Experiments Procedure

This research is an experimental study to identify the quality of biocompost from various alloys of raw materials that have different characteristics. Test the quality of the compost produced based on the physical (optical), chemical (acidity) and biological (physical form of good biocompost) properties. This research was conducted in several stages, namely as follows:

Preparation phase

In the preparation stage, the researcher prepares various materials and tools needed in the research. At this stage, a biopore infiltration hole (LRB) is made with a diameter of 15 cm and a depth of 80 cm as many as 5 LRB. After that the

researchers made a composter as a tool for making organic fertilizer. The composter is made with a certain construction so that the fermentation conditions are very optimum for microbial growth, so that quality organic fertilizers can be obtained.

The raw materials used in this research are leaves and sawdust. EM4 (bioactivator) is used for a mixture of biocompost samples made from sawdust + leaves. EM4 is mixed into other samples as a variation of biocompost, because it is very useful for removing odors in sewage, accelerating waste treatment and processing waste materials into biocompost more quickly [5]. In addition, this research also makes biocompost which is only made from raw material leaves without being mixed with bioactivators. It aims to compare the results of the quality of biocompost mixed with activator and without being mixed with activator.

Implementation Stage

The implementation of this research was started by cutting the leaves to be decomposed into biopore infiltration holes (LRB). To vary the compost with other samples, the researchers mixed leaves + sawdust + EMP. After being mixed well, it is then decomposed into the biopore infiltration hole (LRB).

To determine the quality of the finished biocompost, an analysis of its physical (optical) properties was carried out, chemistry (acidity degree), and biology (physical form of good biocompost). The optical properties of the compost were analyzed with a luxmeter to determine the level of light intensity. The luxmeter tool used to test the light intensity is the LDR luxmeter with a microcontroller based.

3. Result and Discussion

Result

Biocompost is the result of decomposition of plant residues caused by the activity of decomposing microorganisms. The composting process that has been carried out by researchers uses variations in the length of fermentation time and the raw materials used to make compost. The variation of time used for composting is for 2 weeks, 1 month and 1 month over 1 week. Composting organic matter with biopore infiltration hole (LRB) technology. While the variety of organic materials used to make compost are: 1) Samples in the form of leaf materials; 2) Samples in the form of leaves mixed with sawdust and bioactivator EM4. The process of composting organic matter duration is shown in Table 1.

Table 1. Composting Time

Sample	Material	Time	
		Start	Finish
A	Leaf	14-04-19	1-05-19
B		14-04-19	14-05-19
C	Leaf+	14-04-19	1-05-19
D	sawdust+	14-04-19	14-05-19
E	EM4	14-04-19	23-05-19

The time used for compost decomposition in the biopore infiltration hole (LRB) greatly affects the quality of the biocompost. The longer the composting fermentation, the better the quality of the compost will be. Biocompost whose decomposition process takes a long time invites many decomposing microorganisms, so that the ingredients for biocompost can be completely decomposed and the biocompost is completely ripe.

The results of the composting that have been tested by researchers show that organic waste biocompost between leaves and leaves mixed with sawdust, the quality of biocompost made from organic waste in the form of leaves alone is better than the quality of biocompost made from leaves. -leaves mixed with sawdust and bioactivator EM4. This is because the leaves have very high nitrogen. This nitrogen is used as a building block for amino acids. The effect of the quality of biocompost apart from the type of raw material is also influenced by the time used for the composting fermentation process. This is shown from the results of the study in Table 2.

Based on Table 2, it is shown that the electrical conductivity (EC) is used to determine the level of variability in the soil. Electrical conductivity (EC) is a phenomenon of electric current originating from charged particles (colloidal ions) that form an electric field

strength. There is a relationship between electrical conductivity when measuring light intensity in biocompost. Biocompost consisting of compounds and elements containing positively and negatively charged ions, when an electric current occurs from positive to negative, an electric field appears that affects the mobility of ions/colloids which are used as a source of nutrients for plant growth. With the electric current, when testing biocompost with the LDR luxmeter, if the quality of the biocompost is very good, the light bulb lights up brightly. This is indicated by the quantitative data that appears on the laptop. The lower the resistance value (R) in the biocompost, the better the quality of the biocompost, because it has a higher light intensity value.

Table 2. Compost Quality Test Results

Sample	Material	pH	Properties	
			Electric	Optic
A	Leaf	7.0	22 Ohm	1004
B		6.5	14 Ohm	1017
C	Leaf+	8.5	55 Ohm	990
D	sawdust	7.3	19 Ohm	1010
E	+ EM4	7.0	17 Ohm	1013

Seen from Table 2, the pH value of each raw material for making compost and the length of time used for fermentation have different values. According to Indriani (2012), the degree of acidity or pH in the biocompost pile also affects the activity of microorganisms. A good pH range for composting is around 6.5 – 7.5 (neutral). The pH properties of the biocompost are presented in Table 2 in sample C, the pH value is 8.5 so that it is alkaline. In addition, samples A, B, D, E, the pH value of the biocompost was between pH 6.5 and 7.5 so that it was neutral. In the compost of raw material leaves, which were fermented for 2 weeks, the pH value was 7.0 while that which was decomposed for 1 month, the pH value was 6.5. Biocompost samples C, D, E made from raw materials of leaves and sawdust have a pH of 8.5 for waste decomposition for 2 weeks, pH 7.3 for waste decomposition for 1 month and pH 7.0 for fermentation for 1 month and 1 week. . The degree of acidity in biocompost whose pH is above 7.5 means that the biocompost is suitable for use in places where the soil is acidic.

The optical properties of biocompost by looking at the test results using an LDR luxmeter based on a microcontroller. This tool is designed like a beam in which there is a light bulb. From Table 2, it shows that the results of the light intensity for the biocompost sample A: 1004, the biocompost sample B: 1017, the biocompost sample C: 990, the biocompost sample D:1010, and the biocompost sample E: 1013. The sample that has the highest light intensity is the biocompost sample. B while the biocompost sample which has the lowest light intensity is the C biocompost sample.

Discussion

Biocompost used as fertilizer is also called organic fertilizer, because its constituents consist of organic materials [6]. Sawdust contains chemical components such as cellulose, hemicellulose, lignin and extractive substances [7]. Leaves and sawdust from organic waste of some soil fauna such as earthworms work to form biopores and produce worm manure (casting). The rate of water infiltration into the soil can maintain the moisture of organic waste and soil around the LRB, so that the composting process occurs aerobically (enough oxygen). The mixture of biocompost, casting and organic waste material that enters the pit can be harvested together with LRB maintenance.

Biopore Infiltration Holes (LRB) are activated by soil organisms, especially soil fauna and plant roots. The more biopores, the higher the absorption of soil to water, because water will more easily enter the soil profile [8]. Their activities will then create cavities or burrows in the soil that will be used as channels for water to seep into the soil body. Organic waste that is put in the hole as well as biocompost and the resulting casting can improve and maintain soil biodiversity which is important for improving soil ecosystems in residential areas. Through the process of aerobic composting, some of the carbon (C) becomes the organs of various soil biota, and some is converted into humus.

Organic matter that is included in the LRB is not only consumed by soil biota, but also naturally undergoes a weathering/ decomposition process. The end result of this

process is biocompost. Biocompost produced periodically can be harvested. Harvesting can be done using an LRB drill.

The results of biocompost from LRB with variations in composting time and the raw materials used are as follows:

(a) (b)

Figure 1. Material from Leaf at (a) 2 weeks, (b) 1 month

Judging from the picture of biocompost in the pictures listed in points 1 a and b, it shows that the leaf raw material biocompost fermented for 2 weeks is dark brown in color, but lacks moisture and smells like earth. Meanwhile, biocompost as raw material for leaves, which is fermented for 1 month, is dark brown in color and has a moist, earthy smell.

(a) (b)

(c)

Figure 2. Material from Leaf + Sawdust + EM4 at (a) 2 weeks, (b) 1 month, (c) 1 motth and 1 weeks

Judging from the picture of the biocompost listed in points 2 a and b, it shows that the raw material compost of leaves + sawdust + EM4 is fermented for 2 weeks in brown-orange color, for 1 month it is light black brown, and for 1 month and 1 week it is dark brown. Effective microorganisms (EM4) contain bacteria that can accelerate composting, the composting results are often called bokasi [9].

The quality of biocompost can be seen from the optical properties of the biocompost. To determine the optical properties of biocompost, you can do a test with a fluxmeter or light flux. The light flux (F) can radiate due to the presence of a light source. Luminous flux is the amount of energy emitted per unit time with units of watts, for light energy per unit angle of space is called light intensity (I), while light energy per unit area is called lighting strength (E) [10].

Assessment of the physical quality of biocompost on samples A, B, D, and E has met the requirements of the criteria of SNI 19-7030-2004. Biocompost has a soil-like odor, because the material it contains already has soil nutrients and a blackish color formed due to the influence of organic matter is stable. The fine form of biocompost is due to the decomposition of microorganisms that live in the composting process [11]. The physical quality of the resulting biocompost provides an overview of the ability of each decomposer agent in decomposing organic matter in waste [12]. Of the three physical parameters can show the characteristics of good physical quality of biocompost. According to Ismayana et al. (2012) a good form of biocompost, if the final form does not resemble the shape of the material, because it has been destroyed due to natural decomposition by microorganisms that live in the biocompost.

From the results of this study, as appropriate evidence, the researchers did not only analyze the quality of biocompost from its physical form. However, the researchers also analyzed based on the optical properties, namely determining the light intensity in the biocompost. The relationship between light intensity and the quality of biocompost is also related to CEC (Cation Exchange Capacity), because basically this biocompost is used to

improve soil fertility and balance the structure and characteristics of the soil. Cation exchange capacity (CEC) in soil science is defined as the ability of the soil to absorb and exchange or release back into the soil solution.

In the soil, the components that have a charge are clay and soil organic matter (organic compounds). The negative charge of clay and organic matter usually binds to cations (positively charged ions) around it (in soil solution) so that an electron neutrality reaction occurs which results in a chemical balance. Practically, cation exchange is very important in soil physics, soil chemistry, soil fertility, nutrient retention in soil, nutrient uptake by plants, fertilization and liming. In general, the adsorbed cations are available to plants through the exchange of cations with H ions produced by respiration of plant roots. Nutrients added to the soil in the form of liquid fertilizer or biocompost will be retained by the colloid surface.

The results of observations of the degree of acidity (pH) of biocompost from various types of raw materials and the time used for fermentation experienced differences. This is due to the difference in pH as an indicator of the activity of microorganisms in degrading organic matter [13]. If the pH value is in the neutral range, it is easily absorbed and used by plants, and is useful for reducing soil acidity because the original nature of the soil is acidic.

4. Conclusion

Biocompost is the result of decomposition of plant residues caused by the activity of decomposing microorganisms. Good quality biocompost has low resistance, pH 6.5-7.5 (neutral), and has high light intensity. The results of the lowest light intensity on biocompost from this study, namely biocompost raw material leaves + sawdust + EM4 of 990 lux fermented in LRB for 2 weeks. Meanwhile, the highest light intensity value in biocompost as raw material for fermented leaves for 1 month was 1017 lux. The longer the composting period in the LRB, the better the quality of the biocompost. The quality of good biocompost is that it has a blackish color and does not smell bad.

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