The Effects of Concentration and Fermentation Time on Quality of Local Microorganism Solutions (LMS) of Stale Rice, Cassava "Tape"

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The Effects of Concentration and Fermentation Time on Quality of Local Microorganism Solutions (LMS) of Stale Rice, Cassava "Tape", Banana Bumps and Cow's Rumen or Rotten Fruits

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ABSTRACT

The objective of this research was to analyze the quality of bioactivator from stale rice, cassava tape, banana bumps, cow"s rumen / rotten fruit, based on concentration and fermentation time, with factorial design. The first factor was the concentration of stale rice, tape, banana bumps, cow"s rumen or rotten fruit, which was 150 grams and 250. The second factor was fermentation time consisting of: F1 (Fermentation for 10 days) F2 (Fermentation for 20 days). Parameters observed were: total population of bacteria, pH and temperature. Data were analyzed using Anova. The results showed that the highest result of total bacterial population was found on 150 gram banana bumps with fermentation of 20 days ie 41 x 106 and the lowest on 150 gram cassava tape with 10 day fermentation that was 1x102. The highest pH was found on rice with 250 grams of fermented rice with 20 days of 3.00 and the lowest on 250 grams of banana bumps on day 0 which was 5.96. The highest temperature on stale rice was 150 gram with 10 days fermentation, 150 banana bumps and 250 gram with 10 day fermentation of 29.5 0C and the lowest temperature on 150 gram cassava tape, rumen / rotten fruit of 150 gram on day 0 was 27 0C. Anova analysis showed no difference in the number of germs from the eight groups.

Keywords: Concentration, Fermentation, Local Microorganism Solutions, Stale Rice, Cassava "Tape", Banana Bumps, Cow's Rumen, Rotten Fruits

INTRODUCTION

Background

Garbage should be a serious concern, because in addition to the health impacts of residents and the environment from the disease, can also cause natural disasters, such as floods, landslides and so forth. According to1, garbage can pollute the environment and is a burden that spends relatively large funds to handle The use of compost on agricultural land will reduce the use of chemical fertilizers and excessive drugs[2]. Compost is organic materials (organic waste) that have undergone the weathering process because of the interaction of inter-organisms working in it[3].

Compost fertilizer is made because the decomposition process is rarely naturally occurring, because in nature it is likely to occur both in terms of abiotic (physical and chemical factors) and biotic aspects that are not suitable for biological processes that are too low or too high[4]. Local microorganisms can be sourced from various local materials, including cow urine, banana stems, leaves, fruits, stale rice, household waste, bamboo shoots, and elephant grass, which can play a role in the process of waste management of livestock, both waste solid to be used as compost, as well as liquid waste of livestock to be used as bio-urine.

Banana bumps are potentially used as a source of local microorganisms because the nutrient content in the banana bumps can be used as a food source so that microbes develop well. Ingredients include: carbohydrates 66.2%[5,6], proteins, water and essential minerals[8]. In 100 g of dried banana material contains 66.2 g of carbohydrates and fresh banana contains 11.6 g carbohydrates[7]. The banana bumps has a composition comprising 76% starch and 20% water[6]. The content of banana bumps is very good for the development of decomposer microorganisms.

Banana bumps contains high enough nutrient with complete composition that is carbohydrate (66% protein 4,35%, source of organism decomposer organic microorganism or decomposer[9]. Type of microorganisms that have been identified on LMS banana bumps, among others Bacillus sp., Aeromonas sp .,

Aspergillus nigger, Azospirillium, Azotobacter. and cellulolytic microbes. These microbes are used to describe organic matter. Microbes in LMS banana bumps will act as a decomposer of organic matter. Banana bumps contains microbial decomposers organic material. The microbial decomposers are located on both the outer and inner banana holes[10]. The microbial types identified in the LMS of banana cobs include Bacillus sp., Aeromonas sp., And Aspergillus nigger. Microbial is what used to decompose organic matter[10]. Microbials on LMS banana bumps will act as decomposer organic material to be composted. Cow's rumen bacteria consists of a collection of several microorganisms that are very useful in the processing of manure, compost, liquid organic fertilizer, and at the same time able to improve the level of soil fertility. The superiority of cow's rumen bacteria can be self-made, material available and easy to obtain, the equipment needed is simple, very useful for farmers.

LMS research also uses coconut water as a growth medium for microorganisms. Coconut water is a good medium for the growth of microorganisms during the fermentation process because coconut water contains 7.27% carbohydrate; 0.29% protein; some minerals include 312 mg L-1 potassium; 30 mg L-1 magnesium; 0.1 mg L-1 iron; 37 mg L-1 phosphorus; 24 mg L-1 sulfur; and 183 mg L-1 chlorine[11]. The best quality of LMS as liquid fertilizer is found at concentration of 300 gram of gamal leaf with fermentation length for 3 weeks[12]. LMS stale rice with a concentration of 300 grams of stale rice is well used as a composting activator with a treatment dose of 200 ml of stale rice LMS[13].

METHODS

The objective of this research was to analyze the quality of bioactivator from stale rice, cassava tape, banana bumps, cow"s rumen / rotten fruit, based on concentration and fermentation time, with factorial design. The first factor was the concentration of stale rice, tape, banana bumps, cow"s rumen or rotten fruit, which was 150 grams and 250. The second factor was fermentation time consisting of: F1 (Fermentation for 10 days), F2 (Fermentation for 20 days). Parameters observed were: total population of bacteria, pH and temperature. Data were analyzed using Anova.

This research was conducted in May 2017 until August 2017 at Environmental Health Laboratory of STIKes Surya Mitra Husada Kediri, Health Laboratory of Kota Kediri and Mathematics & Natural Sciences Laboratory of Brawijaya University.

RESULTS AND DISCUSSION

Table 1. The results of laboratory examination

No	Sample		Day 0 pH	Day 0 Temperature	Day 10 pH	Day 10 Temperature	Day 20 pH	Day 20 Temperature	Number of bacteria on day 10	Number of bacteria on day 20
1	Cassava tape	10 days	3.83	27.5	3.50	29.0			$1X10^2$	
2	150 gram	20 days	3.83	27.0			3.24	29.0		$5X10^2$
3	Cassava tape	10 days	3.80	27.0	3.43	29.0			$2X10^2$	
4	250 gram	20 days	3.84	28.0			3.43	29.0		$8X10^2$
5	Stale rice 150	10 days	3.79	28.0	3.19	29.5			$2,5X10^4$	
6	gram	20 days	3.85	28.0			3.16	29.0		$1,7X10^4$
7	Stale rice 250	10 days	3.81	27.5	3.28	29.5			$2,3X10^4$	
8	gram	20 days	3.81	28.0			3.00	29.0		$3,1X10^4$
9	Banana	10 days	4.22	27.5	3.52	29.5			$6X10^6$	
10	bumps 150 gram	20 days	5.96	27.5			3.39	29.0		$41X10^6$
11	Banana	10 hari	4.23	27.5	4.28	29.5			$4X10^6$	
12	bumps 150 gram	20 hari	5.05	27.5			3.52	29.0		$6X10^6$
13	Cow's rumen/	10 hari	4.41	27.0	3.23	29.5			$3X10^4$	
14	rotten fruit 150 gram	20 hari	4.34	27.0			3.31	29.0		$2X10^4$
15	Cow's rumen/	10 hari	4.15	28.0	3.35	29.5			$3X10^4$	
16	rotten fruit 250 gram	20 hari	4.36	28.0			4.16	29.0		$1X10^5$

The results showed that the concentration and fermentation time did not significantly affect the total bacterial population. The highest results of total population of bacteria found in 150 gram banana bumps with fermentation of 20 days is 41 x 10^6 and the lowest was found on cassava tape 150 gram fermentation 10 days was $1x10^2$. Total population of LMS bacteria stale rice, cassava tape, banana hump and cow's rumen / rotten

fruits increased in fermentation results. The longer the fermentation, the growth of the total population of bacteria is increasing. The nitrogen source strongly influences the fermentation pattern, the microorganisms will be able to grow rapidly in the presence of nitrogen and some require absolute nitrogen. There are many factors that affect the bacteria growing on the fermentation of substrate, temperature, pH, oxygen, and microbes used. Substrate as a source of carbohydrate is a fermentation raw material containing nutrients needed by microorganisms for plants[14]. The main source in the manufacture of LMS is carbohydrates, glucose, and the source of the microorganism itself. Carbohydrate sources in this research are stale rice, cassava tape, banana hump, rumen cow / fruits of glucose from sugar.

The results showed that the highest temperature was found on 150 gram stale rice with 10 days fermentation, 150 gram and 250 gram banana with 10 day fermentation of 29.5 ^{0}C. The lowest temperature was on 150 gram cassava tape, cow'srumen / rotten fruit 150 gram on day 0 that was 27 ^{0}C. Fermentation time had significant effect on LMS temperature ($p < 0.05$). The highest temperatures were obtained during the 10-day fermentation time, which was generally significantly different from other levels. Increased temperature was related to the activity of microorganisms in decomposing organic matter, which produces energy in the form of heat, CO_2 and water vapor. The heat produced by the fermentation process is related to the growth curve of microorganisms[15]. After reaching the peak, the fermentation temperature began to decline, allegedly because the activity of microorganisms in decomposing organic matter decreases.

The results showed that the concentration and fermentation time had no significant effect on pH of LMS. The highest degree of acidity was found in 250 gram stale rice with 20 days fermentation of 3.00 and the lowest is found in 250 gram banana bumps on day 0 ie 5.96. The pH of LMS decreased to fermentation 20 days and subsequently despite showing an increasing trend but not significantly different. The decrease in pH at the beginning of fermentation is the result of the activity of microorganisms in breaking down organic matter in LMS, which produces H + ions[16]. The effect of fermentation time on pH differs significantly from other levels. In the 20-day fermentation period, the LMS raw material is completely destroyed or decomposed.

Observations show that pH changes from start to finish fermentation. An increase in pH occurs in LMS from rumen cow / fruity 250 gram with 20 days fermentation. pH will encourage bacterial activity optimally. The degree of acidity at the beginning of the fermentation process converts organic matter to organic acid so that it will experience the highest acidity. The reshuffle will produce nitrogen and ammonia, so this promo will cause the pH value to increase[14].

High carbohydrate content in stale rice, cassava tape, banana bumps, cow's rumen / rotten fruit allow it to be fermented into vinegar [18]. In the fermentation process, the carbohydrate will be converted into sugar by S. cerevisiae, the sugar is converted to alcohol and the alcohol will be converted by A. aceti to acetic acid. In addition to the potential in fermentation is also potential as a bioactivator in composting. LMS stale rice, cassava tape, banana stalks and rumes of cows / rotten fruits have a role in the growth of vegetative plants, and plants tolerant to disease. High levels of phenolic acids help the binding of Al, Fe and Ca ions to assist in the availability of useful P in the flowering and fruit formation process[17]. LMS growth is a microorganism made from natural ingredients as a medium for the development of microorganisms that are useful to accelerate the destruction of organic matter (the process of decomposition into compost / organic fertilizer). In addition, LMS also serves as an additional nutrient for plants, which is developed from microorganisms located in the place. LMS can be obtained from various materials around us such as banana sticks, snails, shrimp, papaya, coconut water, fish bones, bamboo shoots, and kitchen waste. These ingredients are combined with other ingredients in order to obtain numerous microorganisms.

The more microorganisms in the material, the process of decomposition of organic matter or the composition of the faster. The function of LMS is as the main ingredient to accelerate the composting of organic material into compost. The bacteria in LMS can be used as starter to make compost, bio-fertilizer, even organic pesticide. The use of organic fertilizer combined with LMS can save the use of chemical fertilizer up to 400 kg per planting season on 1 ha of rice field. Creation time is relatively short and the way of making is easy. In addition, LMS is also environmentally friendly. The preparation of LMS solution must be fermented by using coconut water or sugar. The duration of fermentation process of LMS materials is approximately 10-15 days[10]. The fermentation time by LMS varies from one type of LMS material to the other. This fermentation time is related to the availability of food used as a source of energy and metabolism of the microbes in it[11].

The microbes in LMS tend to decrease after the 7th day. This is related to the availability of food in the LMS. The longer, the food will be reduced because of the use of microbes in it[10]. Addition of LMS as a decomposer aims to accelerate the composting process even though the composting material already contains microbes, especially those that play a role in chemical reshuffling. Factors affecting microbial growth and LMS are sources of LMS, moisture, aeration, temperature, energy sources (organic matter), acidity (pH) and addition of inorganic materials. The LMS source also determines the number of microbes that grow due to the source of LMS as the base material of the bacteria to be grown.

The moisture corresponding to bacterial growth is between 60-80%. Aeration aims to provide good conditions for the growth of microbes, namely to supply gas O2 and CO2 that determine the type of microbes

that grow aerob or anaerob. The bacterial growth temperature is in the range of 15-450C, whereas at the mesophyll (25-35^{0}C) temperature the most growth. The optimum degree of acidity (pH) in bacterial growth between 6.5-7.5[19].

CONCLUSION

Based on the result of the research, it can be concluded that the interaction of LMS concentration (stale rice, cassava tape, banana bumps and cow's rumen / rotten fruit) and fermentation time have no significant effect on single factor, as well as total population parameters of bacteria, pH, and temperature.

Further suggestions are suggested is the need to add the amount of concentration of stale rice LMS, cassava tape, banana hump and rumen cow / rotten fruit, to get real results

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Thank you very much

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