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NPK Level in Anaerobic and Aerobic Composting Using Spoiled Rice MOL

Muliyadi*, Dwi Wahyu Purwiningsih
Poltekkes Kemenkes Ternate, Indonesia
** Correspondent Author: muliyadi.blues90@gmail.com*

ABSTRACT
Nowadays in Indonesia, household waste remains main problem. Every day, waste generating from house-holds tend to be increasing along with the escalating number of products and consumption pattern among the community x. The Purpose of this study is to know NPK level in anaerobic and aerobic composting using Spoiled rice MOL. This type of research is experimental, the research design is a post-test with a control group design. This type of research is experimental research design with Post-test Only Control Design. The design of this study was to determine the nitrogen, phosphorus and Potassium of compost using local microorganisms (MOL) of spoiled rice with anaerobic and aerobic composting methods. From the results of the research, the NPK content in anaerobic composting using Stale Rice MOL is 5% N, 5% P, 5% K. From the results of average measurements of temperature, pH and humidity and NPK. The temperature measurements obtained for MOL of Stale Rice are 50 ° C, 100% humidity, pH 7 and 5% N, 5% P, 5% K.

Keywords: Compost, NPK, Spoiled Rice, Anaerobic, Aerobic

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BACKGROUND

Improper waste management is detrimental to human health. Apart from being unsightly, it causes air pollution, affects water bodies when dumped into the water, as well as depletes the ozone layer when burnt, thereby increasing the impact of climate change. Wastes are often improperly managed (Aruna et al. 2018) using conventional methods. Wastes are burnt, disposed into oceans, waterways, and dumped by the roadsides (Ogwueleka 2009). These practices breed insects and pests, release offensive odours, are unsightly and contribute to global warming (during combustion).

Nowadays in Indonesia, household waste remains main problem. Every day, waste generating from house-holds tend to be increasing along with the escalating number of products and consumption pattern among the community x. The size of population as well as variety of activity in Indonesian cities affect the emergence of problem in municipal infrastructure services, such as waste problem. The provision of final disposal in each city is another problem, meanwhile the amount of unmanage-able waste will cost more. This condition leads to the treatment effort in form of sanitary landfill is rarely founding the final disposal existing in Indonesia. Therefore, continuing efforts for handling waste problem is a must. (Praditya 2012)

Inadequate waste handling is harmful to human health. Besides being inefficient it causes pollution of the air, affects water bodies when dumped into the water, and makes the ozone layer depleted when burned. Wastes are frequently managed improperly by traditional methods (Aruna et al. 2018)(Alam dan Ahmad 2013). Wastes are burnt, dumped by the roadsides, disposed of in oceans and in waterways (Ogwueleka 2009). These practices breed insects and pesticides, release offensive scents, and cause global warming (during combustion). The transformation of organic (degradable) waste is aerobic or anaerobic. Compost is produced when transformed to aerobic conditions (Lasaridi et al. 2018). Biogas and effluents that can be used as biofertilizers are formed in aerobic treatment (Khan et al. 2018).

Composting is a safe waste management approach. Composting is an aerobic process by degrading complex materials and transforming them into organic and inorganic products by microorganisms (Toledo et al. 2018). The byproducts contain 'humic' compounds that distinguish them from native soils, coals, and peats. Composting is the means for transforming various degradable waste into a safe and beneficial product that can be used as biofertilizers and soil modifications (Ying et al. 2007), (Bai, Shen, dan Dong 2010), (Yu et al. 2019).

Compostability helps to prevent contamination of underground water compared to the waste disposal method, which can put underground water at risk from contamination. This is because microbes and chemical pollutants have been reduced during composting. These are the pathogenic microbes in human hazardous waste. Beneficial microbes, such as POPs and EDRs, are absorbed into the soil during composting. Later on, this review gave an elaborate explanation. Compounding increases the productivity of agricultural products and the content of soil organic matter (Luo et al. 2017) due to the sufficient nutrient in composted substances and the presence of plant growth-fostering organisms(Pane et al. 2014).

It contributes to the safeguarding of food products. Compost in bioremediation is useful as well as for use as fertilizer (Ventorino et al. 2019), plant disease control (Pane et al. 2020),weed control (Coelho et al. 2019), pollution prevention (Uyizeye, Thiet, dan Knorr 2019), erosion control, landscaping and wetland restoration. Composting also increases soil biodiversity and reduces synthetic fertilizer environmental risks. (Pose-Juan et al. 2017). Composting is started in a controlled environment rather than a natural and uncontrolled

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process (Cáceres, Malińska, dan Marfà 2018). The control process differentiates between decomposition and composting (a naturally occurring process). It takes time to be ready, the offensive odor has a long time to mineralize, some pathogens may contain, i.e., thermotolerant pathogens and inappropriate nutrient content, to some extent. All of these discouraged farmers from including them as a sustainable farming tool. In that respect, the readily available synthetic counterpart (chemical fertilizers) preferred composting to the organic source.

The advantages and disadvantages of the two nutrient sources should be assessed after comparison. Composting will be further improved by information on how to trap odors, a fast pathogen method, and heavy metal detection.

In seven to eight days, household organic waste can be processed in compost. The addition of earthworms is not necessary to produce compost from organic household waste. Treating compost organic household wastes can reduce the space for the life and breed of agents and disorder vectors, thus preventing people from suffering from diseases or health problems (Khair et al. 2015). The average waste disposal is 35.59%, waste disposed of and delivered to final disposal is 7.97%, disposed of carelessly by 14.01%, and disposed of by (composted and recycled) is only 1.15%. (Subandriyo, Anggoro, dan Hadiyanto 2012)

Household waste was unpleasantly smelling. This condition occurred only about two days in experiments with earthworms. As time passed, the smell of waste tops became soil-like. On the fifth day, the earthworms already had such a soil-like smell, made of household waste as added. This smell was a sign of compost maturity (Aisyah 2013). Based on the background of the problem mentioned above, it is possible to know NPK level in anaerobic and aerobic composting using Spoiled rice MOL

METHODS

This research was conducted at the Poltekkes Ternate workshop. This type of research is experimental, the research design is a post-test with a control group design. This study aims to to know NPK level in anaerobic and aerobic composting using Spoiled rice MOL. This type of research is experimental research design with Post-test Only Control Design. The design of this study was to determine the nitrogen, phosphorus and Potassium of compost using local microorganisms (MOL) of spoiled rice with anaerobic and aerobic composting methods. The sample size used in this study is 6 kg of fruit waste, 6 kg of vegetable waste and 8 kg of sawdust, while the MOL to be used is 6 litres of stale rice MOL and 1 kg of granulated sugar. Data obtained from the results of measurements of the content of N, P, K and physical observations from the MOL-making process to the composting process at week 3, the compost is mashed by sieving and weighing and packaging. The data collection technique in this study is using documentation, namely data collection by utilizing secondary data obtained from documents, regulations, legislation, statistical data which is useful for completing research information, and using treatment with a comparison of activator materials into compost as a time comparison. composting and the amount of compost produced.

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RESULT

The results of initial and final weight of waste can be seen in table 1.

Table 1 Results of initial and final weight of waste

Composting method	Types of compost seasoning	The initial weight of organic waste (kg)	Time of Composting	Final weight organic trash (kg)
Anaerobic	Spoiled rice mole	10 kg	20 days	3 kg
Aerobic	Spoiled rice mole	10 kg	20 days	4 kg

Based on table 1, shows that the compost produced by aerobic composting produces more compost than anaerobic composting. Aerobic composting produces 4 kg of compost while anaerobic composting only produces 3 kg of compost.

Table 2. NPK Measurement Results in Anaerobic Composting Process

Types of compost seasoning	SNI 8%-15%	Results of anaerobic composting of NPK																			
		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14	Day 15	Day 16	Day 17	Day 18	Day 19	Day 20
Spoiled rice mole	N	4%	4%	4%	4%	4%	4%	4%	4,5%	4,5%	4,5%	4,5%	4,5%	4,5%	5%	5%	5%	5%	5%	5%	5%
	P	4%	4%	4%	4%	4%	4%	4%	4,5%	4,5%	4,5%	4,5%	4,5%	4,5%	5%	5%	5%	5%	5%	5%	5%
	K	4%	4%	4%	4%	4%	4%	4%	4,5%	4,5%	4,5%	4,5%	4,5%	4,5%	5%	5%	5%	5%	5%	5%	5%

Based on table 2, it is known that in composting with anaerobic system, the NPK value only increases on the 8th day, namely 4.5 to the 13th day, after the 13th day the NPK value increases to 5% until the 20th day.

Table 3. NPK Measurement Results in Aerobic Composting Process

Types of compost seasoning	SNI 8%-15%	Results of aerobic composting of NPK																			
		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14	Day 15	Day 16	Day 17	Day 18	Day 19	Day 20
Mol nasi basi	N	4	4%	4%	4%	4,5%	4,5%	4,5%	4,5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
	P	4%	4%	4%	4%	4,5%	4,5%	4,5%	4,5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
	K	4%	4%	4%	4%	4,5%	4,5%	4,5%	4,5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%

Based on table 2 it is known that in composting with the aerobic system, the NPK value increases faster, the increase occurs on day 5, namely 4.5 to day 8, after day 8 the NPK value increases to 5% until day 20.

Table 4 Final Physical Conditions of Anaerobic and Aerobic Compost

Composting method	Types of compost seasoning	Compost physical condition		
		Color	Odor	Texture
Anaerobic	Spoiled rice mole	Dark brown	Soil	Smooth
Aerobic	Spoiled rice mole	Dark brown	Soil	Smooth

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Based on table 4, it can be explained that the final conditions of compost both anaerobic and aerobic using stale rice moles have the same criteria, namely blackish brown, smell of soil and have a fine texture.

DISCUSSION

Organic waste can be used as a culture medium (inoculant) for certain local microorganisms (MOL) which can degrade organic materials. Local microorganisms (MOL) are one of the bio activators that can accelerate and improve the quality of compost (Pratiwi, Atmaja, Dan Soniari 2013). MOL is a local microorganism found in various types of decaying organic matter and is usually used to accelerate the degradation process of organic waste in composting. (Wulandari dan Khumaedi 2014). From the research that was carried out using organic waste as a compost spice and as a mixture of compost seasoning with various organic waste, it aims to increase the volume of waste that will be generated in the composting process, the waste used in making MOL is household waste, stale rice as MOL, for mixing MOL with other organic materials The organic waste that is used is vegetable waste, fruit and saws as much as 6 kg of fruit waste, 6 kg of fruit waste and 7 kg of saws. for the manufacture of 6 liters of stale rice MOL.

Anaerobic composting is a composting process that does not require the availability of oxygen but only requires heat from outside. (Susanto 2002). From the research that anaerobic composting lasts for 20 days, composting using a container with a cover so that oxygen cannot enter into and measuring the content of nitrogen, phosphorus and potassium in the anaerobic composting process for 20 days of composting.

The nitrogen content in compost is strongly influenced by the composting process and the raw materials used. In the composting process, the form of nitrogen that can be absorbed by plants from the decomposition of organic matter is ammonia (NH4) and nitrate (NO3), these compounds come from protein breakdown. Elemental Phosphorus (P) According to (Putro et al. 2016) during the composting process, the microorganisms suck up some of the P to form egg white in their bodies. If the compost is made well, 50-60% of the feed will be in a dissolved form so that it is easier for plants to absorb. However, if the composting process lasts longer, the P level will decrease. This is because the P element is consumed by microorganisms so that the P content will be lower. Elemental Potassium (K) The minimum compost content of potassium according to SNI 19-7030-2004 standards is 0.2%. Like nitrogen and phosphorus, the potassium content in compost is greatly influenced by the potassium content in the raw material used. From the results of research conducted on the composting process for 20 days of composting, the content of nitrogen is 5%, phosphorus is 5% and potassium is 5%. From the measurement results then compared with the standard SNI 2803: 2010, the NPK value for compost according to SNI 8% -15% and for the results of the NPK measurement research using stale rice moles, namely N is 5%, P is 5%, K is 5%.

This research is supported by (Surtinah 2013) stated the C / N ratio in compost describing the level of maturity of the compost. The higher the C / N ratio value in the compost indicates that the compost has not broken down completely or is not yet ripe, because of the high amount of ammonia and nitrogen trapped in the pores of the compost pile.

Aerobic composting is a composting process that requires oxygen, oxygen is needed by microorganisms to break down organic matter during the composting process. (Susanto 2002). From the results of research that aerobic composting lasts for 20 days composting and measurements are taken every day, measurements are taken to determine temperature, humidity, pH and NPK in aerobic composting.

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Temperature is one of the factors that influence the rate of composting because each microorganism has an optimum temperature in its activity. The ideal temperature in the composting process, according to SNI characteristics (BSN 2004), temperature at the composting process is a maximum of 50 ºC. an increase in temperature occurs due to the activity of bacteria in decomposing organic matter. Mesophilic conditions are more effective because the activity of microorganisms is dominated by proteobacteria and fungi. The reversal in the composting process causes the temperature to fall and then rise again (Pandebesie dan Rayuanti 2012). Based on the results of research conducted, the temperature in the composting process is 50ºC, which is following the standards set by SNI 19-7030-2004. The temperature at the beginning of composting shows an increase and then decreases on the following days until it is stable in the third week.(Suwatanti dan Widiyaningrum 2017)

Humidity is a very important role in the process of microbial metabolism which indirectly also affects oxygen supply. Microorganisms can take advantage of organic material if the organic material dissolves in water. Humidity 40% -60% is the optimum range for microbial metabolism, so it is very good for the composting process. When taken from 40%, the microbial activity will comply and the activity will be even lower at 15% humidity. If the humidity is more than 60%, the nutrients will be washed off, the air volume will decrease. As a result, microbial activity will decrease and anaerobic fermentation will occur which causes an unpleasant odour (Isroi dan Yuliarti 2009). Based on the results obtained for aerobic composting, the humidity obtained is 10%, which means that the results of aerobic composting have met the standards set by SNI 19-7030-2004, regarding the quality of compost that has been set by SNI, namely 40% -60%.

The solid composting process occurs at the optimum pH range for the composting process ranging from 6.5 to 7.5. According to SNI 19-7030-2004, the optimal pH for composting is 6.5 to 7.5. From the measurement results obtained pH 7, composting using MOL stale rice with aerobic composting method, is in line with research conducted by (Nurullita dan Budiyono 2012). Based on the pH obtained in this measurement, it is suspected that the conditions are very acidic and also influenced by the composted material. However, this is still in the normal pH range as stipulated by SNI 19-7030-2004.

From the results of research conducted on the composting process for 20 days of composting, the content of nitrogen is 5%, phosphorus is 5% and potassium is 5%. From the measurement results then compared with the standard SNI 2803: 2010, the NPK value for compost according to SNI 8% -15% and for the results of the research the NPK measurement using stale rice moles is N is 5%, P is 5%, K is 5%.

Physical observations such as colour, smell and texture. From the results carried out every observer day for 20 days of composting. The results obtained in aerobic and anaerobic composting, physical observations are brownish-black colour, smell like soil and fine texture. This is following the quality standards of compost based on SNI 19-7030-2004, ripe compost has the characteristics of the temperature according to soil temperature, crushed form and texture resembling soil. Overall, the MOL type of stale rice compost has met the compost quality standard. Acoording to (Ismayana et al. 2012) The texture of the compost is good when 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 compost

This research is supported by (Suwatanti dan Widiyaningrum 2017) who concluded that the physical quality of the two compost treatments had the category of blackish colour, smell like soil, and had a fine texture according to the SNI criteria SNI Number 19-7030-2004.

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According to (Wahyudin dan Nurhidyatullah 2018) that the smell of compost is one of the criteria after the compost is ripened, which is indicated by an odour that resembles soil. All compost products produced are completely decomposed, so that they are crushed or smooth, blackish-brown in colour and smell like soil. This condition describes the maturity of the compost (Sahwan, Wahyono, dan Suryanto 2016).

CONCLUSION

From the results of the research, the NPK content in anaerobic composting using Stale Rice MOL is 5% N, 5% P, 5% K. From the results of average measurements of temperature, pH and humidity and NPK. The temperature measurements obtained for MOL of Stale Rice are 50 ° C, 100% humidity, pH 7 and 5% N, 5% P, 5% K.

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