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EFFECT OF ADDING LOCAL MICROORGANISMS IN PINEAPPLE SKIN (*Ananas comosus L. merr*) ON NPK LEVELS IN THE MANUFACTURE OF LIQUID COMPOST BASED ON TOFU WASTE

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ABSTRACT

Effect of Adding Local Microorganisms in Pineapple Skin (*Ananas comosus l. merr*) on NPK Levels in The Manufacture of Liquid Compost Based on Tofu Waste. Tofu industry liquid waste can be used as a basic ingredient in making liquid compost. Liquid compost can be made from liquid organic materials/waste, namely by adding compost activator to the material. One of the activators that can be used is local microorganisms (MOL) resulting from the fermentation of easily found materials, which function in the decomposition of organic compounds and can be used as a substitute for the EM-4 decomposer. This research aims to determine the effect of adding pineapple peel MOL to the N, P and K levels of liquid compost based on tofu waste. This research is experimental research with a Pretest-Posttest with Control Group design. The population and sample of this research is liquid waste from the Dinanti Banjarbaru Tofu Factory. Data analysis used the Kruskal-Walli's test and simple regression test. The research results showed that the addition of pineapple peel MOL had an effect on increasing N, P and K levels in making liquid compost based on liquid tofu waste. The optimum dose for adding MOL pineapple peel for making liquid compost from tofu waste has not yet been found but adding a dose of 200 ml has a statistically significant difference. Pineapple peel MOL can be used as a decomposer to make liquid compost from tofu waste as a substitute for EM-4 but still requires other organic materials to increase the nutrients N, P and K in accordance with applicable quality standards. Future research can combine starter/decomposer composition with organic materials in order to achieve optimal liquid organic fertilizer quality in accordance with applicable compost quality standards.

INTRODUCTION

Tofu is a processed food made from soybeans that is no longer foreign to Indonesian people, apart from its counterpart, tempeh [1]. Soybean-based food is known for its economical price, making it appealing to various levels of society [2]. Liandari's [4] preliminary tests show that tofu industry liquid waste can be turned into liquid compost. This is based on an analysis of the macronutrient content in pure tofu liquid waste, which is made up of N, P2O5, and K2O. We can convert organic materials or liquid organic waste into liquid compost by supplying a

compost activator [5]. The activator/decomposer that is widely available on the market is EM-4, but the cost is more expensive [6]. Local microorganisms (MOL) arise from the fermentation of environmental materials and are readily accessible [7]. They comprise Azobacter sp., Lactobacillus sp., photosynthetic bacteria, yeast, and cellulose-decomposing fungi, all of which contribute to the breakdown of organic compounds [6]. Therefore, MOL can serve as a substitute for the EM-4 decomposer [8]. According to Nuraini [9], there is a water content of 81.72%, crude fiber of 20.87%, carbohydrates of 4.41%, reducing sugars of 13.65%, protein, and the enzyme bromelain in pineapple skin. Pineapple skin contains carbohydrates, sugars, and nutrients that serve as raw materials for the production of local microorganisms (MOL). [10]. Based on the description provided above, researchers are interested in determining the impact of adding pineapple peel MOL on the quality of liquid compost macronutrients, specifically N, P, and K, using liquid tofu waste.

MATERIALS AND RESEARCH METHODS

In this experimental research, we add doses of MOL pineapple peel (200 ml, 300 ml, 400 ml, and 500 ml) to tofu liquid waste, ferment it for 10 days, and then measure the effect on N, P, and K levels. This study employs a pretest-posttest design with a control. The study employs a group design and measures the NPK levels before and after treatment. We present the research data in the form of graphs and tables. We compared the research trial results with Minister of Agriculture Decree No. 261/KPTS/SR.310/M/4/2019, which outlines the Minimum Technical Requirements for Organic Fertilizers, Biological Fertilizers, and Soil Improvers.

RESULTS OF RESEARCH AND DISCUSSION

The results of checking the quality of tofu liquid waste before being treated are seen in the following table.

Table 1. Initial N, P and K levels of Tofu Factory Liquid Waste

No	Parameter	Unit	Rate	Quality Standards
1	N	%	0.02	2 – 6
2	P	%	0.03	2 – 6
3	K	%	0.06	2 – 6
4	pH	-	4.6	4 – 9
5	Temperature	ºC	37.6	-

After checking and measuring the quality of the liquid waste, it was found that tofu liquid waste could be turned into liquid compost. This is because it has a lot of organic matter in it, with protein compounds (N-total) making up the biggest part (226.06–434.78 mg/l). [11]. The quality of liquid waste from the tofu industry depends on the process used; if the tofu industry is good at manufacturing, the organic material content in the waste will also be low. [11].
The following table shows the N levels in tofu liquid waste after treatment with the addition of MOL pineapple peel and 10 days of fermentation.

Table 2. Results of measuring N levels after treatment with the additionof MOL pineapple peel

Repetition	N content (%)			
	Dosage Variations (ml)			
	200	300	400	500
P1	0.05	0.04	0.05	0.08
P2	0.06	0.06	0.07	0.06
P3	0.04	0.08	0.05	0.06
P4	0.04	0.06	0.07	0.07
P5	0.06	0.05	0.06	0.08
P6	0.04	0.05	0.08	0.06
Average	0.048	0.057	0.063	0.068

The percentage increase in N levels from before to after treatment was very small, from initial N levels of 0.02% to 0.048–0.068%. This figure is still very far from the minimum quality standard for liquid organic fertilizer, namely 2%, according to Minister of Agriculture Decree No. 261/KPTS/SR.310/M/4/2019 [12]. Statistical testing of N levels showed that there was an effect of treatment by adding varying doses of pineapple peel MOL, and it was found that the most different treatment was the addition of pineapple peel MOL at a dose of 200 ml. The P levels in tofu waste after treatment are shown in the following table.

Table 3. Results of measuring P levels after treatment with the addition of MOL pineapple peel

Repetition	P content (%)			
	Dosage Variations (ml)			
	200	300	400	500
P1	0.04	0.04	0.04	0.05
P2	0.04	0.05	0.05	0.06
P3	0.04	0.05	0.05	0.05
P4	0.04	0.05	0.06	0.05
P5	0.04	0.04	0.05	0.06
P6	0.04	0.05	0.04	0.06
Average	0.040	0.047	0.048	0.055

Table 3 shows the increase in P levels as the MOL dose of pineapple peel increases, but the increase in numbers is still very small. The percentage increase in P levels from before to after treatment was smaller than the levels of other nutrients, namely N and K levels, from initial P levels of 0.03% to 0.040–0.055%. This figure is still very far from the minimum quality standard for liquid organic fertilizer, namely 2% based on Minister of Agriculture Decree No. 261/KPTS/SR.310/M/4/2019 [12]. Statistical testing of P levels also showed the results of the treatment effect of adding variations in the MOL dose of pineapple skin, with the most significantly different treatment being the treatment dose of 200 ml MOL pineapple skin. The following table presents the results of K levels in tofu liquid waste after adding MOL pineapple peel.

Table 4. Results of measuring K levels after treatment with the addition of MOL pineapple peel

Repetition	K content (%)			
	Dosage Variations (ml)			
	200	300	400	500
P1	0.09	0.10	0.09	0.10
P2	0.10	0.09	0.10	0.11
P3	0.09	0.10	0.12	0.09
P4	0.08	0.09	0.11	0.10
P5	0.10	0.09	0.10	0.11
P6	0.09	0.10	0.09	0.11
Average	0.092	0.095	0.102	0.103

Table 4 above shows the increase in K levels after increasing the MOL dose of pineapple peel, but the increase in numbers is still very small, and only up to a dose of 300 ml experienced an increase. The percentage increase in K levels from before to after treatment was also very small, from initial K levels of 0.06% to 0.092-0.103%. This figure is still very far from the minimum quality standard for liquid organic fertilizer, namely 2%. Statistical testing of K levels revealed that adding MOL pineapple peel improved the quality of the K nutrient, but the final K levels in each dose variation treatment were not statistically different. The larger dose added to tofu waste did not show a significantly different increase in K levels, according to the results of statistical tests.

Because microorganisms had completely decomposed the organic compounds in the waste, the increase in levels did not result in statistically significant differences, nor did the amount of compounds produced have any impact. The addition of a higher dose of microorganisms leads to an increase in the number of microbes involved in the degradation process, causing an imbalance between the number of organic compounds and microbes, ultimately resulting in the complete degradation of the existing organic compounds. Research by Widari, Rasmito, and Rovidatama (not yet available) indicates that an increase in the volume of added microorganisms leads to their constant levels. [13].

There are other factors that can influence the final quality of the compost produced in the composting process [5]. These include the C/N ratio value of the tofu liquid waste and the local microorganisms used, the occurrence of aeration during the decomposition process, the temperature of the tofu liquid waste being too hot for the microorganisms used, the pH of the waste being too acidic, and the composting time, which is related to the C/N value of the materials used. outlined [14].

Based on research results, the combination of tofu liquid waste and pineapple skin MOL caused an increase in N, P, and K levels. This is consistent with Liandari's research results [4], which show that tofu processing wastewater contains macronutrients such as protein. The added pineapple skin MOL contains nutrient compounds and bacteria, which act as renovators. Research by Susi, Surtinah, and Rizal [15], which states that organic fertilizer from pineapple peel waste contains the nutrients nitrogen, phosphate, potassium, calcium, sodium, magnesium, iron, copper, manganese, zinc, and organic carbon, supports the presence of nutrients in pineapple skin MOL.

CONCLUSIONS AND RECOMMENDATIONS

Before treatment, the tofu liquid waste had an N content of 0.02%, a P content of 0.03%, and a K content of 0.06%, with an average pH of 4.6 and an average temperature of 37.6 oC. The average N content at a 200-ml dose was 0.048%, a 300-ml dose was 0.057%, a 400-ml dose was 0.063%, and a 500-ml dose was 0.068%. The average P level at the 200 ml dose was 0.040%, the 300 ml dose was 0.047%, the 400 ml dose was 0.048%, and the 500 ml dose was 0.055%. The average K level at a 200-ml dose was 0.092%, a 300-ml dose was 0.095%, a 400-ml dose was 0.102%, and a 500-ml dose was 0.103%. We have not yet discovered the ideal dosage for incorporating MOL pineapple peel into tofu waste to create liquid compost, yet a 200 ml addition yields a statistically significant variation. Future research can combine starter/decomposer composition with organic materials to achieve optimal nutrient quality in liquid organic fertilizer according to applicable compost quality standards.

REFERENCES

1. Rosita, R., Hudoyo, A. and Soelaiman, A. (2019) *Analisis Usaha, Nilai Tambah, Dan Kesempatan Kerja Agroindustri Tahu Di Bandar Lampung*, Jurnal Ilmu-Ilmu Agribisnis, p. 211. doi: 10.23960/jiia.v7i2.211-218.

2. Samsudin, W., Selomo, M. and Natsir, M. F. (2018) *Pengolahan Limbah Cair Industri Tahu Menjadi Pupuk Organik Cair dengan Penambahan Effektive Mikroorganisme-4 (EM-4)*, Jurnal Nasional Ilmu Kesehatan, 1(2), pp. 1–14.
3. Azmi, M., HS, E. and Andrio, D. (2016) *Pengolahan Limbah Cair Industri Tahu Menggunakan Tanaman Typha latifolia dengan Metode Constructed Wetland*, Jom F TEKNIK, 3(2), pp. 1–5.
4. Liandari, N. P. T. (2017) *Pengaruh Bioaktivator EM4 dan Aditif Tetes Tebu (Molasses) Terhadap Kandungan N, P dan K dalam Pembuatan Pupuk Organik Cair dari Limbah Cair Tahu*. Universitas Muhammadiyah Surakarta.
5. Nugroho, P. (2019) Panduan Membuat Pupuk Kompos Cair. Yogyakarta: Pustaka Baru Press.
6. Kurniawan, A. (2018) *Mol Production (Local Microorganisms) With Organic Ingredients Utilizaton Around*, Jurnal Hexagro, 2(2), p. 36.
7. Mulyono (2016) Membuat Mol dan Kompos dari Sampah Rumah Tangga. Jakarta: AgroMedia Pustaka.
8. Nisa, K. dkk (2016) Memproduksi Kompos & Mikro Organisme (MOL). Pondok Kelapa: Bibit Publisher.
9. Nuraini, D. N. (2011) Aneka Manfaat Kulit Buah dan Sayuran. I. Edited by B. Rini W. Yogyakarta: Penerbit ANDI.
10. Sholeha, N. (2020) Pengaruh Penambahan MOL Limbah Tomat (Solanum lycoperisum l) dan MOL Limbah Kulit Nanas (Ananas Comusus l.merr) Terhadap Kualitas Kompos. Poltekkes Kemenkes Banjarmasin
11. Herlambang, A. (2002) *Teknologi Pengolahan Limbah Cair Industri Tahu-Tempe*, in Teknologi Pengolahan Limbah Cair Industri. Jakarta: Badan Pengkajian dan Penerapan Teknologi, p. 712.
12. Kepmentan RI (2019) *Keputusan Menteri Pertanian Republik Indonesia Nomor 261/KPTS/SR.310/M/4/2019 tentang Persyaratan Teknis Minimal Pupuk Organik, Pupuk Hayati, dan Pembenah Tanah*.
13. Widari, N. S., Rasmito, A. and Rovidatama, G. (2020) *Optimalisasi Pemakaian Starter Em4 Dan Lamanya Fermentasi Pada Pembuatan Pupuk Organik Berbahan Limbah Cair Industri Tahu*, Jurnal Teknik Kimia, 15(1), pp. 1–7. doi: 10.33005/jurnal_tekkim.v15i1.2302.
14. Titania, E. P. R. V. and Siswanto (2021) *Pemanfaatan Kulit Nanas dan Kulit Pisang sebagai Pupuk Organik Cair*, Journal of Chemical and Process Engineering, 2(1), pp. 53–58.
15. Susi, N., Surtinah, S. and Rizal, M. (2018) *Pengujian Kandungan Unsur Hara Pupuk Organik Cair (POC) Limbah Kulit Nenas*, Jurnal Ilmiah Pertanian, pp. 46–51. doi: 10.31849/jip.v14i2.261.