JICR - Journal of Innovation and Creativity Resource
Vol. 1, No. 2, 2023, pp. 43-48

The potential of liquid tofu waste as an alternative to liquid organic fertilizer in West Labuhbaru Village

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ABSTRACT

Tofu is the most widely consumed food product by Indonesian people. Tofu production in Indonesia still uses conventional methods and the waste produced has not been utilized optimally. Making tofu produces quite a large volume of waste, especially liquid waste. This tofu liquid waste contains high protein which decomposes quickly. Tofu waste also contains organic compounds with a low pH and is a pollutant contributor to the aquatic environment if no processing is carried out before being discharged into the environment. If this liquid is discharged into the environment without prior treatment, it can cause a foul odor and an unpleasant atmosphere. Tofu waste treatment can be done by several methods, such as the addition of effective microorganism bacteria, plasma ozonation, biogas, and food production. The potential of processing tofu waste into more useful products is not widely known by the public. Therefore, an alternative method of processing tofu waste is needed which is more effective and efficient so that it is easy to apply to the community. Some processing of tofu waste has the potential to become liquid organic fertilizer and reduce pollutant levels so that it is safer to dispose of it into the environment. Therefore the purpose of this community service activity is to process tofu liquid waste into organic fertilizer using fermentation. The fermentation process takes 14 days with the addition of EM4, coconut sugar, and enough water. All ingredients are mixed and stirred evenly then put in a closed container. After two weeks the liquid organic fertilizer can be used to fertilize plants by the community in West Labuhbaru Village. This activity involved nine students in real work lectures. The form of evaluation is carried out periodically by visiting, directly monitoring the fermentation process; and limited use of liquid fertilizer products.

ARTICLE INFO

Article history:

Received Apr 7, 2023
Revised May 17, 2023
Accepted Jun 26, 2023

Keywords:

Fermentation
Liquid Organic Fertilizer
Tofu Liquid Waste

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1. INTRODUCTION

Pekanbaru is one of the cities that has a fairly rapid development in Sumatra. In plain sight, it can be observed that the physical development of the city of Pekanbaru is very fast these days. This situation has a positive effect on the development of the economic sector of the population, including

the emergence of many factories on a diverse household scale. Factories produce various types of food to fulfill daily needs [1-7]. One of the many factories found in West Labuhbaru Village, Payung Sekaki District is a tofu factory. In addition to producing tofu products, this factory also serves as a source of livelihood and absorbs the labor of residents Production activities take place every day and the amount of production is adjusted to the amount of market demand [8-14].

The tofu industry generally operates in the form of household businesses, and the waste produced is unmanaged and flows directly into the nearest waters. The lack of management of this tofu waste causes it to continuously damage the quality and pollute the environment [15-21]. Tofu waste is generated from the process of cleaning soybeans, cleaning equipment, soaking, and molding tofu. Tofu waste contains the element of carbon (C) which can affect BOD and COD levels. In addition, tofu factory waste also contains gases such as oxygen (O_2), hydrogen Sulfide (H_2S), Carbon Dioxide (CO_2), and ammonia (NH_3), this gas when exceeding the predetermined quality standards can pollute the environment [22].

Based on research conducted by Farhana and Wijaya (2021), it is stated that the wastewater produced from the tofu factory contains various types of organic substances which can result in the rapid growth of microbes in the water [23]. The properties contained in liquid waste produced from tofu factories are: liquid waste contains soluble organic substances and will decompose if left stagnant in the open for several days; the average tofu liquid waste temperature ranges from 40°C – 600°C which means it is very high from the surrounding environment; tofu liquid waste is acidic due to the agglutination process of soybean juice which has acidic properties so that it can kill microbes. This causes dissolved oxygen levels in the waters to decrease.

The content of nutrients in tofu waste is 1.24%, P_2O_2 5.54%, K_2O 1.34%, and C-organic 5.803% which is an element of essential nutrients that plants need. In addition, tofu waste has an organic material composition in the form of 40% – 60% protein, 25% – 50% carbohydrates, and 10% fat. All of these organic materials can affect the concentration of phosphorus, nitrogen, and sulfur in the water [24]. According to Nurman et al. (2017), tofu liquid waste contains organic matter, namely 0.1% carbohydrates, 0.42% protein, 0.13% fat, 4.55% Fe, 1.74% phosphorus, and 98.8% water [25]. The protein contained in the tofu waste is broken down by soil microorganisms to release N compounds that will be absorbed by plants. Giving tofu liquid waste with a concentration of 50% will have a good impact on the growth of chili. In addition, based on research conducted by Mardhiana et al. (2021) shows that tofu liquid waste when used as fertilizer on corn plants can increase the number of cobs, cobs, wet weight, cob weight and stem height [26].

The use of biofertilizers as a source of plant nutrients is an alternative to substitute the use of organic fertilizers in the fertilization process in plants. Reducing the use of inorganic fertilizers can reduce environmental pollution and be more economical. The use of fertilizers made from tofu factory liquid waste can overcome various environmental problems caused by the disposal of tofu waste into the river stream. Making tofu fertilizer in West Labuhbaru Village is one of the programs in the real work lectures (RWL) of the Abdimas Universitas Riau in 2023 which aims to utilize waste and help increase the growth of plants owned by residents.

2. IMPLEMENTATION METHOD

The implementation of this work program activity was carried out in West Labuhbaru Village. The stages of implementing this activity begin with:

a. Literature study on the manufacturing method and composition of the additives used.
b. The collection of tofu liquid waste is carried out at one of the tofu factories located on Fajar Ujung Street, RW 01 West Labuhbaru Village, PayungSekaki District.
c. The process of making fertilizer by reducing the scale of manufacture 10 times.
d. The fermentation process of liquid fertilizer waste to activate the microorganisms contained in EM4 for 12 days.

3. RESULT DAN DISCUSSION

Tofu is a processed soybean product that is widely consumed by Indonesians because it contains complete amino acids and has high digestibility. In addition, tofu is one of the foods that has a relatively cheap price so that many people consume it every day. The tofu industry is currently

growing very rapidly in the community [27]. The tofu industry produces customary waste in the form of tofu pulp and liquid waste from soybean washing, soaking residue, boiling, clumping, and tofu molding. Solid waste can be utilized as raw materials for making tempeh gembus and animal feed. While liquid waste can be used as an additive to animal feed and as a biofertilizer. Waste generated by the tofu industry must be managed properly. this is done to reduce pollution that occurs in the environment. One form of utilization of tofu waste is the manufacture of liquid organic fertilizer. Liquid organic fertilizer from tofu waste has a composition of essential nutrients such as N, P, and K needed by plants. The nutrient content of tofu waste after fermentation can be absorbed directly by plants. Nitrogen element phosphorus is useful for controlling activity in cells and helping the process of breathing and assimilation. While the potassium element is useful for forming proteins and sturdier stems.

Figure 1. Tofu factory in West Labuhbaru Village.

This factory operates every day starting from 08.00 AM until 14.00 PM producing market demand as well as tofu pulp which is a by-product of the tofu making process. which can be used as animal feed. This material is easily available and has a fairly good nutritional content with a crude protein content of 21% [28]. As an additional feed, tofu pulp also has a function to complement protein from forage. Tofu dregs will become rotten and not cattle like within 2 – 3 days. This will cause farmers to only stock feed for 2 days.

Based on an assessment conducted by Pambudi et al. (2021), the characteristics of tofu liquid waste were obtained, namely BOD levels of 2.290 mg/L, COD 7.904 mg/L, and pH 2.65 [29]. The low hydrogen ions dissolved in water can be seen from the low pH level, which can be caused by the high content of amino acids from the soybean fermentation process. The high content of BOD and COD in tofu waste is due to the large content of organic substances in it. Disposal of tofu waste without prior treatment will cause an increase in microorganisms. In addition, it has the potential to reduce dissolved oxygen in water so that it can cause damage to aquatic biota. The death of aquatic biota can damage the balance of the ecosystem which continues to have a negative impact on human activities. Therefore, tofu wastewater treatment is needed to prevent adverse effects. In addition to using the plant as a waste treatment, tofu waste can also be utilized into liquid organic fertilizer as done in work program of RWL integrated Abdimas Universitas Riau 2023. The stages of processing organic fertilizer from tofu liquid waste are as follows:

a. Put 1.8 L of tofu liquid waste into the bucket.
b. Add 12 ml of EM4 activator.
c. Brown sugar solution was added as much as 60 ml.
d. The mixture is stirred using a wooden stirrer until evenly mixed.

e. Put the solution that has been mixed evenly into the bottle, close the bottle tightly so that anaerobic fermentation takes place.
f. The solution was fermented for 15 days.
g. Liquid organic fertilizer is ready for use.

EM4 stands for effective microorganism 4, which is a solution containing a solution that is a mixture of local microorganisms that are effective in increasing the rate of fermentation of organic materials such as sugars, carbohydrates, amino acids, proteins, and other organic compounds. The addition of EM4 can accelerate the formation of tofu waste liquid organic fertilizer. The potential of tofu liquid waste into liquid organic fertilizer can help and improve the fertility of farmers in West Labuhbaru Village. Waste utilization is one of the right solutions to do in an effort to reduce environmental pollution, especially around the production site.

4. CONCLUSION

Based on the efforts made to utilize tofu liquid waste which is still rich in essential nutrients and organic compounds into liquid organic fertilizer that can help farmers and residents in West Labuhbaru Sub-district, Payung Sekaki District. Tofu waste is harmful to the environment if it is continuously made in the river flow besides being able to damage the ecosystem tofu waste can also cause unpleasant odors and eutrophication.

ACKNOWLEDGEMENTS

The author would like to thank LPPM Universitas Riau for the support of facilities and financial support through Grant DIPA FMIPA Universitas Riau so that this community service activity can be carried out properly.

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