Phytoremediation of *Enceng Gondok* Plants for Treating Wastewater Tofu Tempe In Agroindustrial Areas

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Abstract

Introduction: The waste water of tofu and tempeh produced contains suspended and dissolved solids which will undergo physical, chemical and biological changes so that they can be active in non-toxic substances and can create growth media. Bacteria can be germs that cause disease, odors and other types of germs that can harm humans.
Gaya Baru Village Two communities have a tofu and tempeh industry but, based on the Data on the Top Ten Diseases at the Seputih Surabaya Health Center, Seputih Surabaya District, Central Lampung Regency in 2018, diarrheal diseases are included in the top 10 existing diseases. Possible one of the causes of groundwater pollution is the waste water of tofu and tempeh.
Method: tofu and tempeh wastewater needs to be treated with Phytoremediation, Phytoremediation is a certain plant system that works together with microorganisms in the media (soil, coral and air) that can change contaminants (pollutants / pollutants) to be reduced or harmless. Compared with other tempe tofu wastewater treatment, it requires an effective, easy and inexpensive water treatment building for small industries, because it uses plants to describe the parameters of BOD, COD, and TSS wastewater so that the treated wastewater can meet the quality standard value.
Result and discussion: The effect of variations in the concentration of tofu and tempeh wastewater, 100% concentration, 75% concentration and 50% concentration on the quality of wastewater. pH, BOD, COD and TSS using the Anova test have a significant effect on the quality of the pH, BOD, COD and TSS test parameters this can be seen from the significance value (sig) all of which have a value of 0.05. The highest reduction in tofu wastewater content was found in the 3 Water Hyacinth plant variety with a concentration of 50% for parameters BOD, COD, TSS 67% (180 mg/l) 66%. (316 mg/l), (186 mg/l) 77% were, 2 water hyacinth plants, 3 water hyacinth plants were. And the Suggestion from this research is the implementation of the design of the Tofu Tempe Wastewater Treatment Plant as an application of research using the Phytoremediation method.
Conclusion : 1) the quality of the wastewater wastewater, the concentration of 100% of parameters BOD, COD, TSS, pH is 1800 mg/l, 2912 mg/l, 4050 mg/l, 4, Concentration of 75% parameters BOD, COD, TSS, pH is 864 mg / l, 1369 mg / l, 1985 mg / l, 5.5, the concentration of 50% parameters BOD, COD, TSS, pH was 540 mg / l, 917 mg / l, 810 mg / l, 6; 2) the quality of tofu and tempe wastewater with variations in contact time of 0 days, 3 days, 6 days and 9 days, the parameters of BOD, COD, TSS and pH tend to decrease unless the concentration of wastewater is 100% the trend does not decrease and the water hyacinth plants in the tub -the experimental tots are all dead.
***Keywords** : Phytoremediation, Wastewater, Tofu Tempe*

1. Introduction

The manufacture of tofu and tempeh is a small industry that is able to absorb a large number of workers, both those directly involved in the production process and those related to the trade of materials which are inputs and processed products. However, along with the development of the tempe industry has a negative effect on the environment. The tempe industry will produce a waste stream in the manufacturing process.

The tempe production process requires a lot of water which is used for soaking, boiling, washing and exfoliating soybeans. The waste obtained from the process can be in the form of liquid or solid waste. The impact of solid waste on the environment has not been felt, because it can be used as animal feed, but the liquid waste is able to smell and when it is disposed of directly into the ditch or it will cause pollution. The resulting liquid waste contains suspended and dissolved solids which will undergo

physical, chemical, and biological changes to produce toxic substances if not treated properly and can create a medium for bacterial growth. Bacteria can be germs that cause disease or other types of germs that have the potential to harm humans. If toxins remain in the sewage, the wastewater will turn black in color and produce an odor. This odor can cause respiratory disease, and if the waste passes through the ground close to a water well, it is certain that the well cannot be used again. Waste that is discharged into the river will pollute the river and if the water is used, it can cause diarrhea and other diseases.

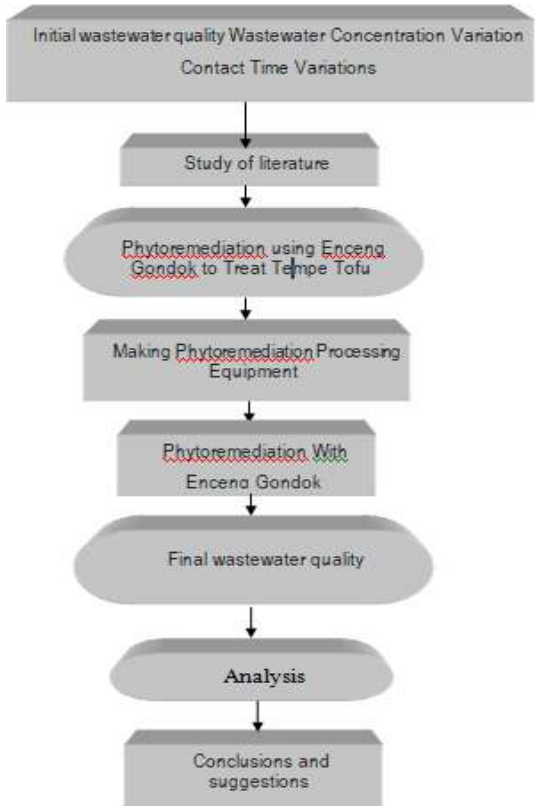
Gaya Baru Village Dua, Seputih Surabaya, the people have a tofu and tempeh industry, however, based on Data on the Top Ten Diseases at the Seputih Surabaya Health Center, Seputih Surabaya District, Central Lampung Regency, in 2018, diarrheal diseases were included in the top 10 existing diseases. It is possible that one of the causes of groundwater pollution is the waste water of tofu and tempeh.

Therefore, tofu and tempeh wastewater needs to be treated with phytoremediation. Phytoremediation is the reduction of harmful contaminants in the environment to safer concentrations by using green plants. Phytoremediation is a system in which certain plants work together with microorganisms in the media (soil, coral and water) which can change contaminants (pollutants / pollutants) to be reduced or harmless (Mahendra Dewi, N. L. P. et al., 2014).

Compared with other tofu and tempe wastewater treatment which requires physical buildings so that it becomes expensive and cannot be reached by the small industrial community of tofu and tempe, phytoremediation processing is effective, easy and inexpensive for small industries, because it uses water hyacinth plants to describe BOD wastewater parameters. , COD, and TSS so that treated wastewater can meet the quality standard value.

According to Puspita, 2017, Phytoremediation using 1 (one) water hyacinth was able to reduce the BOD content of 59.84% with an optimum contact time of 10 days. So that the focus of the research is to add variations in the amount of water hyacinth and contact time to reduce the levels of BOD, COD, and TSS in the tofu waste water in the test reactor batch. In the end, the data obtained from this study can be used to design the Tofu Tempe Wastewater Treatment Plant using the Phytoremediation Method.

2. Material and Methode



3. Result and Discussion

A. Initial Wastewater Quality

Tofu contains elements of water, Examination of the quality of wastewater carried out at the Integrated Laboratory of Poltekkes Tanjung Karang with the measured parameters, namely BOD, COD, TTS and pH. The results of measuring the quality of the tofu and tempeh industrial wastewater can be seen in the table below protein, fat and carbohydrates with the followinglevels:

Water : 84 – 90%

Table Results of Analysis of Tofu Tempe Industrial Liquid Waste

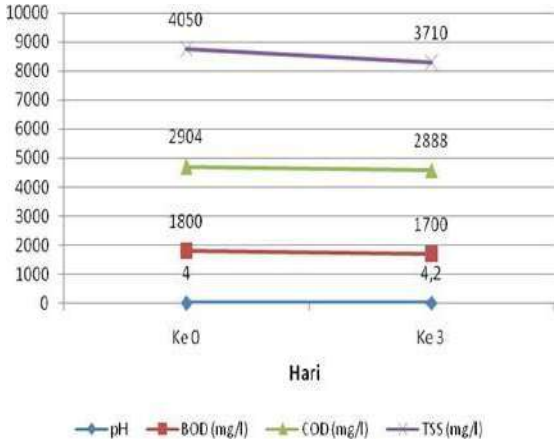
No	Parameter	Satuan	Quality Standards	Avarage Cocentratin 100 %	75 %	50 %	Method
1	BOD	mg/L	150	1800	864	540	Volumetri
2	COD	mg/L	300	2912	1369	917	Volumetri
3	TSS	mg/L	100	4050	1985	810	Gravimetri
4	Ph	-	6-9	4	5,5	6	Elektroda

Source : Reaserch Result , 2019

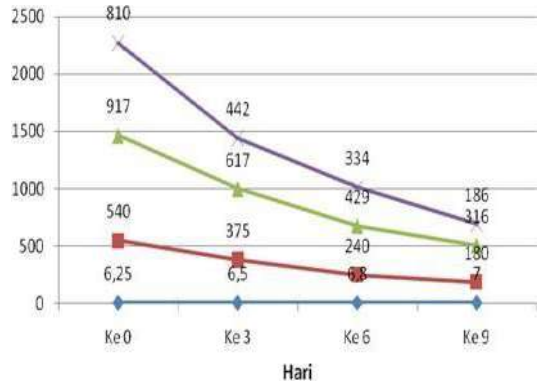
Protein: 5 - 8%
Fat : 3 – 4%
Carbohydrates: 2 - 4%

Wastewater consists of 84-90% of liquid water which is the result of decomposition of wastes and fluids that enter the environment, for example surface water, groundwater, rainwater and others. The entry of the liquid can increase the volume of tofu and tempe waste water which is then stored in the cavity between the soil components and will flow if possible. In general, the characteristics of tofu and tempe waste water include: the color varies from light white to gray, generally smells bad and sometimes produces a green color on the surface of the water

B. Tofu and tempeh wastewater quality with variations in contact time 0 days, 3 days, 6 days and 9 days



Graph Wastewater Quality in Contact Time 3 Days



Graph Wastewater Quality in Contact Time 6, 9 Days

The quality of tofu and tempeh raw water is used to describe the ability of the phytoremediation method using water hyacinth in treating tofu and tempeh wastewater. The raw water of tofu and tempeh is put into tubs containing water hyacinth plants, for 0 days, 3 days, 6 days and 9 days, then the processed tofu water is examined in the laboratory

The content of organic substances represented by BOD and COD parameters is in the high category. Oxygen demand in wastewater is indicated by BOD and COD. BOD (Biological Oxygen Demand) is the oxygen needed by microorganisms to oxidize chemical compounds. Within 5 days (BOD5), the oxidation of organic carbon will reach 60-70%. COD is the need for oxygen in the chemical oxidation process. The COD value will always be greater than the BOD because most compounds are more easily oxidized chemically than biologically. COD measurement requires a faster time, which can be done for 3 hours, while BOD measurement takes at least 5 days. If the BOD and COD values are known, the condition of the wastewater can be known (Siregar, 2005: 23).

C. The effect of variations in the concentration of wastewater on the quality of wastewater

In this study, a statistical analysis was carried out on the test results of the test parameters aimed at determining the effect of variations in the concentration of tofu and tempe waste water on the parameters of BOD, COD, TSS and pH. The first step of this statistical analysis is to determine the test parameters that affect variations in the concentration of 100% wastewater, 75% wastewater concentration and 50% wastewater concentration with one-way ANOVA (analysis of variance) analysis. The significance level in this analysis is 5% with a 95% probability of truth. Tests were carried out on the results of the respective wastewater concentrations of 100%, 75% and 50% of Enceng Gondok Plants 1, 2 and 3.

Based on Table ANOVA Test Results of Concentration Variations, it is known that the parameters pH, BOD, COD and TSS for variations in wastewater concentrations of 100%, 75% and 50% have a significant effect on the quality of the test parameters pH, BOD, COD and TSS. This can be seen from the significance value (sig), all of which have a value of ≤ 0.05.

The next step is to find the effect of variations in the concentration of wastewater on the test parameters that affect the ANOVA test results. This second stage is carried out using the

Tukey test, which is to compare the influential test parameters from the ANOVA test results with variations in the concentration of tofu and tempeh wastewater at 100%, 75% and 50%. The results of this analysis can be seen in the table below, Table 4.6 Tukey Test Results with Variation in Concentration of 100%, 75% and 50%

Based on the table above, the wastewater concentration parameters 100%, 75%, 50% have a significant effect on the test results of pH, BOD, COD and TSS parameters. This can be seen from the significance value (sig) all of which have a value of 0.05.

D. Decreased quality of tofu and tempe wastewater with Enceng Gondok, 2 water hyacinth plants and 3 water hyacinth plants.

Graph Decrease of Wastewater Concentration Test Parameters

The decrease in BOD parameters in the experimental bath occurred through physical and biological processes. Physical removal from BOD occurs through a process of deposition and capture of particulate material in the plant media. Dissolved BOD is removed by microbial growth on the surface of the media and adheres to plant roots and rhizome penetration into the bed. This decrease occurs by microorganisms that play a very important role in the removal of organic matter, whose decomposition process requires oxygen (BOD). Aerobic microorganisms can live in water and swamps under anaerobic conditions thanks to the flow of oxygen released by the roots of aquatic plants in the rhizosphere zone. Aerobic treatment takes place in the root zone and the top of the sediment. While anaerobic treatment takes place at the bottom of the sediment or sometimes takes place in water when the oxygen supply has been used up.

The decrease in COD in the flow reactor flows over the surface of the plant media through the entry of water and minerals (inorganic elements derived from the breakdown of organic matter by microorganisms) into the plant through rhizomes (root hairs). Extensions of epidermal cells have sticky walls and are firmly attached to soil particles. This makes the rhizomes come into direct contact with water which is also firmly attached to the soil media particles. While the entry of minerals occurs in the presence of water that is absorbed by the roots or without water, because minerals enter due to different concentration gradients, namely from low concentration (plant media) to high concentration (root cells). The water and minerals will be transported to the leaves. Furthermore, water can be used for photosynthesis and transpiration

In addition, the mechanism of decreasing organic matter in the experimental tanks occurs through physical and biological processes. Physical processes that occur through the process of sedimentation and capture of organic matter in plant media. Organic matter is degraded by microorganisms that grow on the surface of the media and adhere to plant roots, as well as penetration of rhizomes in the media, then the organic matter that has been decomposed into simple forms is absorbed by plants

The process of reducing TSS in the experimental tanks includes filtration, sedimentation, uptake and microorganisms, adsorption. As well as TSS can be absorbed by plants through the roots or by microorganisms converted to other elements. Most of the removal of TSS compounds is carried out by the deposition process and microorganisms. Plants have an indirect but very important role in the process, namely as a place for microorganisms and supply oxygen to support the growth of aerobic bacteria. The remains of dead plant parts become a source of organic carbon needed by bacteria as an energy source in the deposition process and microorganisms.

In addition to the role of living things, the process of removing TSS through sedimentation and filtering of solid particles containing organic matter, as well as the process of adsorption into organic and inorganic sediments

4. Conclusion

The conclusions in the study are as follows:

a. The initial wastewater quality of tofu and tempeh wastewater with a concentration of 100% parameters BOD, COD, TSS, pH is 1800 mg / l, 2912 mg / l, 4050 mg / l, 4, 75% concentration parameters BOD, COD, TSS, pH is 864 mg/l, 1369 mg/l, 1985 mg/l , 5.5, Concentration of 50% parameters BOD, COD, TSS, pH is 540 mg/l, 917 mg/l, 810 mg/l, 6

b. The quality of tofu and tempeh wastewater with variations in contact time of 0 days, 3 days, 6 days and 9 days, the BOD, COD, TSS and pH parameters tended to decrease except for the 100% wastewater concentration the trend did not decrease and the water hyacinth plants in the tub all of the experimenters are dead.

c. The effect of variations in the concentration of tofu and tempeh wastewater, 100% concentration, 75% concentration and 50% concentration on wastewater quality

e. The highest reduction in the water content of tofu and tempeh was found in the 3 water hyacinth plant variety with a concentration of 50% for the parameters BOD, COD, TSS 67% (180 mg/l), 66% (316 mg/l), (186 mg/l)) 77% were, 2 plants of water hyacinth, 3 plants of water hyacinth were

4. Acknowlegdement

Gratitude goes to the parties who have helped carry out this research, such as the Director of the Tanjungkarang Health Polytechnic, the Head of the Environmental Health Department of the Tanjungkarang Poltekkes, Head of research and community service center Tanjungkarang Health Polytechnic, Enumerators and research field assistants, and the editors of this research article, I hope this research can be useful for the development and application of science. knowledge especially in the field of solid solid waste.

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