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A Comparative Test Of Effectiveness Between Lotus *(Nymphaea Firecrest)* And Water Hyacinth *(Eichhornia Crassipes)* To Reduce Tofu Wastewater Pollutants

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Abstract

Tofu industrial liquid waste is waste generated in the process of making tofu or when washing soybeans. In Ternate City, North Maluku, tofu waste is generally discharged into the sea; this causes environmental pollution. This study aims to compare the effectiveness of lotus (*Nymphaea Firecrest*) and water hyacinth (*Eichhornia Crassipes*) to reduce levels of pollutants TDS (Total Dissolved Solids) and TSS (Total Suspended Solid) in tofu wastewater in the Tofu Industry in Jambula Village by "phytoremediation process." The research method used in this study is the Experiment Method. The sample total used is 30 liters. From the results of this study indicate that the results of the first examination for water hyacinth, TDS 525mg / l and TSS 449mg / l and lotus, TDS 598 mg / l and TSS 421mg / l, for the second examination for water hyacinth, TDS 445mg / l, and TSS 330mg / l and for lotus, TDS 598 mg / l, and TSS 421mg / l, and for the third examination of water hyacinth, TDS 720mg / l, and TSS 311mg / l and for lotus, TDS 600mg / l and TSS 419mg / l. It can conclude that the most effective way to reduce TSS (Total Suspended Solid) and TDS (Total Dissolved Solids) content is by using Water Hyacinth.

Keywords: Lotus; Water Hyacinth; Tofu; Wastewater; Polutan

INTRODUCTION

Industrial wastewater is a significant factor in water pollution. All industries which produce liquid waste must do the processing. It intended that industrial wastewater can meet quality standards before being discharged into the environment (Zulkifli, 2014)

Among the many industries that produce liquid waste, one of which is the tofu industry. Generally, the industry is a cottage industry. Most of the tofu waste produced is discharged directly into water bodies, this, of course, can be a source of problems for the environment because it contains high organic matter (Asmadi & Suharno, 2012)

The Characteristics of liquid tofu waste will be significantly influenced by how tofu produced. Where in the process of making tofu, there are two types of treatment given. For example, by adding CH3COOH (acetic acid) or CaSO4 (calcium sulfate), this occurs in the process of tofu clumping into tofu. (Yudhistira, Andriani, & Utami, 2016)

Compounds play a significant role in tofu waste pollution, for example, carbohydrates, fats, proteins, and oils. Proteins and carbohydrates generally have the most quantities, which are around 40% -60% and 25% -50% and 10% fat. The processes that produce the most tofu liquid waste are boiling and clumping. For this reason, the need for further handling related to tofu liquid waste produced to be following the required quality standards. There are

several types of parameters in tofu waste pollution that are important such as temperature, pH, BOD levels, COD levels, and TSS (Ministry of Environment Regulation, 2010)

The impacts most often felt due to tofu wastewater pollution is damage to the environmental quality where the main thing is water. Tofu wastewater affects existing ecosystems in the polluted aquatic environment and will threaten human life. Because tofu waste has toxic and dangerous material for the aquatic environment (Jessy adack, 2013)

Human who drink water containing tofu waste will also be affected, such as disease due to the high PH, COD, BOD, TSS, and TDS values in water. (Irwanto, 2011). The problems that occur in the tofu industry that is the tofu industry has not treated the waste as a whole, so this will significantly impact the environment. The high operational costs and equipment that will be used in the treatment of liquid waste this year so that producers know they prefer to dump their waste into water bodies or the surrounding environment. One of them is the tofu industry in Jambula village in the city of Ternate, which dumps its waste directly into the water body without being treated first. Generally, the process of making tofu will produce waste that contains protein, organic matter, and high TDS and TSS, with a low pH. This results in decay by microorganisms quickly occurring. Decomposition that occurs will emit an awful aroma to the surrounding environment.

There are various kinds of processes in tofu wastewater treatment, including the ones that use aerobic-anaerobic reactors, aerobic biofilter, and constructed wetland. However, this process is considered quite expensive (Azmi, Hs, & Andrio, 2016). There are also ways to reduce TDS values , as stated in the study (Januardi, Setyawati, & Mukarlina, 2014), namely the addition of moringa leaf powder and tamarind.

A lot of tofu wastewater treatment that is found and classified into an inexpensive and efficient treatment and also environmentally friendly, namely phytoremediation. These green plants will generally work together with microbiota, enzymes, water consumption, soil changes and many techniques to eliminate, deliver, load dangerous contaminants that exist in the environment such as, pesticides, xenobiotics, organic compounds, toxic aromatic pollutants, acid mine drainage, and heavy metals (Dordio, A., 2011)

The research of (Nurfadillah, B, & Nurinsa, 2016) states that phytoremediation can improve the quality of wastewater and meets the quality and is safe for disposal into the environment. Several studies have also proven that processing using plants either through water produced or juice or the plant itself can stabilize the liquid waste content as stated by (Rahayuningsih & Lestari, 2017). The aim of this study is a comparative test between lotus plants (nymphaea firecrest) and water hyacinth (Eichhornia crassipes) to reduce levels of pollutants in tofu wastewater.

METHOD

Recruitment and data collection co-occurred between May 2019 at the chemistry laboratory, Poltekkes Kemenkes Ternate. The material used was tofu wastewater in the tofu industry in Jambula, Ternate.

This research uses the process phytoremediation which means the use of plants, microorganisms to minimize and detoxify pollutants

Plant media used are lotus plants and water hyacinth. Each container is filled with 15 liters of tofu wastewater and also 15 lotus plants and water hyacinth divided into different containers. After that, soak for 14 days. Moreover, in 14 days and carried out three times during the treatment to see a comparison of the reduction in the content of TDS and TSS in the tofu wastewater.

The inspection used a manual method of filtering paper for TSS inspection and vapor cup for TDS inspection. Once the results obtained from the sample, weights calculating used the TDS and TSS calculation formulas.

RESULT AND DISCUSSION

Table 1 Results of the TDS, TSS content of the tofu wastewater before treatment

Media	Parameter	Lots of sampel solution (ml)	Quality Standard	Results
Water Hyacinth	TSS	100 ml	100-250 mg/l	449mg/l
	TDS		250-850 mg/l	618mg/l
Lotus	TSS	100 ml	100-250 mg/l	421mg/l
	TDS		250-850 mg/l	598mg/l

Table 1 shows that the preliminary examination showed TDS of 630 mg / l, TSS 450 mg / l in 100 ml of sample water used in each trial. When compared with the quality standard following Ministry of Environment Regulation, 2010 that the results obtained have exceeded the quality standard, therefore treatment must be carried out to reduce the value.

Table 2: TDS, TSS contents of tofu wastewater examination results on water hyacinth and lotus media on Day 1

Media	Parameter	Lots of sampel solution (ml)	Quality Standard	Results
Water Hyacinth	TSS	100 ml	100-250 mg/l	449mg/l
	TDS		250-850 mg/l	618mg/l
Lotus	TSS	100 ml	100-250 mg/l	421mg/l
	TDS		250-850 mg/l	598mg/l

Based on table 2 shows that the comparison between the ability of water hyacinth and lotus plants to reduce levels of tofu wastewater pollutants on water hyacinth plants TSS value on the second examination was 449 mg / l and TDS value was 525 mg / l. At the same time, on lotus plant media, the value of TSS of 421 mg / l and TDS of 598 mg / l meaning that there is a decrease from the first examination before treatment. However, according to Ministry of Environment Regulation, 2010 the value found does not meet the quality standard requirements.

Table 3. Test results of tofu wastewater pollutants on water hyacinth and lotus media on the second test

Media	Parameter	Lots of sampel solution (ml)	Quality Standard	Results
Water Hyacinth	TSS	100 ml	100-250 mg/l	330 mg/l
	TDS		250-850 mg/l	455 mg/l
Lotus	TSS	100 ml	100-250 mg/l	420 mg/l
	TDS		250-850 mg/l	465 mg/l

Based on table 3 shows that the comparison between the ability of water hyacinth and lotus plants to reduce levels of tofu wastewater pollutants on water hyacinth plants TSS value on the second examination was 330 mg / l and TDS value was 455 mg / l. At the same time, on lotus plant media, the value of TSS of 420 mg / l and TDS of 465 mg / l meaning that there is a decrease from the first examination before treatment. However, according to Ministry of Environment Regulation, 2010 the value found does not meet the quality standard requirements.

Table 4 The test results of pollutant content in tofu liquid waste on water hyacinth and lotus media on the third test

Media	Parameter	Lots of sampel solution (ml)	Quality Standard	Results
Water Hyacinth	TSS	100 ml	100-250 mg/l	311 mg/l
	TDS		250-850 mg/l	720 mg/l
Lotus	TSS	100 ml	100-250 mg/l	419 mg/l
	TDS		250-850 mg/l	600 mg/l

Based on table 4 shows that the comparison between water hyacinth and lotus media to reduce levels of tofu wastewater pollutant that is on water hyacinth TSS value on the fourth test was 311 mg / l and TDS value was 720 mg / l whereas on lotus plant media the value of TSS was 419 mg / l and TDS of 600 mg / l means that there is a decrease from the third examination for TSS values but the TDS rises higher. However, according to Ministry of Environment Regulation, 2010 the value found does not meet the quality standard requirements.

At the first test before treatment, the TDS (*Total Dissolved Solids)* and TSS (*Total Suspended Solid)* values are very high. They exceed the quality standards set by the Ministry of environment where the standard based on the standard quality value should be TDS (*Total Dissolved Solids),* and TSS (*Total Suspended Solid)* are 100 to 350 mg /l. While the results obtained at the time of tofu wastewater checked before treatment for TSS (*Total Suspended Solid)* was 450 mg / l while TDS (*Total Dissolved Solids) was* 630 mg / l. which means that the value is very high from the specified

quality standard. As we know, the liquid waste released by the tofu industry is still a problem for the surrounding environment. The application of methods for processing on a real scale, especially in Indonesia, is relatively complicated and requires high costs. Therefore industrial entrepreneurs often dump tofu waste into water bodies without prior processing. This problem should be a concern that effective and efficient wastewater treatment is needed. (Nurhasmawaty Pohan, 2008).

TDS in water is one of the determinants of water quality (Cahyani, Harmadi, & Wildian, 2016). In the first examination for water hyacinth media, the value of TSS (Total Suspended Solid) and TDS (Total Dissolved Solids) decreased in value, meaning the water hyacinth media was effective in reducing the level of pollutants. Moreover, for the lotus plant media also decreased for the value of TSS (Total Suspended Solid) and TDS (Total Dissolved Solid). However, in this second examination, the value of TSS (Total Suspended Solid) on water hyacinth media is lower than the value of TSS (Total Suspended Solid) on Lotus media. In contrast, the value of TDS (Total Dissolved Solids) on Lotus media is lower than the TDS value (Total Dissolved Solid) on water hyacinth media. Therefore, the first examination showed a decrease in both media due to the alleged biological activity that oxidizes organic and inorganic compounds contained in the wastewater (Djo, Suastuti, Suprihatin, & Sulihingtyas, 2017)

On the second test, the value of TSS (Total Suspended Solid) on the water hyacinth media was lower than the value of TSS (Total Suspended Solid) on the Lotus media. Likewise, the value of TDS (Total Dissolved Solids) on water hyacinth media is also lower than that of lotus media. However, when viewed from the first examination, the value of TDS (Total Dissolved Solids) and TSS (Total Suspended Solid) on water hyacinth media decreased considerably compared to lotus media. Water hyacinth plants have many roots and are long so that the contact surface area between wastewater and roots is getting bigger. (Dyah Puspito Rukmi, 2014). This research is in line with the research conducted by (Ruhmawati et al., 2017), where Rahmawaty said that there was a significant influence between variations in a contact time of hydrilla water plants on reducing levels of TSS wastewater from tofu factories.

In this study, the value of TSS (Total Suspended Solid) on water hyacinth media was still lower than the value of TSS (Total Suspended Solid) on Lotus media. The TDS (Total Dissolved Solids) value in the water hyacinth media is also lower than the TDS (Total Dissolved Solids) value in the Lotus media. However, for the value of TDS (Total Dissolved Solids), both media have increased dramatically. According to the study, the increase in the results of the examination occurred because it was caused by the sample not being homogeneous entirely so that it could affect the results studied (Rosmilya, 2014)

CONCLUSION

The test results showed that the lotus plant media was not able to reduce levels of TDS and TSS pollutants in the tofu wastewater industry in the Jambula district. While the results of the examination showed that the water hyacinth media was able to reduce levels of TDS and TSS pollutants in the tofu wastewater. Because the results of the examination showed that the water hyacinth plant media experienced a very significant decrease in TDS and TSS values. So for the comparison of the two media, it was found that water hyacinth was better able to reduce the TDS and TSS content in tofu wastewater from the tofu industry in Jambula district, Ternate city.

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