International Journal of Advanced Technology in Mechanical, Mechatronics and Materials (IJATEC)

Vol. 02, No. 2 (2022) 61-65
Institute for Research on Innovation and Industrial System (IRIS)

Green Mussel Shells (Perna Viridis) To Reduce the pH Of Liquid Waste Resulting from Tofu Processing

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Abstract. The food processing industry in every production process always produces waste. One of the food industries in the Jakarta area is the tofu making industry. Waste from the tofu processing process is divided into 2 types, liquid waste and solid waste. Problems that arise include the occurrence of deposition and decomposition of organic matter in water bodies which causes silting of rivers, and causes unpleasant odors. An alternative solution to reduce the pollution load is to use filter media with material from green mussel shells (Perna viridis). Meanwhile, green scallop shells are solid waste for the environment which were used in this study as a filter medium for the liquid waste left over from tofu processing and tested in the home-scale tofu processing industry in the Semanan area, West Jakarta. The test results on the pH level of the waste, green mussel shells have been able to reduce the degree of acidity by up to 52%. Visually, turbidity and foam in the liquid waste from tofu processing are reduced. It is undeniable that filter media from green mussel shells can be used as an alternative filter material for liquid waste. This research has succeeded in reducing the impact of liquid waste pollution from tofu processing.

Keywords: green mussel shells; filtration; tofu processing waste

DOI: 10.37869/ijatec.v3i2.60
Received 6 March 2022; Accepted 29 June 2022; Available online 30 November 2022

1. Introduction

The food processing industry in every production process always produces waste. Direct disposal of waste without further processing will cause problems for the environment. One of the food industries in the Jakarta area is the tofu making industry. Waste from the tofu processing process is divided into 2 types, namely liquid waste and solid waste [1]. Solid waste is generally reprocessed into tempe gembus or used as animal feed, while liquid waste is discharged directly into water bodies without being accommodated and without further processing. Problems that arise include deposition and decomposition of organic matter in water bodies [2]. Other problems that arise due to liquid waste from tofu processing include unpleasant odors and silting in the river. There needs to be an alternative effort to reduce the pollution load with materials that are cheap, widely available and processing that is easy to use as a filter media. This study uses an alternative material from green mussel shells (Perna viridis) as a filter medium. Green mussels are one source of animal food that is found in Indonesian waters. A report from the Statistics Agency of the Ministry of Maritime Affairs and Fisheries in 2018 stated that the production of shellfish produced by waters in Indonesia reached 94,708.84 tons. The high production yield needs to be balanced with the utilization of the remaining processing of green mussels. Based on these data, shellfish waste is only used by a percentage, namely 8% as fill and 18% as raw material for handicrafts [3].

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ISSN: 2720-9008

Various designs of filters or filters in previous studies have been carried out using different media, such as water Eco-filters using blood clam shell media to reduce turbidity and TSS (Total Suspended Solid) levels [4]. the use of a combination of natural adsorbents as a filtering medium to reduce the levels of BOD (Biological Oxygen Demand) and COD (Chemical Oxygen Demand) in liquid waste [5] and to filter laundry using a multimedia filter [6]. From these various studies, green mussel shells have not been widely used as an alternative filter media. In general, the use of filter media with shellfish media is able to control the pH of the water [7]. Shellfish shells also have pores that are able to absorb chemical substances and can improve water parameters. In addition, the clam shell filter media can absorb heavy metals dissolved in the waters [8].

Based on these problems, the researchers had the idea of using green mussel shell waste as a filtering medium. Manufacture of a filter for processing liquid waste from tofu processing using simple green clam shells (Perna viridis), so that it can be used to treat liquid waste left over from tofu production. The results of the design of the tool are expected to be useful for reducing the problem of liquid waste from tofu production and processing green mussel shell waste into useful media materials.

2. Research Methodology

The test method used in filtering tofu liquid waste water is by repeating 5 times for each thickness of the material. Before using the filter tools, the shells are placed in a container. The tools used in this study are shown in Figure 1.

Figure 1. Filter

2.1 pH measurement procedure

Before Measuring the pH content of the wastewater, the first step that needs to be done is to calibrate the pH meter with 2 pH buffer solutions that have been adjusted to the measurement range. After calibration, the next steps are:

1. Rinse the pH meter electrode using aqua dest (mineral-free water), then dry it using soft tissue.
2. Dip the pH meter into the wastewater sample that has been taken, wait until the pH meter shows a stable scale or number.
3. Record the results of reading the numbers displayed on the pH meter.
4. Rinse again using mineral-free water after taking measurements.

Figure 2. pH meter

2.2 *Procedure for measuring water discharge*

Measurement of water discharge is carried out simply. The steps taken are to prepare a stopwatch, measuring cup, and 1 liter of wastewater sample. The following steps are then carried out:

1. Enter a sample of 1 liter of wastewater in the filter circuit that has been made.
2. Wait until the water volume reaches 1 liter again after being passed through the circuit.
3. Record the time required for the process, repeat the process 1-3 5 times to get a comparison of results.
4. Calculate the water discharge with the equation of 1-liter volume divided by the time required during the filtering process.
5. Record the calculation results and create a table.

3. Result and Discussion

3.1 Results of testing pH and water discharge

The results of testing the pH of the wastewater left over from tofu processing after the filtration process are carried out are shown in Table 1.

Table 1. pH value after filtration

Trials	Thickness			Permen-LH-5-2014
	8 cm	16 cm	24 cm	
First pH	4,8	4,4	4,5	
1	5,1	5	5,5	6-9
2	5,3	5,7	5,8	
3	5,5	6	6,2	
4	5,8	6,3	6,4	
5	6	6,6	6,7	

Based on the results of Table 1, after several treatments with different thicknesses of filter media, the pH of the wastewater changed to a neutral pH. The test was carried out 5 times bypassing the wastewater sample into the filter channel. The volume of water used in the test is 1 liter of wastewater and the thickness of the filter media used varies, starting from a thickness of 8 cm, 16 cm, and 24 cm. The pH graph is shown in Figure 3.

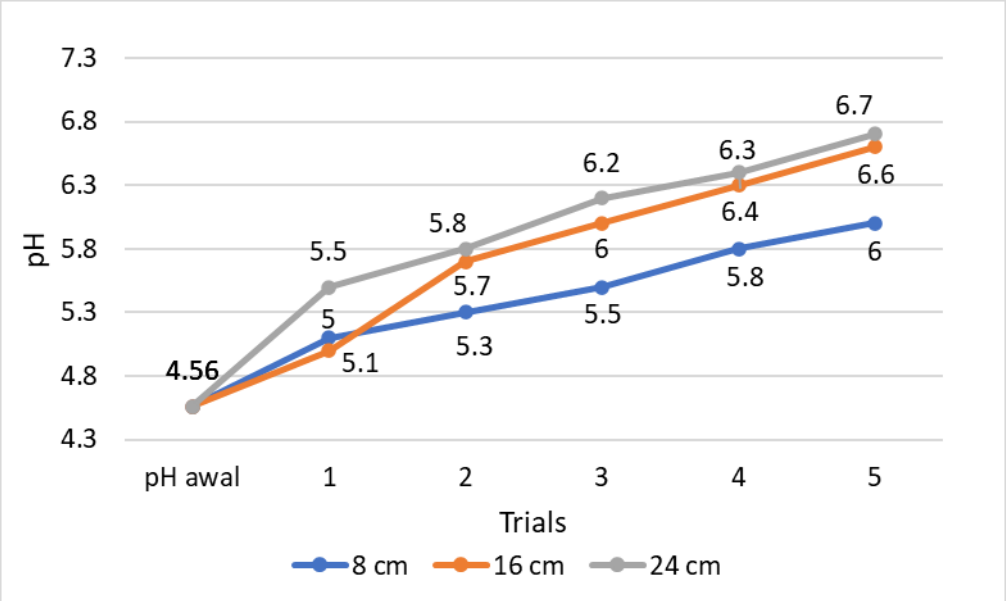

Figure 3. pH graph

Testing water discharge, volume, and thickness of the material used are the same as when testing water pH. The wastewater discharge graph is shown in Figure 4 below:

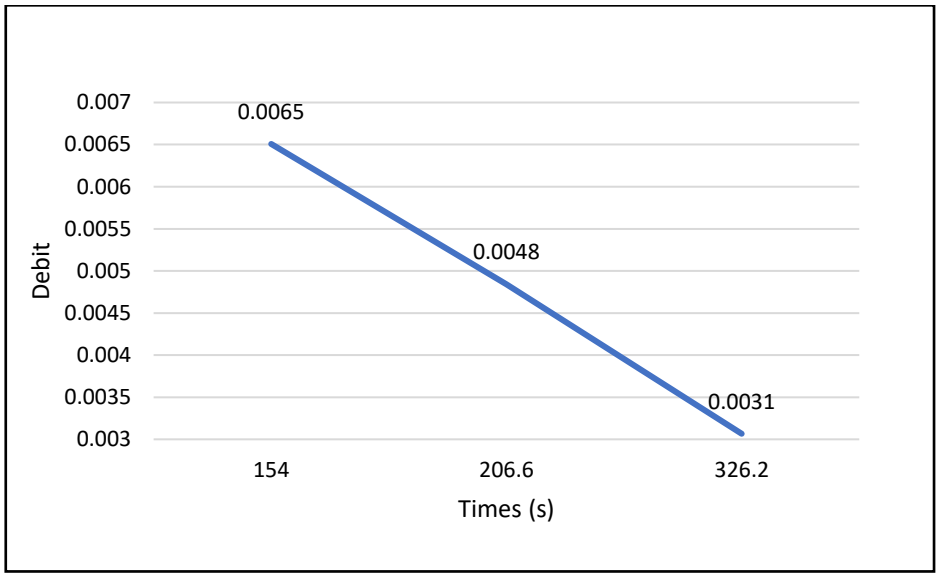

Figure 4. Water discharge graph

The results showed that the thickness of the filter media affects the flow of water. Small water discharge has large reduction effectiveness because small discharge has a longer contact time, so the absorption effectiveness is greater. The time required to filter water with a volume of 1 liter at a thickness of 24 cm takes longer by 326.2 seconds, while the time required to filter water with a volume of 1 liter at a thickness of 8 cm only takes 154 seconds.

4. Conclusions

After conducting a series of experiments, conclusions can be drawn from the research, including:

1. The design made already meets the needs of a laboratory scale but needs to be further developed for a small industrial scale, especially on the filter volume.
2. Filter media from green mussel shells can reduce the degree of acidity up to 52%. Based on the Regulation of the Minister of the Environment of the Republic of Indonesia No. 5 of 2014 concerning the quality standard of wastewater for soybean processing businesses, the permissible value for pH is 6-9. In this study, the pH value after filtering was 6.8. Visually, turbidity and foam in the liquid waste from tofu processing are reduced. The thicker the filter media used, the slower the flow of water that comes out will affect the filtering process because it takes longer.

Acknowledgments

The authors would like to thank to RISTEK-BRIN & Universitas Mercu Buana for their support through the founding of this research.

References

[1] Fibria Kaswinarni. 2007. Kajian Teknis Pengolahan Limbah Padat Dan Cair Industri Tahu - *Neliti*.
[2] Muliatiningsih, M., Romansyah, E., & Karyanik, K. (2018). pemanfaatan limbah bambu sebagai bahan filtrasi untuk mengurangi kandungan nitrogen total dalam air buangan limbah tahu. *Jurnal Agrotek Ummat.*
[3] Sawiji, A., & Perdanawati, R. A. (2017). pemanfaatan limbah kerang dengan pendekatan masyarakat berbasis aset (studi kasus: Desa Nambangan Cumpat, Surabaya) - *Repository UIN Sunan Ampel Surabaya. Marine Journal, 3 (1).*
[4] Jalaly, M. J. H. (2020). Eco Filter Air dengan Memanfaatkan Cangkang Kerang Darah (Anadara granosa) sebagai Media Filtrasi untuk Menurunkan Kekeruhan dan Kadar TSS (Total Suspended Solid).

[5] Meity, P., Septiany, P., & Farly, T. (2019). Penurunan kadar BOD dan COD dalam limbah cair laundry menggunakan kombinasi adsorben alam sebagai media filtrasi | *Fullerene Journal of Chemistry.*
[6] Zahro, S. F. (2020). Rancang bangun filter limbah cair laundry skala rumah tangga dengan menggunakan multimedia filter - *Digilib UIN Sunan Ampel Surabaya*.
[7] Istiqomah, N. (2020). Pemanfaatan media cangkang kerang sebagai filter tambak untuk mereduksi mikroplastik pada air laut - *Digilib UIN Sunan Ampel Surabaya*.
[8] Auliah, A. (2009). Lempung Aktif Sebagai Adsorben Ion Fosfat Dalam Air. *Chemica: Jurnal Ilmiah Kimia Dan Pendidikan Kimia, 10(2), 14–23.*
[9] Peraturan Menteri Lingkungan Hidup Republik Indonesia Nomor 5 Tahun 2014 Tentang Baku Mutu Air Limbah. (2014). Berita Negara Republik Indonesia, 47.