Conserve: Journal of Energy and Environmental Studies (CJEES),
Vol.6, No.1, June 2024, pp.8 – 18. ISSN: 2580-0116

Analysis of River Pollution Level Due to Tofu Industry Waste using The Pollution Index Method in Baturetno Village, Bantul

Berliana Putri, Trisno Fallo*, Andri Prasetyo Nurgroho
Department of Environmental Engineering, Universitas Proklamasi 45, Yogyakarta, Indonesia
*Email: trisnofallo@up45.ac.id

Abstract

Currently, the industrial sector in Indonesia is increasingly growing and diversifying, resulting in various industries contributing significantly to the discharge of liquid waste into rivers. The liquid waste from tofu production contains high levels of organic substances such as COD and BOD. The tofu industry in Karangturi Padukuhan, Baturetno Village, Bantul, Yogyakarta, produces wastewater of 6000 liters per day. This wastewater is directly discharged into the river streams without any prior treatment, which can harm the aquatic life in the river and disrupt the river's water quality. The study aims to analyze the river water quality impacted by tofu waste using the pollution index method and to assess the compliance of the wastewater with water quality standards. The research methodology includes quantitative and qualitative methods, involving data collection through literature sources and the measurement of physical and chemical parameters by laboratory testing. The study indicates that the wastewater produced by the tofu factory exceeds the water quality standards for the river flowing. Based on the pollution index (IPj) method, the river flowing through Karangturi Padukuhan, Baturetno Village, Bantul, experiences mild pollution, which IPj value have varied from 0,95 – 4,49 at point A, and 6,89 – 7,35 at point B.

Keywords*: river, liquid waste, tofu industry, environmental pollution.*

1. Introduction

One of the natural resources that serves several purposes for human existence and sustenance is the river, which provides water. Rivers provide a variety of purposes, including transportation, irrigation, fishing, and drinking water. Rivers can be controlled and used for human existence as they evolve (Irvan et al. 2020). A river is a place and container as well as a place where river water flows from the spring to the estuary, which is bounded on the right and left and throughout its flow by an observation line (Government Regulation No. 35 of 1991). Rivers play a very important role in meeting household, agricultural, industrial, and environmental sanitation needs. River pollution occurs due to the influence of wastewater quality that exceeds wastewater quality standards, besides that, it is also determined by the discharge of wastewater produced. Apart from physical and chemical indicators of river pollution, it can also be seen biologically (Azwir 2006).

Human activities certainly affect the decline in river water quality, such as producing liquid waste. A factor that has a big influence on environmental problems is the large human population. As the population increases, living needs, food needs, and economic needs increase so waste generation also increases. Apart from that, various human activities in fulfilling their daily needs originating from industrial, household, and agricultural activities are also the cause of the decline in river water quality (Suriawiria 2003).

Tofu is a processed-food made from soybeans. In Indonesia, tofu is typically consumed as the primary source of protein. Tofu has been the most widely consumed food in Asia for a very long time. Protein and vitamins are abundant in tofu (Faisal, 2016). Furthermore, tofu has 35% more protein than food derived from raw plants or animals. When digested by the human body, the soy protein in tofu contains eight necessary amino acids. There are no significant distinctions between plant and animal proteins, as is well known. Low-cost soybeans don't contain cholesterol. This explains why a lot of individuals enjoy dishes made from soy, including tofu. As the demand for consumption rises, so does the amount of tofu produced (Novembrianto et al. 2021).

According to (Ridha, 2015), there are around 85,000 micro, small, and medium-sized firms (MSMEs) in Indonesia that produce tofu, employing 285,000 people, 40–50% of whom are women. There are around 203 significant enterprises in Indonesia, with 86 of the largest being in East Java, according to the Ministry of Industry. Approximately 2.56 million tons of soybeans are produced each year by Indonesian tofu producers. Accordingly, each tofu factory generates over 1024 million tons of solid waste and 20 million m3/year of liquid waste. About 1.5–2 m3 of water is needed for every 100 kg of soybeans used in production. About 40% of the 100 kg of soybeans produced by the tofu industry typically end up as solid waste (Novembrianto et al. 2021).

Many factories release their liquid tofu waste into rivers, which undoubtedly kills biotic life, lowers water quality because of large levels of organic compounds, and pollutes groundwater from the surface. Regretfully, those industries continue to adopt industrial methods that harm the environment (Novembrianto et al. 2021). The tofu industry has the potential to contaminate nearby river since it generates liquid waste with high pH, Total Suspended Solids (TSS), Biochemical Oxygen Demand (BOD), and Chemical Oxygen Demand (COD). The Suyanto tofu factory wastewater in Kemlagi District, Mojokerto, has high levels of acidity and organic pollutants, with a pH of 3.91, TSS of 1050 mg/L, BOD of 2063 mg/L, and COD of 5135 mg/L (Zalfain et.al. 2024). Based on Minister of Environment regulation No. Kep51/MENLH/10/1995 concerning Liquid Waste Quality Standards for Industrial Activities, the maximum levels for BOD, COD, and TSS are 50, 100, and 200 mg/l respectively.

The production of liquid waste by the tofu industry can alter the physical and chemical characteristics of water, which can harm aquatic creatures' ability to survive, if it is not processed and released into bodies of water (Widayat et al., 2019; de Souza Moraes et al., 2022). If the river water is used for the daily needs and activities of residents, it will cause health problems such as itching, diarrhea, colitis, cholera, and other diseases (Kaswinarni 2007). Waste resulting from the tofu industry will also cause an unpleasant aroma, disrupting the life of the surrounding ecosystem and damaging the aesthetics of the environment (Herlambang, et al. 2002). The environment may be impacted by business actors' frequent ignorance of tofu wastewater management (Nasir et al., 2015).

Baturetno is a village located in Banguntapan Subdistrict, Bantul Regency, Special Region of Yogyakarta, Indonesia. This village plays an important role as the administrative center of Banguntapan Subdistrict. Baturetno Village was established in 1946 and is the result of a merger of three old villages before independence, namely Mantup Village, Wiyoro Village, and Ngipik Village. The combination of these three villages gave birth to Baturetno Village, located in Kota Gede District, Yogyakarta.

The tofu factory located in Padukuhan Karangturi, Baturetno Village, Bantul Regency, Indonesia, is a tofu industry that has been operating for ± 25 years. With so much tofu production every day, it is possible to use a lot of water, so a lot of wastewater is produced. Based on the results of observations made on November 1, 2022, it produces ± 6,000 L per day. The wastewater is directly discharged into nearby rivers without any prior processing. This can damage the living systems in the river water and can disrupt the quality of the river water.

The aims of this research are to analyze the quality of river water resulting from tofu factory waste in Baturetno Village based on the pollution index method, and analyze the suitability of liquid waste produced by the tofu factory with water quality standards regulations.

2. Materials and Methods

The method used is descriptive research which aims to provide a complete picture and accurate results. The sampling that will be carried out by researchers when carrying out research will be carried out based on Indonesian National Standards. The information to be collected is based on primary and secondary data. According to Arikunto (1998), data sources refer to subjects or origins from which data can be obtained. Sutopo (2006) states that data sources refer to places where data are obtained using certain methods, such as through humans, artifacts, or documents. In this research, two types of data sources are used, namely primary data and secondary data.

The primary data collection technique used by the author follows the Indonesian National Standard (SNI) in accordance with the author's previous research proposal, which is: a) River Water Sampling Based on Indonesian National Standard (SNI) 6989:57:2008 on the method of surface water sampling, the author takes samples based on natural sources and polluted water sources. Natural sources are locations that have not or have slightly experienced pollution, while polluted water sources are locations that have received waste. According to Indonesian National Standard (SNI) 6989:57:2008, surface water sampling techniques can be seen from the flow rate of the river.

Primary data in this research was obtained from field observations to see the condition of the river flowing in Padukuhan Karangturi, Baturetno Village, Banguntapan, Bantul, Yogyakarta. Physical parameter testing was conducted at the Environmental Quality Laboratory of the Faculty of Civil Engineering and Planning, Islamic University of Indonesia. The parameters that the author has tested are odor, color, and Total Dissolved Solids (TDS). Chemical parameter testing was also conducted at the same Laboratory. The parameters that the author has tested are BOD, COD, and pH.

Secondary data is information obtained from existing sources in the form of literature studies. Secondary data is used as a comparison to obtain as-built data and source spatial data pollution by creating time intervals for all data within a predetermined period. The secondary data collection technique used by the author is to gather information obtained from existing sources in the form of literature studies from the Bantul Environmental Office (DLH).

As stated by Sugiyono (2013:224), the data collection technique is a very important and strategic step in research because the main purpose of research is to obtain the required data. In the data collection process, there are several steps that the author has taken, including:

1. In the first step, the author conducted a preliminary survey to the research location. The author looked for a tofu factory location close to a river flow. Then the author interviewed the factory owner, asking questions related to the waste disposal from the tofu factory.
2. Observation is a data collection technique carried out by direct observation of the phenomena being studied. Observations can be made with the involvement of the researcher (participant observation) or without the involvement of the researcher (non-participant observation). Observations are often conducted in the field or in real-world situations where the researcher observes behaviors, interactions, or events occurring. Observation allows the researcher to gain an in-depth understanding of the context being observed and helps identify aspects that cannot be revealed by other methods.

3. The document study technique involves analyzing and interpreting existing information in the form of written documents such as reports, books, archives, and historical documents.
4. The experimental data collection technique is conducted by controlling certain variables and observing changes in other variables. Experiments are often conducted in laboratories or controlled environments. The author conducted experiments at the Environmental Quality Laboratory of the Faculty of Civil Engineering and Planning, Islamic University of Indonesia.

Determining water quality status using the Pollution Index Method can be done in several stages, as follows:

a) Prepare and determine the schedule and personnel involved in determining water quality status.
b) Prepare water quality data to be analyzed.
c) Prepare a table consisting of 5 (five) columns and the number of rows depends on the number of parameters to be analyzed. Column (1) name of water quality parameter; Column (2) measurement sample concentration (Ci); Column (3) concentration value of water quality parameters listed in the water quality standards according to utilization/designation (Lij).
d) Calculate the (Ci / Lij) measurement value for each parameter in column (4), and calculate the new (Ci / Lij) in Column (5) of the table in point b.3. Ci / Lij (column 5).

3. Results and Discussion

3.1. History of the Tofu Factory

The tofu factory in Baturetno, Indonesia, has a long history. Tofu is a traditional Indonesian food made from fermented soybeans. Generally, tofu was made at home by the community. However, with the development of the food industry, many modern tofu factories have been established in various regions. Although it is difficult to find accurate information about the history of the Baturetno Tofu Factory, traditional tofu production has long been practiced in Java and is believed to have existed for hundreds of years.

Tofu is a popular product widely available in Indonesia, so it is not surprising that tofu factories have developed in various regions. The tofu factories in Baturetno are generally commercially active, supplying tofu to local, regional, and national markets. Some tofu factories also export tofu to other countries. The tofu factory in Baturetno not only brings economic benefits to the local community by creating jobs but also expands the market for tofu products. Additionally, the tofu factory helps preserve the tradition of producing tofu in large quantities, allowing Indonesian culinary culture to be preserved and further developed.

The research location is at the tofu factory named Pak Rahman Tofu Factory. This tofu factory has been operating for approximately 25 years since Pak Rahman was young. The tofu factory produces thousands of tofu pieces daily, with an estimated liquid waste output of around 6000 L/day. This tofu factory is a household-scale factory with a modest-sized facility.

3.2. Factory Compliance with Environmental Permits

Household-scale tofu factories in Indonesia generally do not require an Environmental Impact Analysis (Amdal), an Environmental Management Effort (UKL), or an Environmental Monitoring Effort (UPL). Amdal is usually required for activities that have significant environmental impacts or exceed certain thresholds. Although Amdal is not required for tofu factories, it should be understood that good environmental management practices are still expected from domestic-scale operations. This includes monitoring and

controlling waste, using environmentally friendly raw materials, safe waste management, and compliance with applicable environmental regulations. In Indonesia, this can be found in the Minister of Environment and Forestry Regulation (Permen LHK) No. 6 of 2018 on the Types of Activities Required to Conduct UKL-UPL. There are no specific restrictions in Permen LHK that explicitly mention the tofu industry. However, there are threshold values for the food industry applicable to several processing and production methods. The thresholds depend on daily or annual production capacity and the type of materials used or produced.

Based on the research location taken by the author, namely Pak Rahman Tofu Factory, it does not have environmental permits, either Amdal or UKL-UPL. This tofu factory is a household-scale factory, so its waste does not have a significant impact on the surrounding environment. This factory also does not exploit renewable natural resources, so it does not require an environmental permit in the form of Amdal. The factory can apply for an environmental permit in the form of UKL-UPL or SPPL.

3.3. Test Results

Based on the author's observations at the location, it was found that the river's flow rate is <5 m^3/s, so the surface water is taken at one point in the middle of the river at a depth of 0.5 times the depth from the surface or taken with an integrated sampler tool to obtain water samples from the surface to the bottom evenly.

In this research test, it was carried out in the river area in Karangturi, Baturetno Village, where this river originates from the flow of the Baturetno Village Lake. To determine river water pollution in Baturetno Village, it was divided into 2 segments with 2 river water sampling points. The 2 segments were conducted on March 16, 2023, and on March 24, 2023, with 2 sampling points approximately 100 meters apart.

Each point was labeled AS (River Water) with numbers 1 and 2 at the first and second points. The first point (A) was taken at a location where there was little or no pollution (Natural Source), while the second point (B) was taken at a location that had received wastewater (Polluted Source). According to the sampling scheme at Figure 4.1.

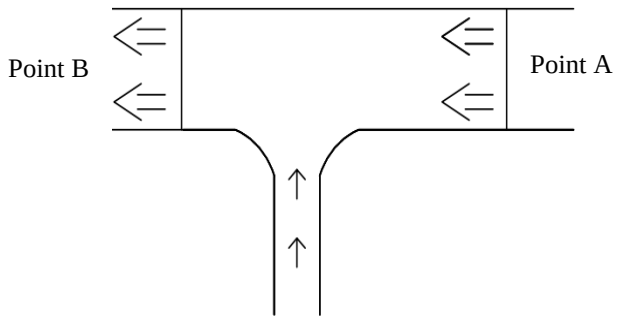

Figure 4.1 Sampling Scheme Diagram

Sampling point A and point B were taken from the Padukuhan Karangturi River in Baturetno Village at a depth of 0.5 times the depth from the surface. Hereby, the author presents the data from the research conducted on March 16, 2023, and March 24, 2023.

a) First Testing Results (March 16, 2023)

The first testing was conducted at a location where there was little contamination from Pak Rahman tofu factory waste.

Tabel 4.1 Results of the First Parameter Test

No	Parameter	Unit	Results		Test Methods
			Point A	Point B	
a. Physical Parameters					
1	TDS	mg/L	240±10.1	448±18.2	SNI 6989.27:2019
2	Odor	-	No smell	Smell	Organoleptic
3	Colour	Pt-Co	<3.88	<3.88	SNI 6989.80:2011
b. Chemical parameters					
4	pH	-	8.11±0.29	8.14±0.22	SNI 6989.11-2019
5	BOD	mg/L	6.87±0.26	241±10.9	SNI 6989.72-2009
6	COD	mg/L	12.8±1.80	441±5.77	SNI 6989.2-2019

b) Second Test Results (March 24, 2023)

The second test was conducted at a location that has received wastewater from Pak Rahman's tofu factory (Polluted Water Source).

Table 4.2 Second Parameter Test Results

No	Parameter	Unit	Results		Test Methods
			Point A	Point B	
a. Physical Parameter					
1	TDS	mg/L	252±11.1	332±14.2	SNI 6989.27:2019
2	Odor	-	No smell	Smell	Organoleptic
3	Colour	Pt-Co	9.61±2.48	21.8±2.42	SNI 6989.80:2011
b. Chemical parameters					
4	pH	-	7.26±0.26	6.25±0.23	SNI 6989.11-2019
5	BOD	mg/L	58.3±2.61	298±15.4	SNI 6989.72-2009
6	COD	mg/L	107±2.30	601±7.70	SNI 6989.2-2019

Based on the results of tests carried out by the author on March 16 2023 at the Environmental Quality Laboratory, Faculty of Civil Engineering and Planning, Islamic University of Indonesia, it was found that data had been processed according to the pollution index method formula as can be seen in Table 4.3.

Table 4.3 Calculation of IPj value for point A on March 16 2023

Titik A (16 March)

No	Parameter	Ci (Laboratory test result)	Lij (water quality standar)	Ci/Lij	New Ci/Lij
1	Odor		X		
2	Colour		X		
3	TDS	240	1000	0.24	0.24
4	BOD	6.87	6	1.145	1.2940
5	COD	12.8	50	0.256	0.256
6	pH	8.11	6 sd 9	-0.4067	-0.4067
Maximum					1.29
Mean					0.35
Ipj					0.95

Table 4.4 Calculation of IPj value for point B on March 16, 2023

Titik B (16 March)					
No	Parameter	Ci (Laboratory test result)	Lij (water quality standar)	Ci/Lij	New Ci/Lij
1	Odor		X		
2	Colour		X		
3	TDS	448	1000	0.448	0.448
4	BOD	241	6	40.1667	9.0193
5	COD	441	50	8.82	5.7273
6	pH	8.14	6 sd 9	-0.4267	-0.4267
Maximum					9.02
Mean					3.69
IPj					6.89

Table 4.5 Calculation of IPj value for point A on March 24 2023

Point A (24 March)

No	Parameter	Ci (Laboratory test result)	Lij (water quality standar)	Ci/Lij	New Ci/Lij
1	Odor		X		
2	Colour		X		
3	TDS	252	1000	0.252	0.252
4	BOD	58.3	6	9.7167	5.9375
5	COD	107	50	2.14	2.6520
6	pH	7.26	6 sd 9	0.16	0.16
Maximum					5.94
Mean					2.25
Ipj					4.49

Table 4.6 Calculation of IPj value for point B on March 24 2023

Point B (24 March)					
No	Parameter	Ci (Laboratory test result)	Lij (water quality standar)	Ci/Lij	New Ci/Lij
1	Odor		X		
2	Colour		X		
3	TDS	332	1000	0.332	0.332
4	BOD	298	6	49.6667	9.48032
5	COD	601	50	12.02	6.39952
6	pH	6.25	6 sd 9	0.8333	0.8333
Maximum					9.48
Mean					4.26
Ipj					7.35

After processing the data according to the Pollution Index Method formula, the IPj value was found in accordance with table 4.3; table 4.4; table 4.5; and table 4.6. It can be seen that the Pollution Index value of the Padukuhan Karangturi river water, Baturetno Village, Bantul, Yogyakarta due to Mr. Rahman Tofu Factory Waste can be adjusted to the quality status based on the IPj price by the Decree of the Minister of the Environment Number 115 of 2003 as seen in Table 4.7.

Table 4.7 Quality Status of IPj Prices based on KepMenLH No. 115 of 2003

No	Sampling Date	Sampling location	IPj	Conclusion
1	March 16, 2023	Point A	0.95	Good condition (complience to standard quality)
		Point B	6.89	Moderately polluted
2	March 24, 2023	Point A	4.49	Lightly polluted
		Point B	7.35	Moderately polluted

Based on the quality status of IPj prices according to Minister of Environment Decree No. 115 of 2003, if the IPj value range is below 1, then the quality status is deemed to meet quality standards (good condition), if the IPj value range is between $1.0 < IPj \leq 5.0$ then it is assessed as lightly polluted, then for the IPj value range of 5, $0 < IPj < 10$ is considered moderately polluted, while for an IPj value range of $IPj > 10$ it is considered heavily polluted.

In the first test sample carried out on March 16, 2023, it was found that the IPj value of point A met the quality standards (Good Condition), which means that the river water before being exposed to tofu factory waste water was not polluted. Meanwhile, point A in the second test sample carried out on March 24 2023 was categorized as lightly polluted, which means that the condition of the water before it was exposed to tofu wastewater was already lightly polluted.

After researchers carried out observations of the location again, they found a cement factory crossing the same river, where on that day the cement factory was operating, whereas on March 16 2023 the factory was not operating. The cement factory rarely operates because the factory follows the large number of orders that come in, so it is concluded that the cement factory rarely operates. Then for the test samples at point B for the first and second tests, the quality status was found to be in the moderately polluted category because the IPj value in each of the first and second tests was below 10. During the sampling process in the Padukuhan Karangturi river, Baturetno Village, Bantul, Yogyakarta, the author saw bioindicators such as catfish that lived in the river water. The physical condition of these bioindicators is considered very healthy.

4. Conclusion

Based on the results of the discussion in the author's research on the river water flow in Karangturi Padukuhan, Baturetno Village, Bantul, Yogyakarta, the following conclusions can be drawn:

1. The Pollution Index (IPj) value of the river water sample due to the wastewater from Pak Rahman's tofu factory at point A during the first test on March 16, 2023, falls under the good condition category with an IPj value of 0.95. However, for point A during the second test on March 24, 2023, it falls under the lightly polluted category with an IPj value of 4.49, indicating light pollution as the IPj value is above 1. At point B, both the first and second tests fall under the moderately polluted category with each test yielding IPj values of 6.89 and 7.35 respectively, as the IPj range for moderate pollution is between 5-10. The sample at point A taken on March 24, 2023, falls under the lightly polluted category due to wastewater from a cement factory. The cement factory operates infrequently, thus on March 16, 2023, the river was not polluted because the cement factory was not in operation.

2. The liquid waste produced by Pak Rahman's tofu factory that flows into the river in Karangturi Padukuhan, Baturetno Village, Bantul, Yogyakarta exceeds the water quality standards set by the Regulation of the Governor of the Special Region of Yogyakarta Number 20 of 2008. Pak Rahman's tofu factory does not yet have an environmental permit. However, the tofu factory is not required to have an Environmental Impact Assessment (Amdal), but Pak Rahman's tofu factory can apply for an Environmental Management and Monitoring Plan (UKL-UPL) or a Statement of Environmental Management and Monitoring Capability (SPPL).

References

Azwir. 2006. Analisa Pencemaran Air Sungai Tapung Kiri Oleh Limbah Pabrik Kelapa Sawit PT. Peputra Masterindo Di Kabupaten Kampar[Tesis]. Program Studi Ilmu Lingkungan. Universitas Diponegoro. Semarang.

de Souza Moraes, B., Palacios-Bereche, R., Martins, G., Nebra, S. A., Fuess, L. T., Silva, A. J., ... & Berni, M. D. (2022). Biogas production: Technologies and applications. *Biofuels and Biorefining* (pp. 215-282). Elsevier. https://doi.org/10.1016/B978-0-12-824116- 5.00009-X

Faisal, M. Treatment and Utilization of Industrial Tofu in Indonesia. *Asian Journal of Chemistry*. DOI: 10.14233/ajchem.2016.19372

Firman Syah dkk.2019. Keanekaragaman Ikan Kabupaten Kampar. Jawa Tengah: Lakeisha.

Ghufran H, Andi Baso Tancung. 2007. Pengelolaan Kualitas Air Dalam Budidaya Perairan. Cetakan ke- 1. Jakarta: Rineka Cipta.

Henni Wijayanti, "Kajian Kualitas Perairan Di Pantai Kota Bandar Lampung Berdasarkan Komunitas Hewan Makrobenthos". (Tesis Untuk MemenuhiSebagian Persyaratan Guna Mencapai Derajat Magister (S2), Universitas Diponegoro Semarang.

Herlambang, A., dkk. 2002. Teknologi Pengolahan Limbah Cair Industri.

Hidayat, C.W. Suhartono. Dharminto. 2016. Jurnal Kesehatan Masyarakat (*eJournal*), Volume 4, Nomor 3, Juli 2016 (ISSN: 2356-3346).

Irvan, Rajagukguk Y., Wahyuningsih H., Nabilah Y. 2021. The effect of industrial waste on the water quality of Padang River in the industrial area of Tebing Tinggi. *IOP Conf. Series: Materials Science and Engineering 1122 (2021)* 012072, doi:10.1088/1757-899X/1122/1/012072.

Jiao Ding et al, 2015. Klasifikasi Kualitas Air Sungai, Jaka. Bandung

Kaswinarni, F. 2007. Kajian Teknis Pengolahan Limbah Padat dan Cair Industri Tahu. Tesis. Program Study Magister Ilmu Lingkungan Program Pascasarjana Universitas Diponegoro. Semarang

Kep-MENLH Dalam UUD Pasal 23 ayat 2 No 32 Tahun 2009 tentang Perlindungan dan Pengelolaan Lingkungan Hidup.

Nasir, M., Saputro, E. P., & Handayani, S. (2015). Manajemen Pengelolaan Limbah Industri. *BENEFIT: Jurnal Managemen dan Bisnis, 19 (2)*, 143–149. https://doi.org/10.23917/benefit.v19i2.2313

Novembrianto, R., Ayu, R.H., Rosariawar, F. 2021. Tofu Wastewater Treatment with the Growth Suspended Microorganism Using Different Air Flowrate. *Al-Ard: Jurnal Teknik Lingkungan Vol.7 No.1* – September 2021 (hal. 01-08).

Peraturan Pemerintah Nomor 82 Tahun 2001 tentang Pengelolaan Kualitas Air dan Pengendalian Pencemaran Air

Peraturan Undang-undang Nomor 4 Tahun 1982 Pokok Pengelolaan LingkunganHidup

Peraturan Pemerintah Nomor 35 Tahun 1991 Tentang Sungai

Ridha, M. 2015. Promoting Eco-Friendly Production in Indonesia Tofu and Tempeh Industry. Impact Sheet-Switch Asia Project.

Suharti, S., & Nurika, I. 2018. Teknologi Pengolahan Limbah Agroindustri. Malang: UB

Press
Suriawiria, U. 2003. Mikrobiologi Air & Dasar-Dasar Pengolahan Buangan Secara Biologis. Bandung: PT Alami.
Wardhana, W.A.2004. Dampak Pencemaran Lingkungan.Yogyakarta: Andi Offset.
Widayat, W., Philia, J., & Wibisono, J. (2019, March). Liquid waste processing of tofu industry for biomass production as raw material biodiesel production. *IOP Conference Series: Earth and Environmental Science (Vol. 248, No. 1, p. 012064)*. IOP Publishing. https://doi.org/10.1088/1755-1315/248/1/012064
Zalfain, M., Noerhayati, E., & Rahmawati, A. (2024). Mitigating environmental pollution from tofu industry wastewater: Case of Suyanto Tofu Factory, Mojokerto. Applied Environmental Science, 2(1), 31-48. https://doi.org/10.61511/aes.v2i1.2024.819