



# Evaluation of Water Pollution Due to Tofu Industrial Waste: Studies Case and Strategy Countermeasures

Muhammad Hanifta Man Andira, Roifah Fajri, Sakina Enova Rahmadhani, Sharifah Hasna Rosyida, Hashfi Hawali Abdul Matin\*

Department of Environmental Science, Faculty of Mathematics and Natural Sciences, Universitas Sebelas Maret, Indonesia  
Email: [hawalihashfi@staff.uns.ac.id](mailto:hawalihashfi@staff.uns.ac.id)

**Abstract** - Livestock operations generate wastewater which is characterized by high biological oxygen demand and chemical oxygen demand concentrations, high levels of solids including fats, oils, and grease. Its high nutrient content, particularly phosphorus and nitrogen, is an important factor because of its adverse environmental impact. To reduce these, nutrient contaminants can either be captured or removed from liquid manure before disposal. Several techniques, including chemical, electrochemical, biological, and advanced oxidation, are used to treat this wastewater. Most of them have some limitations. Conventional and biological processes are time-consuming and cost-intensive, requiring a large treatment area, and generating large amounts of sludge. Lately, electrolysis has attracted attention as a potential strategy for wastewater treatment due to its environmental compatibility. Livestock waste chemistry differs considerably from industrial wastewater. Hence, the selection of electrode material with anode and cathode combination mode is critical to removing pollutants at low energy consumption. A total of 72 published articles were reviewed in this paper focusing on system configuration, contaminant removal, operation timing, and achievement of this electrocoagulation process. The commonly used electrode materials are aluminium, iron, and mild steel. In treating livestock wastewater, different combinations (Al-Al, Al-Fe, and Fe-Fe) and wiring modes of anode and cathode have been reported in the literature. It is anticipated that this study will guide researchers in the future as a milestone in the treatment of wastewater from livestock farms.

**Keywords** - Tofu waste, tofu industry, water pollution, Krajan river

**Doi:** <http://dx.doi.org/10.14710/wastech.12.1.16-19>

[How to cite this article: Andira, M. H. M., Fajri, R., Rahmadhani, S. E., Rosyida, S. H., Matin, H. H. A. (2024). Evaluation of Water Pollution Due to Tofu Industrial Waste: Studies Case and Strategy Countermeasures. Waste Technology, 12(1), 16-19 doi: <http://dx.doi.org/10.14710/wastech.12.1.16-19>]

## 1. Introduction

Tofu is a type of protein food source made from soybeans which is very popular with Indonesian people. This food is affordable for all circles, so that make it choice main for various types of dishes, starting from snacks to main meals (Rindiani, 2023). With relatively cheap prices and wide availability, Tofu is a favorite food that is easily accessible to various levels of society. The industry knows is Wrong One business Which easy found in various regions in Indonesia, one of which is in Krajan Village. Krajan Village is located in Mojosongo Village, Jebres District, Surakarta City. Physically, Krajan Village is an area that has a high population density, with the economic condition of the community which is classified as lower middle class (Cicik and Yonathan, 2021). Condition economy This make industry know as Wrong One eye worker important for resident locally, making a significant contribution to the local economy. The tofu industry in Indonesia in general Still use technology Which simple. Matter This cause level

efficiency in utilization resources such as water and raw materials are still relatively low (Khaer et al. 2019). Additionally, use technology simple Also impact on its height level production waste. Waste liquid Which Generated by factory know, If No managed with Good And thrown away direct to flow river, can cause pollution environment.

Environmental pollution due to tofu industrial waste is in accordance with Article 14 of the Law Number 32 of 2009. This law states that environmental pollution occurs when living things, substances, energy, and/or other components are introduced into the living environment by human activities, thereby exceeding established environmental quality standards. The air contaminated becomes susceptible to the growth and development of various causative microorganisms disease, Which can impact negative to health public (Syuhriatin et al. 2022). Pollution or pollution is a condition that changes the original form of the environment into something more bad as a result entry ingredients polluter or pollutants (Bai'un et al. 2021). This

condition can has a negative impact on the health and lives of living creatures that depend on it the air source. Changes that occur in water reservoirs such as lakes, rivers and groundwater the consequences of human activities, both from organic waste originating from residents and industry, are known as air pollution. To find out indicators of whether air quality is good or not, river water pollution can be explained using several sensor indicators. These indicators include pH levels, temperature, total Late Congested (TDS), And Power Send Electricity (DHL) (Abimanyu et al. 2021).

Waste know is residue or waste material from the tofu production process that is no longer used used. This waste is divided into solid waste and liquid waste. Solid waste consists of dregs soybeans, while liquid waste includes residual air from the soaking, clumping and liquid processes light grayish yellow in color which if left untreated will turn black and smell bad (Lolo et al. 2021). Tofu factories produce waste in the manufacturing process, such as tofu dregs, which is often thrown into the air stream, so that the air is polluted and unfit for use (Siregar and Nasution, 2020). Liquid waste from the tofu industry is produced through washing, boiling, pressing, and printing tofu, so the volume is very high. Without proper management Before being discharged into the sewer, this liquid waste can reduce environmental quality by up to impact on living creatures, and polluted river air can contain dangerous substances damages flora and fauna, and increases the risk of disease for people who rely on air river for daily needs (Amah et al. 2023). This research aims to reach the level Air pollution produced by industry that knows and identifies the main pollutant sources found in the Krajan Mojosongo River, and develop appropriate mitigation strategies and appropriate in overcome problem pollution for going to settled.

**2. Materials and Methods**

The type of research used is quantitative descriptive research. Descriptive research aims to describe or describe the condition of the Krajan River objectively. Temporary That, according to Pahleviannur et al. (2022), study quantitative is approach study Which uses numerical data in the form of measurement results to understand, explain, and evaluate pollution in River.

The location of this research was carried out at the upstream river point with coordinates 7°32'57.32"S 110°50'19.20"E, middle with coordinate 7°33'6.16"S 110°50'20.63"E, And downstream with coordinate 7°33'10.25"S 110°50'15.61"E on the Krajan River, Mojosongo, Surakarta, Central Java. It's purposeful to mark the pollution that occurs in the river. With the main focus on evaluation pollution air as a result waste industry know. measurement done on Sick day. Study This implemented in May calculated from May 15, 2024 to June 13, 2024 with a time span of approximately 30 days including location observations, interviews, and searching for secondary data related agencies and distributing questionnaires as a basis for determining issues. For parameter testing TDS,

temperature, PH, And DHL done 2 day on date 28 And 29 May 2024.

Material Which used in study This they is data primary Which obtained from results interviews and data from respondents from communities around the river, and measurements that include parameters TDS, temperature, PH, And DHL. Tool Which used in measurement on study This is multiparameter and pH meters. Method Analysis Data: Process analysis data Which used researcher in study This with use descriptive approach, verification, and conclusion. The data are described in detail systematic and detailed then arranged into an easy-to-understand format. Primary data taken from the measurement results and then compared with the quality standards recorded in the Regulations Central Java Province Region Number 5 of 2012 concerning Waste Water Quality Standards. The data is already there obtained by the researcher, then processed by the researcher, arranged neatly, so that readers can easily understand it and understand Which displayed by researcher.

**3. Results and Discussion**

**3.1. Condition River Krajan**

Research at three points upstream, middle and downstream shows variations in TDS, temperature, pH and parameters DHL. Results measurement This compared to with Regulation Area Province Java Middle Number 5 Year 2012 concerning Quality Standards for Tofu and Tempe Industrial Waste Water. Based on (table 1) regarding the results Observing the Krajan River in the upstream, middle and downstream parts can reveal the physical characteristics of the river Krajan.

Table 1. Results Observation River Krajan

	Date	Smell	Color
Upstream	05/28/24	-	Clear
	05/29/24	+	Clear
Middle	05/28/24	-	A little Green Grey
	05/29/24	++	A little Green
Downstream	05/28/24	++++	Green Murky and Chocolate Grey
	05/29/24	+++++	Grey

Observations on May 28 2024 show that the upper reaches of the Krajan River have Air that is odorless and clear or not cloudy indicates that the area is not too polluted by domestic waste. However, on May 29, 2024, even a little smells, the color is still clear and not cloudy. In the middle part of the river, there is little pollution which is characterized by slightly greenish air on May 28 2024, but does not cause any damage unpleasant smell. However, on May 29 2024, the river started to smell bad and the color of the air turns slightly greenish, indicating that there is household waste pollution. Pollution conditions are getting worse in the lower reaches of the river. On May 28, 2024, the river water smelled unpleasant and pungent, and cloudy green and grayish brown in color. Then, on the 29th May 2024, smell No delicious And smell Still tersium, with color

air changed become greyish. Downstream pollution is mainly caused by tofu industry waste which is dumped into flow river, cause sedimentation Which significant.

Table 2. Results measurement Upstream River Krajan

Date	TDS (mg/L)	Temperature (°C)	pH	DHL (mg/sec)
05/28/24	470	29.3	7	0.711
05/29/24	468	28.39	7	0.732
Std. Quality	2000	38	6-9	-

\*Standart quality: Regulation Area Central Java Province Number 5 of 2012 concerning Water Quality Standards Waste

Based on Table 2. Results of measurements upstream of the Krajan River, on May 28 2024, TDS value of 470 mg/L does not exceed the quality standard of 2000 mg/L, and a temperature of 29.3°C is still within below the temperature quality standard of 38°C, and a pH of 7, which is still within the pH quality standard of 6-9. Although the DHL parameter is not included in the quality standards, its value, namely 0.711 mg/s. On May 29, 2024, the TDS value obtained at 468 mg/L also does not exceed the quality standard of 2000 mg/L, a temperature of 28.39°C is still below the temperature quality standard of 38°C, and a pH of 7 where Still is at on distance standard quality pH as big as 6-9, as well as parameter DHL, even though No enter in standard each other, own mark that is 0.732 mg/s.

Table 3. Results measurement Middle River Krajan

Day	TDS (mg/L)	Temperature (°C)	pH	DHL (mg/sec)
05/28/24	526	30.79	8	0.789
05/29/24	592	30.02	7	0.925
Std. Quality	2000	38	6-9	-

Based on Table 3, it shows that the measurement value in the middle section of the river is on the 28th May 2024 does not exceed the quality standards determined by the Central Java Regional Regulations namely 2000 mg/L, where the TDS value in the middle part of the river is only 526 mg/L, then the temperature was 38°C but in the measurement it was only 30.79°C, and in the pH measurement of 8, this is included in the specified quality standards even though the DHL parameters are not included in the standard value, namely 0.789 mg/s. Likewise for measurements on the 29th May 2024 that the TDS value is 592 mg/L, temperature is 30.0°C, pH is 7, and DHL is 0.925 mg/sec, mark the has in accordance with standard quality Which has determined.

Table 4. Results measurement Downstream River Krajan

Day	TDS (mg/L)	Temperature (°C)	pH	DHL (mg/sec)
05/28/24	743	31.23	6	1.15
05/29/24	512	31.38	7	0.745
Std. Quality	2000	38	6-9	-

Based on Table 4. Results measurement downstream River Krajan, measurement all parameter shows the highest figure in this part of the region. TDS measurement on May 28 2024 was 743 mg/L, temperature of 31.23°C, pH of 6, and DHL 1.15. On measurements made on date May 29 2024, TDS obtained was 512 mg/L, temperature was 31.23°C, pH of 7, and DHL 0.745. High air parameter values in the middle to downstream areas of the river, especially for TDS, pH, and DHL, No only caused by activity industry knows, but is also influenced by several other factors, namely in the middle to downstream areas, there are many home-based tofu industries that operate without a system management air waste Which capable. Lack knowledge And awareness public about The negative impact of river water pollution on the environment and health also contributes to it its height mark parameter air.

### 3.2. Reason Pollution in River Krajan

All respondents and resource persons are local residents, so everyone knows that there are several tofu industries in the area. Based on interviews and filling out questionnaires has done, all respondents feel exists pollution in the Krajan River. According to residents In the surrounding area, pollution that occurs in the Krajan River comes from tofu industry waste and household waste ladder. This shows that the pollution problem in the Krajan River is an environmental issue which is complex and requires attention and real action from various parties to overcome it. Pollution has a negative impact on humans and the environment, including tofu products has produced. On generally, happen pollution on know caused Because not enough sanitation factory environment (Sudariyantingsih et al, 2021). Many of them raise pigs, chickens, ducks and geese are in the same yard as the factory and cause the animal droppings to pollute the air Which used For production And river in surroundings. Besides that That, a number of factory flow the waste direct to river so that aggravate pollution Which There is. There is also factor culture , Where habit throw away trash.trash in river Still done by part big public. Even though the river is polluted, people still often see fish or other aquatic animals in river the.

### 3.3. Impact Pollution in River Krajan

Although most people do not feel a direct negative impact on it their health from the quality of river water, there were several immigrants who initially experienced problems health before finally managing to adapt to existing conditions. One of the main issues that facing public is an unpleasant odor that is often smelled in the air. This smell is not only bother comfort, but Also lower quality life public around. Besides that That, dust from Tofu industry activities around the river are also a problem that disrupts daily activities inhabitant. Debut This bother process drying clothes And can make houses inhabitant gets dirty quickly. As a result, residents have to clean their houses and wash clothes more often, which of course increases the daily

workload. Apart from that, there is also dust and a strong smell has the potential to reduce the aesthetic value and cleanliness of the surrounding environment, making it even more pressing necessity action for overcome problem pollution in area River Krajan.

#### 4. Conclusion

Tofu waste is divided into solid waste and liquid waste. Solid waste consists of dregs soybeans, while liquid waste includes residual air from the soaking, clumping and liquid processes light grayish yellow in color which if left untreated will turn black and smell bad. This research was carried out in the upstream, middle and downstream parts of the Krajan River, Mojosoongo. Result parameters TDS, temperature, And pH Which Already tested in river Krajan has in accordance is at under limit standard standard The reference quality is Central Java Province Regional Regulation Number 5 of 2012 concerning Water Quality Standards Waste that shows that the TDS value is still far from the quality standard of 2000 mg/L, which is the temperature It is still below the quality standard, namely 38°C, and the pH tends to be normal and still meets the standards The quality standard set is 6-9. Pollution that occurs in the Krajan River comes from waste tofu industry, household waste and livestock waste which are disposed of directly without processing first. The impact felt by residents around the river is the frequent unpleasant odor smelled in air and dust from activity industry know Which bother activity daily.

#### References

Abimanyu, D., Sumarno, S., Anggraini, F., Gunawan, I., & Parlina, I. 2021. Rancang Bangun Alat Pemantau Kadar pH, Suhu Dan Warna Pada Air Sungai Berbasis Mikrokontroler Arduino. *Jurnal Pendidikan dan Teknologi Indonesia*. 1(6) : 235-242.

Amah, V. T., Sudaryantiningsih, C., & Lolo, E. U. 2023. Analisa Dampak Limbah Cair Industri Tahu Di Kampung Krajan, Mojosoongo Surakarta Terhadap Kualitas Fisik Dan Biologis Air Sungai Krajan. *Jurnal Teknik Sipil Dan Arsitektur*. 28(1) : 60-68.

Cicik Sudaryantiningsih, & Yonathan Suryo Pambudi. 2021. Kondisi Personal Hygiene Dan Sanitasi Pabrik Tahu Di Sentra Industri Tahu Kampung Krajan Mojosoongo Surakarta Dan Pengaruhnya Terhadap Hygienitas Tahu Yang Diproduksi. *Jurnal Ekonomi, Sosial & Humaniora*. 2(11) : 30-39

Khaer, A., & Nursyafitri, E. 2019. Kemampuan metode kombinasi filtrasi fitoremediasi tanaman teratai dan eceng gondok dalam menurunkan kadar BOD Dan COD air limbah industri tahu. *Sulolipu: Media Komunikasi Sivitas Akademika Dan Masyarakat*. 17(2), 11-18.

Lolo, E. U., Gunawan, R. I., Krismani, A. Y., & Pambudi, Y. S. 2021. Penilaian Dampak Lingkungan Industri Tahu Menggunakan Life Cycle Assessment (Studi Kasus: Pabrik Tahu Sari Murni Kampung Krajan, Surakarta). *Jurnal Serambi Engineering*. 6(4) : 2337-2347.

Pahleviannur, M. R., De Grave, A., Saputra, D. N., Mardianto, D., Hafrida, L., Bano, V. O., & Sinthania, D. 2022. *Metodologi Penelitian Kualitatif*. Pradina Pustaka.

Rindiani, F. 2023. Pengolahan Limbah Tahu Menjadi Biogas Sebagai Inovasi Guna Mengatasi Krisis Energi. *Jurnal Pendidikan, Sains Dan Teknologi*. 2(3) : 946-951.

Siregar, E. S., & Nasution, M. W. 2020. Dampak Aktivitas Ekonomi Terhadap Pencemaran Lingkungan Hidup (Studi Kasus Di Kota Pejuang, Kotanopan). *Jurnal Education And Development*. 8(4) : 589-589.

Sudaryantiningsih, C., & Pambudi, Y. S. 2021. Analisa Cemar Eschericia Coli Dan Salmonella Sp. Serta Kualitas Fisik Tahu Ditinjau Dari Sanitasi Pabrik Tahu Di Sentra Industri Tahu Krajan Mojosoongo Surakarta. *Jurnal Ekonomi, Sosial & Humaniora*. 3(03) : 1-11.

Syuhriatin, S., Zaenap, Z., & Andini, A. S. 2022. Tingkat Pencemaran Air Sungai Oloh Bawi Abian Tubuh Kota Mataram Yang Disebabkan Limbah Perusahaan Tahu Menggunakan Metode ALT (Angka Lempeng Total). *Lombok Journal of Science*. 3(3) : 17-26.