Case study

The Study of Impact of Tofu Industrial Waste Treatment Plant on Parameters of Chemical Oxygen Demand Level in Residents Well of Central Lamper Village, Semarang-Indonesia

ABSTRACT

The sources of clean water in shallow groundwater or wells needed by humans need to pay attention to water quality from contaminants such as chemicals, physics and biology according to Government Regulation of the Republic of Indonesia Number 32 of 2017. Industrial processing installations located in the middle of the Central Lamper village settlement are feared to provide impact on the quality of resident well water. Research aims assessing the Impact of Tofu Industrial Waste Treatment Plant (WWTP) based on chemical oxygen demand (COD) parameters on the quality of the Wells of the villagers of Central Lamper, Semarang, Indonesia. The results showed that the chemical oxygen demand parameter from the Bajak river was 51.8 mg/L (starting point) and 238 mg/L (end point). The value of the chemical oxygen demand parameter in resident wells is resident well 1 of 12.2 mg/L, well 2 is 9.12 mg/L, resident well 3 is 3.05 mg/L, resident well 4 is 33.05 mg/L L, resident well 5 is 3.05 mg/L, resident well 6 is 15.2 mg/L, resident well 7 is 27.4 mg/L and resident well 8 is 3.05 mg/L. The conclusion: Chemical oxygen demand value exceeds the quality standard due to the entry of domestic liquid waste and liquid waste from the tofu industrial processing installation through the seepage process, this is due to poor construction of resident wells. Suggestion: recommended for residents to use drinking water from the Regional Drinking Water Company of Semarang city and improve the construction of residents' wells so that there is no wastewater intrusion from the Tofu waste treatment plant and the domestic waste of local residents

Keywords: Chemical oxygen demand, Resident well, Wastewater treatment installation, Domestic waste, Tofu Industrial Waste

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1. INTRODUCTION

The clean water is water that is used by humans and living things to meet the needs of daily life, namely as raw material for drinking water, for bathing, washing and latrine purposes, supporting modes of transportation, agricultural needs, industrial needs, and needs for recreation [1] [2]. Sources of clean water in shallow groundwater or wells needed by humans need to pay attention to the quantity of water to maintain the availability of clean water sources and maintain the quality of clean water sources from contaminants such as chemicals, pathogenic bacteria and radioactivity that can affect color, smell, and taste. Therefore, water quality must meet the requirements according to the parameters based on Government Regulation of the Republic of Indonesia Number 32 of 2017 [3]

The existence of industry in residential areas can produce waste that can affect the quality of groundwater used by the community so that the water quality does not qualify as clean water. Waste-producing industries that can pollute the environment and clean water [4], for example, are the tofu- making industry located in the residential area of Lamper Tengah Village, Semarang, Indonesia

Resident well water can be polluted due to the intrusion of tofu industry waste into resident well water, causing water quality parameters to exceed the quality standard criteria as well as non-optimal waste treatment results can affect water quality, both shallow well water and river water so that the ecological burden becomes not balanced. [5] The initial survey of the tofu-making industrial liquid waste which has undergone processing at the Waste Treatment Plant at the outlet, is cloudy white in color and still smells bad, reduces environmental aesthetics and is worried that it can contaminate well water

This study aims to study the impact of the tofu waste treatment installation on the quality of well water based on chemical oxygen demand (COD) parameters

2. METHODS

This type of research is descriptive by using survey method and cross sectional approach.[6] The samples studied were resident well water with a total of 8 points of collection and 2 point samples of river water, sampling based on the category of distance from the tofu waste treatment plant, namely close distance. medium and far from the tofu waste treatment installation point.

The titration method used for the determination of Chemical Oxygen Demand (COD) is oxidation-reduction titration using a solution of Ferro Ammonium Sulfate (FAS), after testing, the value of Chemical Oxygen Demand (COD) was obtained from the titrimetric method of SNI 6989.73:2019. [7] Data analysis using the comparative technique is to compare the chemical oxygen demand parameters of resident well water, chemical oxygen demand parameters of river

water chemical oxygen demand parameters of tofu processing wastewater in accordance with Government Regulation of the Republic of Indonesia No. 82 Th. 2001 [8]. The sampling in this research was carried out at the following coordinates: (Figure 1)

Table 1. Coordinates of Sampling Location

No	Location	Coordinate
1	Resident's Well 1	110.4418103,-7.010133784
2	Resident's Well 2	110.4420998,-7.008776686
3	Resident's Well 3	110.4420367,-7.008624179
4	Resident's Well 4	4,110.4418436,-7.008551367
5	Resident's Well 5	110.442042,-7.00832741
6	Resident's Well 6	110.4417674,-7.007992034
7	Resident's Well 7	110.4417343,-7.007836285
8	Resident's Well 8	110.4416503,-7.00764543
9	Waste treatment plant 1	110.4417183,-7.009894378
10	Waste treatment plant 2	110.4417057,-7.010098448
11	Bajak River 1	110.4417183,-7.009894378
12	BajakRiver2	110.4415056,-7.007543225

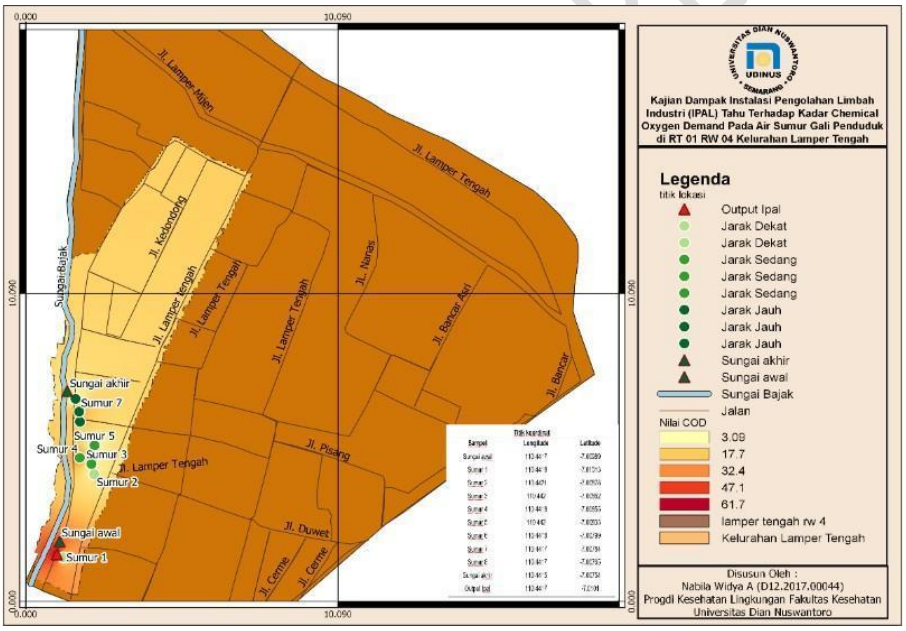

Fig 1. The Location of Sampling [9]

3. RESULTS AND DUSCUSSION

The tofu-making industry in the Lamper Tengah sub-district, Semarang is a small community industry located in residential areas. The results of the production process produce liquid waste which is channeled through pipelines to the integrated waste treatment plant. [10]. The liquid

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waste from the wastewater treatment installation is then discharged into the Bajajak river. On the banks of the Bajak river, there are settlements that still use well water to meet their daily needs, including as a source of drinking water, so it is possible that well water can be polluted by the tofu-making industry waste, due to leaks from sewage treatment installations and intrusion of resident wells.[11]. Based on an initial survey conducted on July 29, 2021, several residents living around the Industrial Waste Treatment Plant stated that the well water belonging to some residents smelled bad, giving rise to the perception that the well water was contaminated with liquid waste from the tofu industry.

Based on the general description of the research location, measurements were made on the quality of COD at the tofu waste treatment plant, the quality of the river as an estuary for waste disposal and the quality of well water that was suspected to be polluted, as follows:

Table 2. Parameters of Wastewater Quality Inspection at Waste Treatment Plants with Chemical Oxygen Demand (COD) parameters

Location	Parameter	Quality Standard	January	April	July	October	Avg
Inlet	COD	275 mg/L	2500 mg/L	1311 mg/L	1071,5 mg/L	1202,5 mg/L	1521,25 mg/L
Outlet	COD	275 mg/L	53,06 mg/L	75,51 mg/L	60,87 mg/L	58,45 mg/L	61,97 mg/L

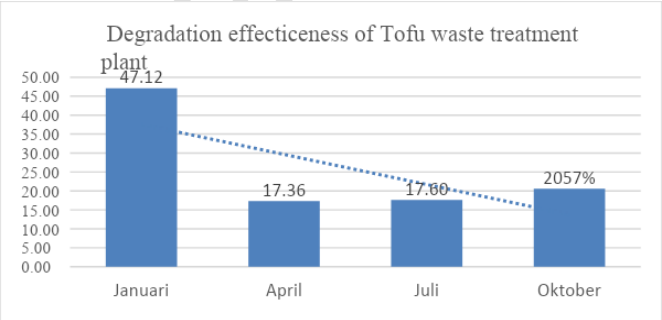

Fig 2. Degradation effectiveness of Tofu waste treatment plant (%)

Based on table 2 and graph 2, the COD parameter can be reduced with an average decrease of 12057%. (1521.25 ~~mg/lt~~ - 61.97 mg/l) with the average final result that meets the quality standard of tofu waste treatment is 61.97 mg/lt from the quality standard of 275 ml/lt. The effectiveness of the waste treatment plant performance based on data from January to October 2021 shows negative results, this shows the effectiveness of the waste treatment plant from January to October 2021 is getting better (decreasing), with the modeling equation y = - 7,9389) x + 45,511. Figure 2. tofu waste treatment plant in Central Lamper District, Semarang, as

follows:

Fig 3. Tofu Waste Treatment Plant, Central Lamper Village, Semarang-Indonesia

The processing waste from the tofu waste treatment installation is then channeled through the drainage channel to the pirate river. Table 2 is the data from the measurement of river water quality based on the chemical oxygen demand parameter at the sampling point before the waste disposal outlet and after disposal in the plow river, as follows

Tabel 3. Data of Bajak river water quality inspection based on COD parameters

Location	Parameter	Baku Mutu	Januari	April	Juli	Oktober	Juli	Avg
Sampling before the WWTP result sewer	COD	25 mg/L	44,03 mg/L	75,51 mg/L	19,97 mg/L	43,02 mg/L	51,8 mg/L	46,86 mg/L
Sampling after the WWTP result sewer	COD	25 mg/L	54,03 mg/L	82,93 mg/L	71,78 mg/L	70,02 mg/L	238 mg/L	83,53 mg/L

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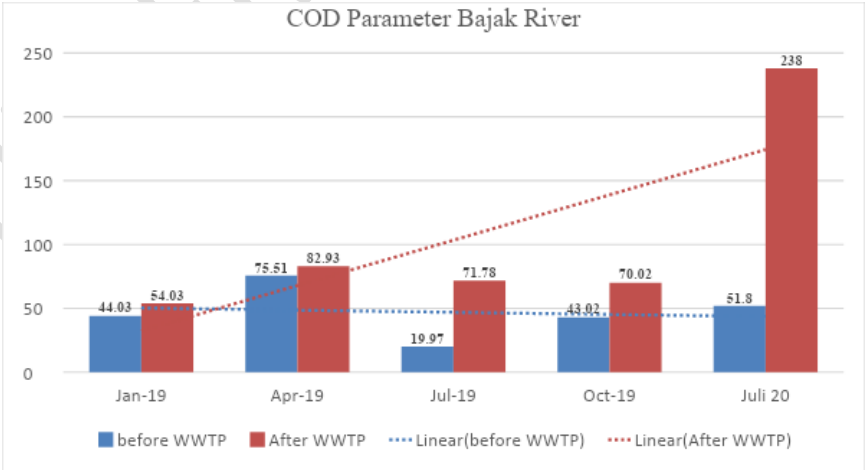

Figure 1. ~~Graph 1.~~ ~~Graph~~ of Bajak river water quality inspection based on COD parameters

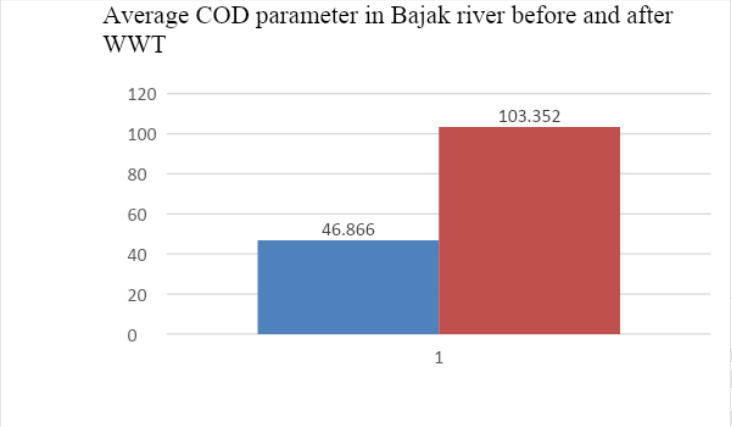

Figure 2. ~~**Graph** 2~~. ~~Graph~~ of average COD parameter on bajak river before wwt and after wwt

The measurement data shows that the concentration of chemical oxygen demand in the bajjak river after waste disposal through drainage is getting higher, this is due to the entry of domestic waste due to the activities of the surrounding community. Fig 2 shows the comparison of the average cod concentration before the sampling point and after the sampling point [12] The modeling results show that the concentration of chemical oxygen demand after the sewer shows a positive trend with the equation y = 35,530x + 5,157 (the trend is getting worse due to the increase in the concentration of chemical oxygen demand), while before the sewer there is a negative trend with the equation y = -1,695 x + 51,951 (the trend is getting better/COD concentration is decreasing), but the measurement results at each sampling point are still above the quality standard determined based on the Attachment of Government Regulation no. 82 of 2001, chemical parameters, namely chemical oxygen demand with a quality standard of 25 mg/L (Widodo, Budiastuti and Komariah, 2018). This condition is due to the condition of urban communities who are less aware of environmental sanitation and the consequences of pollution to the aquatic environment and its impact on community well water intrusion. Concerns about wastewater intrusion from sewage treatment installations and wastewater intrusion during wastewater flow through drainage can affect the quality of resident well water (chemical Oxygen Demand parameter), This is a special concern, because there are public complaints about the occurrence of unwanted odors in resident wells [4] Table 4. is the result of measuring the Chemical oxygen demand OD parameter in community well water, based on distance categories, showing the following results:

Table 4. The COD Parameter Test Results in Resident's Well Water [14]

No	Sample	Parameter	Value	Condition of resident wells	Category distance from WWTP	WHO Standard
1	Resident's Well 1	COD	12,2 mg/L	Moderate	Short Distance, 10 meter – 160 meter	4,5 mg/L
2	Resident's Well 2	COD	9,12 mg/L	Moderate	Short Distance, 10 meter – 160 meter	4,5 mg/L
3	Resident's Well 3	COD	3,05 mg/L	Moderate	Short Distance, 10 meter – 160 meter	4,5 mg/L
4	Resident's Well 4	COD	33,5 mg/L	Not qualify	Medium Distance, 161meter -200 meter	4,5 mg/L
5	Resident's Well 5	COD	3,05 mg/L	Moderate	Medium Distance, 161meter -200 meter	4,5 mg/L
6	Resident's Well 6	COD	15,2 mg/L	Not Qualify	Medium Distance, 161meter -200 meter	4,5 mg/L
7	Resident's Well 7	COD	27,4 mg/L	Not Qualify	Long distance, 201meter -270 meter	4,5 mg/L
8	Resident's Well 8	COD	3,05 mg/L	moderate	Long distance, 201meter -270 meter	4,5 mg/L

Figure 5. shows the condition of the community wells observed during the study, as follows :

Fig 4. . The community well conditions

Noted: 1. Resident's Well 1. 2. Resident's Well 2. 3. Resident's Well 3. 4. Resident's Well 4. 5. Resident's Well 5. 6. Resident's Well 6. 7. Resident's Well 7 and 8. Resident's Well 8

Figure 5 menunjukan Simulation of decreasing COD concentration in wells with fairly good conditions based on the distance from the tofu waste treatment plant

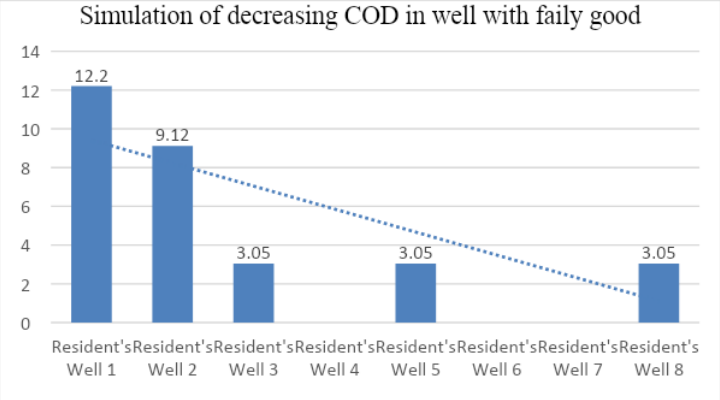

Fig 5. Simulation of decreasing COD concentration in wells with fairly good conditions based on the distance from the tofu waste treatment plant

Based on simulations and predictions, the farther the well is from the sewage treatment plant, the lower the COD concentration in well water [15], based on the measurement of the water quality of residents' wells that have fairly good/moderate well construction conditions, with the modeling y = - 1.1866x + 10.63. COD concentrations in resident wells, 3, 5 and 8 showed COD concentrations below the quality standard (4 ppm), in the moderate category (good enough) 161 m – 270 m from the distance from the sewage treatment plant. sewage treatment has a brighter color. The modeling does not involve the results of measuring water wells for residents 4, 6 and 7 because they have poor construction conditions and based on residents' information that the wells have a bad smell [16]

4. CONCLUSIONS

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The condition of the residents' wells around the sewage treatment plant is in poor and moderate categories, thus allowing the entry of waste from the Waste Treatment Plant into the residents' wells, especially at a distance of 10-160 meters. The entry of pollution in the discharge pipe by domestic waste, community activities greatly burden the concentration of COD in the plow river so that the concentration of COD becomes very high. The community is expected to be able to use drinking water for their daily needs from the State Drinking Water Company because the quality condition of the community wells does not meet the specified standards and it is necessary to repair the residents' wells into wells that meet the requirements (watertight) so that there is no waste water intrusion from the treatment plant. waste into resident wells. Using closed and watertight drainage/pipes used to drain processed waste products into rivers

DISCLAIMER

All research materials used in this study are materials commonly used, nothing specific, there is no conflict of interest between the author and third parties and any parties for litigation. This research is intended for scientific advancement only, and this research was financed by the personal efforts of all authors.

DATA AVAILABILITY

All relevant data has been recorded with supporting file information. This research will help researchers to uncover critical areas related, especially in the study of the impact of tofu industrial waste treatment plants on parameters of chemical oxygen demand levels in the wells of the Villagers of Central Lamper, Semarang-Indonesia

CONSENT

The research was carried out in accordance with research standards that apply in the Republic of Indonesia, written consent has been collected and kept by the author

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