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Characterization and Pollution Profile of the Tanning Industry by Distance in Gandong River, Indonesia

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ABSTRACT River water quality is influenced by several factors, one of them is caused by industrial waste discharged into river bodies. Effluent discharged into water bodies contains heavy metals, pungent odours, and makes the colour of water in water bodies cloudy. The purpose of the study examined the effect of tannery effluent distance on the water quality of the Gandong River in Magetan Regency. Benefits For the company As a consideration to maximize WWTP processing actions so as not to pollute the river environment. for the surrounding community to know also the consequences caused by pollution of tanning industry waste so that they are more careful in reprocessing the use of river water. This type of the research was observational with a cross sectional approach. A purposive sampling technique was used. The data analysis method was a correlation test by comparing laboratory test results with Gandong River water quality standards according to PP. RI. No 82 of 2001. Parametric statistical tests using Product-Moment Correlation to determine the relationship between distance from the tannery industry affects the water quality of the Gandong River in Magetan Regency. The results showed that the water quality of Gandong River did not meet the requirements of COD 118 mg/l and colour 61.85 TCU/PtCo, at a distance of 250 m which exceeded the quality standards of COD 133 mg/l and colour 54.90 TCU/PtCo, at a distance of 500 m which did not meet the requirements of COD 89 mg/l, at a distance of 750 m which did not meet the requirements of COD 89 mg/l. temperature and TSS parameters. The highest results at a distance of 0 m of 27°C and 368 mg / l meet the quality standard requirements for odour obtained odorous results. From the results of the study, it can be concluded that the parameters of pH, TSS, Temperature, and Odour still meet the quality standards and the parameters of colour, COD do not meet the quality standards. Based on the Product Moment correlation analysis, the relationship between distance and river water quality shows different values for correlation results that have a relationship, namely the parameters of odour, colour, COD and results that do not have a correlation of temperature and TSS. So the farther the distance from the pollutant source, the better the river water quality.

INDEX TERM Water quality, effluent distance, river, tannery waste

I. INTRODUCTION

The progress of the industrial field in the present time is due to the application of technological advances by humans to achieve a better quality of life, but on the other hand it can have an impact that is detrimental to human survival. These impacts must be prevented because the balance of the environment can be disturbed by industrial activities from technology [1]. One that has a role in the industrial sector now is the leather tanning industry.

The tanning industry is an industry that converts rawhide into leather with tanning machines. to produce various products [2]. During the tanning process, only the

collagen used as the main ingredient can react with the tanning agent, eliminating all non-collagen rawhide [3].

The Small Industry Environment (LIK) is a gathering place for the tanner community to carry out tanning work and where the cooperation process between the tanning community and the Technical Implementation Unit (UPT) in the leather and product industry takes place. In UPT LIK Magetan, there are 35 tanneries that all depend on the same Waste Water Treatment Plant (IPAL) [4]. The sewage treatment process at the Magetan Small Industrial Environment (LIK) Wastewater Treatment Plant (IPAL) is a complete treatment process in the form of a physical

process using a coarse screen (bar screen), fine screen (mechanical screen), sludge settling basin and filtration basin. The chemical process in the tank neutralizes, coagulates and creates flocculation. Bacterial process using activated sludge in aeration tank [5].

Operationally, the Wastewater Treatment Plant (WWTP) of the Magetan tannery industry has not been effective in increasing the amount of wastewater produced. This ineffectiveness is due to the processes that occur in biological treatment that cannot run properly, thus affecting the performance of the Wastewater Treatment Plant (WWTP) and making the effluent discharged into water bodies contain heavy metals, pungent odours, and make the colour of water in water bodies cloudy [6]. Since Tannery effluent is classed as the highest pollutant among all industrial effluents [7]. Heavy metal penetration from tannery effluents has toxic effects on soil and groundwater [8]. Wastewater from tanneries generally contains a wide range of salinity, organic and inorganic matter, dissolved and suspended solids, ammonia, organic nitrogen and specific pollutants (sulphide, chromium and residues) other toxic metal salts [9]. Water quality standards are used by Government Regulation NO 82 of 2001 deals with water quality management and water pollution control as a standard for water pollution. In addition, it can be used as an instrument to control activities that discharge wastewater into rivers to meet the required quality standards so that water quality is maintained in its natural condition [10]. Based on data from the examination of wastewater outlet samples from the tannery industry in Magetan Regency, there are still parameters that do not meet the requirements. The processing results of the Waste Water Treatment Plant (WWTP) are flowed into the Gandong River water body. Wastewater from the tannery industry discharged into the Gandong River has a negative impact, one of which is disturbing not only for people passing around the Gandong River, but also for the surrounding community.

In the Gandong River flow when there is tannery industry effluent discharge. The distance of the effluent also affects the results of the waste discharge because the further the distance will affect Results of measuring water quality of Gandong river. A factor that can affect water quality change of the Gandong River is water discharge. River water quality is affected by flow volume and water quality status in the upstream area. During the dry season where the water discharge flowing through the river is relatively small, it will worsen the quality of the river [11]. In addition, the speed of river flow and the shape of the river can affect river water quality.

Determining the effect of waste from the tanning industry on the water quality of the Gandong River, it is necessary to know the changes in the concentration of water parameters present in river water. The parameters used to determine the state of the Gandong River water include physical parameters of colour, temperature, odour, TSS and chemical parameters, namely pH, COD. This study also aims to analyze the effect of the effluent distance of tanning

industry liquid waste on the water quality of the Gandong River in Magetan Regency.

II. METHOD

This type of study uses an observational approach with a cross-sectional approach. Research location is the Gandong River near the tannery industry waste disposal located in Ringinagung Village, Magetan District, Magetan Regency.

The research sampling technique used purposive sampling with the independent variable is the distance of effluent after being polluted by tannery industry waste and the dependent variable is the physical quality of Colour, Temperature, Odour, TSS and chemical quality of pH, COD. The data collection procedure uses primary data, namely by observation and laboratory tests where researchers get data by taking river water samples and in laboratory tests the physical quality is TSS, temperature and chemical quality are pH and COD.

River water sampling is carried out 1 (one) time. Water sampling is carried out by grab sample. The analysis used was a choleration test and a normality test in this study using the Shapiro wilk test.

III. RESULT

The results of research and direct observation in the field can be seen in the table and graph. The physical parameters used in this study include temperature odour, pH colour and TSS (Total Suspended Solid) and the chemical parameters used in this study are COD.

Table 1.
Odour Condition of Gandong River Water

Point	Distance Of The River (M)	Odour
1	0	Strong Odour
2	250	Odourous
3	500	No Odour
4	750	No Odour

Source: 2021 Field Analysis

Based on the results of direct observation in the field using the five senses of smell in Table V.1 shows that at point 1 at a distance of 0 m after the treatment of industrial waste from the tannery, the river water had an acrid odor, then, at point 2, at a distance of 250 m after the treatment of industrial waste from the tannery, the odor condition in water decreased and when sampling point 3 at 500m and point at 750m after treatment of industrial waste from tanneries, there was no odor.

Table 2.
Water Temperature Condition of Gandong River

Point	Distance Of The River (M)	Temperature
1	0	27
2	250	25
3	500	25
4	750	25

From the results of the table above, it can also be seen the graphical relationship between temperature values and distance as shown in **FIGURE 1**

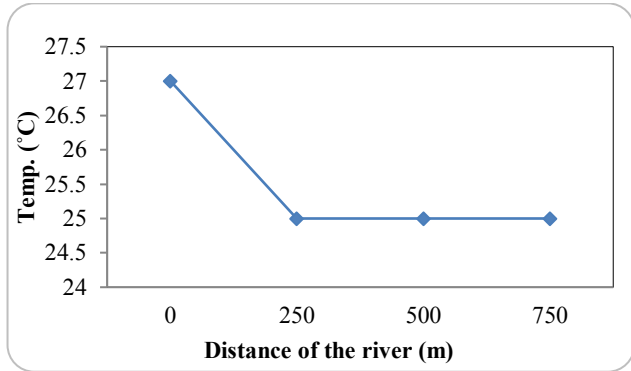


FIGURE 1. Graph of Relationship between Temperature value and distance

Based on **TABLE 2.** and **FIGURE 1.** measurement results from points 1 - 4, it can be seen that the temperature of the Gandong River ranges from 25 - 27 °C. It is known that the highest value is located at point 1, which is 27 °C. The increase in river water temperature is due to the influence of the temperature of tanneries discharged into the river. At points 2, 3, 4 the temperature is constant 25°C.

Table 3

Point	Distance Of The River (M)	Color	Quality Standard (Ptco)
1	0	61,85	50
2	250	54,90	
3	500	46,50	
4	750	35,10	

From the results of the table above, we can also see the graphical relationship between the colour concentration value and the distance as shown in **FIGURE 2.**

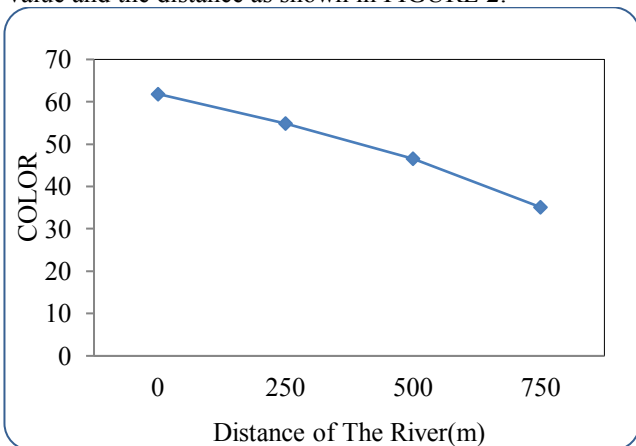


FIGURE 2. Relationship between colour and river distance

Based on **TABLE 3.** and **FIGURE 2.** above, it shows that the colour condition of river water at point 1 At a distance of 0 m after discharge of waste from the tanning industry, the concentration value of 61.85 PtCo exceeds the quality standard of 50 PtCo and there is a change in colour

to cloudy, at point 2 At a distance of 250 m after discharge of waste from the tanning industry, the concentration value of 54.90 PtCo exceeds the quality standard of (50 PtCo), there is a change in colour slightly cloudy. At point 3 with a distance of 500 m after the tannery industry waste disposal, the concentration value of 46.50 PtCo does not meet the quality standard. Point 4 at a distance of 750 m after discharging waste from the tanneries with a concentration value of 35.10 PtCo also does not meet the quality standards, the murky colour of industrial wastewater that pollutes river water has decreased significantly and returned to clear.

TABLE 4.

Point	Distance Of The River (M)	Tss	Quality Standard (Ptco)
1	0	368	400
2	250	184	
3	500	116	
4	750	132	

From the results in the table above, it can also be seen that the results of the water laboratory in the Gandong River have a graphical relationship between the TSS concentration value and the distance as shown in **FIGURE 3.**

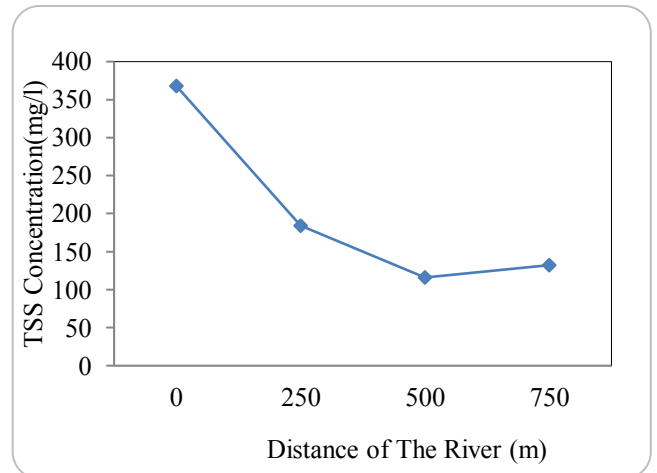


FIGURE 3. Relationship between TSS concentration value and river distance

The results of laboratory tests of TSS levels in **TABLE 4** and **FIGURE 3** show a fluctuating distribution pattern of TSS concentrations, starting from the initial point of concentration increase at point 1 at a distance of 0 m after tannery industry waste disposal, TSS levels are at the highest concentration with a concentration value of 368 mg/litre and at point 2 at a distance of 250 m after tannery industry waste disposal, TSS concentration value is 184 mg/litre. At point 3 at a distance of 500 m after removing the waste from the tanneries, the SS concentration decreased by 116 mg/liter and increased again at point a

distance of 750 m after removing the waste from the tanneries 132 mg/litre. The results of collection points 1, 2, 3, 4 with TSS concentration levels meet the quality standards.

TABLE 5.
pH Concentration of Gandong Sungai Water

Point	Distance of The River (M)	Ph	Quality Standard
1	0	8	6-9
2	250	7,8	
3	500	7,8	
4	750	7,7	

From the results in the table above, it can be seen that the laboratory results of water in the Gandong River have a graphical relationship between pH concentration values and distance as shown in **FIGURE 4**.

Based on **TABLE 5.** and **FIGURE 4**, the distribution pattern of the pH concentration of Gandong River water, both before pollution and after pollutant loading, does not show a fluctuating pattern.

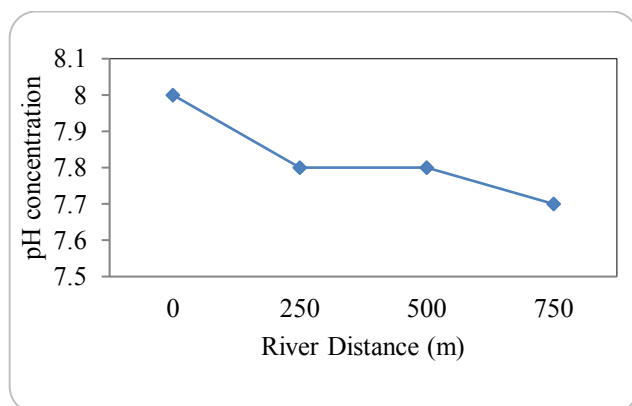


FIGURE 4. Relationship between pH concentration and river distance

This is evidenced by the pH level at point 1 at a distance of 0 m after removal of waste from the tanneries, where the pollutant load begins to enter with a pH of 8 and decreases at point 2 at a distance of 250 m after the treatment of tanneries waste, with a pH of 7.8 and at point 3 at a distance of 500m after tannery waste treatment of 7.8 and a slight decrease at point at a distance of 750m after removal of tanneries waste disposal of 7.7.

TABLE 6.
Cod Concentration of Gandong River Water

Point	Distance Of The River (M)	Cod	Quality Standard (Mg/L)
1	0	118	50
2	250	133	
3	500	89	
4	750	89	

From the results of the In the table above, we can also see the results of the Gandong River water experiment graphical relationship between COD concentration values and distance as shown in **FIGURE 5**.

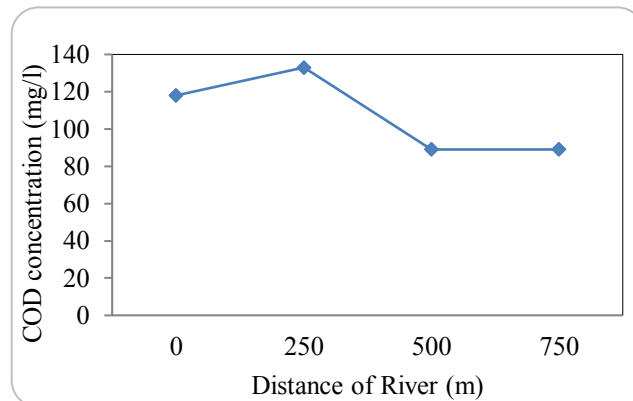


FIGURE 5. Relationship between COD and river distance

Based on the test results of COD levels in **TABLE 6** and **FIGURE 5**, the COD concentration the value of the Gandong River varies from 89 - 133 mg/litre. The high COD concentration value is due to the large amount of organic matter contained in the tannery industry wastewater. At point 1 the value of the Gandong River varies from tannery industry waste discharge, it is known that the COD value is 118 mg/litre, for this size the river water at point 1 can be declared polluted, because the COD value in unpolluted waters is usually less than 50 mg/litre. At point 2 At a distance of 250 m after the discharge of the tanneries, the COD level increased sharply to 133 mg/litre, indicating that the industrial waste load entering the river stream is completely mixed. At point 3, 500 m after discharge of wastewater from the tanneries, the COD value drops to 89 mg/litre. At a distance of 750 m later tannery industry waste disposal point 4 the COD concentration is still constant at a value of 89 mg/litre.

IV. DISCUSSION

Sampling of river water in this study, namely physical quality parameters are TSS, temperature and chemical quality are pH and COD carried out in September - October 2021 by sampling 4 points with each distance of 250 m after the tannery industry waste disposal. River water samples were sent to the laboratory of the Poltekkes Kemenkes Surabaya D3 Sanitation Study Programme, Magetan Campus. Based on the results of direct observation in the field using the five senses of smell, it shows that at point 1 at a distance of 0 m the river water smells pungent, then at point 2 at a distance of 250 m the smell in the water decreases and at the sampling location point 3 at a distance of 500 m and point 4 at a distance of 750 m the river water no longer smells bad. The results showed that there is an influence between the distance of tannery effluent discharge on the water quality of Gandong River.

The odour is caused by the formation of sulfuric acid and ammonia. Odour can be caused by the decomposition of organic substances such as bacteria by aquatic microorganisms and may be a direct result of environmental pollution, especially sanitation systems. [12]

Based on the results of the Spearman Rank test, the results obtained $p = 0.225$ or $p < 0.05$, which means that there is no effect of distance with temperature concentration due to tannery industry liquid waste in Gandong River water. Government Regulation No. 82 2001 on water quality management and water pollution control. Based on research results, it is known that the highest value is located at point 1, which is 27°C . The increase in river water temperature is due to the influence of the temperature of the tannery effluent entering the river. An increase in water temperature can cause oxygen solubility in water to decrease so that oxygen consumption of aquatic biota is also disrupted. The increase in temperature causes an increase in the speed of decomposition of organic matter by microbes and at points 2, 3, 4 at a distance of 250 m, 500 m, 750 m the temperature is constant 25°C . Based on the results of the study, it is known that the highest value at point 1, is 27°C . The increase in river water temperature is due to the effect of the temperature of tanneries discharged into the river. An increase in water temperature can cause oxygen solubility in water to decrease so that oxygen consumption of aquatic biota is also disrupted. The increase in temperature causes an increase in the speed of decomposition of organic matter by microbes [13]. High temperatures will cause the dissolved oxygen content in the water to decrease which will kill organisms and organic waste will increase nitrogen levels into nitrate compounds which cause a foul odour [14].

Optimum temperature range for growth. Temperature greatly affects the distribution pattern and abundance of aquatic biota. In general, the growth rate increases with increasing temperature. The impact that occurs due to an increase in temperature in the form of a decrease in the amount of dissolved oxygen, an increase in chemical reactions, will reduce the life activity of aquatic organisms [15]. Temperature changes affect the physical, chemical and biological processes of water bodies [16].

An increase in water temperature can be caused by the discharge of hot wastewater into water bodies. In addition, the presence of organic matter waste, which further undergoes biological and chemical degradation processes, often increases water temperatures [17]. The fluctuation in river water temperature usually depends on the season, geographic location, sampling time and temperature of effluents entering the stream [18]. Based on the results of the Product Moment correlation test, the results obtained $p = 0.005$ or $p < 0.05$, which means that there is an effect of distance with the colour concentration due to tannery industry liquid waste in Gandong River water. The further the distance of tannery industry waste disposal, the lower the concentration. Based on the results of the study at point 1 and point 2 at a distance of 0 m and 250 m, the laboratory results exceeded the quality standards by 61.85 TCU / PtCo

and 54.90 TCU / PtCo, the quality book value should not exceed 50 TCU / PtCo. At point 3 at a distance of 500 m and point 4 at a distance of 750 m, the contraction results decreased to meet the quality standards, namely 46.50 TCU / PtCo and 35.10 TCU / PtCo.

The color of water can be caused by the presence of organic matter (presence of plankton or humus) and inorganic matter such as metal ions of iron, manganese and industrial waste [19]. Water color can be observed with the naked eye (directly) or measured using the platinum cobalt scale (in PtCo units), comparing the color of the water sample and the standard color [20]. The difference in colour values obtained may be due to the presence of different amounts of organic substances or the geology of the stream [21].

Based on the results of the Product Moment correlation test, the results obtained $p = 0.134$ or $p < 0.05$, which means that there is no effect of distance with TSS concentration due to tannery industry liquid waste in Gandong River water. the results of the study at point 1 at a distance of 0 m after the disposal of leather industry waste, the TSS concentration showed the highest value of 368 mg / l and decreased at point 2 at a distance of 250 m and at point 3 500 m away.

According to [22] This is due to the presence of many rocks in the flow of the Gandong River so that the process of settling / filtering sediment solids naturally occurs on these stones. Total Suspended Solid (TSS) content has a close relationship with water clarity. The lower the level of Total Suspended Solid (TSS), the higher the value of dissolved oxygen and clarity [23].

Suspended solids include particles that are smaller in size and weight than sediment, such as clay, some organic matter, microbial cells, etc [24]. TSS may consist of organic particles, inorganic or mixed thereof. The high value of TSS in a water can affect the life of organisms living in these waters, especially benthos and plankton types [25]

Based on the results of the Product Moment correlation test, the results obtained $p = 0.017$ or $p < 0.05$, which means that there is an effect of distance with pH concentration due to tannery industry liquid waste in Gandong River water. Determining the pH is very important in the water purification process because acidity in water is often caused by oxide gases dissolved in water, especially carbon dioxide [26]. According to the results of the study, the highest pH level was located at point 1 at a distance of 0 m after mixing with tannery industry waste with a pH concentration of 8. Most natural waters have a pH in the range of 6-9 [27]. The pH value also greatly affects aquatic biochemical processes such as nitrification [28].

Based on the results of the Product Moment correlation test, the results obtained $p = 0.048$ or $p < 0.05$, which means that there is an effect of distance with COD concentrations due to tannery industry liquid waste in Gandong River water. According to PP No.82 of 2001, the chemical quality

of COD exceeds the quality standard of 50 mg/l. The collection point that has a high concentration value at point 2 at a distance of 250 m after mixing with tannery industrial waste, this is because the industrial waste load entering the river flow has been mixed perfectly. According to [29] This can be caused by the wastewater being tested is wastewater that contains a lot of organic oxygen capture substances, which can come from inorganic ammonia, heavy metals, and oxygen scaven.

The COD parameter describes the oxygen demand for organic matter waters chemically and results in reduced dissolved oxygen in the water [30]. Nilai COD menunjukkan jumlah oksigen (dalam miligram per liter produk) yang dibutuhkan untuk mengoksidasi atau menstabilkan limbah [31] As a result of high concentrations of COD in water bodies, the number of microorganisms both pathogenic and non-pathogenic will cause various diseases for humans.

The results of the study obtained the effect of tannery industry effluent distance on river water quality for physical quality is Odour, colour and for chemical quality COD. Gandong river water quality does not affect the tannery industry wastewater flow as temperature and TSS parameters.

The liquid waste that has been processed by the tannery industry is discharged into the Gandong River, causing the water quality in the river to decrease because the discharged liquid waste contains chemical tanning chemicals. Although the industry has neutralised the liquid waste that will be discharged, the liquid waste still contains chemicals. Reducing the losses experienced by the community around the Gandong River water should be better for the tannery industry WWTP manager to check the quality of wastewater that will be discharged into the Gandong River water body. This research still lacks many river water quality parameters that have not been tested and river water laboratory results may change at any time depending on the weather.

V. CONCLUSION

This study aims to analyze the effect of the effluent distance of tanning industry liquid waste on the water quality of the Gandong River in Magetan Regency. Results of measuring water quality of Gandong river for the odour parameter at point 1 (distance 0 m) smelled strong, point 2 (distance 250 m) smelled less or less strong, points 3 and 4 (distance 500 m and 750 m) did not smell. there is an influence between the distance of tannery industry effluent discharge on the water quality of the Gandong River.

The results of measuring water quality of Gandong River show that the temperature parameters meet the quality standards of government regulation No. 82 in 2001 At point 1 (distance 0 m) the temperature was obtained at 27°C and at points 2, 3, 4 (distance 250 m, 500 m and 750 m) the temperature obtained a constant value of 25°C. there is no effect of distance on temperature concentration due to

tannery industry effluent in Gandong River water.

The results of measuring water quality of Gandong river show that the pH parameter meets the quality standards according to the Government's Regulation No. 82 in 2001 with quality standards (pH 6-9). At point 1 (distance 0 m) the pH result is 8, points 2 and 3 (distance 250 m and 500 m) the pH result is 7.8 and point 4 (distance 750 metres) obtained a pH result of 7.7. there is an effect of distance with pH concentration due to tannery industry liquid waste in Gandong River water.

The results of measuring the water quality of Gandong River show that the COD parameter does not meet the quality standards according to the Government's Regulation No. 82 in 2001 on quality standard of 50 mg / l at point 1 (distance 0 m) the result of a concentration of 118 mg / l, point 2 (distance 250 m) the result of a concentration of 133 mg / l and points 3 and 4 (distance 500 m and 750 m) obtained a concentration of 89 mg / l. there is an effect of distance with COD concentration due to tannery industry liquid waste in Gandong River water The results of the analysis of the effect of tannery industry effluent distance on the water quality of the Gandong River. The results of the study obtained the effect of effluent distance on river water quality only physical quality is the Odour parameter, colour for COD chemical quality. Gandong River Water Quality Temperature and TSS parameters do not affect the distance of discharge. This research can be used as a reference for water quality in the Gandong River to conduct other studies regarding environmental impacts or sources of disease due to tannery industry waste discharges to the surrounding community. The results of this study can be carried out further research related to several untested parameters and different sample taking times so as to improve the results of research on the water quality of the gandong river around the tanning industry.

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