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Analysis of the Water Quality of the Iwan River in Darmaji Village, Kopang District, Central Lombok Regency

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Abstract: The Iwan River is one of the rivers in Darmaji Village, Kopang District, Central Lombok Regency. People often use This river for daily life, washing, bathing and irrigating rice fields. People also throw household waste into river water bodies. This hamlet does not yet have clean water and a PDAM network. This research uses the pollution index method to determine the water quality of the Iwan River in Darmaji Village and the water quality status of the Iwan River in Darmaji Village. The research method used is quantitative research with an experimental approach according to Government Regulation Number 22 of 2021 and Water Quality Status with the Pollution Index. Based on the results of the Iwan River water quality, it is still below quality standards, so it is still safe for washing and agricultural activities; namely, in upstream samples, there are TSS results of 0.724 mg/L, temperature 26.8, pH 7, BOD 0.5 mg/L, COD 8 mg/L, oil and fat 1.518 mg/L and total Coliform 24000 MPN/ml while the middle sample had TSS results of 1.574mg/L, Temperature 26.7, pH 6, BOD 1.1mg/L, COD 4mg/L, oil and fat 0.066 mg/L, and total Coliform 930 MPN/ml. In downstream samples, there were TSS results of 1.68 mg/L, Temperature 26.8, pH 7, BOD 0.5 mg/L, COD 12mg/L, oil and fat 0.108mg/L and total Coliform 230MPN/ml and Based on the Pollution Index calculation results, the Iwan River is polluted (lightly polluted) but still safe to use for agriculture.

Keywords: Iwan River; Pollution Indeks Calculation; Water Quality.

Introduction

Rivers are very important ecosystems for humans. A river is an open flow with geometric dimensions, namely a cross-section. It can change over time, depending on water discharge, base material and cliffs. Each river has different characteristics and shapes from one another; this is caused by several factors, including topography, climate, and all-natural phenomena in their formation [1].

A river is a form of water characterized by a current flowing from upstream to downstream to the estuary. Rivers are also a form of aquatic ecosystem that has an important role in the hydrological cycle and functions as a water catchment area (catchment area) for the surrounding area. For humans, rivers are places for various activities and sources of life, such as drinking water, agricultural irrigation, ponds and other activities. Natural and human factors influence river water quality. Natural factors influencing rivers include heavy rain, floods, dry seasons, volcanic eruptions and so on [2].

The presence of these factors can cause rivers to overflow and become cloudy or dry. In contrast, factors originating from humans include waste disposal from various industrial activities, agriculture, plantations and domestic waste (household waste) [3]. The final part that will collect this waste is the area around the estuary; this is because the meeting of river and seawater flows will accumulate in the estuary area. After all, the water coming from upstream will be retained by seawater before slowly combining with seawater. So, all waste the river has received is expected to end up in the estuary, which can decrease water quality at the river mouth [4]. The existence of water sources plays a vital role in human life. However, water resources in several areas are unsuitable for use as a source of raw water [5]. Reports that decreasing water quality is a priority issue in developing countries. The decline in the quality of surface water sources results from pollution pressure from low levels of environmental sanitation efforts and wastewater treatment installations [6].

The Iwan River is one of the rivers in Darmaji Village, Kopang District, Central Lombok Regency. People often use This river for daily life, washing, bathing and irrigating rice fields. People also throw household waste into river water bodies. This hamlet does not yet have clean water and a PDAM network. Therefore, it is necessary to research the quality of the Iwan River water in Darmaji Village. Indications of pollution at the research location use quality standards that refer to Government Regulation No. 22 of 2021 concerning the Implementation of Environmental Protection and Management Appendix VI. Then, the quality status of water quality will be assessed using the pollution index method. The water pollution index method is a way to determine water quality status by comparing water conditions with predetermined quality standards. The water Pollution index can assess water quality for various uses, such as drinking water, recreation, fish cultivation and irrigating plants. The pollution index method was chosen because it has the advantage of determining the quality status of monitored water quality using one data series, so it requires low cost and relatively short time. This research aims to Determine the water quality of the Iwan River Quality status.

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Research Methods

Tools

Tools used: Stationery, Camera, Sample Bottle, 100 ml Measuring Cup, Glass Funnel, 500 ml Erlenmeyer, Measuring Pipette, Dropper Pipette, Glass Beaker, Watch Glass, Rubble Bulf, Burette, Fume Cupboard, Cool Box

Materials

MnSO4 solution, Alkaline Lodida Azide solution, K2Cr2O7 solution, concentrated H2SO4 solution, 0.025 Na-thiosulfate solution, Amylum indicator solution, ferrous ammonium sulfate solution, river water samples, distilled water, labels and tissue.

River Water Sampling Techniques

Prepare sterilised tools before using them to take river water samples. Rinse the tools or containers twice with the water sample to be taken. The sample bottle is put into the river water at a tilt of 450 against the river flow, and close the sample bottle. Label the bottle and put it in a cool box. The sample is ready to be taken to the laboratory for testing.

TSS work procedures

Prepare a 100 ml water sample using a 100 ml measuring cup. Weigh the empty filter paper using an analytical balance and record the initial weight. Slowly filter the water sample into an Erlenmeyer flask using filter paper and a glass funnel to place the filter paper until the sample has been filtered. Heat the filter paper containing residue using a furnace at a temperature of 1050C for 10-15 minutes until constant. Weigh the filter paper that has been used again and record the final weight.

BOD work procedures (DO_0 and DO_5)

Prepare tools and materials; take river water samples with a 125 ml Winkler bottle until there are no air bubbles. Incubate for 5 days in a dark room for DO5 samples and painless incubation for DO0 samples.

Add 2 ml of 40% manganese sulfate (MnSO4) solution, let it sit for a few minutes, and homogenize it. Add 2 ml of alkali iodidaazide (NaOHKI), and let it sit until a brown precipitate appears. Transfer the 25 ml solution containing a lot of sediment into a 125 ml Erlemeyer.

Add 2 ml concentrated sulfuric acid (H2SO4) until the precipitate dissolves. h) Titrate with 0.025N sodium thiosulphate (NO2S2O2) solution until a light yellow colour forms. Add the starch indicator until a blue colour forms and continue titration with titration until the blue colour disappears, then record the titration volume. Subtracting the DO0 and DO5 values.

COD Work Procedures

Take a water sample using an Erlemeyer. Take a 10ml water sample and put it into another Erlemeyer. Add 5ml K2Cr2O7 0.025N, then pipette 10 ml concentrated H2SO4 and cover using a watch glass. Leave for 30 minutes. After 30 minutes add 7.5 ml of distilled water, add 3 drops of ferroin indicator then homogenize. Titrate with 0.1N ferrous ammonium sulfate solution (from green to orange solution) and pay attention to the titration volume.

Fat Oil Working Procedure

A 50 ml sample was acidified by adding 2 drops of H2SO4 until the pH was less than 2. The separating funnel was extracted with 10 ml of n-hexane and shaken for 2 minutes. The lid of the separating funnel was opened so that the gas formed could escape from the separating funnel. Leave/let the layers of water and n-hexane separate. The water phase was separated into an Erlenmeyer flask. In contrast, the n-hexane phase layer was passed through filter paper containing 1 gr of anhydrous Na2SO4 and collected in a distillation flask of known weight (Wo) e) The n-hexane phase layer was distilled in a water bath at temperature 700C when it was seen that the condensation of the solvent has stopped, the distillation is stopped. f) Cool and dry the distillation flask in an oven at 700C for 30-45 minutes. Place the distillation flask in a desiccator/or cool in an airtight container for 30 minutes. Weigh the distillation flask until a constant weight is obtained (W1).

Total Coliform Working Procedure

Media lactose broth double strength (LBDS）

We weighed 2.5 grams of LBDS and dissolved it in an Enlenmeyer flask containing 125 ml of distilled water. 3) Dissolved at the hot temperature on a hot plate, pipetted 10 ml of LBDS q and put in 3 different test tubes, which had previously been inserted into inverted Durham tubes, then covered with gauze or cotton. Sterilize the media using an autoclave at a temperature of 121 ℃ and a pressure of 1 atom for 20 minutes.

Media lactose broth single strength (LBSS)

We weighed 1.625 gr of LBSS, dissolved it in an Erlenmeyer flask with 125 ml of distilled water, pipetted 10 ml of LBSS, and put it in 3 different test tubes. Then, the media was put in an inverted Durham tube and covered with gauze or cotton. We Sterilized the media using an autoclave at 121 ℃ and a pressure of 1 atom for approximately 1 hour.

pH Working Procedure (SNI 06 6989.11-2004)

Place a water sample whose pH will be measured in a container. Turn on the pH meter and insert the probe into the water sample. Wait until the pH reading is stable and record the pH value displayed on the screen. Make sure the pH meter is calibrated before use. The working principle of a pH meter involves a glass electrode and a measuring instrument.

Temperature work procedures (SNI 23-2005)

Dip the thermometer into the tested sample and leave it for 2 to 5 minutes until the value stabilizes. Record the thermometer's results.

Results and Discussion

The research was conducted in Darmaji Village, Central Lombok Regency, West Nusa Tenggara. This village is one of the villages that has successfully developed a tourist village, with a population of 3072 families or 9639 people. Some residents make their living as farmers. The research location is in Iwan Hamlet, Darmaji Village, Kopang District. Upstream samples were taken with coordinates 116.340687°, middle samples with coordinates 116.339713°, and downstream samples with coordinates 116.3333°.

Table 1. Iwan River Water Quality

No	Parameter	Re			Unit	PP RI NO.22 TH.2021
		Upstream	Middle	Downstream	-	Class 4
1	TSS	0.724	1.574	1,68	mg/L	400
2	Temperature	26.8	26.7	26.8		
3	pH	7	6	7		6-9
4	BOD	0.5	1.1	0.5	mg/L	12
5	COD	8	4	12	mg/L	80
6	Oil and Fat	1.518	0.066	0.108	mg/L	10
7	Total Coliforms	24000	930	230	MPN/ml	10.000

Based on Table 1 above, the results of testing the Iwan River water in Darmaji Village, Central Lombok Regency, the results of the TSS levels obtained after testing were 0.724mg/L in the upstream sample, while in the Middle sample, it was 1.574mg/L and in the Downstream sample it was 1.68mg. /L with a quality standard of 40mg/L Referring to Government Regulation Number 22 of 2021 concerning class IV river water quality standards, the Temperature in upstream samples is 26.8 in the middle 26.7 and downstream samples 26.8. Meanwhile, the results of testing pH levels for upstream samples are 7 for Middle 6 and downstream 7 samples with class IV quality standards, namely 6-9. The concentration of COD levels in upstream samples is 8 mg/L, in middle samples 4 mg/L and for downstream samples, it is 12 mg/L, while the quality standard in PP number 22 of 2021 is 80 mg/l for class IV. The results for the BOD level in the upstream sample are 0.5 mg/L, in the middle sample 1.1 mg/L and in the downstream sample it is 0.5 mg/l, and the quality standard for BOD parameters for class IV is 12 mg/L. The result for the oil and fat content concentration in the upstream sample was 1.518 mg/L. The middle sample was 0.066, and the downstream sample was 0.108 mg/L with a quality standard in class 3 of 1 mg/L. The concentration of Total Coliform levels is found in upstream samples with a value of 24,000 MPN/ml, in middle samples 930 MPN/ml and for downstream samples with a value of 230 MPN/ml, and the quality standard in PP 22 of 2021 for class 3 is 1,000 MPN/ml.

TSS

TSS is the weight in milligrams per litre (mg/l) of dry sludge in wastewater after filtering with a 0.45-micron membrane. The results of the laboratory tests showed that the middle upstream and downstream river-water samples had different results. The measurement results in the upstream river sample were 0.724 mg/L, while in the middle sample, it was 1.574 mg/L and in the downstream sample, 1.68 mg/L. This river water sample was declared below the quality standards of Government Regulation 22 of 2021. 4 regarding river water quality standards because the maximum limit for TSS levels is 400 mg/l. There are low TSS values in the upstream and downstream samples, while for the middle samples, there are high or increasing values. What causes the middle samples to rise is the large amount of pollutants in the river, which causes the TSS levels to be high, but it is still safe because it is still in the river below quality standards.

Temperature

The laboratory test results of the three samples are the upstream sample with a value of 26.8, the middle sample is 26.7, and the downstream sample is 26.8. An increase in temperature causes an increase in oxygen consumption, but on the other hand, it also decreases oxygen in the water [7]. An increase in temperature. This results in decreased dissolved oxygen, and the speed of chemical reactions increases so that living things in it die [8].

pH

pH is an essential parameter in water quality analysis because it influences biological and chemical processes [9]. pH is a value that produces hydrogen ion activity in water, such as acidic, basic or neutral. For pH 7 is the middle boundary between acid and alkaline (neutral), the lower the pH of a water medium, the more acidic it is, and vice versa; the higher the pH value of a water medium, the more alkaline it is. The results of pH measurements on water quality at the three sample points showed that sample 1 was 7, sample 2 was 6 and sample 3 was 7. From the three sample points, the pH of the Iwan River water in Darmaji village was still within the safe range as a source of clean water based on health quality standards. environment for water media for agricultural purposes and washing, referring to Government Regulation no. 22 of 2021 concerning Standard Standards for Class 4 (four) water quality, which is water that can be used to irrigate crops and/or other purposes that require the same water quality as the intended use. Based on research results, the white elephant tributary that flows in the middle of an urban environment has a good pH value and is in accordance with the quality standards of PP No. 22 of 2021, so the use of river water is declared safe for irrigation facilities [10].

BOD

BOD is another important parameter for determining water quality, especially river water [11]. BOD shows the amount of organic material in water that can be degraded biologically [12]. BOD is the amount of biological oxygen in ppm or mg/L that is needed to decompose organic matter by bacteria so that the waste water becomes clear again. Bacteria will use oxygen to oxidize these organic objects. BOD units are needed to measure the need for oxygen, and with this BOD, the pollution load is determined. The higher the BOD number, the lower the water quality will be [13].

The laboratory test results of upstream, middle and downstream river water samples show different results, where the upstream river has a result of 0.5 mg/l, the middle river has a result of 1.1 mg/L, and the downstream has a result of 0.5 from PP Number 22 In 2021, the class 4 quality standard for BOD is 12 mg/l, so that the Iwan River water in Darmaji Village, Central Lombok Regency in the upstream, middle and downstream samples is declared safe because it is still below the quality standard.

COD

COD is the amount of oxygen needed to oxidize organic substances in a water sample. COD is a measure of water pollution by organic substances that can naturally be oxidized through microbiological processes, resulting in reduced dissolved oxygen in the water. in water. COD is the amount of oxygen in ppm or milligrams per litre (mg/L) needed under special conditions to decompose organic matter chemically [11].

From the results of laboratory tests obtained on upstream, middle and downstream river samples polluted by different human activities, the value for the upstream river was 8 mg/L. In comparison, for the middle river samples, it was 4 mg/L, and for the downstream river samples, it was 12 mg/L. In PP Number 22 of 2021 class 4, there is a river water quality standard for the COD parameter, namely 80mg/l, while in the Iwan River water in Darmaji Village, Central Lombok Regency, the upstream, middle and downstream samples from laboratory tests are stated to be still below the quality standard.

Oil and Fat

Oil and fat are the main components of food and can also be found in water. Sampling river water with hexane can determine the oil and fat content. Oils and Fats form esters and alcohols. Fat is classified as a permanent organic material and is not easily broken down by bacteria [14]. The formation of a water-in-oil emulsion will create a layer that covers the surface of the water and can be detrimental because the penetration of sunlight into the water is reduced, and the oil layer inhibits the uptake of oxygen from the air [15].

Laboratory test results for upstream, middle and downstream rivers show different results. The results of measuring oil and fat content in the upstream samples showed a value of 1.518 mg/L, while in the laboratory results for the Central samples, there was a value of 0.066 mg/L. In comparison, it was 0.108 mg/L for the downstream samples. For PP Number 22 of 2021 class 4 concerning pollution quality standards, River water has a quality standard of 10 mg/l, so the Iwan River water in Darmaji Village, Central Lombok Regency, in the upstream, middle and downstream samples is said to be still safe because it is still below the quality standard. The results of this research are the same as the results carried out, namely 1 - < 1 however if fatty oil continues to be added to water bodies (rivers), it can reduce the penetration of light and oxygen into the water, thereby inhibiting the rate of natural purification [16].

The source of the fatty oil in the Iwan River is household waste from the people of Darmaji Village, who throw it directly into water bodies. Darmaji Village does not yet have an IPAL to process domestic liquid waste, and there is a lack of education regarding the impact of liquid waste on the environment.

Total Coliforms

The analysis results of upstream, middle and downstream river water show an increase in the upstream samples and a decrease in the middle and downstream samples, where the value for the upstream samples was 24,000 MPN/ml. In contrast, for the middle samples, it was 930 MPN/ml, and for the downstream samples, 230 MPH/ml, the Total Coliform quality standard in PP Number 22 of 2021 class 4 is 10.000, so the upstream sample is stated to be above the quality standard. The people of Darmaji Village are still defecating and throwing organic waste directly into the river. In contrast, in the middle and downstream samples, it was stated that they were still safe below the quality standards because they were far from places where the community directly disposed of waste.

Iwan River Water Quality Status with Pollution Index

The results of calculating the water pollution index for the Iwan River in Darmaji Village are as follows:

Table 2. Iwan River Water Quality Status with Pollution Index

Parameter	Result			Unit
	Upstream	Middle	Downstream	
TSS	0.724	1.574	1.68	Mg/L
Temperature	26.8	26.7	26.8	
pH	7	6	7	
BOD	0.5	1.1	0,5	Mg/L
COD	8	4	12	Mg/L
Fat and Oil	1.518	0.066	0.108	Mg/L
Total coliforms	24000	930	230	MPN/ml
Pollution Indeks	Lightly Pollutes	Good	Good	

The Pollution Index Method was used to determine water status based on the Decree of the Minister of Environment Number 115 of 2003 concerning the Guidelines for Determining Water Quality Status. Water quality can be determined by measuring and calculating physical, chemical and biological parameters. Parameter values must be interrelated and cannot be separated to determine water quality status. So, all values resulting from parameter calculations must be transformed into a single, representative value. The single value of the water pollution index is used to evaluate the pollution level in the aquatic environment. The water pollution index method is one way to determine water quality status by comparing predetermined quality standards. This method can be used to describe the condition of water, whether it is polluted or not.

Based on the IP calculation results in sample 1, the result was 2.12 (because it was close to the disposal of pesticide products from agricultural residues), sample 2 was 0.89 (positioned in the middle of the river, far from rice fields so that dilution of the Iwan river water occurred) and Sample 3 of 0.58 (downstream position of the river, because it is far from rice fields and residents so that dilution of the Iwan river water occurs). Based on the Decree of the State Minister for the Environment Number 115 of 2003 concerning Water Quality Status, the condition of the water in the Iwan River is included in the quality status of Lightly Polluted.

Conclusion

Based on the results of the research that has been carried out, it can be concluded that the water quality of the Iwan River is still below quality standards, so it is still safe for washing and agricultural activities; namely in the upstream sample, there was a TSS result of 0.724 mg/L, a temperature of 26.8, pH 7, BOD 0.5 mg/L, COD 8 mg/L, oil and fat 1,518 mg/L and total coliform 24,000 MPN/ml. In comparison, the middle sample had TSS results of 1,574 mg/L, temperature 26.7, pH 6, BOD 1.1 mg/L, COD 4 mg/L, oil and fat 0.066 mg/L, and total coliform 930 MPN/ml. In downstream samples, there were TSS results of 1.68 mg/L, temperature 26.8, pH 7, BOD 0.5 mg/ L, COD 12 mg/ L, oil and fat 0.108 mg/ L and total Coliform 230 MPN/ml. Based on the IP calculation, the water in the Iwan River is declared polluted, whereas the IP condition upstream is 2.12. At the same time, in the middle sample, it decreases to 0.89. In the downstream sample, it decreases to 0.58 with the category being lightly polluted based on the Decree of the State Minister for the Environment Number 115 2003 concerning Water Quality Status, Pollution Index value with an IP score of 1.1-5.0. In the water quality classification, it is said to be safe because it is in the lightly polluted range.

Author's Contribution

Yohahes Umbu: Contributed to Taking water samples from the Iwan River in Darmaji Village, Kopang District, Central Lombok Regency. Tina Melinda: Contributed to Compiling research results and looking for the latest journals to support articles. Muhamad Majdi: Contributed to Managing research permits at the location and laboratory for sample examination.

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