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Analysis of Water Quality in the Aik Nyet Natural Tourist Attraction, Buwun Sejati Village, West Lombok Regency

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ABSTRACT

Water quality is a condition that indicates the quality of water in a body of water, water sources and river basins. Water quality requires testing and analysis by considering its physical conditions, chemical content, and biology. Aik Nyet natural tourist attraction is one of the famous water sources in the Lombok area, West Nusa Tenggara. Bathing and swimming activities in this area can potentially cause pollution of water quality, but until now there has been no information regarding the quality of water in this natural tourist attraction. Therefore, this study aims to analyze the quality of water in the Aik Nyet Natural Tourist Attraction, Sesaot Resort, KPHL Rinjani Barat, Lombok. Water quality is assessed using Class Two water quality standards in accordance with the Decree of the Minister of Environment No. 115 of 2003, alongside identification using the US Environmental Protection Agency (US-EPA) system. Sampling was performed at three distinct points to analyze physical, chemical, and biological parameters. The results of the analysis showed that several parameters such as temperature, pH, ammonia levels, and the number of E. coli bacteria met the quality standards, while the chemical parameters DO and BOD showed mild pollution

INTRODUCTION

Aik Nyet Natural Tourist Attraction located on Lombok Island, is one of the tourist destinations that is in great demand by both local and foreign tourists. Administratively, it is located in Buwun Sejati Village, Narmada District, West Lombok Regency, but geographically, its location is in the Sesaot Resort protected forest area, KPHL West Rinjani Barat. This natural tourism has four pools whose water comes from natural springs that flow through a small river, then dammed to form a bathing pool. The natural conditions and the beauty of the surrounding environment make this natural tourism a favorite place for visitors who want to bath and swim.

Bathing and swimming activities in this area can potentially cause pollution to water quality. As explained by Latuconsina (2020), humans often use water resources, such as rivers, for various purposes including drinking, agriculture, fisheries, industry, and transportation. Aquatic ecosystems, especially rivers, are very important in supporting human life. However, this ecosystem is increasingly threatened by increasing human activity, where population growth can also increase the risk of pollution through the pollutants produced.

Although the Aik Nyet Natural Tourism Attraction is a popular recreation spot, until now there has been no research that has studied in depth the water quality at the location. This is important to anticipate considering the potential for pollution that can have a negative impact, not only on the environment but also on the health of visitors. Water quality is an important indicator that shows the level of pollution of a water source, as well as its compliance with the quality standards set by the government. According to Arsyad (2000), water quality is related to the level of suitability of water

for use in meeting human needs, such as irrigating plants, giving livestock water, and direct needs such as drinking, bathing, and washing.

The objective of this study is to analyze the water quality at the Aik Nyet Natural Tourist Attraction, located in Buwun Sejati Village, West Lombok Regency. The analysis will be conducted using Class Two water quality standards as per the Decree of the Minister of Environment No. 115 of 2003. Additionally, the study will employ the United States Environmental Protection Agency (US-EPA) system to identify potential sources of pollution. The findings of this research are expected to contribute significantly to environmental conservation efforts and to ensure that Aik Nyet remains a safe and healthy destination for all visitors.

METHODS

A. Time and Location of Research

This research was conducted over the period from March to April 2023 at the Aik Nyet Natural Tourist Attraction, located within the Buwun Sejati Village, West Lombok regency (8°31'59.8"S, 116°14'21.1"E). The study employed a descriptive method with a quantitative approach to assess the water quality at the site. The location and specific research stations were selected using a purposive sampling technique, ensuring that the sampling points were representative of the areas with the most visitor activity, particularly where bathing and swimming occurred. Data collection and water sampling were performed at a single location with three distinct points, each situated in areas where visitors frequently bathe and swim. Below is a sketch of the water sampling points at the Aik Nyet Natural Tourist Attraction.

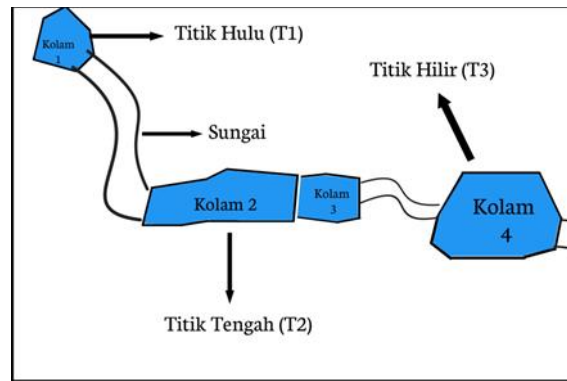


Figure 1. Sketch of Sampling Location

B. Sampling Technique

Water sampling was conducted at three designated points based on predetermined parameters, which included physical parameters (temperature), chemical parameters (pH, Dissolved Oxygen (DO), Biological Oxygen Demand (BOD), and Ammonia), and biological parameters (*E. coli*). Data collection was performed twice daily over a 14-day period, both before and during the presence of visitors, to capture any variations in water quality. Temperature and pH measurements were conducted on-site following the guidelines set forth in SNI 06-6989.23-2005. The remaining parameters were analyzed in the laboratory using water samples collected from the three designated points, with samples taken in both the morning and afternoon.

For laboratory testing, water samples were collected using two-liter sample bottles at each sampling station. The samples were carefully labeled with appropriate identifiers to prevent any mix-up during analysis. The labeled water samples were then stored in a coolbox to maintain their integrity during transportation and were subsequently sent to the Mataram Construction Material Testing Center for detailed analysis.

C. Sample Testing

Laboratory testing was conducted for DO, BOD, Ammonia, and *E.coli* parameters at the Mataram Construction Material Testing Center Laboratory based on SNI-6989-73-2019 and APHA:2017.

D. Data Analysis

The test result data was calculated and analyzed using the Storet method, which involves comparing the water quality against the Class 2 water quality

standards as outlined in PP No. 22 of 2021 concerning the Determination of Water Quality Status. The determination of water quality status was conducted using the "US-EPA (Environmental Protection Agency)" classification system, which categorizes water quality into four classes:

1. Class A: Very Good - Score = 0 (Meets quality standards)
2. Class B: Good - Score = -1 to -10 (Light pollution)
3. Class C: Moderate - Score = -11 to -30 (Moderate pollution)
4. Class D: Poor - Score \geq -30 (Heavily polluted)

The process for determining water quality status follows the guidelines specified in the Ministerial Decree No. 115 of 2003 and includes the following steps:

1. Data Collection: Collect water quality data periodically to develop time series data, which provides a comprehensive overview of water quality trends over time.
2. Comparison with Standards: Compare the measurement data for each water quality parameter against the standard quality values corresponding to the relevant water class.
3. Scoring for Compliance: If the measurement results meet the water quality standards (i.e., the measurement results are less than the quality standards), a score of 0 is assigned.
4. Scoring for Non-Compliance: If the measurement results exceed the water quality standards (i.e., the measurement results are greater than the quality standards), a specific score is assigned based on the degree of deviation from the standards

Table 1. Determination of the Value System for Determining Water Pollution Status

Number of Examples	Mark	Parameter		
		Physics	Chemistry	Biology
< 10	Maximum	-1	-2	-3
	Minimum	-1	-2	-3
	Average	-3	-6	-9
> 10	Maximum	-2	-4	-6
	Minimum	-2	-4	-6
	Average	-6	-12	-18

5. The negative sum of all parameters is calculated, and the quality status is determined from the total score obtained using the value system.

chemical, and biological. These parameters serve as essential indicators in determining the overall quality of water in a given area, classifying it as either good or poor. To ascertain whether the water quality meets established standards, laboratory testing is required. The average results of the water quality tests conducted at three points within the Aik Nyet bathing area are presented in Table 2.

RESULTS AND DISCUSSION

Water Quality Test Results

Water quality is assessed by considering a minimum of three key parameters: physical,

Table 2. Water Quality Test Results

No	Parameter	T1		T2		T3	
		Average	SD	Average	SD	Average	SD
1	Physics Temperature (°C)	21.27	0.86	21.34	0.82	21.12	0.28
2	Chemistry pH	6.97	0.31	6.94	0.50	6.97	0.60
	DO (mg/L)	4.80	0.09	4.90	0.07	4.59	0.44
	BOD (mg/L)	5.30	0.69	5.09	0.66	5.06	0.19
	Amonia (mg/L)	0.06	0.00	0.11	0.10	0.08	0.04
3	Biology <i>E.coli</i> (MPN/100 MI)	38.00	39.89	143.33	121.40	595.00	346.48

Description: DO, Dissolved Oxygen; BOD, Biological Oxygen Demand; SD, Standard Deviation

Based on Table 2, the physical parameters in the form of temperature have average values at the upstream point (T1), midpoint (T2), and downstream point (T3) respectively of 21.27 °C, 21.34 °C and 21.12 °C. The highest average temperature value is at the midpoint (T2), and the lowest average temperature value is at the downstream point (T3). These temperature values are still classified as normal temperature values and do not indicate any pollution. In accordance with what was conveyed by Yusuf, (2012) who stated that good water has a

normal temperature ranging from 8 °C to 27 °C (room temperature).

The chemical parameters of water quality include pH, Dissolved Oxygen (DO), Biological Oxygen Demand (BOD), and ammonia levels. The pH value is a crucial factor in determining the acidity or alkalinity of water, which in turn influences the toxicity of chemical compounds, biochemical processes in water, and the metabolic processes of aquatic organisms (Anggraini and Syahwanti, 2022). The average pH values recorded at the upstream (T1), midpoint (T2), and downstream (T3) sampling

points were 6.97, 6.94, and 6.97, respectively (Table 2). According to the Class 2 quality standards outlined in Government Regulation No. 22 of 2021, a pH value between 6 and 9 is considered acceptable. The pH levels measured at Aik Nyet indicate that the water is within this range, suggesting that the water is neither too acidic nor too alkaline (Verawati, 2016).

Another key chemical parameter is Dissolved Oxygen (DO). The average DO values recorded at the upstream point (T1), midpoint (T2), and downstream point (T3) were 4.80 mg/L, 4.90 mg/L, and 4.59 mg/L, respectively. Notably, the highest average DO value was observed at the midpoint (T2) at 4.90 mg/L, while the lowest was at the downstream point (T3) at 4.59 mg/L. According to the Class 2 water quality standards specified in Government Regulation No. 22 of 2021, a DO value of 4 mg/L is considered the minimum acceptable threshold. The measured DO values at all points exceed this standard, indicating that the water quality is still good. This is because higher dissolved oxygen content generally reflects better water conditions (Trofisa, 2011). In contrast to DO, the Biological Oxygen Demand (BOD) values indicate the level of organic pollution in the water, with higher BOD values suggesting greater contamination by organic matter (Djoharam et al., 2018). The average BOD values at the upstream point (T1), midpoint (T2), and downstream point (T3) were 5.30 mg/L, 5.09 mg/L, and 5.06 mg/L, respectively. The highest BOD value was recorded at the upstream point (T1) at 5.30 mg/L, while the lowest was at the downstream point (T3) at 5.06 mg/L. According to the Class 2 quality standards, a BOD value of 3 mg/L is considered acceptable. The recorded BOD values at Aik Nyet bathing area indicate a higher level of organic pollution, suggesting that the water quality is compromised in this regard.

Ammonia is a colorless liquid with a sharp odor and high solubility in water. According to the measurements reported in Table 1, the average ammonia concentrations at the upstream point (T1), midpoint (T2), and downstream point (T3) were 0.06 mg/L, 0.11 mg/L, and 0.08 mg/L, respectively. The Class 2 quality standard set by Government Regulation No. 22 of 2021 stipulates that ammonia levels should not exceed 0.2 mg/L. The measured ammonia concentrations at Aik Nyet bathing area are well within this standard. However, excessive ammonia exposure can be harmful to humans if it exceeds 100 mg/kg per day, potentially affecting metabolic processes and altering the body's acid-base balance (Fawell et al., 1996).

Table 2 also provides data on the biological parameter of *E. coli* bacteria. The average *E. coli* concentrations at the upstream point (T1), midpoint (T2), and downstream point (T3) were 38.00 MPN/100 mL, 143.33 MPN/100 mL, and 595.00 MPN/100 mL, respectively. *E. coli* are microorganisms typically found in human and animal waste, as well as in runoff from agricultural sources and other forms of contamination. The presence of *E. coli* in water suggests potential contamination by other harmful pathogens, such as those causing typhoid, cholera, dysentery, and other serious diseases. These coliform bacteria serve as indicators of fecal contamination and overall water quality, highlighting the need for vigilance in water safety and sanitation.

Water Quality Analysis Using the Storet Method

The STORET method is a method used to analyze water quality by comparing the results of measurement values with the standard quality values set by the government. The results of the water quality analysis at the Aik Nyet Natural Tourist Attraction using the STORET method are presented in Table 3.

Table 3. Results of Water Quality Analysis Using the STORET Method

No	Parameter	Point	Storet Score					Information	
			Min	Max	Average	Total	Standard *)		
1	Physics	Suhu	1	0	0	0	0	Dev 3	Fulfil
			2	0	0	0	0	Dev 3	Fulfil
			3	0	0	0	0	Dev 3	Fulfil
2	Chemistry	pH	1	0	0	0	0	-6	Fulfil
			2	0	0	0	0	-6	Fulfil
			3	0	0	0	0	-6	Fulfil
		DO	1	-2	-2	-6	-10	4	Lightly contaminated
			2	-2	-2	-6	-10	4	Lightly contaminated
			3	-2	-2	-6	-10	4	Lightly contaminated
		BOD	1	-2	-2	-6	-10	3	Lightly contaminated
			2	-2	-2	-6	-10	3	Lightly contaminated
			3	-2	-2	-6	-10	3	Lightly contaminated
		Amonia	1	0	0	0	0	0.2	Fulfil
			2	-2	0	-6	-8	0.2	Lightly contaminated
			3	0	0	0	0	0.2	Fulfil
3	Biology	<i>E.coli</i>	1	0	0	0	0	5000	Fulfil
			2	0	0	0	0	5000	Fulfil
			3	0	0	0	0	5000	Fulfil

Description: DO, Dissolved Oxygen; BOD, Biological Oxygen Demand; Min, Minimum Value of All Measurement Results; Max, Maximum Value of All Measurement Days. The *) Sign Indicates the Class 2 Water Quality Standards Based on the Decree of the Minister of State for the Environment No. 115 of 2003 Concerning Determination of Water Quality Status.

Based on Table 3, several parameters tested such as temperature, pH, ammonia levels, and the presence of *E. coli* bacteria meet the Class 2 water quality standards intended for water recreation, freshwater fish farming, livestock, irrigating plants, and other uses. Meanwhile, chemical parameters such as DO and BOD have not met the standards. The results of the storet analysis in Table 3 show the total DO and BOD score values (T1), (T2) and (T3) respectively are -10, -10, and -10. According to the Decree of the Minister of Environment No. 15 of 2003, which outlines the method for determining water quality status using the "US-EPA" system, a score of -10 is classified as Class B. This classification indicates that the water quality is good but exhibits light pollution.

Dissolved Oxygen (DO) is a crucial indicator of water quality, as it is essential for the

survival of aquatic organisms. The concentration of DO in water can fluctuate due to various factors, including pollution levels. Typically, higher DO levels are associated with better water quality, whereas lower DO concentrations suggest increased pollution. In polluted waters, DO levels often decrease due to the elevated oxygen demand from decomposing organic matter and other pollutants. This relationship underscores DO as an important measure of the overall health of aquatic ecosystems and the degree of pollution affecting water bodies. Wardhana (2004) elucidates that in polluted waters, the oxygen content is generally very low because microorganisms consuming organic waste deplete the dissolved oxygen, converting it into volatile forms. Meanwhile, the Biochemical Oxygen Demand (BOD) value, as explained by Agatha and Wulandari (2018), does not directly measure the

quantity of organic material present. Instead, it measures the amount of dissolved oxygen required to decompose organic material biologically. BOD, therefore, serves as an indirect measure of the organic pollution level, reflecting the impact of organic waste on the oxygen levels in the water.

CONCLUSION

Based on the results of the analysis, the water quality at the Aik Nyet Natural Tourist Attraction generally complies with the Class 2 water quality standards for several key parameters, including temperature, pH, ammonia levels, and the presence of *E. coli* bacteria. However, the findings indicate mild pollution in the chemical parameters, specifically Dissolved Oxygen (DO) and Biological Oxygen Demand (BOD). These results suggest that while the water quality is largely within acceptable limits, ongoing monitoring and corrective measures are necessary to ensure that the water remains safe and healthy for visitors.

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