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Analysis of the Quality of the Anahoni River Based on Physical and Biological Parameters

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Abstract

This study aimed to analyze the quality of the waters of the Anahoni River due to gold mining by covering physical and biological parameters. Physical parameters included color, temperature, and Total Suspended Solids (TSS). The color of the waters of the Anahoni and Waelata Rivers at all research stations, ranged from 1 to 5 NTU, which is still below the maximum limit. The water temperature values at the research stations varied between 26.4 – 34.40C. The measured TSS values at all research stations ranged from 0.011 to 0.018, indicating that the TSS value was below the quality standard value. Biological parameters of the coliform bacteria. The results of using fecal coliform bacteria varied at each research station with a range of 0 – 68 MPN/100 mL

Keywords: *brown algae, in silico, insulin resistance, phlorotannins, PTP 1B*

1. INTRODUCTION

For humans, water plays a very large role not only in meeting biological needs, but also in sustaining various forms of daily activities such as washing, cooking, industrial needs, tourism, and others (Wiryono, 2013). It cannot be denied that the current decline in water quality is the result of human activities that exploit the environment excessively. The pattern of people's lives that pays little attention to environmental aspects, such as the careless disposal of garbage and other hazardous waste, has had a negative impact, both directly and indirectly, on the natural environment, including water sources (Sulistyorini, et al., 2016).

The current problem that occurs in gold mining in the Buru district, especially on the Anahoni River, is the change in the color of the river water, which becomes blue. This condition needs to be a concern, because the changing color of river water not only reduces the quality of river water, but also indicates the presence of dangerous chemical compounds used by gold miners on a large scale, which can harm the environment and humans. Moreover, this condition is exacerbated by the rainy season that occurs at the mining site, which can cause hazardous waste to overflow not only in the Anahoni River, but also in several other places such as agricultural lands and settlements of local residents. In general, water quality is a physical, chemical, and biological factor that greatly influences the life of the biota in an ecosystem. including for cultivation purposes

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(Kordi and Tancung, 2005). Sulistyorini, et al. (2016) stated that the water quality level required for each particular activity has different quality standards. In the context of river water quality and environmental management, the water quality status must be quantified and expressed by a single water quality index that can be linked to an operational strategy for ecologically sustainable river management (Bovee et al, 1988 and Parparove et al, 2006 in Saraswati et al, 2014). Therefore, a test must be conducted to determine the conformity of the quality with its designation. Water quality can be analyzed using physical, chemical, and biological parameters. Water quality management and water pollution control. Obtainable biological parameters were used to determine the water quality as total coliform bacteria. Pratiwi et al. (2019) stated that the quality of river water can be identified using microbiological indicators such as viruses or bacteria. Confirm bacteria can be used as water indicators.

2. METHOD

Data Types and Sources

This research included field and Laboratory Research (laboratory research). Field research (field research), namely, research conducted systematically by collecting existing data in the field using qualitative methods. While laboratory research (Laboratory Research) is carried out in a certain place (laboratory).

Method of collecting data

The research design stage includes determining the research objectives and approaches. The important thing to do at this stage is to determine the sampling and research locations. The next step after the stage is mature, is to start gathering the elements used, such as capital, computers, human resources, and other required equipment.

In the second stage, all research resources, both facilities/tools and research personnel, are synergized to carry out research according to the targets that have been previously designed, by synchronizing it with the research methods for each type of sample.

In the third stage, the data collection method is a follow-up from the results of field research, where all the data that has been taken is then collected and classified according to the planned object.

The fourth stage was laboratory analysis. At this stage, all collected sample data then tested/analyzed in the laboratory.

Analysis Method

All collected samples were tested and analyzed in the laboratory. Total suspended solids (TSS), color, and odor were analyzed at the Maluku Provincial Health Office Laboratory. The pH was measured in situ (in the field).

3. RESULTS AND DISCUSSION

Water Physical Parameters

The physical parameters of the water samples measured in this study were color, temperature, and TSS.

1. Color

The color of water is caused by the presence of chemicals or microorganisms (plankton) dissolved in the water. The color caused by chemicals is called apparent color, which is harmful to the human body. The color caused by microorganisms is called true color, which is not harmful to health. The results of measuring the color of the waters are shown in Table 1.

Table 1. Water Color Measurement Results

Location Sampling	Station Observation	Sample Code	Color (NTU)	Quality standards
Upper Anahoni River (mining site)	St. 1	AIAD	1	100 NTUs *
	St. 2	AIIBD	1	
Middle of the Anahoni River (mining site)	St. 3	AIIICD	5	
	St. 4	AIVDD	1	
The mouth of the Anahoni River	St. 5	AVED	1	
	St. 6	AVFD	5	
	St. 7	AVIIGD	5	
	St. 8	AVIIIGD	5	
Waelata River	St. 9	WIAD	1	
	St. 10	WIIBD	1	

Information:* Class III water quality standards based on PP R1 No. 22 of 2021 concerning the Implementation of Environmental Protection and Management.

The results of measuring the color of the waters of the Anahoni River and Waelata River at all research stations ranged from 1 to 5 NTU, which is still below the maximum limit based on Class III water quality standards based on PP R1 No. 22 of 2021 concerning the Implementation of Environmental Protection and Management. The quality standard level is 100 NTU. Thus, the color of the water in the Anahoni River can still be used for the cultivation of freshwater fish, animal husbandry, water for irrigating plants, and/or other uses that require the same water quality as those used.

2. Color

Temperature affects the solubility of oxygen, metabolic processes, and chemical reactions in water. The results of the water temperature measurements are listed in Table 2.

Table 2. Results of Water Temperature Measurements

Location Sampling	Station Observation	Sample Code	Temperature (0C)	Quality standards
Upper Anahoni River (mining site)	St. 1	AIAD	28,8	Air temperature ± 3* (Deviation 3/22 – 280C)
	St. 2	AIIBD	32,6	
Middle of the Anahoni River (mining site)	St. 3	AIIICD	34,4	
	St. 4	AIVDD	31,7	
The mouth of the Anahoni River	St. 5	AVED	26,7	
	St. 6	AVFD	26,4	
	St. 7	AVIIGD	26,8	
	St. 8	AVIIIHD	26,9	
Waelata River estuary	St. 9	WIAD	28,2	
	St. 0	WIIBD	28,2	

Information: * Class III water quality standards based on PP R1 No. 22 of 2021 concerning Implementation of Environmental Protection and Management.

Based on Table 1, the temperature of the waters at the research stations varies in the range of 26.4 – 34.40C. This temperature value, when compared with the Class III water quality standards according to PP No. 22 in 2021, the water temperature at four stations on the Anahoni River (St. I, St. II, St. III, St. IV) and two stations on the Waelata River (VIII and St. IX) passed the quality standard. The standard for water quality in class III, namely normal water temperature, has a deviation of three at ambient air temperature. Low water temperatures dominate the estuary area of the river. This is because the estuary area is covered by many mangrove plant communities, which causes a lack of intensity of incoming sunlight. This was related to the geographical conditions of the region. In addition, differences in water temperature also occur owing to variations in measurement time. In line with Agustiningsih (2012), the high and low temperatures in river water can be affected by the surrounding air temperature and the intensity of exposure to sunlight entering the water body. The intensity of sunlight can be affected by cloud cover, seasonal changes, and time of day. The higher the intensity of sunlight hitting a body of water, the higher is the temperature of the river water. Exposure to sunlight is the main factor that has a major effect on temperature changes in water bodies (Sari & Wijaya, 2019). The high and low temperatures in river water can be influenced by the surrounding air temperature and the intensity of exposure to sunlight entering the water body. Intensity of sunlight can be affected by cloud cover, seasonal changes, and time of day. The higher the intensity of sunlight hitting a body of water, the higher is the temperature of the river water. Exposure to sunlight is the main factor that has a major effect on temperature changes in water bodies (Sari & Wijaya, 2019). The high and low temperatures in river water can be influenced by the surrounding air temperature and the intensity of exposure to sunlight entering the water body. The intensity of sunlight can be affected by cloud cover, seasonal changes, and time of day. The higher the intensity of sunlight hitting a body of water, the higher is the temperature of the river water. Exposure to sunlight is the main factor that has a major effect on temperature changes in water bodies (Sari & Wijaya, 2019).

3. TSS (Total Suspended Solids)

TSS is a solid substance that can reduce oxygen in water. TSS content was closely related to the brightness of the water. The presence of suspended solids can block the penetration of light into the water, so the relationship between TSS and the brightness of the water is inversely proportional (Gazali et al, 2013). The results of the TSS measurements are presented in Table 3.

Table 3. Results of Water TSS Measurements

Location Sampling	Station Observation	Sample Code	TDS (mg/L)	Quality standards	
Upper Anahoni River (mining site)	St. 1	AIAD	0.011	100 mg/l *	200 mg/l **
	St. 2	AIIBD	0.008		
Middle of the Anahoni River (mining site)	St. 3	AIIICD	0.018		
	St. 4	AIVDD	0.016		
The mouth of the Anahoni River	St. 5	AVED	0.014		
	St. 6	AVFD	0.012		
	St. 7	AVIIGD	0.011		
	St. 8	AVIIIHD	0.016		
Waelata River	St. 9	WIAD	0.012		
	St. 10	WIIBD	0.014		

Information:* Class III water quality standards based on PP R1 No. 22 of 2021 concerning the Implementation of Environmental Protection and Management.

** = Ministry of Environment Decree No. 202 of 2004 concerning Wastewater Quality Standards for Gold and or Copper Ore Mining Businesses and or Activities.

The measured water TSS values at all research stations based on Table 3 ranged from 0.011 to 0.018, indicating that the TSS value was below the quality standard value based on the Class III water quality standard according to PP R1 No. 22 of 2021 concerning the Implementation of Protection and quality standards based on Minister of Environment Decree No. 202 of 2004 concerning Wastewater Quality Standards for Gold and Copper Ore Mining Businesses and/or Activities. TSS content is influenced by domestic waste around rivers.

As shown in Table 3, the concentration of TSS in the water at all research stations was not significantly different. This is because the research station is connected to gold mining in Anahoni, both in the extraction of gold material and its processing.

Considering that the sampling station area has gold mining activities with high dredging and processing activities for gold-containing soil materials, the TSS concentration should be high. However, the obtained measurement results were poor. The TSS solids can precipitate immediately because they are not soluble in water. Several materials belonging to suspended particles are settled, floating, and colloidal. The contents of suspended solids include organic and inorganic materials (Supriyantini et al., 2017). Inorganic materials are in the form of clay and sand, while organic materials are in the

form of plant remains, animal waste, human waste, sludge, industrial waste, and other biological solids, such as algae cells, and bacteria.

Aquatic Biological Parameters

The aquatic biological parameters measured in this study were total coliform. Coliform bacteria are a group of bacteria that are used as an indicator of water quality in the presence of microbial contamination, usually through dirt whose conditions are not good for water quality. The results of the Total Coliform water measurements are shown in Table 4.

Table 4. Measurement Results of Total Coliform in the Waters

Location Sampling	Station Observation	Sample Code	Total. Coli.(MPN/100 ml)	Quality standards
Upper Anahoni River (mining site)	St. 1	AIAD	4,5	10,000 MPN/100 mL *
	St. 2	AIIBD	0	
Middle of the Anahoni River (mining site)	St. 3	AIIICD	0	
	St. 4	AIVDD	4,5	
The mouth of the Anahoni River	St. 5	AVED	0	
	St. 6	AVFD	6,8	
	St. 7	AVIIGD	0	
	St. 8	AVIIIGD	0	
Waelata River	St. 9	WIAD	0	
	St. 10	WIIBD	0	

Information: * = Class III water quality standards based on PP R1 No. 22 of 2021 concerning Implementation of Environmental Protection and Management.

The results of the analysis of the total coliform bacteria at each research station are shown in Table 4. The results showed that fecal coliform bacteria varied at each research station within the range of 0 – 6.8 MPN/100 ml. This total coliform value when compared with the total coliform quality standard based on PP R1 No. 22 of 2021 concerning the Implementation of Environmental Protection and Management for Class III water, where the maximum total coliform value is 10,000 MPN/100 ml, it can be concluded that the total coliform present at all research stations did not pass the quality standard.

Pracoyo (2006) explained that the presence of coliform bacteria in water greatly affects its quality. The fewer bacteria found in the water, the better the quality of the water. Meanwhile, the more bacteria found, the worse the quality of water.

The low abundance of coliform bacteria in water indicates that environmental conditions at the research station have not decreased biologically, because coliform bacteria are indicators of pollution in water (Safitri et al, 2018).

Average Value of Measurement of Physical Parameters and Aquatic Biology

The measurement of the physical and biological parameters of water includes water and sediment. The water measurement at all research stations showed varying values. The measurement of physical parameters in water included color, temperature, and TSS, the results of which are presented in Table 5.

Table 5. Average value of physical parameter measurements

Sample Type	Physical Observation Parameters		
	Color (NTU)	**Temperature (0C)**	**TSS (mg/L)**
River water	2,6	29.07*a	0.0132
Quality standards	100 NTU a	22 – 280C a	100 mg/l 200mg/lb

Information:

* = Not according to Quality Standards.

a = Class III water quality standards based on PP R1 No. 22 of 2021 concerning the Implementation of Environmental Protection and Management.

b = Quality Standards based on PP No. 82 of 2001 concerning Water Quality Management and Water Pollution Control

Table 5 shows that the average value of water color at research stations on the Anahoni River is 2.6 NTU, which is still in accordance with Class III water quality standards based on PP R1 No. 22 of 2021 tconcerning the Implementation of Environmental Protection and Management. Thus

The color of the water in the Anahoni River can still be allocated according to its function.

The temperature parameter has an average value29 of.070C, which has passed the Class III water quality standard based on PP R1 No. 22 of 2021 concerning the Implementation of Environmental

Protection and Management. Gazali (2013) explained that an increase in water temperature can increase the body's metabolism of organisms, including decomposing bacteria, so that the decomposition process of organic matter also increases. Changes in water temperature affect the physical and chemical processes of water, as well as aquatic biota. Fauziah (2012) stated that an increase in water temperature tends to increase the accumulation and toxicity of heavy metals, which occurs due to the increased metabolic rate of aquatic organisms. Happy et al. (2012) stated that rising temperatures will not only increase the metabolism of aquatic biota, but also increase the toxicity of heavy metals in water. The TSS, had an average value0 of.0132 mg/L, which is still in accordance with Class III water quality standards based on PP R1 No. 22 of 2021 concerning the Implementation of Environmental Protection and Management. This TSS value is in line with the color quality of the water, which is still in accordance with quality standards, because a low TTS can reduce water turbidity (Gazali et al, 2013).

4. CONCLUSIONS AND SUGGESTIONS

Based on the results of this study, it can be concluded that the water quality conditions of the Anahoni River due to Unlicensed Gold Mining in the Regency based on physical and biological parameters mostly still meet the established quality standards, so that they can still be allocated according to their functions. Even so, there are several parameters that are not in accordance with the quality standards, namely,: physical parameters in the form of water temperature.

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