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PRELIMINARY MONITORING OF WATER QUALITY AT BANTURUNG VILLAGE, BUKIT BATU DISTRICT, PALANGKA RAYA CITY

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ABSTRACT

Water is a vital necessity for human and living things in general. It is undeniable that the decline in water quality today is the result of human activities that overexploit the environment. People's lifestyles that pay less attention to environmental aspects such as throwing garbage out of place, disposing of hazardous waste, and changing the function of forest areas that can increase the potential for erosion and often cause sedimentation at the bottom of the waters have a negative impact both directly and indirectly on the natural environment, especially water sources. High rate of forest degradation and deforestation has a significant impact on changes and decreases in water quality. In this study, water quality monitoring was conducted using several parameters as an initial step to understand the condition at the Dam and Clean Water Facility in Banturung Village, Bukit Batu District, Palangka Raya City. The results obtained from the analyzed parameters include odorless, pH 5.9, turbidity 1.0 NTU, temperature 28.1 °C, color 3.63 TCU, total dissolved solids (TDS) 10.2 mg/L, nitrate (NO_3^-) 0.608 mg/L, nitrite (NO_2^-) 0.002 mg/L, iron (Fe) 0.038 mg/L, and manganese (Mn) 0.006 mg/L.

Keywords: Water quality; Water parameters; Environmental; Palangka Raya; Banturung

INTRODUCTION

Water is a vital necessity for human life and living beings in general. The availability of water on Earth is always constant, meaning it neither increases nor decreases because water undergoes a hydrological cycle. Although the amount of water on Earth remains unchanged, the quality of water changes with the growth of the human population and the activities that accompany it, often leading to a decline in water quality. The high growth of the population has resulted in not all components of society being able to enjoy clean water (Alihar, 2018; Lininger et al., 2022).

Water has many functions, as a universal solvent it is used by organisms for chemical reactions in metabolic processes and serves as a medium for transporting nutrients and metabolic products. For humans, water plays a significant role not only for their biological needs, such as survival. In addition, freshwater is needed by humans for cooking and drinking, washing, irrigating plants, industrial purposes, and so on. Therefore, it is undeniable that sometimes the limited supply of water to meet these needs can trigger social conflicts in the community (Suryani, 2016; Wiryono, 2013).

It cannot be denied that the decline in water quality today is a result of human activities that excessively exploit the environment. The lifestyle of society, which often neglects environmental aspects such as improper waste disposal, disposal of hazardous waste, and the conversion of forest areas, increases the potential for erosion and often causes sedimentation at the bottom of water bodies. These activities have negative impacts, both directly and indirectly, on the natural environment, especially water sources. The high levels of forest degradation and deforestation significantly impact the changes and decline in water quality (Dessie & Bredemeier, 2013; Mapulanga & Naito, 2019).

Monitoring the condition of water is the first step to understanding and mitigating the adverse impacts on the environment. In this research, an analysis of water parameters was conducted at the Dam and Clean Water Facilities in Banturung Village, Bukit Batu District, Palangka Raya City to determine whether the water in the area is suitable for hygiene and sanitation based on the Regulation of the Minister of Health of the Republic of Indonesia (PERMENKES-RI) Number 2 of 2023 (Kementerian Kesehatan Republik Indonesia, 2023).

METHOD

Water samples were collected at the Dam and Clean Water Facility in Banturung Village, Bukit Batu District, Palangka Raya City. The obtained samples were then taken to the laboratory for further analysis.

The analyzed parameters included odor, pH, turbidity, temperature, color, total dissolved solids (TDS), nitrate (NO_3^-), nitrite (NO_2^-), iron (Fe), manganese (Mn). The specific methods used are shown in Table 1.

Table 1. Analyzed Parameters and Methods Specification

No.	Parameters	Methods Specification
1	Odor	Organoleptic
2	pH	SNI 6989.11:2019
3	Turbidity	SNI 06-6989.25-2005
4	Temperature	APHA 23rd edition, 2550 B, 2017
5	Color	SNI 6989.80:2011
6	Total dissolved solids (TDS)	Electrometry
7	Nitrate (NO_3^-)	APHA 23rd edition, 4500-NO_3 B, 2017
8	Nitrite (NO_2^-)	SNI 06-6989.9-2004
9	Iron (Fe)	SNI 6989.84:2019
10	Manganese (Mn)	SNI 6989.84:2019

RESULT AND DISCUSSION

The condition of water is very important to consider, as water is essential for life. Contaminated water can significantly disrupt life systems because living beings need water of good quality and adequate quantity, and its availability must be sufficiently continuous.

Based on the analysis results, the findings are presented in Table 2 and then compared with the water quality standards for hygiene and sanitation purposes according to the Regulation of the Minister of Health of the Republic of Indonesia (PERMENKES-RI) Number 2 of 2023.

Table 2. Analysis Results

No.	Parameters	Results	Standard
1	Odor	Odorless	Odorless
2	pH	5.9	6.5-8.5
3	Turbidity	1 NTU	<3 NTU
4	Temperature	28.1 °C	Air temperature ± 3 °C
5	Color	3.63 TCU	10 TCU
6	Total Dissolved solids (TDS)	10.2 mg/L	<300 mg/L
7.	Nitrate (NO_3^-)	0.608 mg/L	20 mg/L
8	Nitrite (NO_2^-)	0.002 mg/L	3 mg/L
9	Iron (Fe)	0.038 mg/L	0.2 mg/L
10	Manganese (Mn)	0.006 mg/L	0.1 mg/L

Based on the 10 parameters tested, 9 parameters met the quality standards compared to those for hygiene and sanitation purposes. One parameter did not meet the standard, which is the pH of the sample at 5.9, whereas the allowable standard range is 6.5-8.5.

Each tested parameter can have various effects on water characteristics and the impacts that occur when used in daily life.

Odor

Odor testing is a fundamental assessment of water quality that can be analyzed through organoleptic methods. The testing by organoleptic does not require specialized instruments but relies on olfactory sensing. According to the analysis, the water sample was found to be odorless. Contaminated water sources can emit unpleasant odors due to the presence of metals, organic compounds, and other minerals. Detecting and identifying water odors are crucial for assessing potential health risks and ensuring compliance with water quality standards (Akcaalan et al., 2022).

Based on the tests, the water sample was odorless and met the standards. Generally, odor analysis is complemented by taste testing because these tests can serve as initial indicators of water condition. According to Adams et al., (2022), pH testing can affect taste and odor, which in turn can impact the presence of metals and even bacteria.

pH

The pH analysis is crucial for assessing water quality as it measures the acidity or alkalinity of water, which is vital for the health of aquatic ecosystems and the suitability of water for various purposes.

The pH analysis resulted in a measurement of 5.9, indicating an acidic condition, whereas the standard range is 6.5-8.5. Water with an acidic pH contains more hydrogen ions (H^+) and tends to increase the precipitation of metals in water. Conversely, water with a basic pH contains hydroxyl ions (OH^-) which can be more harmful to aquatic life (Chen et al., 2012).

Additionally, pH levels significantly impact water quality. Highly acidic water tends to have higher levels of dissolved oxygen, increased turbidity, and greater chemical oxygen demand. In contrast, highly alkaline water typically exhibits lower dissolved oxygen levels, reduced turbidity, and higher conductivity (Dewangan et al., 2023).

Turbidity

Turbidity analysis is essential for evaluating water quality as it measures the clarity or cloudiness caused by suspended particles in water. Elevated turbidity levels can indicate the presence of sediment, silt, or organic matter, which can impact aquatic habitats by reducing light penetration necessary for photosynthesis (Teng et al., 2007). It also serves as an indicator of potential contamination from runoff, erosion, or wastewater discharge. Monitoring turbidity is critical for assessing water suitability for drinking, supporting aquatic life, and recreational activities (Austin et al., 2017). Additionally, turbidity levels are regulated to ensure compliance with water quality standards and to preserve the ecological health of water bodies.

The turbidity analysis showed a small amount of suspended solids in the water, with a turbidity of 1.00 NTU. Turbidity reflects water clarity and indicates the presence of pollutants, organic matter, and sediments in the water (Pramesti & Puspikawati, 2020).

Temperature

The temperature outside where we took the sample was, around 29.8 °C. When we analyzed the water temperature it was at 28.1 degrees Celsius. These readings are within the accepted range of 29.8 ± 3 °C according to water quality standards. Checking the temperature is crucial when assessing water quality because it affects how fast organisms metabolize and consume oxygen impacts the solubility of oxygen and other gases and influences how quickly chemical reactions occur. Additionally different aquatic species thrive best within temperature ranges highlighting why monitoring temperatures is key, to keeping ecosystems healthy and following water quality regulations (Bonacina et al., 2023).

Temperature can also impact other factors such as dissolved oxygen, ammonia, nitrate, total nitrogen, chemical oxygen demand, and phosphate levels within the water (Li et al., 2013).

Color

The analyzed water color result was 3.63 TCU, which is below the standard of 10 TCU. Water color analysis is conducted to assess water quality because it can indicate the presence of contaminants, such as organic materials or inorganic substances, and signal pollution from industrial discharges, agricultural runoff, or sewage.

It also reflects natural processes such as the decomposition of organic matter or the presence of naturally occurring minerals. The presence of iron oxides causes the water to have a reddish color, while the presence of manganese oxides causes the water to have a brownish or blackish color (Effendi, 2003).

Total Dissolved Solid (TDS)

Total dissolved solids (TDS) are analyzed to assess water quality because they represent the concentration of dissolved substances in water, including minerals, salts, metals, and organic compounds. Elevated TDS levels can indicate pollution from industrial discharges, agricultural runoff, or natural sources like mineral springs. High TDS can affect the taste, odor, and appearance of water, as well as its suitability for drinking, irrigation, and industrial processes. Monitoring TDS helps evaluate the overall purity of water and ensures it meets regulatory standards for various uses. Additionally, TDS levels can impact the health of aquatic organisms and the integrity of aquatic ecosystems, making it a critical parameter in water quality assessments (Raj et al., 2023; Weber-Scan & Duffy, 2007).

The TDS result is 10.2 mg/L, which meets the required standards. TDS indicates the number of solid particles contained in water and can provide information on substances such as magnesium (Mg), sodium (Na), potassium (K), and other contaminants (Islam, 2016; Wang, 2021).

Nitrate (NO_3^-)

Nitrate (NO_3^-) is analyzed in water quality assessments due to its importance as a nutrient and potential pollutant. It originates from various sources such as agricultural fertilizers, animal waste, and sewage effluent. Elevated nitrate levels in water can lead to eutrophication, where excessive nutrient enrichment promotes algal blooms and disrupts aquatic ecosystems (Isaza et al., 2020). Additionally, high nitrate concentrations can pose health risks if consumed, potentially leading to conditions such as methemoglobinemia (Ward et al., 2005). Monitoring nitrate levels is crucial for protecting both environmental health and human well-being, ensuring that water remains safe and suitable for consumption while maintaining ecological balance.

The analysis shows that the nitrate content in the water sample was 0.608 mg/L, which meets the standard of 20 mg/L. Nitrate in water can result from environmental factors such as the use of nitrogen-rich fertilizers, livestock, sewage pipe leaks, and improper household disposal methods (Ramalingam et al., 2022).

Nitrite (NO_2^-)

Nitrite (NO_2^-) is analyzed in water quality assessments due to its potential toxicity, which can indicate contamination and pose health risks. Nitrite forms from the oxidation of ammonia and is a byproduct of the decomposition of organic matter and nitrogen-containing compounds. Elevated nitrite levels in water can be harmful to aquatic organisms, especially fish, by impairing their ability to transport oxygen, potentially leading to suffocation. In humans, excessive nitrite consumption, often through contaminated drinking water or food, can interfere with oxygen transport in the bloodstream, causing serious health issues. Monitoring nitrite levels is essential for preventing environmental degradation, ensuring the safety of aquatic ecosystems, and protecting public health.

The analysis shows that the nitrite content in the water sample was 0.002

mg/L, which meets the standard of 3 mg/L. Excessive nitrite levels in water can pose health risks, potentially causing methemoglobinemia in children (Nadhila & Nuzlia, 2021; Ward et al., 2005).

Iron (Fe)

Iron (Fe) is analyzed in water quality assessments due to its potential impacts on both health and aesthetics. The analysis shows that the iron content in the sample was less than 0.038 mg/L, which meets the standard of 0.2 mg/L.

Elevated levels of iron in water can lead to several issues. Aesthetic concerns arise because high concentrations of iron can impart a metallic taste and cause reddish-brown staining on plumbing fixtures, laundry, and dishes. Moreover, excessive intake of iron through drinking water can cause gastrointestinal distress and potentially contribute to other long-term health problems. Environmental impacts include iron precipitation, which forms deposits that can degrade aquatic habitats and affect sediment composition. Monitoring iron levels is crucial to ensure water safety and compliance with regulatory standards (Viana et al., 2021).

Manganese (Mn)

Manganese (Mn) is analyzed in water quality assessments due to its potential impacts on health and water system infrastructure. The analysis shows that the manganese content in the sample was less than 0.006 mg/L, which meets the standard of 0.1 mg/L.

Elevated levels of manganese in drinking water can cause black or brown staining of plumbing fixtures, laundry, and dishes. Health concerns arise when manganese levels exceed regulatory limits, potentially leading to neurological effects, particularly in infants and children. Additionally, manganese can affect the taste and odor of water.

Manganese exposure can affect nervous system functions and may even cause an irreversible Parkinson-like syndrome known as manganism. Symptoms include weakness, anorexia, muscle pain, apathy, slow speech, emotionless facial expression, postural difficulties, rigidity, tremors, decreased mental status, and slow clumsy movement of the arms and legs (Alvarez-Bastida et al., 2018).

CONCLUSION

The results obtained from the analysis of various parameters include odorless water, pH 5.9, turbidity 1.0 NTU, temperature 28.1 °C, color 3.63 TCU, total dissolved solids (TDS) 10.2 mg/L, nitrate (NO_3^-) 0.608 mg/L, nitrite (NO_2^-) 0.002 mg/L, iron (Fe) 0.038 mg/L, and manganese (Mn) 0.006 mg/L. Based on these parameters, the only parameter that does not meet the standards for hygiene and sanitation set by PERMENKES-RI No. 2 (2023) is pH, as it falls outside the acceptable range of 6.5-8.5. The results of this water parameter analysis are intended to provide an overview of the environmental water conditions.

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