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DETERMINATION OF WATER QUALITY STATUS OF SITU CISANTI USING THE STORET METHOD

Penentuan Status Kualitas Air Situ Cisanti dengan Metode Storet

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ABSTRACT

Situ Cisanti has the main function which is, being utilized by the surrounding community for various activities such as plantations, fisheries and tourism activities. The many activities in Situ Cisanti have an impact on the decline in water quality in the waters of Situ Cisanti. The water quality in Situ Cisanti must meet water quality standards because Situ Cisanti is the zero point of the Citarum River so that it has a direct impact on fish farming activities and drinking water sources along the Citarum River. Determination of water quality status in a body of water can be done by several methods, one of which is the STORET Method. Through the STORET Method, the water quality status of Situ Cisanti can be determined. The method used is the survey method. Determination of sampling points is determined based on considerations of the zoning of the water body consisting of inlets, the middle of the waters and outlets. Data analysis is carried out by comparing it with water quality standards and scoring it. Based on the results, the water quality status of Situ Cisanti is categorized as "lightly to moderately polluted" with a score between -10 to -11 for class 1 water quality standards and is categorized as lightly polluted with a score of -10 for class 2 quality standards. So it can be concluded that it does not meet the quality standards set by Government Regulation Number 22 of 2021 for raw water for drinking water and fisheries activities.

Keywords: Situ Cisanti, STORET, Water Quality.

ABSTRAK

Situ Cisanti memiliki fungsi utama yaitu dimanfaatkaan oleh masyarakat sekitar untuk berbagai aktivitas seperti perkebunan, perikanan dan kegiatan wisata. Banyaknya aktivitas tersebut berdampak pada penurunan kualitas air yang ada di perairan Situ Cisanti. Kualitas air Situ Cisanti harus memenuhi standar dikarenakan Situ Cisanti merupakan titik nol dari Sungai Citarum yang dapat berdampak secara langsung pada kegiatan budidaya ikan maupun sumber air minum sepanjang aliran Sungai Citarum. Penentuan status kualitas air pada suatu perairan dapat dilakukan dengan beberapa metode salah satunya dengan Metode STORET. Sampling dilakukan dengan menggunakan metode survei. Penentuan titik sampling ditentukan berdasarkan pertimbangan zonasi badan perairan yang terdiri atas inlet, bagian tengah perairan, dan outlet. Analisa data dilakukan dengan cara membandingkan dengan standar kualitas air dan diberi skoring. Berdasarkan hasil didapatkan status kualitas air Situ Cisanti dikategorikan ”Tercemar ringan hingga sedang” dengan skor antara -10 sampai -11 untuk standar kualitas air kelas 1 dan dikategorikan tercemar ringan dengan skor -10 untuk standar kualitas kelas 2. Sehingga dapat disimpulkan bahwa tidak memenuhi standar kualitas yang telah ditetapkan oleh Peraturan Pemerintah Nomor 22 Tahun 2021 untuk baku air minum dan kegiatan perikanan.

Kata Kunci: Situ Cisanti, STORET, Kualitas Air

INTRODUCTION

Situ Cisanti is a form of inland public water ecosystem located in West Java Province, in Tarumajaya Village, Kertasari District, Bandung Regency. Situ Cisanti is one of the sources of the Citarum River. The Citarum River is the largest and widest river in West Java Province (Fathurrohim, 2022). Situ Cisanti has seven flowing springs: Pangsiraman, Cikawedukan, Koleberes, Cikahuripan, Cisadane, Cihaniwung, and Cisanti (Diana & Pasya, 2016).

Situ Cisanti primarily serves as a water source and is utilized by the local community for various activities such as plantations, fisheries, and tourism. One example of plantation activity is tea plantations. Tea plantations are suspected of causing the influx of chemicals such as phosphates and nitrates into Situ Cisanti. This is clarified by (Fathurrohim, 2022), who noted that Situ Cisanti appears increasingly cloudy and contains pools of pesticide residue. Fishery activities, such as fishing, often add to the pollution burden by dumping waste, such as food scraps and plastic, into the lake. The numerous activities in Situ Cisanti have resulted in a decline in water quality. This decline in water quality in a body of water certainly impacts the existing ecosystem, such as the survival of species in Situ Cisanti and habitat destruction.

One way to assess water quality in a body of water is by assessing its water quality status. Water quality status can be assessed through physical, chemical, and biological parameters, providing an overview of the extent to which Situ Cisanti can support existing activities without negatively impacting aquatic life and the environment. Water quality assessment is a crucial step in water resource management. Analysis of physical and chemical parameters is crucial to understanding the condition of water quality in Situ Cisanti. Water quality in Situ Cisanti must meet water quality standards because Situ Cisanti is the zero point of the Citarum River, directly impacting fish farming activities and drinking water sources along the Citarum River. Furthermore, poor water quality in Situ Cisanti has the potential to exacerbate water pollution in the Citarum River. According to the Decree of the Minister of State for the Environment No. 115 of 2003, determining the water quality status of a body of water can be done using several methods, one of which is the STORET method.

The STORET method is used to determine water quality status by comparing measured water quality data with established water quality standards. This method is regulated in the Decree of the Minister of Environment No. 115 of 2003. Using the STORET method, the water quality status of Situ Cisanti can be determined by analyzing physical and chemical water quality parameters. Therefore, the purpose of this study was to determine the water quality status of Situ Cisanti using the STORET method based on physical and chemical parameters.

RESEARCH METHODS

Place and Time

The research was conducted from January to February 2025 at Situ Cisanti, Pejaten Village, Tarumajaya Hamlet, Kertasari District, Bandung Regency. Sampling was conducted four times with 14-day intervals. The research was conducted in situ at Situ Cisanti and ex situ at the Aquatic Resources Management Laboratory of the Faculty of Fisheries and Marine

Sciences, Padjadjaran University, and at the Environmental Laboratory Technical Implementation Unit (UPTD) of the West Java Environmental Agency (DLH).

Tools and Materials

The parameters used included physical and chemical parameters. The tools, methods, and research locations are shown in Table 1.

Table 1. Physical and Chemical Parameters

Parameter	Unit	Methods	Tools	Information
I. II. Physical parameters				
Temperature	°C	Potentiometry	Thermometer	*In situ*
Total Dissolved Solids	mg/l	Gravimetry	Filter Paper	Laboratory
Total Suspended Solids	mg/l	Gravimetry	Filter Paper g	Laboratory
Transparency	Cm	Visual	Secchi Disk	*In situ*
III. IV. Chemical parameters				
pH	-	Potentiometry	pH meter	In situ
Dissolved Oxygen	mg/l	Potentiometry	DO meter	In situ
Biochemical Oxygen Demand	mg/l	Iodometric Titration	Titration	Laboratory
Ammonia	mg/l	Spectrophotometry	Spectrophotometry	Laboratory

Research Methods and Station Determination

The method used in this research is a survey method, with water sampling using purposive sampling. In this study, sampling points were determined based on considerations of the water body's zoning, which consists of the inlet, midwater area, and outlet.

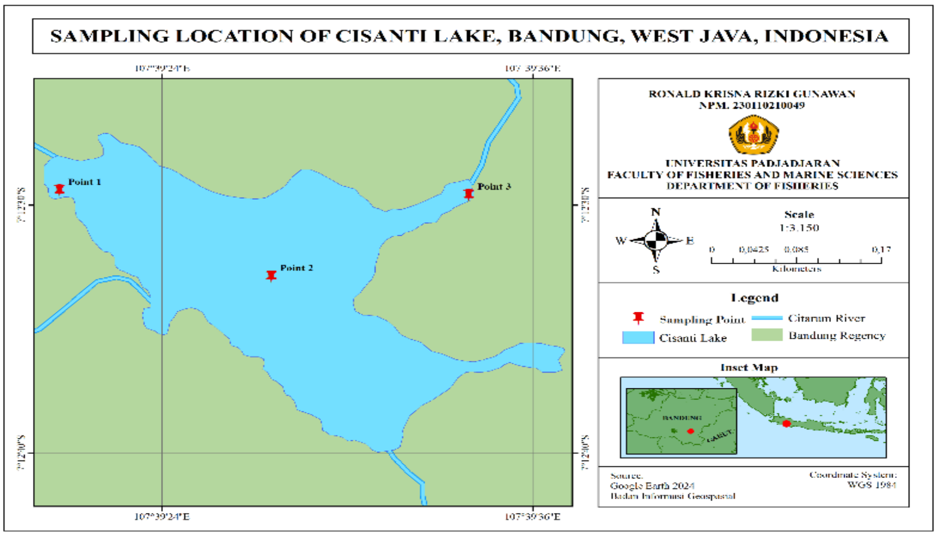

Figure 1. Location of Research Station

The locations of the sampling stations were based on considerations of the water body's zones and the activities occurring in the waters, which indicated the pollution load on Situ

Cisanti, thus providing a comprehensive overview of the research site. These stations encompassed three points in the inlet, outlet, and midlet zones of Situ Cisanti. Each research station was replicated four times with a 14-day interval. The coordinates of the research stations are shown in Figure 1 and Table 2.

Table 2. Research Stations

Stasiun	Coordinate		Information
	Latitude	Longitude	
Stasiun 1	7°12'30.15"S	107°39'20.68"E	Cikahuripan Spring, Inlet, is the cleanest and most uncontaminated spring water source.
Stasiun 2	7°12'32.91"S	107°39'27.54"E	The central part of Situ Cisanti, thought to be the deepest waters, is considered a clean spot because it is rarely visited by tourists.
Stasiun 3	7°12'29.62"S	107°39'33.94"E	The outlet section of Situ Cisanti, the final section or point where the water exits. It is estimated that the point with poor water conditions is due to the large amount of pesticide accumulation.

Data Analysis

The water quality status of Situ Cisanti was determined using the STORET method. According to Masykur et al. (2018), STORET begins with periodic sampling. Water quality is then measured based on physical and chemical parameters, as these directly impact the aquatic ecosystem. The results of measurements of temperature, TSS, TDS, transparency, DO, pH, and BOD are then compared with the quality standards stipulated in Government Regulation of the Republic of Indonesia Number 22 of 2021 for classes 1 and 2. The ammonia values are compared with the quality standards stipulated in Government Regulation of the Republic of Indonesia Number 82 of 2001 for classes 1 and 2. The water quality standards for each parameter are shown in Table 3.

Table 3. Water Quality Standards

No	Parameter	Unit	Class 1	Class 2	Information
1	Temperature	°C	Dev 3	Dev 3	The difference in air temperature above the surface of air
2	Total Dissolved Solids	mg/L	1.000	1.000	
3	Total Suspended Solids	mg/L	25	50	
4	Transparency	m	10	4	
5	Degree		6-9	6-9	Not applicable to peat water (based on its natural conditions)
6	Acidity (pH)	mg/L	2	3	
7	Biochemical Oxygen Demand	mg/L	6	4	Minimum limit
8	Dissolved Oxygen	mg/L	0,5	0,02	

If the measurement results meet the quality standards (measurement results < quality standards), a score of 0 is given. If the measurement results exceed the quality standards (measurement results > quality standards), a negative score is given according to table 2. Then, the sum of the negative scores of all measured parameters is calculated. This score will be used to determine the water quality status based on the established classification. Based on the total score, the water quality status is classified into the following categories:

(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 ≥ -31 → heavily polluted

RESULT

Physical Parameters

At Situ Cisanti, temperature values fluctuate. The temperature measurement data can be seen in Figure 2.

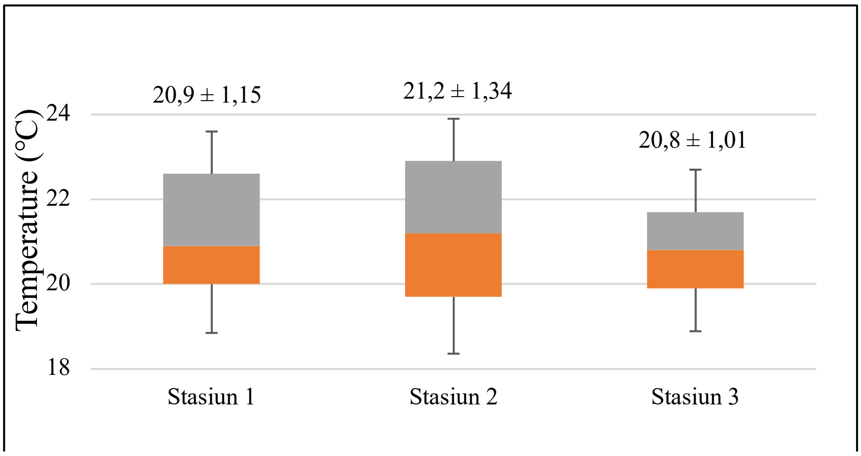

Figure 2. Average temperature during research at Situ Cisanti

Figure 2 shows that the average water temperature at Situ Cisanti ranges from 20.8 to 21.2°C. The highest average temperature is at station 2, at 21.2°C, with a standard deviation of 1.34, while the lowest average temperature is at station 3, at 20.8°C, with a standard deviation of 1.01. Furthermore, the TSS value at Situ Cisanti fluctuates. The TSS measurement data can be seen in Figure 3.

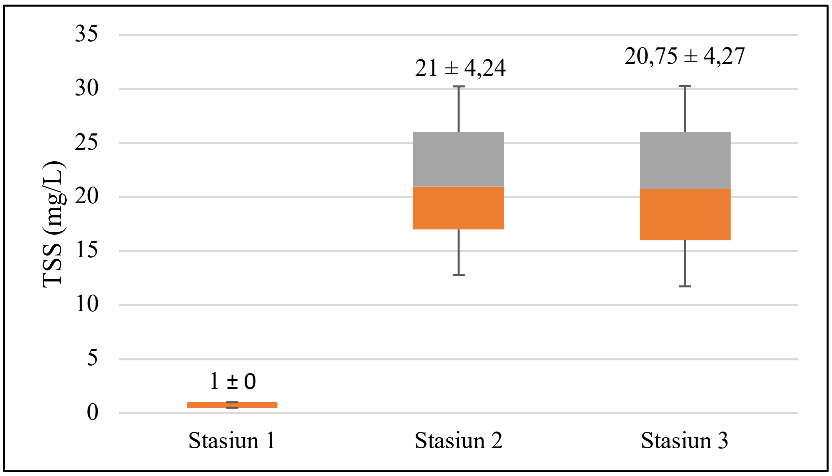

Figure 3. Average TSS during research at Situ Cisanti

Figure 3 shows that the average TSS value of Situ Cisanti water ranges from 2 to 21 mg/L. The highest average TSS value of Situ Cisanti water is at station 2, at 21 mg/L with a standard deviation of 4.24. Meanwhile, the lowest average value is at station 1, at 1 mg/L with a standard deviation of 0. Furthermore, the TDS value shows fluctuating results. The measurement data are presented in Figure 4.

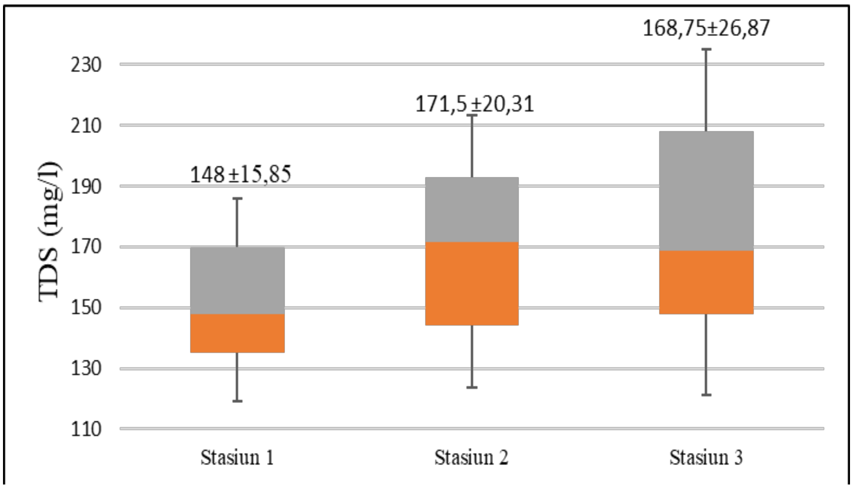

Figure 4. Average TDS during the study at Situ Cisanti

Figure 4 shows that the average TDS value during the study ranged from 148 to 171.5 mg/L. The highest average TDS value was at station 2, at 171.5 mg/L, with a standard deviation of 20.31. The lowest TDS value was at station 1, at 148 mg/L, with a standard deviation of 15.85. Finally, transparency values decreased with each study station. Transparency data can be seen in Figure 5.

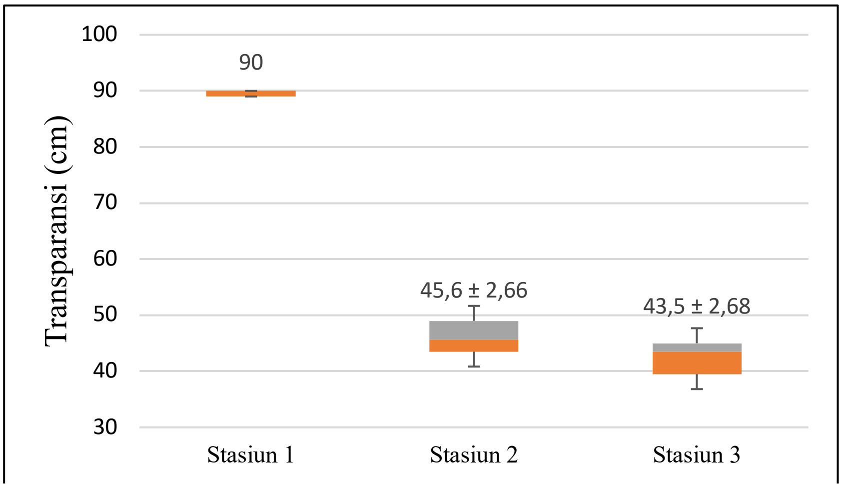

Figure 5. Average transparency during the study at Situ Cisanti

Figure 5 shows that the average transparency of Situ Cisanti ranged from 43.5 to 90 cm. The highest average transparency value was at station 1, at 90 cm, with a standard deviation of 0. While the lowest average transparency value was at station 3, at 43.5 cm, with a standard deviation of 2.68.

Chemical Parameters

At Situ Cisanti, DO values showed a decrease along with the research station. The research data are presented in Figure 6.

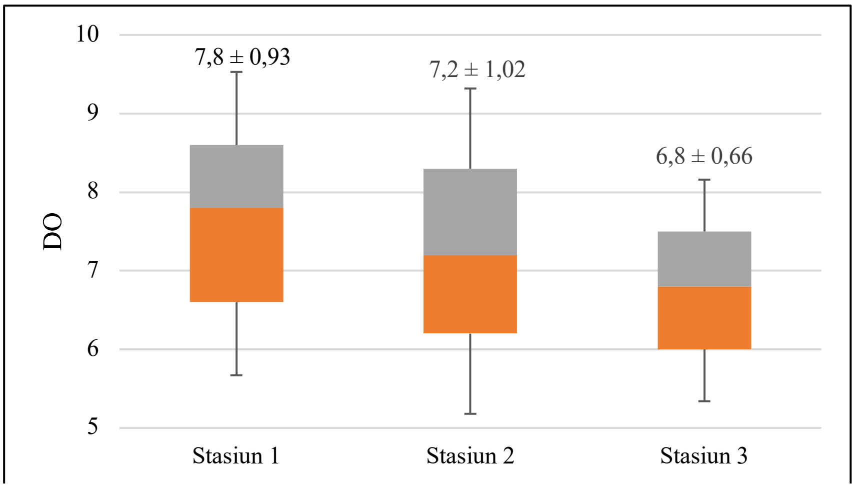

Figure 6. Average DO during research at Situ Cisanti

Figure 6 shows that the average DO value ranged from 6.8 to 7.8 mg/L. The highest average DO value was at station 1, at 7.8 mg/L, with a standard deviation of 0.93. Meanwhile, the lowest average DO value was at station 3, at 6.8 mg/L, with a standard deviation of 0.66. Furthermore, the pH value showed an increase with each research station. The measurement data are presented in Figure 7.

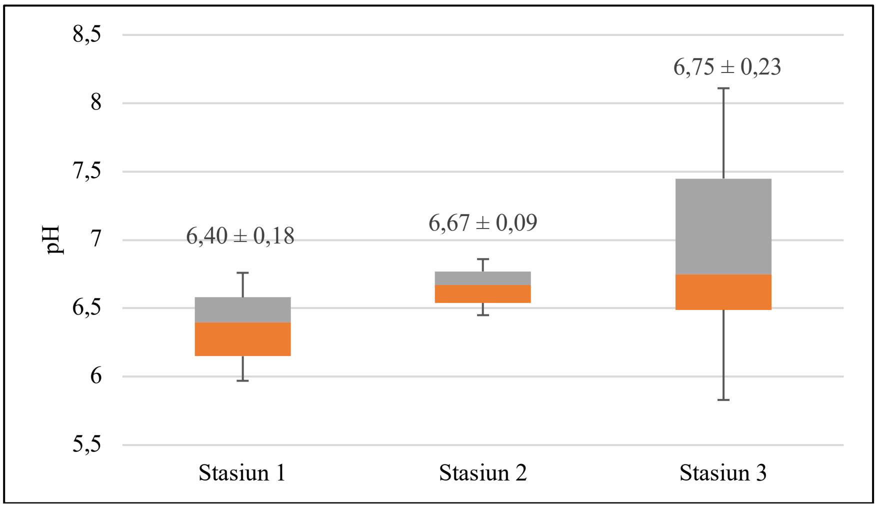

Figure 7. Average pH during research at Situ Cisanti

Figure 7 shows that the average pH value at Situ Cisanti during the study ranged from 6.40 to 6.75. The highest average pH value was at station 3, at 6.75, with a deviation of 0.23. The lowest average pH value was at station 1, at 6.40, with a deviation of 0.18. Furthermore, the BOD value at Situ Cisanti showed fluctuating results. The BOD measurement data are presented in Figure 8.

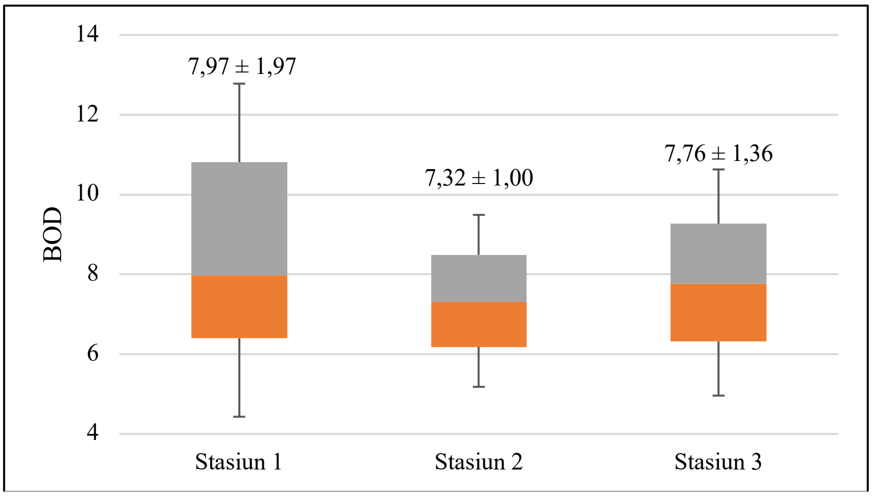

Figure 8. Average BOD during research at Situ Cisanti

Figure 8 shows that the average BOD of Situ Cisanti water ranges from 7.32 to 7.97 mg/L. The highest average BOD of Situ Cisanti water is at station 1, at 7.97 mg/L with a standard deviation of 1.97. Meanwhile, the lowest average BOD of Situ Cisanti water is at station 2, at 7.32 mg/L with a standard deviation of 1.00. Also, ammonia values in Situ Cisanti show fluctuating results. The measurement data are presented in Figure 9.

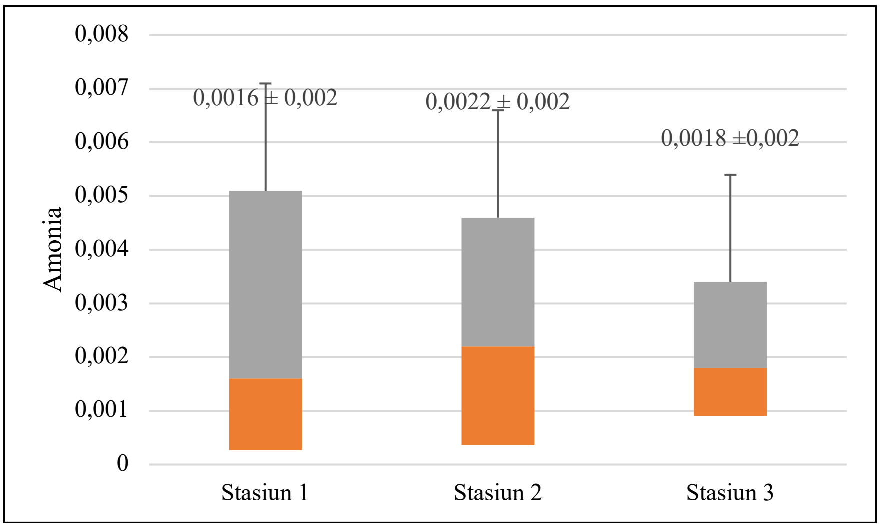

Figure 9. Average ammonia during research at Situ Cisanti

Figure 09 explains that the average ammonia content of Situ Cisanti water ranges from 0.0016 – 0.0022 mg/L. The highest average ammonia content is at station 2 at 0.0022 mg/L with a standard deviation of 0.002, while the lowest average ammonia content is at station 1 at 0.0016 mg/L with a standard deviation of 0.002.

Water Quality Status based on the STORET Method

Based on the data analysis, an assessment of water quality status was carried out using the STORET method, comparing eight water quality parameters with class 1 and 2 water quality standards, presented in Table 4.

Table 4. Water pollution status of Situ Cisanti according to the STORET method

Stasiun	Class 1	Class 2
1	-10	-10
2	-11	-10
3	-11	-10

Information:

Class A: very good, meets quality standards
Class B: good, lightly contaminated
Class C: moderate, moderately polluted
Class D: bad, badly polluted

Table 4 shows the results of calculations using the STORET method that the water of Situ Cisanti has experienced pollution with a pollution status categorized as "Light to moderate pollution" with a score ranging from -10 to -11 for class 1 quality standards and categorized as "Light pollution" with a score of -10 for class 2 quality standards. In addition, the results of the STORET method calculations show that station 1 is included in the "Light pollution" category while stations 2 and 3 are included in the "Light to moderate pollution" category. This shows that Situ Cisanti does not yet meet the requirements for raw water for drinking water or fish farming activities according to Government Regulation No. 22 of 2021.

DISCUSSION

Physical Parameters

The phenomenon of the average temperature at station 1 being lower than at station 2 is caused by the absorption of solar energy by suspended particles that absorb sunlight more effectively than clear water. This is supported by the statement of Birmachu et al. (2024), which explains that the larger the suspended particles in the water, the higher the temperature of the water. In addition, vegetation cover also affects the penetration of light received by the water, where station 1 is surrounded by many trees while at station 2 there are no trees. However, it can be seen that there is a decrease in temperature from station 2 to station 3. This is because station 3 is surrounded by trees and there are many branches on the water surface so that the sunlight received by the water at station 3 is less. According to de Lima et al. (2022), branches on the water surface can affect water temperature, especially by reducing the intensity of sunlight entering the water. Although the water temperature of Situ Cisanti shows a fluctuating trend, it still meets the water quality standards set by Government Regulation No. 22 of 2021. The water temperature standard according to Government Regulation No. 22 of 2021 is a deviation of 3. Meeting these temperature parameters contributes to a favorable water temperature for fish metabolism and maintains the DO balance in Situ Cisanti.

Furthermore, according to Government Regulation No. 22 of 2021, the TSS water quality standard for Class 1 is 25 mg/L, while for Class 2 it is 50 mg/L. Therefore, the maximum value at stations 2 and 3, at 26 mg/L, exceeds the water quality standard set for Class 1. However, for Class 2, both the minimum, maximum, and average values still meet water quality standards. This is due to Situ Cisanti being surrounded by community agricultural land, which allows runoff to carry fertilizer or soil particles. This is supported by research by Tamara et al. (2022) in Lake Lut, agricultural activities around Lake Lut have caused an increase in TSS levels in the water. To ensure TSS parameters meet established water quality standards, a strategy is necessary. One such strategy is the use of a floating wetland system with Heliconia densiflora plants. According to Purnamasari (2021), floating wetlands with Heliconia psittacorum can reduce TSS by 88% within a few weeks.

Furthermore, TDS values at all stations meet water quality standards based on Government Regulation No. 22 of 2021 for class 1 and class 2. Based on Government Regulation No. 22 of 2021, the water quality standard for class 1 and class 2 is 1000 mg/L. Therefore, the TDS parameters in the water of Situ Cisanti still meet water quality standards. This is confirmed by the TDS data obtained by Hanifah et al. (2024) in Situ Cisanti, where TDS data ranged from 83 mg/L to 141 mg/L, with an average of 100.78 mg/L and a standard deviation of 13.26. Meeting TDS requirements in Situ Cisanti results in low turbidity, thus optimizing sunlight penetration.

Finally, the decrease in transparency values across stations is due to hydrodynamic factors. Station 1 is located at the spring, resulting in less sediment inflow, and Station 3 is located at the outlet, resulting in sediment accumulation, resulting in lower transparency values. This is supported by the conditions at each station: Station 1 appears clear, Station 2 is greenish, and Station 3 is greenish, with visible tree branches. Furthermore, according to Hasan et al. (2013), transparency results at Situ Cisanti show that the inlet transparency value is greater than the outlet, with the inlet transparency value ranging from 62.83 to 90.33 cm, while the outlet transparency value is 62 cm. Based on Government Regulation No. 22 of 2021, the water quality transparency standard for Class 1 is 10 cm, while for Class 2 it is 4 cm. Therefore, Situ Cisanti's transparency still meets the established water quality standards.

Chemical Parameters

Figure 6 shows that DO decreases along with the location of the research station. According to Pribadi et al. (2022), this phenomenon occurs because aerobic microorganisms decompose organic matter by consuming DO, resulting in DO decreasing along with the water flow. Furthermore, domestic waste and organic waste increase along with the water flow, increasing the load of organic matter that must be decomposed, gradually decreasing DO from inlet to outlet. However, according to Government Regulation No. 22 of 2021, the DO water quality standard for Class 1 is 4 mg/L and for Class 2 is 4 mg/L. Therefore, despite the decrease in DO in Situ Cisanti, the water still meets the established water quality standards.

Furthermore, the increase in pH along with station location is caused by the decomposition of organic matter such as twigs and logs in the middle of the water, which causes aerobic decomposition, producing alkaline compounds. Therefore, Station 3 has the highest pH value compared to the other stations. Overall, the pH values obtained indicate that the water in Situ Cisanti meets the water quality standards set by Government Regulation No. 22 of 2021. Based on Government Regulation No. 22 of 2021, the water quality standard for pH classes 1 and 2 ranges from 6 to 9. Meeting these pH standards indicates that the stability of Situ Cisanti's aquatic ecosystem is maintained, which supports fish metabolism and the nitrification process. According to Hanunrandi et al. (2022), a pH that meets water quality standards supports the metabolic processes of fish and other aquatic organisms, including biochemical processes such as nitrification.

Figure 8 also shows that BOD decreased at station 2 but increased again at station 3. This decrease in BOD at station 2 is due to active decomposition by midges, which reduces the presence of organic matter. This is evident from the presence of tree trunks on the surface, which act as a substrate for microorganisms to decompose, enabling active decomposition. Furthermore, according to Royani et al. (2021), the decrease in BOD in the midstream can be influenced by natural dilution by water flow which results in a reduction in organic matter in the water. Furthermore, there was an increase in BOD at station 3 due to a decrease in DO levels which caused the decomposition process to be suboptimal and organic matter accumulated at station 3. This is supported by the greenish color of the water at station 3 indicating a large amount of accumulated organic matter. This is supported by the statement of Daroini and Arisandi (2020), who stated that stations with low DO have high BOD due to the large amount of organic matter, such as mangrove litter, which acts as a substrate for microorganism decomposition, thus increasing BOD. This is also supported by DO data obtained during the study which shows a downward trend in DO levels along with the station. Based on Government Regulation No. 22 of 2021, the BOD water quality standard for class 1 is 2 mg/L while for class 2 is 3 mg/L. Therefore, the BOD parameters of Situ Cisanti water, both the minimum, maximum, and average values, do not meet the established water quality standards for both Class 1 and Class 2. Failure to meet BOD standards can result in low DO levels in the water, which can lead to mass fish deaths. It can also impact human health. According to Napitupulu and Putra (2024), E. coli and Salmonella bacteria can multiply five times faster if DO levels exceed 6 mg/L. This phenomenon can be addressed in various ways, one of which is by using aquatic plants. According to Hasanah et al. (2021), aquatic plants such as pumice and water spinach can help reduce BOD levels in water.

Finally, ammonia in water can be influenced by various factors, such as the input of organic waste in the form of fertilizer. Furthermore, low DO levels affect the nitrification process, causing ammonia to accumulate (Hendrawan et al. 2021). Figure 9 shows that ammonia levels fluctuate, with an increase at station 2 followed by a decrease at station 3. This is due to the clean and DO-rich conditions at station 1, which facilitate the smooth nitrification process. Therefore, the ammonia level at station 1 is the lowest. Then, an increase occurs at station 2, possibly due to a decrease in DO levels at station 2 (midlet) due to the accumulation of organic matter, which inhibits the nitrification process. Then, a decrease occurs again at station 3, caused by the flow of water out of Situ Cisanti, resulting in a lower ammonia level than at station 2. Despite the fluctuations in ammonia levels, the ammonia level in Situ Cisanti water still meets established water quality standards. Because based on the Republic of Indonesia Government Regulation No. 82 of 2001, the ammonia water quality standard for class 1 is 0.5 mg/L while for class II it is 0.02 mg/L.

Water Quality Status based on the STORET Method

The water of Situ Cisanti has been polluted, with a pollution status categorized as "Light to moderate pollution," with a score ranging from -10 to -11 for the Class 1 quality standard, and "Light pollution," with a score of -10 for the Class 2 quality standard. Furthermore, the STORET method calculation results indicate that station 1 falls into the "Light pollution" category, while stations 2 and 3 fall into the "Light to moderate pollution" category. This indicates that Situ Cisanti does not meet the requirements for drinking water or fish farming activities according to Government Regulation No. 22 of 2021.

This is due to the failure to meet the TSS and BOD parameters based on the water quality standards set by Government Regulation No. 22 of 2021. This indicates that the primary source of pollution in Situ Cisanti comes from organic matter. This is supported by direct observations that found twigs at stations 2 and 3. According to Yulianti (2019), organic matter such as twigs and plant debris are part of the suspended solids that affect TSS values and water quality. Furthermore, the high BOD results during the study indicate that organic matter in Lake Cisanti is still abundant and has not yet degraded. Furthermore, DO values decrease with station location. According to Rizal et al. (2025), a high BOD indicates the presence of abundant, poorly degraded organic matter in the water. Microorganisms decompose this organic matter using DO, so a high BOD is usually accompanied by a decrease in DO.

Therefore, efforts are needed to address the failure to meet TSS and BOD parameters in Lake Cisanti. One management approach is to control pollution sources. Considering the source of pollution originating from organic matter, Lake Cisanti managers need to regularly clear tree branches in Lake Cisanti. Furthermore, Lake Cisanti managers can monitor activities around the lake, such as agricultural activities. This can reduce the amount of pollutants entering the water. This approach is supported by research by Panjaitan et al. (2023) in Lake Toba, monitoring activities around the lake and controlling sources of pollution can reduce ecological pressure and improve the condition of Lake Toba's waters. Another effort that can be made is the use of aquatic plants. According to Hasanah et al. (2021), aquatic plants such as pumice and water spinach can help reduce BOD levels in water.

CONCLUSION

Based on the results of the study "Determination of the Water Quality Status of Situ Cisanti Using the STORET Method", it can be concluded that the results of the analysis using the STORET method indicate that the water quality status of Situ Cisanti is categorized as "Lightly to moderately polluted" with a score between -10 to -11 for class 1 water quality standards and is categorized as lightly polluted with a score of -10 for class 2 quality standards so that it does not meet the quality standards set by Government Regulation Number 22 of 2021 for raw water for drinking water and fisheries activities. Parameters that do not meet include TSS and BOD parameters.

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