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WATER QUALITY STATUS OF JATIGEDE RESERVOIRS IN SUMEDANG

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ABSTRACT

Jatigede Reservoir is located in Sumedang Regency, West Java Province. This reservoir was built by damming the Cimanuk River in the Jatigede District, Sumedang Regency. After a period of flooding, many elements of nitrogen and phosphate enter the waters of the Jatigede Reservoir, the inclusion of these elements comes from the discharge of wastewater from residential areas carried by the Cimanuk river flow. Natural and anthropogenic activities that surround the reservoir will cause a decrease in the quality of the reservoir water. Declining water quality will reduce the usability, yield, productivity, carrying capacity and capacity of the reservoir. This research was conducted to determine the water quality of the Jatigede Reservoir so that it is expected to be used as input to determine the right management effort so that water quality can be maintained and sustainable. The research method used was descriptive comparative with 4 stations and 6 sampling times. The results showed that the condition of the quality of the Jatigede Reservoir based on parameters of temperature, pH, nitrate, phosphate and chlorophyll-a showed that it was suitable as class II and class III water quality standards based on Government Regulation No. 82 of 2001.

Keywords: Jatigede reservoirs, water quality, Cimanuk river

INTRODUCTION

Jatigede Reservoir is located in Sumedang Regency, West Java Province. This reservoir was built by damming the Cimanuk River in the Jatigede District, Sumedang Regency. Jatigede Reservoir has various functions, including irrigating 90,000 ha of irrigation canals in the North-West Java region, controlling floods covering 14,000 ha, capacity of 3,500 liters / second of raw water to service the Sumedang, Indramayu and Cirebon communities, the tourism sector and the fisheries sector catch (Fitriani 2013).

After the flooding period, many elements of nitrogen and phosphate enter the Jatigede Reservoir waters, the inclusion of these elements comes from waste water discharge from residential areas carried by the river flow (Nugroho 2014). Oxygen, nitrogen and phosphate are essential nutrients needed for the growth of organisms. Oxygen is needed for the respiration process of organisms and oxidizes organic matter (Nybakken 1992). Nitrogen is needed in synthesizing complex protein molecules and influencing the growth and reproduction of these organisms (Susana 2004). Phosphate is very important for the life of aquatic organisms because it functions in the storage and transfer of energy in cells and functions in the genetic system (Cole and Weihe 2015).

Reservoirs as one of the public water bodies that are easy to change due to input from the river flow and surrounding activities are very easy to experience a decrease in water quality. Natural and anthropogenic activities that surround the reservoir will cause a decrease in the quality of the reservoir water. Declining water quality will reduce the usability, yield, productivity, carrying capacity and capacity of the reservoir. Maintenance of water quality is needed so that the water body can remain in its original condition. Therefore, it is necessary to monitor the quality of water in the Jatigede Reservoir as an effort to manage and control water pollution wisely. This study aims to monitor the water quality of the Jatigede Reservoir so that it is expected to be used as input to determine the appropriate management effort so that water quality can be maintained and sustainable.

Method

This research was conducted in June - September 2018 in the Jatigede Reservoir waters with 4 observation stations which are inlet, center and outlet reservoirs. Station 1 is the Sukamenak village area located at coordinates 6o56'00.5 "LS and 108o5'23,1" BT is the area of water input from the Cimanuk river and former rice fields included in the riverine zone. Station 2 is located in the village of Leuwihideung at coordinates 6o54'37.8 "LS and 108o6'5.8" BT is an area that is still found in undeveloped plants, this area belongs to the transition zone. Station 3 is located in Jemah village at coordinates 6^o53'3.03 "LS and 108^o5'40.5" BT is an area with relatively clear water conditions and is included in the transition zone. Station 4 is located in Cipaku village at 6^o51'40.02 "LS and 108^o5'45.2" BT coordinates of the dam area so that it is included in the lacustrine zone (Figure 1).

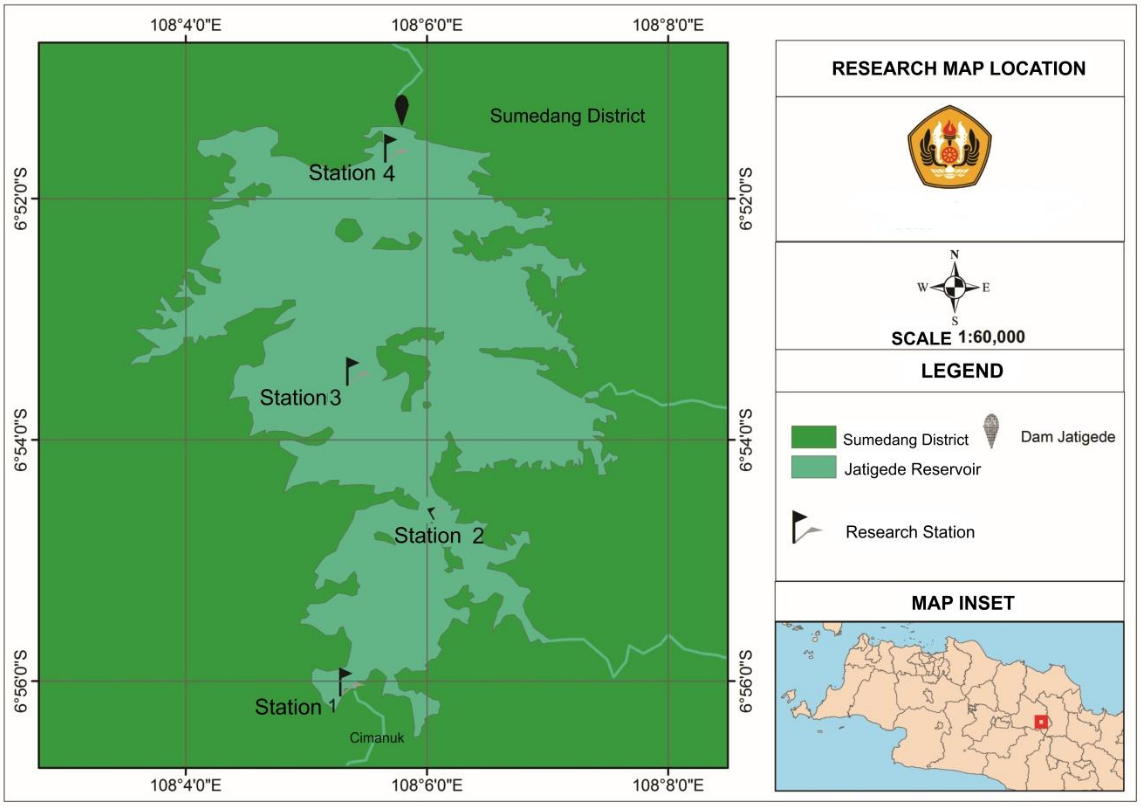

Figure 1. Research Station Map

Sampling is 6 times with an interval of 14 days. Water quality parameters analyzed include temperature. Brightness, pH, DO, nitrate, phosphate and chlorophyll-a. The research method used is descriptive comparative.

Result and Discussion

Temperature

The temperature at each station during the study can be categorized that the temperature of the Jatigede Reservoir is normal, with an average temperature of 26.5°C which ranges from 24.8°C to 28.7°C. The temperature of the Jatigede Reservoir does not exceed the standard specified in PP. Number 82 of 2001 concerning management of water quality and water pollution control for classes I and II, so that in this condition it also shows that the temperature of the waters of the Jatigede Reservoir supports the life of aquatic organisms, especially plankton. Effendi (2003) states that good temperatures for the growth of plankton from phylum Chlorophyta and diatoms are in the range (30-35°C) and (20-30°C) while Cyanophyta can tolerate higher temperatures. This temperature is also in accordance with the optimum zooplankton temperature for life because, Effendi (2003) states that the optimum temperature range for zooplankton growth is between 20-30ºC. The water temperature of the 20-30°C reservoir is good for supporting the lives of biota and phytoplankton (Arum 2017). Temperature plays a role in gas solubility in waters. Water temperatures above 15°C can support the development of microorganisms and chemical reactions in waters (Boukari 2016).

Brightness

The brightness value in the Jatigede Reservoir ranges from 22.5 to 224.3 cm with an average of 113.51 cm. The higher the transparency of the light, the easier the light is to enter the waters, and vice versa. The lower transparency of light in a waters will certainly inhibit the process of photosynthesis carried out by phytoplankton. The growth of phytoplankton is strongly influenced by the intensity of light in a waters (Nurhasanah 2017). Transparency is an important factor in controlling aquatic productivity because it is related to the level of penetration of sunlight that determines photosynthetic rates and primary productivity of waters (Widyastuti 2008). Phytoplankton responses to light intensity can vary for each type of phytoplankton, this is because light intensity can affect the high and low temperatures. The optimum temperature for photosynthesis for each type of phytoplankton will be different for each species. In contrast to phytoplankton, zooplankton growth is not influenced by the high and low transparency of light, although light transparency affects the availability of phytoplankton as zooplankton food in a waters.

pH

The pH value of the jatigede reservoir is in the range of 6.67-8.4 with an average of 7.51. The smallest pH value is at station 1 and the largest value at station 4. Changes in pH value in water affect the toxicity of chemical compounds in water. The degree of pH reflects the ability of the body of water to neutralize hydrogen ions entering the water where aquatic organisms are very sensitive to changes in water pH (Corsita 2014). In the Corsita (2014) study located in the jatiluhur reservoir, the pH range was 6.93-8.81 with an optimal pH of 7-8.5. In the study of Zahidah (2006) in the Cirata reservoir the pH value was 6.8-7.5 and was the optimal condition for the designation of carp and tilapia. If the pH of the water is lower than 5 and higher than 9 indicates the waters have been polluted so that they can interfere with the life of the biota inside (Fisesa 2014).

DO (Dissolved oxygen)

Dissolved oxygen concentrations fluctuate daily (diurnal) and seasonally depending on mixing and turbulence of water masses, photosynthetic activity, respiration and effluent entering the water body (Effendi 2003). The DO average of the Jatige Reservoir during research is 4.85 mg/L. The highest dissolved oxygen concentration was at Station 4 at the reservoir dam at 5.72 mg/l (Figure 1). These results meet the requirements of DO values for class II and class III water quality standards. Government Regulation No. 82 of 2001 requires DO values for class II water quality standards of at least 4 mg/L and class III at least 3 mg/L.

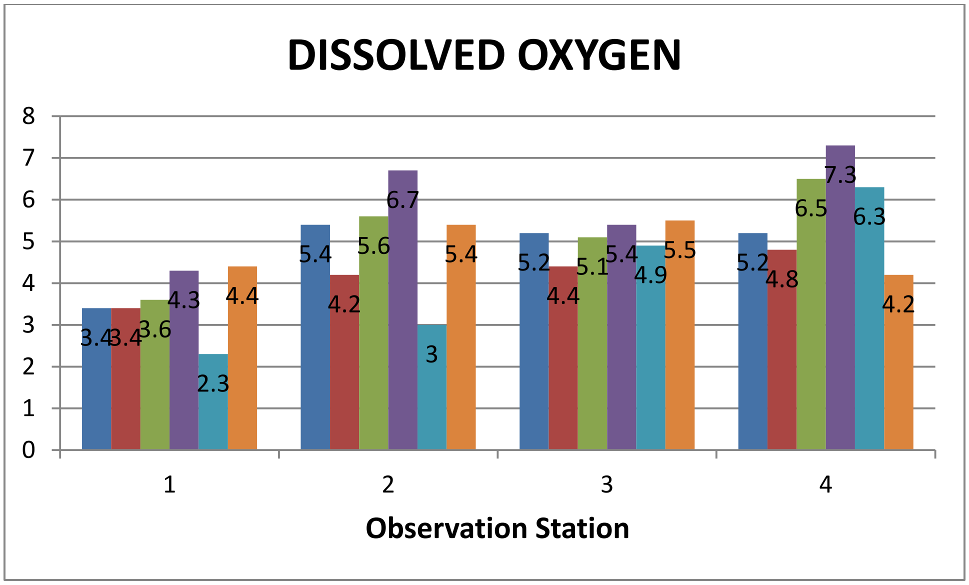

Figure 2. Dissolved Oxygen Content During Research

The lowest DO value at station 1 is 2.3 mg / L. The low value of dissolved oxygen at station 1 is caused by the high organic matter where station 1 is the riverine region so that the input of nutrients obtained from the Cimanuk river stream in the end the microorganisms in the area consume oxygen for the metabolic processes of organic matter. Dissolved oxygen is a limiting factor in waters, because most aquatic organisms cannot directly utilize free oxygen. Dissolved oxygen is highly fluctuating in water, a decrease in dissolved oxygen can be caused by the decomposition of organic compounds (Wang 2007). Factors affecting dissolved oxygen concentrations in the waters include temperature, light penetration, and abundance of primary producers (Sastrawijaya 2000). According to PP No. 82 of 2001, the minimum limit of DO concentration in the waters for class III category (fisheries) is 3 mg/L.

Nitrate (NO_3)

The average nitrate concentration of the Jatigede Reservoir is 0.343 mg/L. The highest nitrate concentration is found at station 1 (Figure 3). The high content of NO3-N in station I is thought to be because station I is a location adjacent to the residential area so that there are many domestic waste settlements that enter the waters (Baihaqi 2016). Based on PP no. 82 of 2001, the range of nitrate values was still below the standard standard of 10 mg/L for classes I and II, and 20 mg/L for class III and IV use. Nitrate is not toxic to aquatic organisms but, if the levels are too high, can cause enrichment of aquatic nutrients so that the algae grow in excess amounts or commonly called algae blooms (Effendi 2003). Nitrate levels in natural waters are almost never more than 0.1 mg/L. Nitrate levels of more than 5 mg/l illustrate the occurrence of anthropogenic contamination originating from human activities.

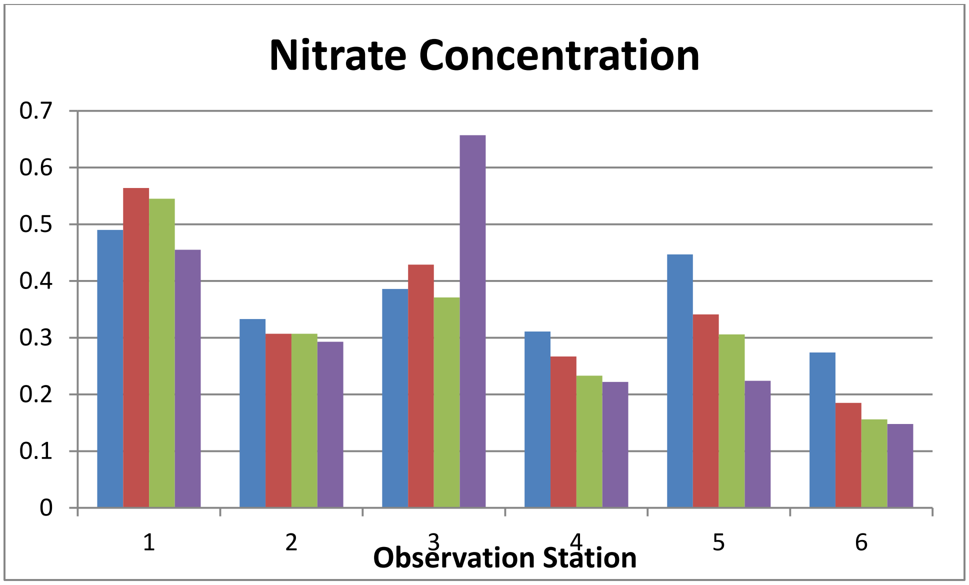

Figure 3. Nitrate Concentration During Research

In the study of Zulfia (2013) in the reeling swamp, the nitrate content in the range was 1.32-2.12 mg / l. This value is relatively high compared to the data obtained by the Jatigede reservoir. The high nitrate content can come from the waste of aquaculture and agriculture activities around the waters (Fried et al 2003). The Jatigede Reservoir has a prohibition on building KJA, so fisheries activities in this reservoir are limited but there are still some parties who continue to establish KJA on a small scale. Therefore the measurement of nitrate content shows a relatively low value. However, referring to Goldman & Horne (1983) based on its nitrate content, the waters of the Jatigede reservoir are included in eutrophic waters with a value of> 0.2 mg / l. According to Boukari (2016) the main supplier of nutrients in lakes is agricultural activities because agricultural runoff contains high levels of phosphate, nitrogen and pesticides.

Phosphate (PO_4)

The average phosphate concentration at each research station was 0.17 mg / l. The lowest concentration value is at station 3 which is 0.14 mg / l and the highest at station 1 is 0.20 mg / l (Figure 4). Station 1 which has the highest phosphate value is because station 1 is a reservoir inlet which belongs to the riverine zone so that it is easy to get input from organic material from the river (allohtonous). Referring to Vollenweider in Effendi (2003), based on the average value of phosphate in all stations, the waters of the Jatigede reservoir are classified as eutrophic waters. The range of phosphate values obtained is still below the standards required by PP no. 82 of 2001, which is 0.2 mg / l for class I (drinking water and other allotments which are equal) and II (recreation of water, planting and cultivation), 1 mg / l for class III (cultivation and cultivation), and 5 mg / l for class IV (planting and other designations that are the same).

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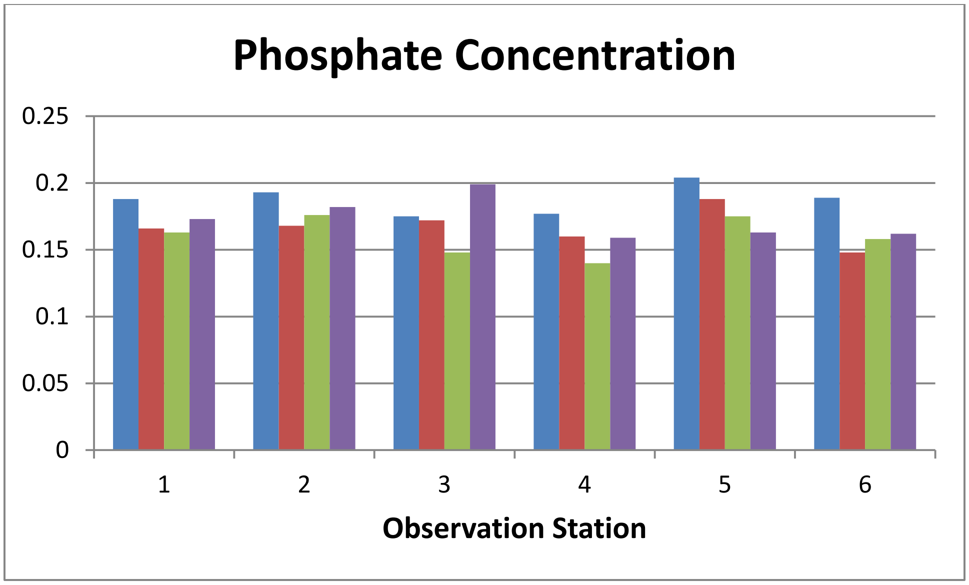

Figure 4. Phosphate Concentration During Research

Chlorophyll-a

The chlorophyll-a concentration obtained during the study obtained an average of 8.36 mg / m3. The lowest value of chlorophyll-a concentration is at station 4 which is 2.06 mg / m3 and the highest at station 1 is 48.5 mg / m3. Station 1 has a much more dominant chlorophyll-a concentration compared to other stations. According to Kep. MNLH (2004), the chlorophyll-a category, <15 mg / m3 was categorized into good conditions, while 15-30 mg / m3 in the moderate category and> 30 mg / m3 was categorized as bad. The higher the chlorophyll-a level indicates the high abundance of aquatic phytoplankton, the higher abundance indicates the high primary productivity of a waters. Chlorophyll content in phytoplankton is influenced by species, time and intensity of sunlight. Besides that, it is also influenced by nitrate, phosphate, stirring water, temperature and other water quality levels (Fitra 2013).

Conclusion

The water quality condition of Jatigede Reservoir based on the results of measurements carried out at each observation station based on parameters of temperature, pH, nitrate, phosphate and chlorophyll-a shows that it is suitable as class II and class III water quality standards based on Government Regulation No. 82 of 2001.

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