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Condition of Singingi River Water Quality Due to Unlicensed Gold Mining (PETI) in Tanjung Pauh Village, Singingi Hilir District, Kuantan Singingi Regency

Kondisi Kualitas Air Sungai Singingi Akibat Tambang Emas Tanpa Izin (PETI) di Desa Tanjung Pauh, Kecamatan Singingi Hilir, Kabupaten Kuantan Singingi

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Abstract

Rivers play a vital role in society by preserving clean water resources, cultivating fish, and supporting daily life. In Tanjung Pauh Village, the Singingi River has experienced a decline in water quality due to human activities, namely Unlicensed Gold Mining without permission activities. The research was carried out in March-May 2024. The method used in this research was field surveys and measurements of physical and chemical parameters. Sampling was carried out at three stations: Station 1, an oil palm plantation area; Station 2, a gold mining area; and Station 3, an area downstream of the Singingi River due to the confluence of the Sushadow River and the Singingi River. The research results show that the value of temperature ranged from 28.8 - 33°C, brightness ranged from 2.48-3.11 cm, turbidity ranged from 85.6 - 251.2 NTU, current speed ranged from 4.85 - 7.06 m/s, TSS ranged from 145–182.6 mg/L, and depth ranges from 350 – 533 cm. Chemical parameters, namely dissolved oxygen ranges from 5,5 – 5,7 mg/L, pH 5, BOD_5 ranges from 3– 3.6 mg/L, TOM ranges from 11.7 – 15.2 mg/L, COD ranges from 85.3 – 297.3 mg/L. According to PP no. 22 of 2021 class III concerning the Implementation and Management of the Environment. The waters of the Singingi River are polluted, which falls into the mild to heavily polluted category. Six parameters have passed the threshold regarding physical parameters, namely temperature, brightness, turbidity, and TSS and based on chemical parameters, namely pH and COD.

Keywords: Water Quality Analysis, Gold Mining, Singingi River

Abstrak

Sungai memiliki peran yang sangat penting bagi masyarakat sebagai sarana sumber daya air bersih, budidaya perikanan dan penunjang kehidupan sehari-hari. Desa Tanjung Pauh, Sungai Singingi diduga mengalami penurunan kualitas air akibat aktivitas Tambang Emas Tanpa Izin (PETI). Dalam upaya mengetahui kondisi kualitas air di Sungai Singingi di Desa Tanjung Pauh, penelitian ini dilakukan pada bulan Maret-Mei 2024 di Desa Tanjung Pauh. Penelitian ini bertujuan untuk mengetahui kondisi kualitas air di Sungai Singingi di Desa Tanjung Pauh. Metode yang digunakan dalam penelitian ini adalah survei lapangan dan pengukuran parameter fisik dan kimia. Pengambilan sampel dilakukan di 3 stasiun dan penelitian ini dilakukan sebanyak 3 kali dengan interval waktu 1 kali per bulan. Hasil penelitian mengukur parameter fisik, yaitu suhu berkisar antara 28,8 - 33 °C, kecerahan

berkisar antara 2,48 - 3,11 cm, kekeruhan berkisar antara 85,6 - 251,2 NTU, kecepatan arus berkisar antara 4,85 - 7,06 m/s, TSS berkisar antara 145 – 182,6 mg/L, kedalaman berkisar antara 350 – 533 cm. Parameter kimia, yaitu oksigen terlarut, berkisar antara 5,5 – 5,7 mg/L, pH 5, BOD5 berkisar antara 3 – 3,6 mg/L, TOM berkisar antara 11,7 – 15,2 mg/L, COD berkisar antara 85,3 – 297,3 mg/L. Menurut PP no. 22 Tahun 2021 kelas III tentang Administrasi dan Pengelolaan Lingkungan Hidup. Kondisi perairan Sungai Singingi berada dalam kondisi tercemar, yang termasuk dalam kategori tercemar ringan hingga berat. Ada 6 parameter yang telah melewati ambang batas (MAB) dari segi parameter fisik, yaitu suhu, kecerahan, kekeruhan, TSS dan berdasarkan parameter kimia, yaitu pH dan COD.

Kata kunci: Analisis Kualitas Air, Penambang Emas, Sungai Singingi

1. Introduction

Riau Province is one of the provinces known to have mining resource potential, and minerals include petroleum, coal, and precious metals such as gold (Anjami & Nurhamlin, 2018). Unlicensed gold mining (PETI) has multiplied in recent years in one of the districts in Kuantan Singingi. Gold mining has been carried out on large rivers, and the environmental damage caused by this has been visible. The waters of the Singingi River are an area with various natural aquatic biota. The Singingi River has a vital role for the community as a means of clean water resources, fish cultivation, transportation facilities, and supporting daily life. The existence of illegal gold mining activities has resulted in a decline in the water quality of the Singingi River.

The waters of the Singingi River have become polluted because they are thought to contain heavy metals which are toxic to aquatic organisms. Unlicensed Gold Mining Activities (PETI) suction river water and mud to obtain gold using dangerous chemicals, namely cyanide, mercury, arsenic and sulfuric acid. Mercury carried by water currents will be difficult to decompose, forming new compounds. If fish eat these organisms, these compounds will enter the body and the food chain, then enter the body and settle.

Increasing community activities by exploiting the potential exploitation of gold mineral resources in the Singingi River, such as gold mining without permits (PETI) and oil palm plantations (PKS), has resulted in disruption of water quality and the life cycle of organisms in the Singingi River as well as reduced water availability and clean. Apart from that, these activities can accelerate the process of lowering land potential, which will impact future development and destroy the sustainability of the ecosystem. So, the author is interested in researching the water quality conditions of the Singingi River due to unlicensed gold mining (PETI) in Tanjung Pauh Village, Singingi Hilir District, and Kuantan Singingi Regency.

2. Material and Method

2.1. Time and Place

Study This will be implemented in March - May 2024 in Sungai Singingi, Tanjung Pauh Village, Singingi Hilir District, Kuantan Singingi Regency, Riau Province. Measurement and analysis of water quality parameter samples were measured and analyzed in the field and the Ecology and Aquatic Environmental Management Laboratory, Faculty of Fisheries and Marine, Universitas Riau.

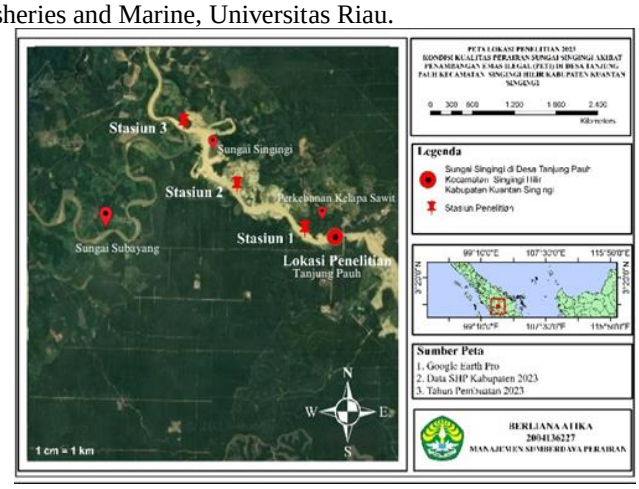

Figure 1. Map of research locations

2.2. Methods

The method used in this research is the survey/observation method, namely, carrying out observations and measurements directly at the research location. This method collects data with physical and chemical parameters; the physical parameters measured are temperature, brightness, turbidity, current speed, Total Suspended Solid (TSS), and depth. Meanwhile, chemical parameters are dissolved oxygen, pH, BOD_5, Chemical Oxygen Demand (COD), and Total Organic Matter (TOM). The samples taken are then taken to the laboratory for analysis.

2.3. Procedures

Location determination is carried out using purposive sampling, considering the conditions and circumstances of the research area. Water sampling locations were carried out at 3 (three) different stations. Station 1 is an oil palm plantation area, station 2 is a gold mining area, and Station 3 is an area in the lower reaches of the Singingi River. Measuring and analyzing water quality parameters from 3 research stations was carried out 3 times with a time interval of 1 per month. Measurements and sampling were carried out at 08.00-16.00 WIB.

2.4. Data Analysis

The data obtained during the research in field measurement data and laboratory analysis are presented as tables and graphs. All data were analyzed descriptively and referred to literature related to the research.

3. Result and Discussion

The Singingi River is located in the Kuantan Singingi Regency in Tanjung Pauh Village, Singingi Hilir District, Kuantan Singingi Regency, Riau Province. Singingi Hilir District has an area of 1,530.97 km^2, or around 20% of the total area of Kuantan Singingi Regency. This river flows in 8 villages/sub-districts in 2 Kuantan Singingi Regency sub-districts, namely Singingi and Singingi Hilir Sub-district. The role of the Singingi River is vital as a means of transportation, a source of clean water, and a source of fisheries cultivation.

The results of measuring the water quality parameters of the Singingi River at each station during the research period varied namely temperature ranged from 28.80 – 33.00 °C, brightness ranged from 2.48 – 3.11 cm, turbidity ranged from 85.6 – 251.2 NTU, current speed ranges from 4.85 – 7.06 m/s, TSS ranges from 145.00 – 182.60 mg/L, depth ranges from 350 – 533 cm, dissolved oxygen ranges from 5.50 – 5.70 mg/L, pH 5, BOD_5 ranged from 3.00 – 3.60 mg/L, TOM ranged from 11.70 – 15.20 mg/L, COD ranged from 85.30 – 297.30 mg/L. Can be seen in Table 1.

Tabel 1. The average value of water quality parameters

No	Parameter	Unit	Station			Standard
			I	II	III	
	Physics					
1	Temperature	°C	30,80	33	28,8	Dev 3
2	Brightness	cm	2,74	2,48	3,11	-
3	Turbidity	NTU	212	251,20	85,6	-
4	Flow Speed	m/s	4,85	5,08	7,06	-
5	TSS	mg/L	174,30	182,60	145	≤100
6	Depth	cm	400	350	533	-
	Chemistry					
7	Dissolved Oxygen	mg/L	5,60	5,50	5,70	≥3
8	pH	-	5	5	5,2	6 – 9
9	BOD5	mg/L	3,30	3,60	3	≤6
10	TOM	mg/L	14	15,20	11,70	-
11	COD	mg/L	116,6	297,30	85,30	≤40

The measurement results for temperature parameters in the waters of the Singingi River at each station during the research ranged from 28.80 - 33.00 ℃. The highest temperature was at station 2, 33 ℃, and the lowest was at station 3, 28.80 ℃. PETI activities caused the high temperature at station 2. Miners carry out the mining process using known machines with the designation *Dompeng*. This tool is used to carry out several activities to separate precious metals from other minerals that cause input from contaminated wastewater discharge.

Meanwhile, the lowest temperature was at station 3, with a value of 28.80 ℃, because there was water input and vegetation around the waters in this area, and no activities resulted in input from contaminated wastewater discharge. Based on PP no. 22 of 2021 Class III concerning Environmental Administration and Management, the threshold (MAB) has passed. The temperature values in the waters of the Singingi River do not support the growth and life of aquatic organisms.

The measurement results for brightness parameters in the waters of the Singingi River at each station during the research ranged from 2.48 – 3.11 cm. The highest brightness is at station 3, namely 3.11 cm, and the lowest is at station 2, namely 2.48 cm. The highest level of brightness is at station 3, namely 3.11 cm, due to the confluence of two rivers, namely the Sushadow River and the Singingi River, which is the estuary of the Singingi River with

relatively strong currents that prevent mud and soil particles from settling. The Sushadow River is also relatively bright due to unlicensed gold mining activities (PETI). Meanwhile, the lowest brightness value is at station 2, 2.48 cm. This low brightness is caused by many community activities involving unlicensed gold mining (PETI) using suction machines. Suction machines are used to suck up gravel, sand and mud, which causes the waste to be thrown back into the water, causing the water to become cloudy. The optimum brightness for water is good enough to support the life of fish and other organisms, namely 20 – 40 cm (Hasim, 2015). It was concluded that compared to the brightness values from field measurements during research in river waters, it does not support the growth and life of aquatic organisms, especially phytoplankton.

The measurement results for turbidity parameters in the waters of the Singingi River at each research station ranged from 85.6 – 251.2 NTU. The highest turbidity value was at station 2, TU, and the lowest was at station 3, 85.6 NTU. In the measurement results, the turbidity level at each station was very high. The high turbidity value at station 2, namely 251.2 NTU, was caused by the large number of unlicensed gold mining activities (PETI) operating during sampling in the field. This mining activity uses a reasonably large suction machine to extract/suction sand, gravel and mud so that the turbidity level is high.

Meanwhile, the lowest turbidity value at station 3 was 85.6 NTU due to the confluence of two rivers, the Sushadow River and the Singingi River. Besides that, no activities were carried out by the community. The minimum value for turbidity level is 5 NTU, and the maximum value permitted is 25 NTU (Alearts & Santika, 1987). From the measurement results, the turbidity value in the waters of the Singingi River has exceeded the threshold (MAB), disrupting the life and growth of organisms in the waters.

The measurement results for the current speed parameters of the Singingi River waters at each station during the research ranged from 4.85 to 7.06 m/s. The highest current speed is at station 3, namely 7.06 m/s, and the lowest current speed is at station 3, namely 4.85 m/s. The high value of the current speed at station 3 is 7.06 m/sec because the water conditions are the downstream part of the Singingi River, which is slightly steep. Apart from that, there are two river confluences, namely the Sushadow River and the Singingi River, and the community carries out no activities at station 3. Meanwhile, the lowest current speed value at station 1 is 4.85 m/s because it has a water bottom that tends to be muddy. There is no river slope, and the depth is relatively shallow. Current speed can be divided into four categories, namely current speed 0 – 0.25 m/s slow current, speed 0.25 – 0.50 m/sec medium current, speed 0.50 – 1 m/s fast current, and above speed 1 m/s is a swift current (Harahap, 1999). The current speed in the Singingi River includes waters with very fast current speeds.

The measurement results for the TSS parameters of the Singingi River waters at each station during the research ranged from 145 – 182.6 mg/L. The highest TSS value was at station 2, 182.6 mg/L, and the lowest TSS value was at station 3, 145 mg/L. The highest TSS value was at station 2, 182.5 mg/L because this sample area was at an unlicensed gold mining location (PETI). The high TSS value is in line with the high turbidity value caused by the current unlicensed gold mining activities (PETI), and the waters are a murky brown color. The lowest TSS value was at station 3,145 mg/L due to the absence of gold mining activities. Apart from that, this station is downstream of the Singingi River, and the river's flow is divided into two, namely the Sushadow River and the Singingi River. Value measurement results total suspended Solid (TSS) of the Singingi River when compared to water quality standards PP No. 22 of 2021 class III, and it can be seen that the waters of the Singingi River have passed the threshold (MAB), which is classified as unfavourable for the growth, reproduction and life of aquatic organisms.

The measurement results for the depth of the Singingi River at each research station ranged from 350 – 533 cm. The highest depth is at station 3, namely 533 cm, and the lowest is at station 2, namely 350 cm. The highest depth was at station 3,533 cm because the samples were taken downstream of the river. It was found that the Singingi River was getting deeper, had a relatively gentle slope, and was quite steep. Apart from that, the vegetation condition is still quite natural, and there was high rainfall in the first month (March) and third month (May) of the study, causing the depth to be relatively high.

Meanwhile, the lowest depth was at station 2, namely 350 cm, which was caused by the location of the sampling station being located in an unlicensed gold mining activity (PETI). The depth of productive waters ranges from 75 – 120 cm because the penetrating power of sunlight can penetrate at that depth so that the photosynthesis process can take place well. Based on the results of measurements during the research, the depth of the waters of the Singingi River still meets the established quality standards.

Measurement results for Dissolved Oxygen (OT) parameters. The water quality of the Singingi River during each study ranged from 5.5 – 5.7 mg/L. The highest OT levels were at station 3, 5.7 mg/L, and the lowest OT levels at station 2, 5.5 mg/L. The high value of OT levels found at Station 3, namely 5.7 mg/L, is due to the location of the sampling station being an area classified as natural and the downstream part of the Singingi River. Apart from that, the brightness value is high, and sunlight enters the waters of the Singingi River. This station is an inflow area that can increase the oxygen concentration in the waters of the Singingi River. The low value of oxygen levels at Station 2, namely 5.5 mg/L, is due to Unlicensed Gold Mining (PETI) activities. In Handayani's (2022) research, the dissolved oxygen (DO) value of the Manuhing River ranged from 3.7 – 6.6 mg/L compared to the relatively high DO value of the Singingi River. For aquatic organisms to live correctly, fisheries management can obtain a dissolved oxygen content of <4 mg/L (Nurrachmi, 1999). PP no. 22 of 2021 Class III

concerning Environmental Administration and Management states that the minimum limit is 3 mg/L. Based on the measurement results, the dissolved oxygen value in the waters of the Singingi River is still above the specified threshold. Therefore, the waters of the Singingi River are sufficient to support the growth and life of aquatic organisms and the management of fisheries in the waters of the Singingi River.

The measurement results for the pH parameters of the water quality of the Singingi River during each study ranged from 5 – 5.2. The highest pH is at station 3, namely 5.2, and the lowest is at stations 1 and 2, namely 5. The highest pH is at station 3, namely 5.2, while the lowest is at stations 1 and 2, 5. The difference in each pH value is not too big. At stations 1 and 2, the community conducts oil palm plantation and gold mining activities without permits (PETI). The presence of mercury in the waters of the Singingi River is influenced to a large extent by the pH. The low pH value of the Singingi River waters is due to the very high turbidity value. The fertility level of water is divided into three parts, namely a.) pH 5.5 - 6.5 means unproductive, b.) pH 6.5 - 7.5 means productive, and c.) pH 7.5 - 8.5 is very productive. According to water quality standards, PP No. 22 concerning the Implementation and Management of the Environment in 2021 class III is 6 – 9. Based on the results of measurements, the pH of the Singingi River waters is classified as low, meaning it is not suitable for the life of aquatic organisms.

Measurement results for BOD parameters$_5$ The water quality of the Singingi River during each study ranged from 3 – 3.6 mg/L. BOD$_5$ The highest is at station 2, namely 3.6 and BOD$_5$, the lowest is at station 3, namely 3 mg/L. Nilai BOD$_5$ The highest was at station 2, namely 3.6 mg/L, due to mining activities at this location. Gold mining activities without a permit (PETI) in the surrounding area throw waste from separating gold and other minerals into the waters of the Singingi River, and oil palm plantations enter the waters of the Singingi River. So, the sum is O_2, which oxidizes more extensive organic materials. When it rains, fertilizer residues from palm oil plantations produce much organic input into rivers. BOD value$_5$ There is not much difference between stations. Low BOD value$_5$ was found at station 3, namely 3 mg/L, due to the small number of community activities that are still natural. According to class III quality standards concerning the Implementation and Management of the Environment PP number 22 of 2021, namely BOD$_5$ levels, which are allowed not to exceed 6 mg/L, the result of measuring the BOD value$_5$ The waters of the Singingi River can support the life of aquatic organisms.

The results of measuring the TOM parameters for the water quality of the Singingi River during each study ranged from 11.7 – 15.2 mg/L. The highest TOM was at station 1, 15.2 mg/L, and the lowest TOM was at station 3, 11.7 mg/L. The high TOM value is found at station 2, namely 15.2 mg/L, due to the large amount of pollutant input in the river. This area is located in the middle, so it gets input from the surrounding environment and mining activities containing waste resulting from mining, which is the result of which organic material is produced. It comes from plant and animal remains found in the soil, which will undergo decomposition. The low TOM value is at station 3, namely 11.7 mg/L, because this area is the downstream part of the Singingi River, which has not received much input from the surrounding environment. After all, there is no activity at this station. The appropriate TOM value is around 20 – 30 mg/L. If the total organic material content exceeds 30 mg/L, it is in the polluted group (Ali et al., 2013). The TOM value measurement results do not exceed the TOM limit value in the waters of the Singingi River, which means that the TOM value in the waters of the Singgi River can support the life of aquatic organisms.

The measurement results for the COD parameters for the water quality of the Singingi River during each study ranged from 85.3 – 297.3 mg/L. The highest COD was at station 2, 297.3 mg/L, and the lowest COD was at station 3, 85.3 mg/L. The highest value of COD content in the waters of the Singingi River is at station 2, namely 297.3 mg/L, due to the very high level of turbidity due to gold mining activities without permits (PETI). Apart from that, local communities have oil palm plantation activities that result in water pollution caused by non-oxidized substances. The lowest COD value was found at station 3, namely 85.3 mg/L because the waters at this station are still natural and are an area where two rivers meet, namely the Sushadow River and the Singingi River.

Furthermore, there were no activities carried out by the community. According to PP no. 22 of 2021 class III concerning Environmental Administration and Management, the maximum COD value is 40 mg/L. The results of measuring COD values in the Singingi River have exceeded the recommended threshold (MAB). So the waters of the Singingi River are considered polluted, which means they cannot support the growth and life of organisms.

4. Conclusions

The waters of the Singingi River are polluted, which falls into the mild to heavily polluted category. Six parameters have passed the threshold (MAB) in terms of physical parameters, namely temperature, brightness, turbidity, and TSS and based on chemical parameters, namely pH and COD.

5. References

Alaerts, G., & Santika, S.S. (1987). *Water Research Methods*. Surabaya: National Enterprise, 309.

Anjami, T., & Nurhamlin, N. (2018). *Social Impact of Gold Mining Without a Permit (Cot) in Sungai Sorik Village, Kuantan Hilir Seberang District, Kuantan Singingi Regency*. Pascasarjana. Universitas Riau

Ali, A., Soemarno, S., & Purnomo, M. (2013). Study of Water Quality and Water Quality Status of the Metro River in Sukun District, Malang City. *Sustainable Earth Journal*, 13(2): 265-274

Handayani, T., & Veronica, E. (2022). Analysis of Water Quality Due to Gold Mining in the Manuhing River, Gunung Mas Regency. *Journal of Tropical Fisheries*, 17(2): 57-65.

Harahap, S. (1999). *Level of Water Pollution in Tanjung Balai Karimun Harbor, Riau Islands, Seen from the Macrozoobenthos Community*. Riau University Research Institute. Pekanbaru. 26 p.

Hasim, H., Koniyo, Y., & Kasim, F. (2015). Physical-chemical Parameters of Limboto Lake Waters as a Basis for the Development of Freshwater Aquaculture. *Scientific Journal of Fisheries and Marine Affairs*, 3(4): 130–136.

Nurrachmi, I. (1999). Physical-Chemical Quality of Water Around the Dumai Oil Harbor Dredging Mud 'Dumping Area'. *Berkala Perikanan Terubuk*, 27(76): 2 – 13.