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STUDY OF THE IMPACT OF TIDAL SAND MINING ON THE WATER QUALITY OF THE KAPUAS RIVER

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Abstract

This study focuses on the impact of tidal sand mining on the water quality of the Kapuas River. The research methods include laboratory tests for parameters such as Water Temperature, Turbidity, DO, BOD, COD, TSS, pH, and Color, as well as field measurements using equipment such as Current Meters, ropes with weights, Sechhi Disks, air temperature, and GPS to record sampling locations. The results of the analysis showed a significant increase in BOD and COD values at point A9, 200 meters downstream from the mining location, due to suction and overflow of water from pontoon boats. Despite the increase in values, the DO value indicates that the water quality is still good, although not comparable to the increase in BOD and COD. The influence of water discharge is an important factor, where high water discharge, especially at points A7, A8, and A9, results in dilution and decreased concentration of pollutants. Parameter analysis shows a decrease in water quality in spots, indicating a source of pollutants that may be diffuse. However, the average Pollution Index value shows that the water quality meets class III quality standards. Kapuas River water can still be used for fish farming, livestock, agricultural irrigation, and other related purposes. The importance of monitoring and mitigation to minimize the negative impacts of tidal sand mining on water quality and maintain environmental sustainability.

Keywords: ***Study, Impact of Sand Mining, Water Quality of Upas River***

INTRODUCTION

Mining materials are non-renewable natural resources in the form of minerals and coal, which are limited in nature and are found in the earth. So that it is regulated in the regulations that all forms
Its utilization will be regulated by the state, and then the benefits will be handed over or directed to prosper the Indonesian people. This is because mining materials play a very important role in supporting
national development (Law Number 3 of 2020).

In carrying out the extraction of natural resources in this case in the form of mining materials, it must certainly be done wisely, so that the intended development goals are achieved. Development is expected to be able to realize the welfare of life, and fulfill the lives of many people. As the mining population increases, development activities are growing rapidly, on the other hand, development has a negative impact that has the potential to enter and pollute the aquatic ecosystem, because it is at the lowest elevation and the nature of water which is usually used as the best solvent, making all waste from development activities flow into the aquatic ecosystem (Usman Ahmad et al. 2021).

The development of the industrial sector often does not pay attention to the impact of changes in environmental conditions, so that many problems arise as a result of this activity. Changes in the quality of river water which is the estuary of all waste from activities are influenced by human activities so that it can result in a decrease in the main and supporting functions of water resources. The quality of river water is mostly classified as heavily polluted, this is found in various regions in Indonesia. So that attention is needed in the management and restoration of the quality of river water, considering the great benefits of water for the majority of the Indonesian population. The poor quality of river water certainly threatens the health of the population and living things.

Life Which is at around river (Ministry of Environment and Forestry 2017). The Kapuas River is classified as one of the longest rivers and is a source of life for the province of West Kalimantan, due to its large water resource potential. The length of the Kapuas River is 1,086 km with 33 and 11 main rivers and branches respectively (Rido Simbolon 2019). The Kapuas River has a main function in meeting the needs of clean water for the community in various activities such as bathing, washing, toilets, agriculture, fisheries, also functions as a center of trade and the

community's economy, such as transportation, ports and industry, and is also used as a tourism area. (Muhammad Wahyu Prahardana and Muhammad Kholid Basyaiban 2022).

The benefits and role of the Kapuas River are very large and important for the community. Maintaining the quality of the Kapuas River water is certainly very important. But in fact, in the year 2016-2020 refers to the results of monitoring the quality status of the Kapuas River water quality has decreased. In 2016 the quality status of the Kapuas River was in a condition of light pollution-moderate pollution, in 2017-2018 it experienced a decline in quality with a status of moderate pollution-heavy pollution, and experienced another decline in 2019 to 2020, namely heavy pollution (Widjihatini et al. 2021). This pollution occurs from domestic waste from community activities and industrial waste produced by gold mining activities, industrial waste disposal, plantations and so on. (Muhammad Wahyu Prahardana and Muhammad Kholid Basyaiban 2022).

In addition, the condition of the Kapuas River is worsened by the rampant sand mining activities along the Kapuas River. This is certainly triggered by the increasing need for sand to meet the needs of construction materials. Not only used to meet local needs, tidal sand obtained from the Kapuas River is also often used to meet various national construction activities due to its good quality. This is what causes the rampant growth of Mining Business Permits for tidal sand excavation materials in the Kapuas River, especially in Kubu Raya Regency, because it is located in the downstream part of the Kapuas River, a lot of sand sediment is deposited, and of course it accommodates a lot of pollution loads from the upstream river. It is stated that the condition of water quality in Kubu Raya Regency is decreasing due to various human activities, so it is feared that in the future it will not be able to function according to its designation. (Regional Regulation of Kubu Raya Regency Number 6 of 2014).

RESEARCH METHODS

The location of this research was conducted in Pulau Limbung Village, Sungai Raya District, Kubu Raya Regency. The observation points and water sampling were carried out at 9 points. Geographically located at 109° 45' 27.08" BT- 109° 47' 39.73" BT, and 0° 14' 33.40"LS- 0° 17' 49.79” LS, as seen in Figure 3-1. The research was conducted in November - December 2023. The equipment used in this research is divided into two parts, namely (1) laboratory tests for testing Water Temperature, Turbidity, DO, BOD, COD, TSS, pH, and Color (2) equipment for field measurements such as a Current Meter to measure water current speed, a weighted rope to measure water depth, Sechhi Disk to measure water clarity, temperature for the surrounding air, and GPS to record the location of the sample collection point.

The data used are primary data and secondary data. Primary data are in the form of measurements of water current speed, river depth, water clarity, and also water quality sampling and testing, as well as observing the activities of tidal sand mining activities carried out in the Kapuas River, Kubu Raya Regency. Meanwhile, secondary data were obtained from various sources such as literature studies, previous research, reports and documents from companies or agencies related to this research, namely; Kubu Raya Regency Administrative Map, Map of the distribution of Mining Business Permits for Tidal Sand Commodities in the Kapuas River, Kubu Raya Regency, Satellite Imagery Map and data from water sample tests carried out by tidal sand mining companies.

RESULTS AND DISCUSSION

Activities of Tidal Sand Mining Activities

The Kapuas River located at the research location, apart from being a water source for the community, is also used as a transportation route, both for public transportation and for transportation of industrial needs such as transportation of mining materials, plantations, fuel and others, as seen in Figure 4-1.

Figure 0-1. Activities Along the Kapuas River at the Research Location

Another activity in the Kapuas River at the research location is tidal sand mining. Based on the results of observations at 9 points, only 1 tidal sand mining activity was found, namely at point A8 as seen in Figure 4-2, from a total of 7 Mining Business Permits located along the observation location points. This occurs because tidal sand mining activities at the research location follow consumer demand, so tidal sand mining activities only occur when there is a sales request.

Based on the results of an interview conducted with one of the workers as seen in Figure 4-3, who is actively carrying out tidal sand mining activities, the operational hours of the activity start from 07.30 WIB until the pontoon is fully filled, around 10-11 working hours per day. The number of workers for tidal sand mining operations is 3 people. 1 person as the leader/captain of the suction boat, 1 person as the suction machine operator, and 1 person as the supervisor in the filling area (pontoon boat).

The production capacity of the tidal sand mining carried out is 300m3/day with a total area of 2 Ha permit. The capacity of the pontoon used is 300 m3 as seen in Figure 4-4, so the duration of the mining activity is only 1 day. After being full, the pontoon will be taken to the stockpile location in Pontianak. The pontoon used is adjusted to consumer demand, so the duration of the mining activity follows the pontoon capacity. In the observation of tidal sand mining activities carried out at the research location, it was seen that this mining activity had an impact on water quality, especially in tidal sand suction activities, this activity will disturb the sand and mud material at the bottom of the river, in addition, the overflow water from the suction that entered the pontoon was then immediately discharged through the gaps in the pontoon partitions.

In calculating water discharge, data on water current speed and river cross-sectional area are required, so that in collecting primary data, current speed measurements are carried out using a current meter and river depth measurements. Water clarity is very relative to the penetration of sunlight. Although this is usually determined by the amount of suspended solids in the water, it can also be affected by colored dissolved organic matter (CDOM), and other dissolved solids. Water clarity is measured with the help of a Sechchi disk. Water quality is the nature of water and the content in it, whether in the form of substances, living things or other components. The indicators of water quality can be seen from several parameters, including physical and chemical parameters.

Temperature Conditions

Point A1 is the most upstream point in the research area while point A9 is the most downstream point. A8 is the point where there is tidal sand mining activity. Point A8 shows the highest temperature, also at points A3 and A6. Location conditions with high temperatures often cause a decrease in DO values in the water, which affects the life of aquatic organisms. The good temperature range for the growth of aquatic organisms in river waters is around 200C-300C (Effendi and Hefni 2003). So from here it can be concluded that the temperature conditions in the research area are classified as good and are able to support the growth of aquatic organisms.

Referring to Government Regulation Number 22 of 2021 concerning the Implementation of Environmental Protection and Management. The range of standard quality values in each class has a deviation value of 3 from the air temperature above the water surface, which is 29-300C so that the range of standard quality values ranges from 260C-330C. This shows that the temperature conditions in the research area are still within the water quality standard threshold. Based on the Regulation of the Minister of Health of the Republic of Indonesia Number 416 of 1990, good water conditions are water that has a turbidity limit of 25 NTU, so that the physical water looks clear or clear. Water turbidity can be caused by the presence of inorganic and organic materials contained in the water such as mud and materials produced from industrial activities. This can interfere with sunlight entering the water, so it can endanger fish and their food.

Total Suspended Solids (TSS) Condition

Suspended solids or total suspended solids or commonly known as TSS, is a measurement of the total quantity of solids per volume of water, so it is usually expressed in units of mg/l. This shows that the TSS value is the value of a specific measurement of all suspended solids, organic, and inorganic, based on mass. So that it shows the value of the total solids in the water body, and can be used in calculating the sedimentation rate. This is what distinguishes the TSS value from the turbidity value, as previously discussed.

Acidity (pH) Condition

The acidity (pH) conditions at the research location are shown in Table 4-4, and Figure 4-12. Based on the data above, the pH conditions at the research location range from 6.43 - 7.11. This shows that the pH conditions refer to the quality standards stated in Government Regulation Number 22 of 2021 concerning the Implementation

of Environmental Protection and Management which are still within the threshold, namely 6-9 for all water classes.

Biological Oxygen Demand (BOD) Condition

Referring to the standard quality data of Government Regulation Number 22 of 2021 concerning the Implementation of Environmental Protection and Management, the best BOD value is included in class 1 with a value of up to 2 mg/l, while class 4 has a value of 12 mg/l. If we compare it with the results of the water quality analysis test carried out at 9 observation locations. Overall, the water quality condition when viewed from the BOD parameter is classified into class 3 water, where the BOD value at 9 observation points ranges from 4.21-5.76 mg/l. The highest value is at observation point A9, possibly due to tidal sand mining activities at point A8. The increase in BOD value affects the condition of dissolved oxygen (DO). This is because if BOD increases, of course more organic material will enter the water body, thus reducing the oxygen content in the water.

Pollution Index (IP) of Kapuas River

Pollution index is one method that can be used to determine the level of pollution relative to each water quality parameter. In this study, the calculation of the pollution index was taken based on the points of water sampling locations and also on the predetermined parameters, namely temperature, TSS, pH, BOD, COD, and DO. The water quality standards that are the standards for water quality based on their class refer to Government Regulation Number 22 of 2021 concerning the Implementation of Environmental Protection and Management (attachment VI). And the calculation of the pollution index refers to the Decree of the Minister of State for the Environment Number 115 of 2003. The results of the index calculation pollution at each sampling location as shown in the following table.

Pollution Index (IP) Calculation of the Kapuas River

Location	Pollution Index							
	Class I		Class II		Class III		Class IV	
	IP	Status s	IP	Status s	IP	Status	IP	Status
A1	2.15	Cemar Light n	1.42	Cemar Light n	1.03	Blackened Light	0.98	Memes noah Baku
A2	2.06	Cemar Light n	1.36	Cemar Light N	1.02	Blackened Light	0.98	Memes noah Baku
A3	2.18	Cemar Light n	1.48	CemaR Light N	0.83	Memes noah Baku	0.77	Memes noah Baku
A4	2.35	Cemar Light n	1.62	CemaR Light N	1.06	Blackened Light	1.00	Memes noah Baku
A5	2.17	Cemar Light n	1.45	CemaR Light N	0.92	Memes noah Baku	0.87	Memes noah Baku
A6	2.16	Cemar Light n	1.44	CemaR Light N	0.81	Memes noah Baku	0.76	Memes noah Baku
	2 .	Cema r	1 .	Cema R	1 .		1 .	Memes

	4	Light	6	Light	0	Blackened	0	noah
A7	0	n	8	N	7	Light	0	Baku
	2	Cema	1	Cema	0		0	
	.	r	.	R	.	Memes	.	Memes
	1	Light	4	Light	8	noah	7	noah
A8	9	n	7	N	2	Baku	7	Baku
	2	Cema	1	Cema	0		0	
	.	r	.	R	.	Memes	.	Memes
	6	Light	8	Light	9	noah	8	noah
A9	2	n	8	N	4	Baku	9	Baku
Rat	**2**	**Cema**	**1**	**Cema**	**0**		**0**	
a-	**.**	**r**	**.**	**R**	**.**	**Memes**	**.**	**Memes**
Rat	**2**	**Ring**	**5**	**Ring**	**9**	**noah**	**8**	**noah**
a	**5**	**an**	**3**	**An**	**4**	**Baku**	**9**	**Baku**

Based on the results of the pollution index calculations shown in Table 4-6, it can be concluded that the average water quality is classified into class III water quality standards, namely water that is suitable for freshwater fish farming, livestock farming, water for irrigating crops and/or other uses that are the same as these uses, whereas when viewed into class I and II quality standards, it is classified as lightly polluted, so that pollution control efforts and further processing are required. if it will be used for raw water for drinking water or other uses that require the same water quality as the use (Class I) or water recreation infrastructure/facilities, freshwater fish farming, animal husbandry, water for irrigating crops and/or other uses that are the same as the use (Class II).

In this study, it is not seen that the quality decline occurs from upstream to downstream. It can also be concluded that the source of pollutants (water pollution) occurs in spots or can be classified into non-point sources, namely sources that are spread. The origin of pollutants comes from sources that are not known for certain (Connel and Miller 1995). This is also reinforced by the results of calculations at location point A8 which is the point where there is sand mining activity, A7 location before, and A9 location after the activity, which was initially thought to have an impact on the decline in water quality, but the calculation results show relatively the same thing as other locations, no significant changes. In addition, the influence of varying water discharge also affects the concentration of pollutants, where if the river water discharge increases as seen at points A7, A8 and A9, the concentration of pollutants entering the water body decreases due to the dilution process (Etik Yuliastuti 2011).

CONCLUSION

The activity of tidal sand mining in the Kapuas River has an impact on the quality of river water, especially on the increase in BOD and COD values resulting from the suction and overflow activities on pontoon ships. It can be seen from the BOD and COD values at point A9 which is about 200 meters downstream of the tidal sand mining activity, which has increased compared to other points. However, this increase in value is not comparable to the decrease in DO value, because the DO parameter still shows that the water quality still in good condition. This is partly due to the influence of water discharge. The size of the water discharge affects the concentration of pollutants, where if the river water discharge increases as seen at points A7, A8 and A9, points around the activity location, then the concentration of pollutants entering the water body decreases due to the dilution process. In addition, the existing parameters indicate that the decline in water quality at the research location occurs in spots, it is possible that the source of pollutants occurs in a spread manner (non-point source). The large average value of the Pollution Index in the research area shows that the water quality of the Kapuas River still meets class III quality standards, namely water that is suitable for freshwater fish farming, livestock farming, water for irrigating crops and/or other uses that are the same as these uses.

REFERENCES

Connel, dan Miller. 1995. Kimia dan Etoksikologi Pencemaran, diterjemahkan oleh Koestoer. Disunting oleh Koestoer. Indonesia University Press.

Etik Yuliastuti. 2011. “Kajian Kualitas Air Sungai Ngringo Karanganyar Dalam Upaya Pengendalian Pencemaran

Air." Semarang: Universitas Diponegoro.

Kementerian Lingkungan Hidup Dan Kehutanan. 2017. "Petunjuk Teknis Restorasi Kualitas Air Sungai."

"Peraturan Daerah Kabupaten Kubu Raya Nomor 6 Tahun 2014 Tentang Pengelolaan Kualitas Air dan Pengendalian Pencemaran Air." t.t.

Rido Simbolon. 2019. "Pengembangan Kawasan Wisata di Sungai Kapuas Kota Pontianak," 1–26.

Usman Ahmad, Tri Wiji Nurani, Etty Riani, dan Ni Wayan Kurniani Karja. 2021. Teknologi, Pengelolaan dan Pelestarian Sumberdaya Alam dalam Perspektif Pembangunan Berkelanjutan. 1 ed. Vol. 1. Bogor: IPB Press.

Widjihatini, Setyawan Warsono Adi, Riza Murti S., Raden Rara Endang Nooryastuti, Iwan Nirawandi, dan dkk. 2021. Statistik Kualitas Air, Udara, dan Tutupan Lahan Tahun 2020. Direktorat Jenderal Pengendalian Pencemaran dan Kerusakan Lingkungan.