

Water Quality Status at Trisakti Port PT Pelabuhan Indonesia (Persero) Sub Regional Kalimantan

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ABSTRACT

This study aims to determine the condition of air quality in the Trisakti Port area managed by PT Pelabuhan Indonesia (Persero) Kalimantan Sub-Regional, with reference to the physical and chemical parameters of air according to Government Regulation of the Republic of Indonesia Number 22 of 2021. The analysis results showed that several air quality parameters, such as Total Suspended Solid (TSS), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), and Dissolved Oxygen (DO) did not reach the predetermined quality standards. Assessment of air quality status is carried out using the Pollution Index Method based on the Ministry of Environment Decree Number 115 of 2003. Based on the results of the Pollution Index (IP) calculation, all sampling points show air quality status in the light pollution category. The highest IP values were recorded at the Banjarmasin Container Wharf at 3.13 in May and 4.12 in October with a light pollution category, but these are approaching the upper limit of the category. This finding indicates that the waters at this location are relatively more polluted compared to the other two locations, so it requires more intensive environmental management to preventing an increase in pollution levels.

Keywords: Pollution Index, Quality Status, Trisakti Port, Water quality

INTRODUCTION

Barito River is the main transportation route for Trisakti Port, this port can be accessed by ships from various regions in Kalimantan and from outside the island. The connection between the Barito River and Trisakti Port has a tight association between economic activities along the river and port operations. The development of Trisakti Port is closely related to the government's efforts to improve and expand river infrastructure, such as dredging and river channel improvements. This is to ensure the transportation and navigation of ships entering and exiting the port. Martapura Baru Port is located on the banks of the Martapura River near Trisakti Port, and is intended for intrinsic ship activities with a ship length (LOA) of more than 50m.

Ports as one of the maritime logistics chains play an important role in the entire trade process, both national and international trade. However, port business activities have an impact on environmental quality. From an environmental perspective, the layout of a port is closely related to water quality, ecosystems, and biodiversity. These water quality and ecological conditions influence the sustainable development of the shipping industry and offer a valuable background for

researching the impacts of water-related environmental factors (Wang, et.al, 2025). Trisakti Port is located on Jalan Barito Hilir Trisakti, Telaga Biru Village, West Banjarmasin District, Banjarmasin City, South Kalimantan Province. Trisakti Port is the main supporter of sea transportation. Trisakti Port is an industrial and commercial area as well as a container terminal. Activities at Trisakti port and surrounding industries have resulted in a decline in the water quality status of the Barito River. Activities at the port, such as loading and unloading cargo, refueling ships, and ship maintenance, could produce liquid waste containing hazardous chemicals and other pollutants. If not properly managed, this liquid waste can reduce the water quality status of the Barito River and disrupt the river ecosystem and the health of people who rely on the river as a source of drinking water and daily needs.

Water pollution in Trisakti Port may originate from various sources, which are industrial sources, sources of water transportation activities and domestic waste, as well as unknown sources (*non-point sources*). Industrial Sources, which are activities in the proximity of the port that contribute to the discharge of untreated liquid waste. Industrial sewage and industrial facilities around ports often dump liquid sewage containing hazardous chemicals and toxic substances into waters without adequate treatment. The source of sea transportation activities come from fuel spills and waste from docked ships and loading and unloading activities. Disposal of waste from ships, including domestic waste and waste from operational activities, could negatively impact water quality. Domestic sources of waste come from the discharge of sewage from poorly managed settlements into water bodies. Communities around ports that dump domestic waste directly into waterways or water bodies could cause pollution, especially if there is no adequate sewage treatment system. The discharge of solid waste into waters, including plastics and

organic matter, may contaminate and damage aquatic ecosystems.

The quality status of a body of water is the level of water quality conditions that describes polluted conditions or good conditions in a certain time by comparing it with the quality standards that have been set in Government Regulation of the Republic of Indonesia Number 22 of 2021 concerning the Implementation and Protection and Management of the Environment. Any pollutant that enters water bodies in the waters has the potential to cause a decrease in the quality of the waters which would reduce the biological and ecological functions of the ecosystem (Thunder *et al.*, 2017). In this study, the parameters tested were physical parameters including Temperature, TSS, Chemical Parameters including pH, BOD, COD, DO, Ammonia, Oil and Fat and Microbiological Parameters, such as Total Coliform. This study would provide an overview of which parameters exceed the quality standards so that an analysis of pollution sources around Trisakti Port would be carried out. The purpose of this study is to determine the water quality and water quality status conditions at Trisakti Port of PT Pelabuhan Indonesia (Persero) Sub Regional Kalimantan.

MATERIALS AND METHODS

This study was conducted in Basirih, Banjarmasin City, South Kalimantan Province. The sampling locations in the research to be carried out are three locations: Passenger Terminal Pier, TPKB Pier, Martapura Baru Pier. This study used a quantitative approach and was carried out for 3 months, starting from data collection, data processing, data analysis and report preparation.

The measurement of the water quality status used is the IP (Pollution Index) method with the following formula:

$$PI_j = m \sqrt{(C_i/L_{ij})^2_M + (C_i/L_{ij})^2_R}$$

Information:

PI_j = Pollution index for allocation j

C_i = concentration of water quality parameters i

L_{ij} = the concentration of water quality parameters i listed in the water allocation standard

M = maximum

R = average

$(C_i / L_{ij})_R$ = average index

$(C_i / L_{ij})_M$ = maximum index

Where m = the balancing factor The critical state is used to calculate the value of m $PI_j = 1.0$ if the maximum value of $C_i/L_{ij} = 1.0$ and the mean value of $C_i/L_{ij} = 1.0$ then

$$1.0 = m \sqrt{(1)^2 + (1)^2}$$

$$M = 1 / \sqrt{2}$$

$$PI_j = \sqrt{\frac{(C_i/L_{ij})_M^2 + (C_i/L_{ij})_R^2}{2}}$$

This method could directly link the level of pollution to whether or not the river could be used for a specific use and with the value of certain parameters. Evaluation of PI values is presented in Table 1.

Table 1. Pollution Index

Value	Pollution index
$0 \leq PId \leq 1.0$	Meet quality standards (good condition)
$1.0 < D \leq 5.0$	Light pollution
$5.0 < PId \leq 10$	Moderate pollution
$FIG_j > 10$	Heavy pollution

Source: Ministry of Agriculture and Forestry 115 Water Quality Status (2003)

RESULTS AND DISCUSSION

Water quality is used to control the state of a aquatic environment. Physico-chemical analysis is one of the important evaluation methods in determining river water quality because it allows the measurement of various parameters that could indicate the level of water pollution (Chabib *et al.*, 2025). The water quality parameters used in the study are physical parameters consisting of temperature, TSS, chemical parameters

consisting of pH, BOD, COD, DO, ammonia, fatty oil and microbiological parameters namely Total Coliform. Water quality results of Trisakti Port PT Pelabuhan Indonesia Sub Regional Kalimantan. The results of water quality measurement of physical, chemical and microbiological parameters during the research at Trisakti Port of PT Pelabuhan Indonesia (Persero) Sub Regional Kalimantan with 3 (three) sampling locations shown in Table 2. next

Table 2. Water Quality Results

PARAMETERS	Unit	BM	Sampling Location		
		Class II	TP	TPKB	MB
PHYSICS					
Temperature	°C	Dev 3	25	25	25
TSS	mg/L	50	81*	105*	79*
CHEMISTRY					
Ph		6 - 9	6.2	6.5	7
BOD	mg/L	3	20*	24*	20*
COD	mg/L	25	66*	74*	68*
DO	mg/L	Min 4	2*	1*	2*
Ammonia	mg/L	0.2	0.03	0.03	0.03
Oils and Fats	mg/L	1	0.5	0.5	0.5
MICROBIOLOGY					
Total coliform	MPN/100 mL	5,000	400	40	40

(Source: Primary Data, 2025)

Information

*: Not in accordance with quality standards

TP: Passenger Terminal Pier

TPKB: Banjarmasin Container Terminal Pier

MB: New Martapura Pier

BM: Quality Standards of Government Regulation of the Republic of Indonesia Number 22 of 2021 concerning the Implementation of Protection and Management of LH for River Water Allocation and the Like

The results of water quality temperature at Trisakti Port PT Pelabuhan Indonesia (Persero) Sub Regional Kalimantan with 3 (three) sampling locations shown in Figure 1.

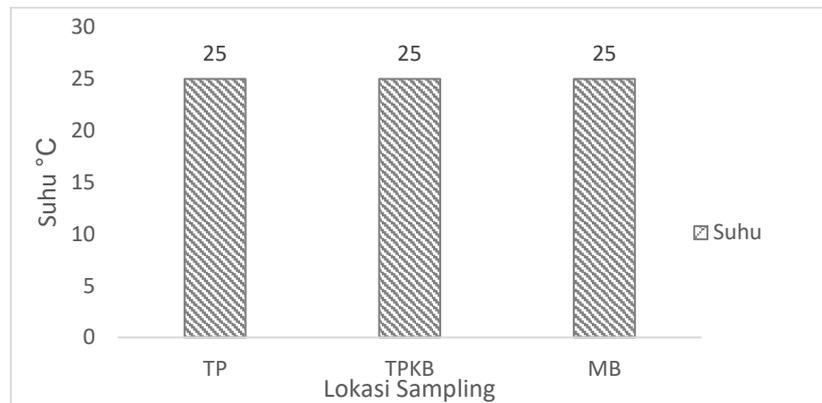


Figure 1. Water Quality Results Temperature

Temperature could control the respiration process and metabolism of aquatic biota so that it affects the behavioral and growth processes as well as its reproductive cycle (Hamuna *et al.*, 2018). The temperature in the 3 (three) locations is still in accordance

with quality standards. The results of TSS water quality at Trisakti Port of PT Pelabuhan Indonesia (Persero) Sub Regional Kalimantan with three (3) sampling locations could be seen in Figure 2.

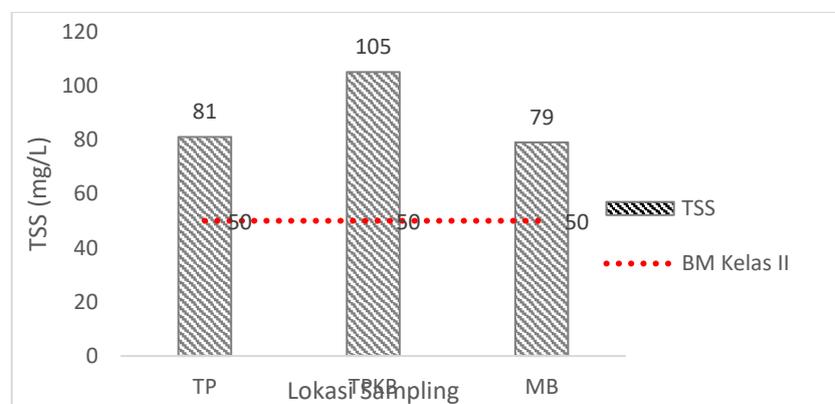


Figure 2. TSS Water Quality Results

The suspended solids level during measurement was 81 mg/L at the passenger terminal dock point, 105 mg/L at the Banjarmasin container terminal dock point, and 79 mg/L at the Martapura Baru dock point. The TSS levels in the three locations exceeded the quality standards. TSS around ports tends to be high because heavy ship traffic could cause stirring of the bottom of the water (sediment resuspension), especially when the ship's propeller rotates or when the

ship anchors and drops anchor. This process lifts sediment from the seafloor into the water column, significantly increasing the TSS. Many ports are located at the mouth of the river. Rivers carried sediment from upstream, especially during the rainy season. Water sampling was carried out in October, which at that time had entered the rainy season. Around the port there are usually industrial activities, settlements, or open land. When it rains, water carries mud, sand,

soil, and other materials from the land surface through drainage channels to the sea. All of these particles contribute directly to the increase in TSS. This is in line with the research of Istomi, *et al.*, (2025) In the rainy season, an increase in TSS and COD can occur due to increased run off and soil erosion. Meanwhile, a decrease in BOD and

a slight increase in DO during the rainy season may indicate a change in the level of organic pollution and water aeration. The results of pH water quality at Trisakti Port of PT Pelabuhan Indonesia (Persero) Sub Regional Kalimantan with 3 (three) sampling locations in Figure 3.

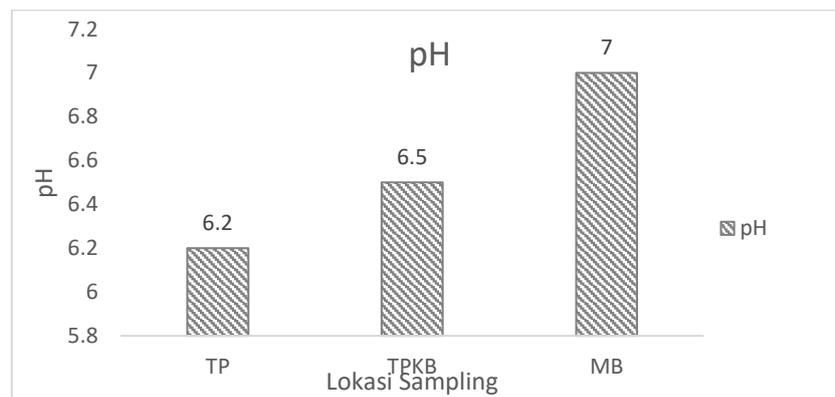


Figure 3. pH Water Quality Results

The ideal pH range of 7–8.5 for biota growth is 7–8 (Ferawati *et al.* 2014), According to Wulandari *et al.* (2015), To maintain its quality of life, each shellfish biota maintains a certain pH level. Seawater has a very strong buffering ability in regulating pH changes. A slight deviation of pH from natural would provide benefits to the buffer system. Because of changes and imbalances

in CO₂ levels that could endanger marine life (Amiluddin 2007; Gaol et al. 2017). The pH level determined by measurement shows the pH level in accordance with the quality at the Passenger Pier Terminal location.

The results of BOD water quality at Trisakti Port of PT Pelabuhan Indonesia (Persero) Sub Regional Kalimantan with 3 (three) sampling locations shown in Figure 4.

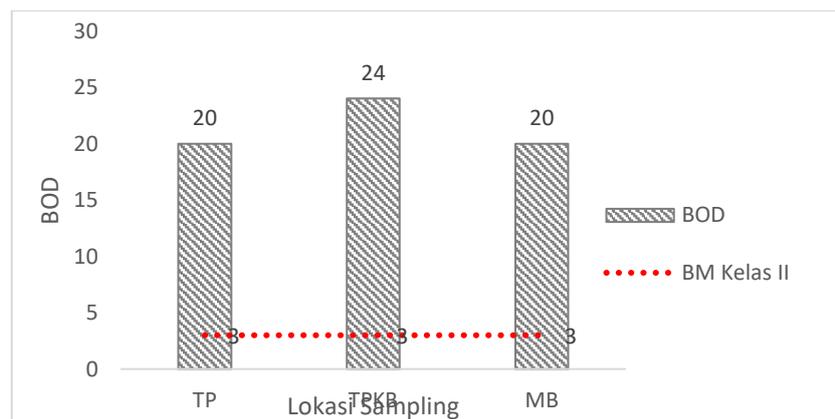


Figure 4. BOD Water Quality Results

BOD is an example of organic matter that can be degraded by aerobic microbes into air and carbon dioxide. Based on water quality data, BOD was obtained at 20 mg/L at the Passenger Terminal Pier point, 24 mg/L at the Banjarmasin Container Terminal Pier

point, and 20 mg/L at the Martapura Baru Pier point. The BOD level is considered increase the quality standard. High BOD values could reduce the availability of dissolved oxygen in water because it is used in the oxidation process of organic matter

that can be broken down by microorganisms. BOD levels have not shown the results of the influx of organic matter, because BOD only shows the level of organic matter that microorganisms are able to decompose. Temperature, plankton decompose, microbial presence, as well as the type and

amount of substances, all affect the BOD of the waters (Daroini & Arisandi, 2020). The results of COD water quality at Trisakti Port of PT Pelabuhan Indonesia (Persero) Sub Regional Kalimantan with 3 (three) sampling locations could be seen in Figure 5.

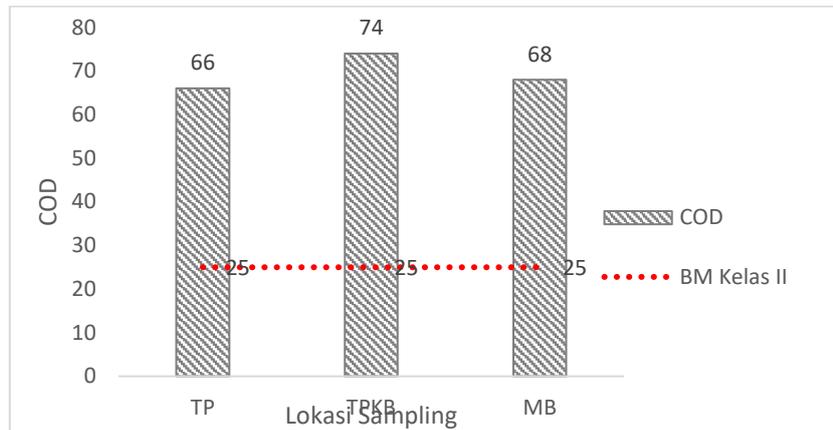


Figure 5. COD Water Quality Results

The COD value is a measure of water pollution by organic substances that can or cannot be oxidized through microbiological processes and result in a reduction in dissolved oxygen in the water. COD (*Chemical Oxygen Demand*) values in the waters around Trisakti Port were taken at three sampling points. From the COD parameter graph, the water quality results at the Passenger Terminal Pier location point are 66 mg/L, at the location point of the Banjarmasin Container Terminal Pier is 74 mg/L, and at the location point of Martapura Baru Pier is 68 mg/L. These results showed that COD exceeds the quality standard. This

indicates significant organic pollution (Istomi *et al.*, 2025). The COD content in river water is the amount of organic waste dissolved in water where the more dissolved organic waste would increase the need for oxygen needed by microorganisms to oxidize organic waste and increase the COD content in water. Apart from this, things that indicate that could increase COD content are water flow from industrial activities that tend to have high COD content to river water flow. The results of DO water quality at Trisakti Port of PT Pelabuhan Indonesia (Persero) Sub Regional Kalimantan with 3 (three) sampling locations can be seen in Figure 6.

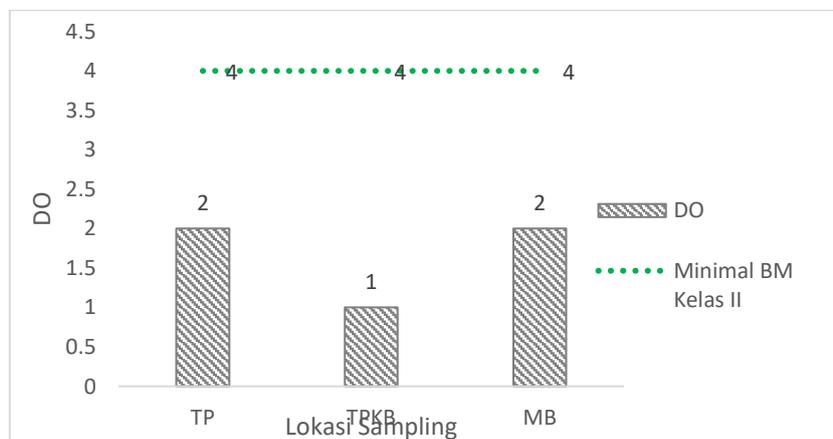


Figure 6. DO Water Quality Results

The DO (Dissolved Oxygen) value in the surrounding waters at Trisakti Port was taken at 3 (three) sampling points. Based on the graph, it shows that DO (*Dissolved Oxygen*) is below the class 2 quality standard value, which is at least 4 mg/L. The water quality results at the location point of the Passenger Terminal Pier are 2 mg/L, at the location point of the Banjarmasin Container Terminal Pier is 1 mg/L, and at the location point of the Martapura Baru Pier is 2 mg/L. DO has a relationship with BOD where the high BOD value will be inversely proportional to the DO. DO in waters would experience a decrease or deficit of oxygen in waters. High DO in waters indicates that water is suitable for use and good for aquatic biota, if low DO levels indicate that the waters have been polluted (Aruan & Siahaan, 2017). It is related to the high results of BOD and COD

so that many organic and chemical materials require oxygen to decompose.

This is inversely proportional to research according to Marselina *et al.*, (2025) Dissolved oxygen (DO) values are often higher during the rainy months due to the process of reaeration, in which oxygen from the air is absorbed into the water, which is facilitated by increased rainfall. In contrast, DO concentrations tend to drop in drier months as water temperatures rise. When considering other parameters, concentrations tend to be lower in the rainy months compared to the dry months, which is largely due to dilution factors. High rainfall during the wet months could be beneficial for the overall quality of water bodies.

The results of Ammonia water quality at Trisakti Port of PT Pelabuhan Indonesia (Persero) Sub Regional Kalimantan with 3 (three) sampling locations show in Figure 7.

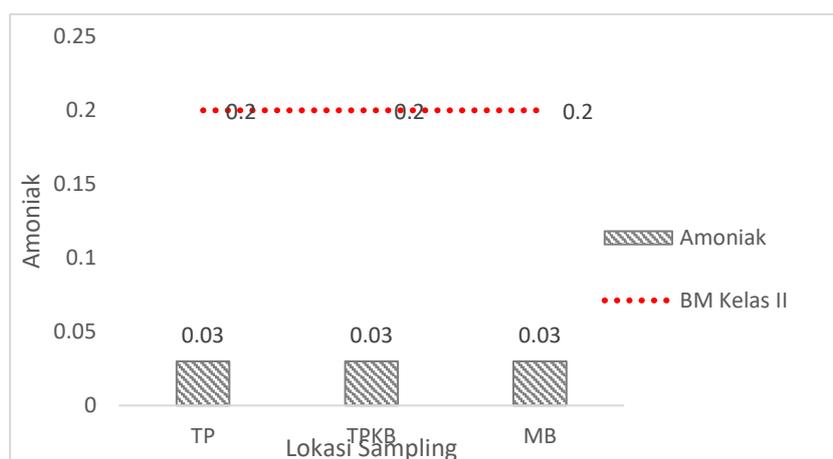


Figure 7. Ammonia Water Quality Results

Ammonia (NH₃) is an inorganic compound derived from nitrogen-hydrogen compounds sourced from nature. Excessive ammonia levels result in the death of organisms living in the environment (Alkindi *et al.*, 2023). (NH₃) is a nutrient that supports the fertility of waters. If the concentration of ammonia (NH₃) in a body of water exceeds the threshold, it has been affected the aquatic ecosystem and the biota in it because toxic condition. A body of water that exceeds the threshold would affect the aquatic ecosystem and the biota that exists in it because it is toxic or toxic. Because the above compounds

reduce the amount of oxygen in the blood, lower the pH of the blood, and affect enzyme reactions, ammonia toxin (NH₃) could help the growth of aquatic organisms and even the possibility of death. The results of Ammonia measurement according to the quality standard showed that all sampling locations are in accordance with the specified quality standards.

The results of Oil and Grease water quality at Trisakti Port of PT Pelabuhan Indonesia (Persero) Sub Regional Kalimantan with 3 (three) sampling locations shown in Figure 8.

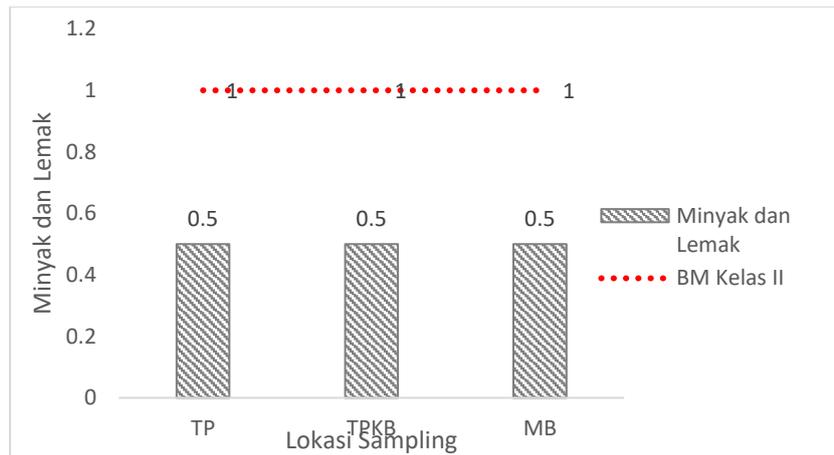


Figure 8. Oil and Fat Water Quality Results

Fatty oil is an organism that could not be biodegraded, meaning it is an organic matter that is most likely to come from microorganisms. The type of limbahini is smaller than air, so it almost always forms a layer of type over the air (Maufilda, 2015) smaller than the air, so it almost always forms a layer of type above the air (Maufilda, 2015). Seen from the surface of the air, fatty oils, if in the air cover the water body, resulting in the use of sunlight penetration and oxygen entering from the air into the air so that it can interfere with biological activities in it (Suseno & Kristiyana, 2021). The value of oil and fat around the waters of

Trisakti Port was taken at three sampling points. Based on the graph above, the oil and fat results at the three points of the Passenger Terminal Pier, the location point of the Banjarmasin Container Terminal Pier and at the location point of the Martapura Baru Pier of 0.5 mg/L. The results show that oil and fat are according to the class 2 quality standard for oil and fat, which is 1 mg/L.

The results of Total Coliform water quality at Trisakti Port of PT Pelabuhan Indonesia (Persero) Sub Regional Kalimantan with 3 (three) sampling locations could be seen in Figure 9.

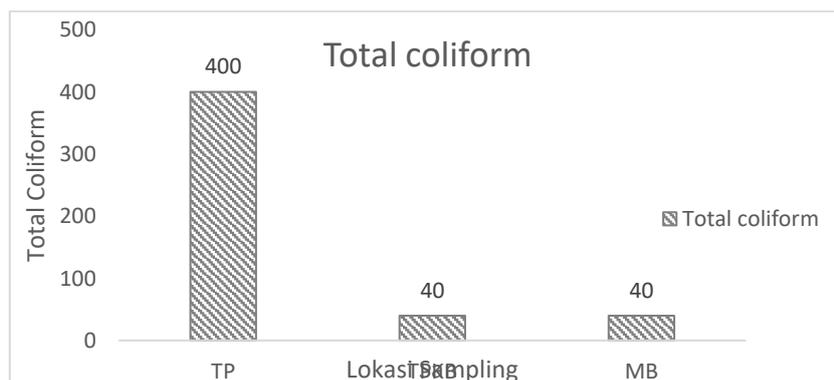


Figure 9. Total Water Quality Results of Coliform

The presence of Coliform bacteria in this area could lead to the development of other petogens. This bacterial coliform bacterium has properties that can be positively correlated with other pathogens (Widyaningsih et al., 2016). The content of *Coliform bacteria* has the potential to cause disease, so its existence is very dangerous for

fishermen and the community around these waters. Based on the graph above, the Total Coliform results at the location point of the Passenger Terminal Pier is 400 MPN/100 ml, the location point of the Banjarmasin Container Terminal Pier is 40 MPN/100 ml and at the location point of the Martapura Baru Pier is 40 MPN/100 ml. These results

showed that Total Coliform in Waters is in accordance with the quality standard of class 2 Total Coliform of 5,000 MPN/100 ml.

Water Quality Status

The results of water quality status using the pollution index during the research at Trisakti Port of PT Pelabuhan Indonesia (Persero) Sub Regional Kalimantan with 3 (three) sampling locations in May and October can be seen in Figure 4.10.

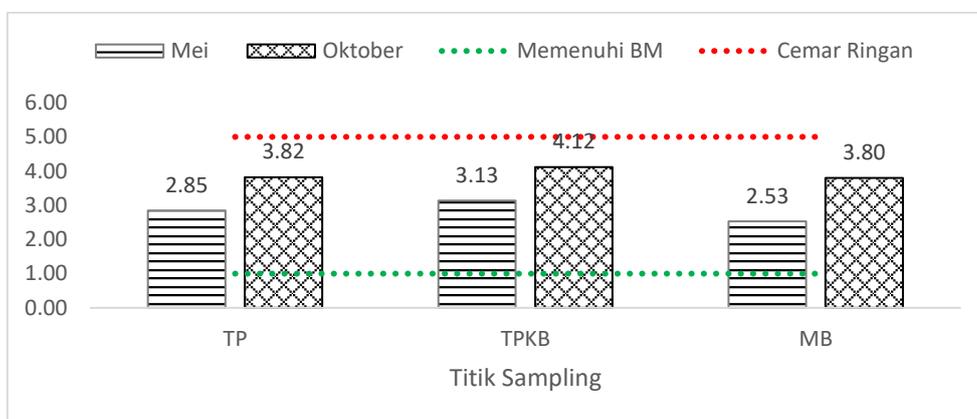


Figure 10. Results of water quality status based on IP

Determining the status of water quality needs to be done as a reference in monitoring water quality pollution (Hamuna *et al.*, 2018). The determination of water quality status in the waters around Trisakti Port was carried out using the Pollution Index (IP) Method. The quality status of Trisakti Port of PT Pelabuhan Indonesia Sub Regional Kalimantan is included in the condition of Light Pollution with a value of $1.0 < PI_j \leq 5.0$. Pollution Index in the waters around Trisakti Port. The results of the Quality Status using the Pollution Index in the sampling of May three locations showed light pollution, namely the location of the Passenger Terminal Pier of 2.85, the location of the Banjarmasin Container Pier of 3.13 and the Martapura Baru Pier of 2.53. The highest pollution value is at the point where the Banjarmasin Container Pier is located. The results of the Quality Status using the Pollution Index in October sampling the three locations showed light pollution, namely the location of the Passenger Terminal Pier of 3.82, the location of the Banjarmasin Container Pier of 4.12 and the Martapura Baru Pier of 3.80. The highest pollution value is at the point where the Banjarmasin Container Pier is located.

The highest IP value recorded at the Banjarmasin Container Pier at 3.13 in May and 4.12 in October was in the category of light pollution, but close to the upper limit for this category, so the water conditions were relatively more polluted than the other two locations. Although still in the category of light pollution, this condition shows that the waters around Trisakti Port no longer meet the quality of natural water and have the potential to decline further if management efforts are not made. In this condition, it shows that sampling in the dry season and rainy season have different levels of pollution. Based on the results of the analysis in the waters around Trisakti Port, it shows that sampling in October, such as the rainy season, the pollution index value is higher because sewage runoff and turbidity are higher than during the dry season which tends to be stable

CONCLUSION

The water quality at Trisakti Port of PT Pelabuhan Indonesia (Persero) Sub Regional Kalimantan has several parameters that are not in accordance with quality standards according to Government Regulation of the Republic of Indonesia Number 22 of 2021 concerning the Implementation of

Environmental Protection and Management for River Water Allocation and which are TSS, BOD, COD and DO.

The assessment of the water quality status at Trisakti Port of PT Pelabuhan Indonesia (persero) Sub Regional Kalimantan using the Pollution Index Method based on KEPMEN LH No. 115 of 2003 concerning Guidelines for Determining Water Quality Status was obtained as a whole sampling location point showing light pollution conditions. The highest IP value recorded at the Banjarmasin Container Pier at 3.13 in May and 4.12 in October was in the category of light pollution, but close to the upper limit for this category, so the water conditions were relatively more polluted than the other two locations.

Declaration by Authors

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