

Analysis And Prevention of Pb Metal Content Suspended In Belawan Waters

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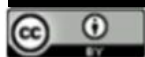
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Abstract

The study of Pb in suspended solid and dissolved in the Belawan Port Waters was conducted on June until November 2021. Analysis of Pb content in suspended solid was measured at Laboratory of Environmental Health and Disease Control Engineering Center (BTKLPP) in North Sumatera Province. Pb content in suspended solid at high tide ranged from $0,02-0,06$ mg/l and at low tide ranged from $0,02-0,065$ mg/l. The content of dissolved Pb at high tide ranged from $0,210-0,651$ mg/l and at low tide ranged from $0,288-0,750$ mg/l. Content of Pb in the waters of Belawan Port has passed quality standard of the Minister of Environment of Republic Indonesia that means the Harbour area is polluted and improper for drinking water as well as for fish cultivation.

Keywords: Pb content, Suspended Solid, Water of Belawan Port

1. INTRODUCTION

Belawan river waters are open waters that are directly related to the Deli River watershed. Deli river is one of the rivers that divide the city of Medan to the North and empties into the Waters of Belawan. The Belawan area is an international standard port area, which is full of industry and settlements as well as other public facilities. Currently, there are around 35 industries such as CPO (Crude Palm Oil) storage, fertilizer industry, and cement industry in Belawan. One of the causes of damage to ecosystems is heavy metals, one of which is heavy metal Pb which can cause poisoning, death, and damage to living tissue (Yeanny, 2018; Miranda & Wahyuningsih, 2021).

The purpose of this study was to analyze the metal content of Pb in the cargo of suspended and dissolved solids in the waters of Belawan and its surroundings at high tide and low tide and to compare the metal content of Pb in the cargo of suspended and dissolved solids in the waters of Belawan port at high and low tide. The expected benefits are to become basic information for other researchers in further research to determine the effect of heavy metal Pb in living tissue, as a reference source in the management of the Belawan Port Waters area which is more environmentally sound and as information for the

local government and local residents, located in Belawan Harbor Waters.

2. METHODOLOGY

This research was carried out on June 14th - November 28th, 2021. Water samples were taken in the waters of Belawan Port and sample analysis was carried out at the Laboratory of Environmental Health and Disease Control Engineering Center (BTKLPP) of North Sumatera Province. Equipment and materials in the field for the measurement of environmental Physico-chemical parameters and equipment and materials used in the laboratory.

Research methods :

1. Determination of the sampling location is divided into 3, namely the estuary area of the Belawan River, the Belawan Port area, and the sea area.
2. Water samples were taken using a sample bottle and put into a coolbox and then brought to the laboratory for analysis.
3. Measurement of environmental Physico-chemical parameters including salinity, temperature, pH, DO, and brightness.

Sample analysis was done in the Laboratory of Environmental Health and Disease Control

Engineering Center (BTKLPP). Data analysis was carried out using the Data Analysis software in Microsoft Excel program to determine differences in the content of heavy metal content Pb in MPT and dissolved at high tide and low tide. Analysis of the distribution of heavy metal content Pb at the research site was carried out using the Surfer software version 8.0 and ArcGIS version 10.5.

3. RESULTS OF RESEARCH IMPLEMENTATION

3.1 Experimental and Material

The material used to analyze samples of Pb metal content is seawater from Belawan waters. The seawater taken from Belawan waters includes 3 locations, namely: the Belawan River estuary area, the Belawan Harbor area, and the sea area. Seawater is put into a sample bottle and then stored in a coolbox that has been provided, then taken to the laboratory for analysis to determine the level of pollution to the 3 research locations.

Several parameters of environmental waters that affect the level of pollution of Belawan waters will be measured including salinity, temperature, pH, DO, and brightness (Yeanny & Barus, 2019).

3.2 Analyzing Sample

Sample analysis was done in the laboratory of Environmental Health and Disease Control Engineering Center (BTKLPP). Data analysis was carried out using the Data Analysis software in Microsoft Excel program to determine differences in the content of heavy metal content Pb in MPT and dissolved at high tide and low tide. Analysis of the distribution of heavy metal content Pb at the research site was carried out using the Surfer software version 8.0 and ArcGIS version 10.5.



Figure 1. Research Sample Water Collection in Belawan Waters.

4. RESEARCH RESULT

4.1 General Condition of Research Site

The condition of the waters from the visual observations in the field visually is that it looks cloudy mixed with organic waste from both households and ships and oil spills from ships. In addition, Belawan waters will sometimes be brownish in color, which is caused by soil particles or mud deposits carried by river flows that empty into Belawan waters such as the Deli River, the result of industrial waste disposal that is widely located around the Belawan port and port activities (North Sumatra Cyber Media, 2008; Sulaiman et al., 2021).



Figure 2. Departing to the Research Location



Figure 3. Research Locations

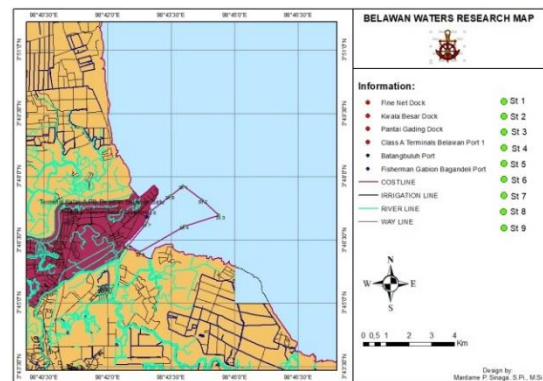


Figure 4. Research Location Map

4.2 Analysis Results

Sample water that has been taken and put into a sample bottle, then brought to the laboratory for research. The results can be seen from Table 1.

1. Comparison of Pb Heavy Metal Content Suspended at High and Low tide.

The heavy metal content of Pb at high tide ranged from $0.02 - 0.06 \text{ mg/l}$ while at low tide it ranged from $0.02-0.065 \text{ mg/l}$. Erlangga (2008) said that the dilution process that occurs in waters is closely related to the influence of tides which will be able to rinse out pollutants and affect the process of spreading them. Statistical test results obtained that the suspended heavy metal content of Pb was significantly different.

2. Comparison of Dissolved Pb Heavy Metal Content at High and Low tide.

The content of dissolved heavy metal Pb at high tide ranged from $0.238-0.651 \text{ mg/l}$ and at low tide ranged from $0.288-0.750 \text{ mg/l}$. According to Rochyatun (2006) that heavy metal levels of Pb become low due to the dilution process when the water from the river carrying this pollutant meets tidal currents and wave-current conditions. Statistical test results showed that the dissolved heavy metal Pb content at high and low tide was not significantly different. According to the Decree of the Minister of the Environment No. 51 of 2004, which is 0.06 mg/l that the heavy metal content of Pb in Belawan Waters has passed the quality standard

limit, which means that Belawan waters have been totally polluted.

3. Comparison of Pb Heavy Metal Content in MPT and Dissolved at Low tide.

The content of heavy metal Pb suspended at low tide ranged from 0.02-0.065 mg/l while the content of heavy metal Pb dissolved at low tide ranged from 0.288-0.750 mg/l. The results of statistical tests showed that the suspended Pb content at low tide was significantly different.

The temperature of Belawan waters at high tide ranges from 29.65 0C - 30.38 0C with an average temperature of 30.176666 (30.2) 0C. The temperature at low tide ranges from 29.05 0C – 29.55 0C. Hutabarat and Evans (1986) say that water is more effective for storing the heat received than land so that water will take a longer time to release heat than land.

Table 1. Comparison of Suspended and Dissolved Pb and Hg Metal Content

Station	Pb Metal Content		Mg Content	
	MPT		Dissolved	
	Tide	Down	Tide	Down
1	0.06	0.065	0.238	0.750
2	0.05	0.065	0.415	0.288
3	0.05	0.065	0.450	0.465
4	0.03	0.055	0.530	0.428
5	0.03	0.045	0.349	0.400
6	0.03	0.045	0.286	0.446
7	<0.020	0.020	0.210	0.650
8	<0.020	0.020	0.364	0.303
9	<0.020	0.020	0.651	0.438
Means	0.041666667	0.044444444	0.388111111	0.463111111
±Standar	0.013291601	0.019913005	0.141682254	0.149864476

The highest pH value at high tide is 8.38 at Station 6 and the lowest at Station 2 is 7.70. At low tide, the highest pH value is at Station 6 of 8.33 and the lowest pH of 7.70 is at Station 3. Water and pH can still support the growth and reproduction of organisms in the water and are still in accordance with the Decree of the Minister of the Environment Number 51 of 2004. Umar (2001) said that the pH will affect the concentration of heavy metals in the waters, in this case, the solubility of heavy metals will be higher at low pH, causing heavy metal toxicity to be greater. The high and low pH values will affect the solubility of heavy metals in pH in the waters because at an alkaline pH the metal ions are in a hydrated form so that their solubility decreases. Dissolved oxygen levels at high tide at each station ranged from 0.10-0.15 mg/l with an average dissolved oxygen level of 0.13 mg/l. At low tide, dissolved oxygen levels at each station ranged from 0.09-0.15 mg/l with an average of 0.12 mg/l. Sastrawijaya (2000) says that the low dissolved oxygen level can be caused by an increase in water temperature, respiration (especially at night), the presence of an oil layer above the water surface, and the entry of easily biodegradable organic waste into the waters.

The salinity value at high tide for each station ranges from 17.65-23.35‰ with an average of 21.13‰. Salinity levels in Belawan waters at low tide range from 13.05 to 21.95‰ with an average of 18.54‰. The high and low salinity values affect the heavy metal content in the waters because high

salinity causes the concentration of heavy metals to be low, while low salinity results in high concentrations of heavy metals.

At high tide, the brightness of Belawan waters ranges from 5-80 cm. At low tide, the brightness of Belawan waters ranges from 50-60 cm. The low level of brightness in Belawan Waters is thought to be due to the large number of inputs from the mainland through the Deli River and Asahan River which empties into Belawan Waters so that the brightness in Belawan Waters becomes very low.

The MPT content ranges from 139-201 mg/l at high tide, with an average of 166.33 mg/l. The high MPT content is thought to be due to activities from the mainland such as industrial waste such as the research of Effendi (2003). That high MPT content can be influenced by weathering of rocks, runoff from the soil, and anthropogenic influences (in the form of domestic and industrial waste) (Khairuni, M., Alfian & Agusnar, 2017).

The position of the station bordering the mainland, and the existence of turbulent currents and waves that break and erode the land. While at low tide, MPT content ranged from 126-198 mg/l with an average of 167.66 mg/l. The MPT content at low tide is lower than at high tide, it is suspected that the waters have not experienced density because the sea water intake has been mixed with materials from the mainland as well as small and large rivers.

Table 2. Condition of Water Quality Parameters in Belawan Waters.

Station Time		Water Quality Parameters					
		Temperature (°C)	pH	DO (mg/l)	Salinity (‰)	Brightness (cm)	MPT (mg/l)
Tide	1	29.65	7.80	0.15	17.65	85	139
	2	30.35	7.70	0.15	18.6	75	145
	3	30.05	7.67	0.14	19.25	75	177
	4	30.65	8.18	0.12	21.75	75	201
	5	30.01	7.85	0.11	21.75	70	140
	6	30.45	8.38	0.10	22.05	65	177
	7	29.95	7.91	0.13	23.05	60	170
	8	30.10	8.35	0.18	23.35	55	182
	9	30.38	8.03	0.11	22.76	50	166
Mean		30.17667	7.985556	0.132222	21.13444	67.7777778	166.3333
±Std		0.3059	0.266417			11.2113534	21.16601
Down	1	29.05	7.63	0.09	13.05	60	126
	2	29.05	7.59	0.11	14.35	80	126
	3	29.15	7.70	0.13	16.45	60	179
	4	29.15	7.71	0.15	19.75	50	198
	5	29.26	8.30	0.12	20.65	30	175
	6	29.26	8.33	0.12	21.45	50	185
	7	29.35	7.89	0.15	18.45	50	162
	8	29.45	7.93	0.11	20.8	50	169
	9	29.55	8.02	0.11	21.95	50	189
Mean		29.25222	7.9	0.121111	18.54444	53.3333333	167.6667
±Std		0.173261	0.275091			13.2287566	25.89401

5. CONCLUSION

Solids charge at high tide ranges from <0.02 - 0.06 mg/l and at low tide it ranges from 0.02-0.065 mg/l, while the heavy metal content of Pb in the Dissolved Solids charge at high tide ranged from 139-201 mg/l and at low tide ranged from 126-198 mg/l. According to the Decree of the State Minister of the Environment Number 51 of 2004 concerning the quality standard of seawater, which is 0.06 mg/l that the condition of Belawan Waters has been polluted because it has passed the quality standard limit and according to Government Regulation Number 82 of 2001 that the quality of Belawan Waters is no longer meet the quality standards for Class I for drinking raw water, Class II for infrastructure/facilities such as water recreation, freshwater fish farming, animal husbandry, and irrigating plants but can still be used as Class IV quality standards, i.e. agricultural purposes and/or other designations that require water quality equals that use.

The average heavy metal content of Pb is much higher in dissolved form than suspended at high tide and low tide, namely at high tide 0.3881 mg/l in dissolved form and 0.4166 mg/l in suspended form

at low tide, while at low tide it is equal to 0.4631 mg/l in dissolved form and 0.0444 mg/l in suspended form.

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