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Correlation of Total Oil Content with Planktonic Diatoms (Bacillariophyceae) in the Waters of Bengkalis Straits, Pangkalan Jambi Village Bengkalis Regency

Hubungan Total Kandungan Minyak dan Kelimpahan Diatom Planktonik (Bacillariophyceae) di Perairan Selat Bengkalis, Desa Pangkalan Jambi Kabupaten Bengkalis

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Abstract

Oil pollution in the waters is one factor affecting the abundance of phytoplankton, especially the diatoms. The waters of Bengkalis Strait, Pangkalan Jambi Village, and Bengkalis Regency are used as international shipping lanes and industrial areas. This study aims to analyze the total oil content, calculate the abundant of planktonic diatoms, and explain the relationships between the total oil content and the abundant of planktonic diatoms carried out in the Bengkalis Strait, Pangkalan Jambi Village Bengkalis Regency, Riau Province. This research uses a survey method. Station 1 is near fish ponds and mangroves, station 2 is in the harbor where the fishing boats moor, station 3 is in wharf bridge and residential areas, and station 4 is in mangrove ecotourism. The result of the oil content analysis obtained an average value of 0.216 ppm. The highest oil content at station 2 is 0.5742 ppm, and the lowest at station 4 is 0.0775 ppm. The calculations of the abundance of planktonic diatoms ranged from 3,323.28 to 11,631.48 ind/L. The highest abundance at station 3 was 9,692.2 ind/L. The lowest abundance was at Station 2, which was 4,154.1 ind/L. Simple linear regression test results obtained equation Y = 6045.927572 + (3013.071268x). The coefficient of determination (R2) = 0.049 states that 4.9% of the abundance of planktonic diatoms is influenced by oil content, and other environmental factors influence the rest. The correlation coefficient (r) = 0.0223, so the relationship between total oil content and the abundance of planktonic diatoms is very weak.

Keywords: Bacillariophyceae, Oil, Pangkalan Jambi Village.

Abstrak

Polusi minyak di perairan merupakan salah satu faktor yang mempengaruhi kelimpahan fitoplankton, terutama diatom. Perairan Selat Bengkalis, Desa Pangkalan Jambi, dan Kabupaten Bengkalis dimanfaatkan sebagai jalur pelayaran internasional dan kawasan industri. Penelitian ini bertujuan untuk menganalisis kadar minyak total, menghitung kelimpahan diatom planktonik, dan menjelaskan hubungan antara kadar minyak total dengan melimpahnya diatom planktonik yang dilakukan di Selat Bengkalis, Desa Pangkalan Jambi, Kabupaten Bengkalis, Provinsi Riau. Penelitian ini menggunakan metode survei. Stasiun 1 berada di dekat kolam ikan dan mangrove, stasiun 2 berada di pelabuhan tempat perahu nelayan berlabuh, stasiun 3 berada di jembatan dermaga dan pemukiman penduduk, dan stasiun 4 berada di ekowisata mangrove. Hasil analisis kandungan minyak diperoleh nilai rata-rata 0,216 ppm. Kandungan minyak tertinggi di stasiun 2 adalah 0,5742 ppm, dan terendah di stasiun 4 adalah 0,0775 ppm.

Perhitungan kelimpahan diatom planktonik.

Kata kunci: Bacillariophyceae, Minyak, Desa Pangkalan Jambi.

1. Introduction

Pangkalan Jambi Village is one of the villages in Bukit Batu District, Bengkalis Regency, Riau Province. The village is located in a coastal area often known as the waters of the Bengkalis Strait. This area is strategic because of its location; its waters are utilized as a track cruise on the international Strait of Malacca. Pangkalan Jambi Village has forest mangroves used as ecotourism places that add to the village's attractiveness, known as the Mangrove Education Center (MEC). Besides that, there is an oil factory, namely PT. Pertamina Pakning River. Busy activity pressures the continuity of ecosystem waters in the Village of Pangkalan Jambi. That is wrong; the only one is the pressure consequence of an oil spill.

Oil contamination can cause direct or indirect disruption to biota in waters. Kindly direct can cause damage to membrane cells by molecules of oil hydrocarbons cause cell fluids to escape and seep into the cells. Indirectly affect the life of organisms in the waters. Put the oil into the water to form a layer of film on the water's surface to affect diatoms (Hutagalung, 2010). 2018 recorded an oil spill in the Bengkalis Strait, specifically in the Village Base Batang, District Bengkalis. The spill occurred due to an explosion, and the party opened faucet oil (valve). There is no answer from the party responsible.

One of the ways that can be done to describe quality water in a region is to see an abundance of diatoms. The abundance of diatoms can give an idea of the condition of a community of organisms; specific values expressed in several index values, and can describe the condition of an area (Abida, 2016). The study's objective is to analyze the total oil content, abundance of planktonic diatoms, and the relationship between total oil content and planktonic diatoms. Monitoring the health condition of the waters is very important for making prevention policies more significant for water damage. Monitoring the condition and the quality of water is very important for creating policies to prevent damage to more water. This can do with known connection content oil with an abundance of planktonic diatoms (Bacillariophyceae) in the waters of Strait Bengkalis, village of Pangkalan Jambi, District Bengkalis. Information about condition waters, this is not yet documented with a fine, acceptable that abundance of planktonic diatoms, as well as the content of the oil in the area. See various types of problems that occur, and then study. It is essential to know and analyze the abundance of planktonic diatoms and content oil and the connection between the abundance of planktonic diatoms and content oil in the area of the village mangrove ecosystem of Pangkalan Jambi.

2. Material and Method

2.1. Time and Place

This research was conducted in January 2023 in the waters of the Bengkalis Strait, Pangkalan Jambi Village, Regency Bengkalis Province Riau. Identification diatoms were done in Laboratory Biology Sea and analysis oil content and Marine Chemistry Laboratory, Department of Science Marine Faculty of Fisheries and Marine Universitas Riau. Station location determination based on purposive sampling. Determination is based on the level of activity in the waters. Station 1 is located in fish and mangrove ponds, station 2 is where fishing boats dock, station 3 is near the wharf bridge And settlements, and station 4 is in the Mangrove Ecotourism area (Figure 1).

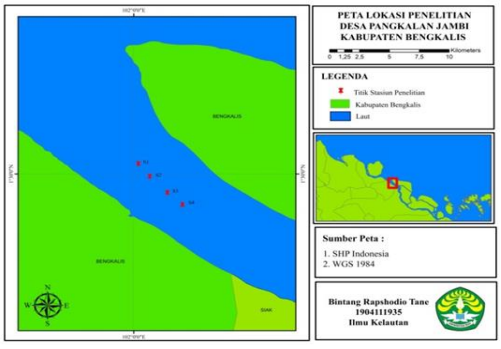

Figure 1. Research location

2.2. Procedure

2.2.1. Analysis Oil Sample

A sampling of oil using aluminum ladle and sample water is put into a bottle glass of as much as 1000 mL, dripped with 2 drops of concentrated H_2SO_4, and labeled. Then put in an ice box filled with ice cubes and taken

to the laboratory to analyze the oil content. Analysis of oil content using the CCl_4 extraction method based on American guidelines The Petroleum Institute is known for the method (API 1240). A water sample of as much as 1000 ml was put into a separatory funnel and extracted with 25 mL chloroform (CCl_4) up to 3 times, and every result extraction was collected in Erlenmeyer. Results filtering are measured by the volume (C/mL). Results the extraction was put into Erlenmeyer, washed clean, rinsed with distilled water, and put in the oven for 1 hour at 105^0C. Then, it cooled in a desiccator for 30 minutes, weighed, and weighed. After the extract was put into the Erlenmeyer, it was put in the oven at 90^0 C until chloroform in Erlenmeyer steam for 30–60 minutes. Then weighed to the nearest 4 decimal places (Sinaga et al. 2022).

2.2.2. Analysis Sample Diatoms

Sampling of diatoms was carried out during the day, namely between 11.00 and 12.00 WIB, because diatoms need optimal sunlight to carry out photosynthesis (Hadi, 2005). Water samples are taken using a 10 L volume bucket, and 100 L of water is taken and filtered using a plankton net no. 25. The filtering results were put into a 125 mL sample bottle and dripped with 4% Lugol as much as 3-4 drops. Then, given the label. Furthermore, the sample that had been preserved was entered into the ice box for identification in the laboratory (Adriana et al., 2017). Observation of planktonic diatoms in the laboratory using Olympus CX 21 microscope with 10x10 magnification using 12 field of view method. Abundance counted use the formula APHA (1992), that is:

$$N = \frac{T}{L} x \frac{P}{p} x \frac{V}{v} x \frac{1}{w}$$

Information:

N = Amount diatoms per L (cell/L)
T = Wide cover glass cover $(25 \times 25mm)^2$
L = Wide visual field $(1.082\ mm)^2$
P = Amount plankton that is counted
p = Amount roomy view (12 roomy view)
V = Sample volume filtered (125 mL)
v = Volume sample in observed (0.06 mL)
w = water volume filtered (100 L)

3. Result and Discussion

3.1. Parameter Quality Water

Parameters of water quality observed include parameters of water physics and water chemistry. The physics parameters of water consist of temperature, brightness, and current speed. At the same time, the chemical parameters of the water consist of pH, salinity, and dissolved oxygen (DO). Based on the results of physicochemical measurements, the condition of the waters is still in deep condition normally (Table 1).

Table 1. Physical parameter values in waters Strait Bengkalis Pangkalan Jambi Village

Station	Sampling Point	Temperature (°C)	Brightness(m)	district Current (m/s)
	1.1	28.2	0.31	0.16
1	1.2	28.4	0.44	0.13
	1.3	29.7	0.57	0.09
Average		**28.7**	**0.44**	**0.12**
	2.1	29.4	0.33	0.32
2	2.2	29.3	0.45	0.47
	2.3	29.7	0.29	0.26
Average		**29.4**	**0.35**	**0.35**
	3.1	29.3	0.28	0.23
3	3.2	29.2	0.40	0.18
	3.3	29.4	0.29	0.31
Average		**29.3**	**0.32**	**0.24**
	4.1	29.2	0.26	0.22
4	4.2	29.6	0.39	0.35
	4.3	29.7	0.34	0.07
Average		**29.5**	**0.33**	**0.21**

3.2. Content Oil in Waters Jambi base

Source content oil in waters sourced from various activity stakeholders covers perpetrator industries located on land, which drain their waste through rivers and empties into the sea, such as oil and gas and ship transportation players. Oil content obtained in the waters of the Bengkalis Strait. This can seen in Table 2 and Figure 2.

The oil content in Pangkalan Jambi waters obtained an average value between 0.0775 and 0.5742 ppm. Mark average oil content station 1 is 0.1032 ± 0.01320 ppm, at station 2 namely 0.3846 ± 0.16613 ppm at station 3,

which is 0.2302 ± 0.12072 ppm, while at station 4 it is 0.1458 ± 0.10140 ppm. Based on Government Decree No 22 of 2021, ie, 1 ppm, the amount of oil content is not yet harmful to aquatic biota and Still can tolerated by organisms in waters.

Table 2. Value of chemical parameters in waters Strait Bengkalis Pangkalan Jambi Village

Station	Point sampling	pH	Salinity (‰)	DO (mg/L)
	1.1	7.01	19	6.18
1	1.2	6.59	20	5.96
	1.3	7.19	20	5.66
Average		6.93	19.6	5.93
	2.1	7.58	19	6.27
2	2.2	7,49	18	6.19
	2.3	7.09	20	5.53
Average		7.38	19	5.99
	3.1	7.21	16	6.17
3	3.2	7.39	20	5.56
	3.3	7.52	21	5.47
Average		7.37	19	5.73
	4.1	7.77	21	6.07
4	4.2	7.61	22	5.83
	4.3	6.89	21	5.76
Average		7.42	213	5.88

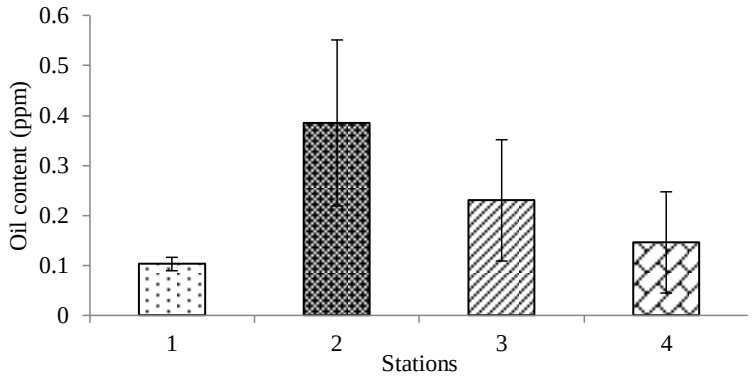

Figure 2. Content oil on water on every station observation

3.3. Classification and Abundance Diatoms Planktonic in Waters Strait Bengkalis

Effendi (2003) stated that diatoms respond differently to water conditions, so the types vary in different places. Based on the results of the observation and identification of 11 species. The diatom species found at each station are *Isthmia* sp species, as seen in Table 3.

Table 3. Composition diatoms planktonic in Waters Strait Bengkalis

No	Type	Order	Family	Species
1.		Achnanthales	Achnanthales	*Bacilaria* sp.
2.		Bacaillariales	Bacilariaceae	*Nitzchia* sp.
3.		Chaetocerotanae	Chaetocerotaceae	*Bacteriastrum* sp.
4.	Pennales		Fragilariaceae	*Synedra* sp.
5.		Leptocylindrales	Pleurosigmataceae	*Gyrosigma* sp.
6.		Thalasiosirales	Skeletonemaceae	*Skeletonema* sp.
7.		Aulacoseirales	Aulacoseiraceae	*Aulacoseira granulata*
8.		Naviculales	Pinnulariaceae	*Pinnularia* sp.
9.		Fragilineae	Fragilariaceae	*Fragilaria* sp.
10.	Centrales	Bidddulphiales	Biddulphiaceae	*Itsmia* sp.
11.		Centrales	Coscinodiacaceae	*Melosira* sp.

Fitri (2011) explained that *Isthmia* sp is a unicellular microscopic alga containing silica on the cell wall (frustule). *Isthmia* sp is a phytoplankton with the highest abundance in waters. This microalga is known to have a heteromorphy type, namely morphological differences within one species as a response to changing environments. Change condition environment on area mangroves is thought to affect the morphology of diatoms as an adaptation form of *Isthmia* sp. against change condition habitats.

The average abundance of planktonic diatoms in the waters varies at each observation station. This value is influenced by environmental parameter conditions that differ from other stations. Community activity happens

daily, producing household waste disposal, thereby increasing the input of organic matter and inorganics inside waters, which also become the wrong factor. Abundance diatoms range between 3,323.28-11,631.48 ind/L. The highest average abundance value is found at station 3, with an average abundance of 9,692.2 ind/L, whereas the mark abundance is lowest at station 2, with a mark abundance average of 4,154.1 ind/L.

3.4. Correlation Oil Content with an Abundance of Diatoms Planktonic

Based on the results analysis, mark regression linear simple obtained equality Y = 6045.927572+3013.071268x with a value of R^2 = 0.049 and a correlation coefficient of r = 0.223 (Figure 5). R-value if compared to the statement by Sugiyono (2017) that connection content oil If seen from mark the correlation own closeness namely 0.00 ± 0.199 relationship very weak, 0.20 ± 0.399 relationship weak, 0.40 ± 0.599 relationship moderate, 0.60 ± 0.799 relationship strong, and 0.80 ± 1.00 relationship very strong. The relationship between oil content and an abundance of diatoms in the waters of the Bengkalis Strait, Pangkalan Jambi Village, is very weak, with a positive value indicating that high oil content will cause the addition of an abundance of diatoms in the waters. Based on equality, the can also influence. In comparison, 95.1% were influenced by environmental factors other factors, namely water physics (temperature, brightness, and currents), water chemistry (pH, dissolved oxygen, salinity, nitrate, and phosphate), and aquatic biology such as mangrove forests. With this, the oil content of no lot influences the abundance of diatoms in Strait Bengkalis Pangkalan Jambi Village waters.

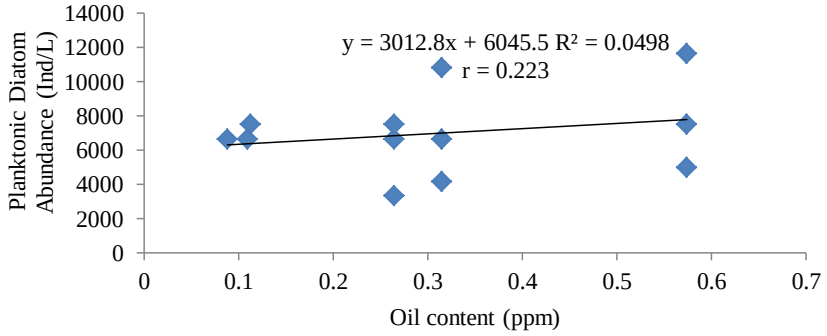

Figure 3. Connection content oil and abundance diatoms planktonic

4. Conclusions

The total oil content in the waters of the Bengkalis Strait, Pangkalan Jambi Village, ranges from 0.0775 to 0.5742 ppm. The abundance of planktonic diatoms ranged from 3,323.28 to 11,631.48 cells/L. The highest abundance of diatom species is *Isthmia* sp. The relationship between the total oil content in water and the abundance of planktonic diatoms is weak (r=0.053).

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