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Tropical Status Evaluation in Lhok Seudu Coastal, Aceh Province, Indonesia

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Abstract

Research on the status of chlorophyll-a in Lhok Seudu coastal, Aceh Province, Indonesia in May 2017 has been done. The aim of the study is to know trophic status in Lhok Seudu coastal. Determination at 3 stations using purposive sampling method and concentration of chlorophyll-a, total nitrate and total phosphate determinate using spectroscopy. The results showed that the concentration of chlorophyll-a ranged from 33 to 22 µmol/L^{-1}, the concentration of total nitrate and total phosphate ranged from 1310 to 1150 µmol/L^{-1} and 86 to 73 µmol/L^{-1}. A mean concentration of chlorophyll-a indicates that trophic status in Lhok Seudu coastal belongs to the eutrophic coastal.

Keywords: Lhok Seudu; Chlorophyll-a; Nitrate; Phosphate; Eutrophic µmol/L^{-1}

Introduction

The coastal of Lhok Seudu are the coastal that become the place of fishing activity and the cultivation of floating net cages. However, such activity may lead to the entry of nitrate and phosphate elements into the aquatic column because it can increase the chlorophyll-a content in the water and determine trophic status [1-3].

Chlorophyll-a is a pigment in all phytoplankton organisms that can perform photosynthesis and the presence of chlorophyll-a is strongly influenced by the availability of nutrients nitrate and phosphate so as to determine the level of primary productivity of a coastal. The high concentration of chlorophyll-a distribution is strongly related to oceanography condition in a coastal. The content of chlorophyll-a is analyzed by determining the nitrate and phosphate content in the coastal as the macronutrient for phytoplankton [4-6].

Information on the availability of chlorophyll-a in Lhok Seudu coastal is still very limited. This study aims to determine the concentration of nitrate and phosphate to the abundance of chlorophyll-a.

Methodology

Location

Data collection was conducted in May 2017 in Lhok Seudu coastal, Aceh Province (Latitude: 5°21'4.7", Longitude: 95°14'14.6") which is divided into 3 stations with 10 meters distance each station by using purposive sampling method to determine the point of research location (Figure 1).

Material

Materials used are UV-Vis Shimadzhu UV-1700, filterphotometer PF-11, universal bettich centrifuge 320, refractometer, pH meter, and thermometer, GPS, dark bottle, vacuum pump, Whatman filter paper GF/C 42 µm, filtering flask and acetone 90%.

Analysis of chlorophyll-a

1 L water sample was filtered using Whatman 42 GF/C 42 µm filter paper. The filter paper containing chlorophyll-a is folded four times until it becomes a small fold and then inserted into aluminum foil. The chlorophyll-a sample folds are stored in the refrigerator at 4°C for a day.

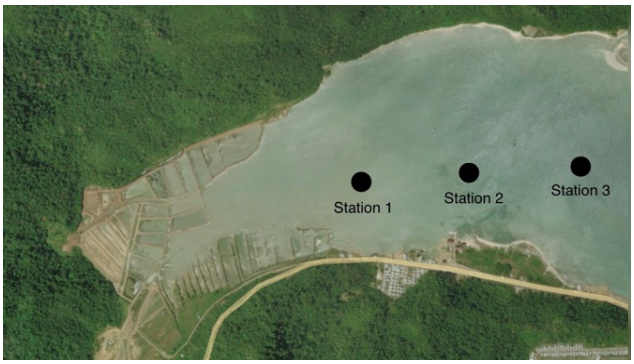

Figure 1: Map of Lhok Seudu Coastal, Aceh Province.

The filter paper was crushed by adding 5 mL of 90% acetone and kept back in the refrigerator at 4°C for an hour. The extracted sample was fed into a bettich 320 universal centrifuge at 3000 rpm for 30 min [7].

Determination of chlorophyll-a concentration using Shimadzu UV-1700 UV-Vis at the Chemistry Laboratory of the Faculty of Teacher Training and Education, Syiah Kuala University. Nitrate and phosphate concentration were determined using a filterphotometer PF-11 at the Marine Chemistry Laboratory of the Faculty of Marine and Fisheries, Syiah Kuala University. Calculation of the chlorophyll-a concentration is calculated using the equation:

$$Chlorophyll-a(mg/L)=\frac{Ca\times Va}{V\times d} \quad (1)$$

Information:

Va: Volume of acetone (10 mL);

V: Water volume of filtered sample (mL);

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D: Diameter of cuvet (1 mm);

Ca: $(11.6 \times E_{665})-(1.31 \times E_{645})-(0.14 \times E_{630})$;

E: Absorbance where wavelength (corrected with 750 nm wavelength).

Results

The results showed that the concentration of chlorophyll-a in Lhok Seudu coastal ranged from 33 to 22 µmol/L^{-1} and total nitrate and total phosphate concentrations ranged from 1310 to 1150 µmol/L^{-1} and 86 to 73 µmol/L^{-1} (Table 1). The presence of chlorophyll-a is strongly influenced by the supply of nutrients originating from the mainland through the flowing water into the coastal [8-11].

The highest concentration of chlorophyll-a 33 µmol/L^{-1} was found at station 1 whereas the lowest concentration was 22 µmol/L^{-1} at stations 3. The chlorophyll-a concentration at station 1 was suspected due to the influence of nutrient supply that settled at the pond cultivation location entering the water column so that the nitrate concentration of 1310 µmol/L^{-1} makes the growth of chlorophyll-a to be optimum compared with the growth of chlorophyll-a at stations 2 and 3 [12-14].

Discussion

Overall, the average concentration of chlorophyll-a at 3 stations is closely related to the presence of nitrate and phosphate elements. A mean concentration of chlorophyll-a indicates that trophic status in Lhok Seudu coastal belongs to the eutrophic category (Table 2) [15-17].

The presence of nitrate and phosphate elements greatly affects the abundance of chlorophyll-a. Total nitrate concentrations ranging from 1310 to 1150 µmol/L^{-1} may be associated with total phosphate concentrations ranging from 86 to 73 µmol/L^{-1} (Figure 2). The presence of phosphate nutrients is thought to be originating from land during rain and human activities, especially detergents and wastes coming from the environment so that Lhok Seudu coastal are in very fertile categories [18-21].

Conclusion

The results showed that the chlorophyll-a concentration at station 1 ranged from 33 to 22 µmol/L^{-1}, total nitrate and total phosphate concentrations ranged from 1310 to 1150 µmol/L^{-1} and 86 to 73 µmol/L^{-1}. The highest concentration of chlorophyll-a 33 µmol/L^{-1} was found at station 1 whereas the lowest concentration was 22 µmol/L^{-1} at station 3. Based on chlorophyll-a concentration, total nitrate and total phosphate indicated as eutrophic coastal.

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Station	Total Nitrate (µmol/L^{-1})	Total Phosphate (µmol/L^{-1})	Chlorophyll-a (µmol/L^{-1})
1	1310	86	33
2	1250	81	28
3	1150	73	22

Table 1: Chlorophyll-a concentration.

Indicator of Trophical Status	Oligotrophic (µmol/L^{-1})	Mesotrophic (µmol/L^{-1})	Eutrophic (µmol/L^{-1})	Hypereutrophic (µmol/L^{-1})
	Range	Range	Range	Range
Chl-a (µmol/L^{-1})	<3	3–7	7–40	>40
TN (µmol/L^{-1})	<400	400–600	600–1500	>1500
TP (µmol/L^{-1})	<15	15–25	25–100	>100

Table 2: Classification of Trophical status.

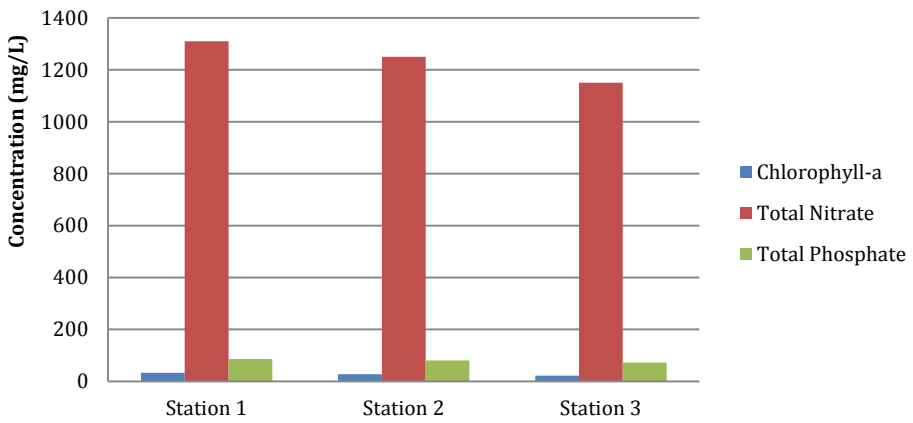

Figure 2: Relationship of chlorophyll-a to nitrate and phosphate concentration.

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