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TOTAL NITROGEN CONTENT IN SEDIMENTS IN THE MANGROVE AND CRAB CONSERVATION AREA OF TARAKAN CITY

Kandungan Nitrogen Total Pada Sedimen Di Kawasan Konservasi Mangrove Dan Kepiting Kota Tarakan

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ABSTRACT

Nitrogen in sediments is an essential element for plants that play a role in the process of photosynthesis and stimulate growth. This study aims to examine the total Nitrogen (N) content in sediments based on differences in depth in the Mangrove and Crab Conservation Area of Pamusian Village, Tarakan City. The method used in the research is quantitative descriptive method by describing the content of Nitrogen (N) in sediments based on differences in depth at each research station and determining the location of sampling points for sampling using purposive sampling method. Sediment sampling was carried out at 3 station points, namely the Pamusian River flow area, the watchtower area and the area near residential areas. Sediment sample testing was carried out at the Soil Laboratory of the Faculty of Agriculture, Borneo University of Tarakan. The results of this study showed that the Nitrogen (N) content in sediments in the Mangrove and Crab Conservation Area of Pamusian Village at a depth of 10 cm ranged from 0.25 - 0.32%, a depth of 20 cm ranged from 0.19 - 0.24%, and a depth of 30 cm ranged from 0.14 - 0.20%. The highest total nitrogen content is at a depth of 10 cm and the station that has the highest total nitrogen content is station 3.

Keywords: Depth, Mangrove, Total Nitrogen, Sediment

ABSTRAK

Nitrogen dalam sedimen merupakan unsur esensial bagi tumbuhan yang berperan dalamproses fotosintesis dan merangsang pertumbuhan. Penelitian ini bertujuan untuk menguji kandungan Nitrogen (N) total pada sedimen berdasarkan perbedaan kedalaman di Kawasan Konservasi Mangrove dan Kepiting Kelurahan Pamusian Kota Tarakan. Metode yang digunakan dalam penelitian adalah metode deskriptif kuantitatif dengan mendeskripsikan kandungan Nitrogen (N) pada sedimen berdasarkan perbedaan kedalaman di setiap stasiun penelitian dan penentuan lokasi titik sampling untuk pengambilan sampel menggunakan metode purposive sampling. Pengambilan sampel sedimen dilakukan pada 3 titik stasiun yaitu daerah aliran Sungai Pamusian, daerah menara pengawas dan daerah dekat pemukiman penduduk. Pengujian sampel sedimen dilakukan di Laboratorium Tanah Fakultas Pertanian Universitas Borneo Tarakan.

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Hasil penelitian ini menunjukkan bahwa kandungan Nitrogen (N) pada sedimen di Kawasan Konservasi Mangrove dan Kepiting Kelurahan Pamusian kedalaman 10 cm berkisar 0,25 – 0,32 %, kedalaman 20 cm berkisar 0,19 – 0,24 %, dan kedalaman 30 cm berkisar 0,14 – 0,20 %. Kandungan nitrogen total tertinggi terdapat pada kedalaman 10 cm dan stasiun yang memiliki kandungan nitrogen total tertinggi terdapat pada stasiun 3.

Kata Kunci: Kedalaman, Mangrove, Nitrogen Total, Sedimen

INTRODUCTION

The Mangrove and Crab Conservation Area of Pamusian Village is one of the mangrove forests in Tarakan City. This area was designated as a conservation area based on Regional Regulation No. 04 of 2002 concerning the Prohibition and Supervision of Mangrove Forests in Tarakan City covering an area of 35 ha, but this area has decreased to 25.19 ha (Tarakan City Environmental Management Agency, 2015). Based on the results of observations in the Mangrove and Crab Forest Conservation Area, there has been a decrease in the area caused by community activities such as fish farming areas, transportation routes, traditional markets, settlements and the wood industry, which has disrupted the role of mangrove forests as a buffer for coastal areas. Mangrove vegetation has a very important role in the environment, one of which is as a provider of nutrients needed in large quantities by organisms to meet food needs (Zuraidah, 2018). A strong root system and dense mangrove cover can increase the nitrogen content in mangrove sediment. The source of nutrients in sediment is produced by the decomposition process and comes from land and sea (Budiasih et al., 2015). One of the important nutrients contained in sediment is nitrogen (N). Nitrogen is an essential element for plants that plays a role in the process of photosynthesis (Ismoyo et al, 2017). The nitrogen content in mangrove sediment has a significant role in increasing the process of photosynthesis and the growth of mangrove plants because it is the main component in the formation of protein and chlorophyll. In addition, nitrogen is a source of nutrients in sediment that is very much needed by organisms as a food source which is generally found in the basic substrate. In mangrove forests, nitrogen is produced from the decomposition process of litter (leaves, fruits, flowers and other mangrove components) that fall to the forest floor. The accumulation of organic matter from mangrove litter increases nitrogen retention in sediment because the decomposition of organic matter releases nitrogen back into the sediment matrix (He et al., 2022).

The availability of nitrogen nutrients plays an important role in mangrove sediment in supporting the growth of mangroves and other organisms and maintaining the food chain that occurs in the mangrove ecosystem. The existence of mangrove ecosystem greatly affects the amount of nitrogen in sediment and vice versa. The higher the nitrogen content, the better the nutrition for mangrove plants so that it can increase the growth and productivity of mangroves (Chrisyariati et al., 2014). However, the density of activities carried out by the community around the Mangrove and Crab Conservation Area such as land conversion into aquaculture areas, settlements and logging for various purposes can interfere with the ability of mangroves to carry out their ecological and biological functions. Therefore, it is necessary to conduct research on the total nitrogen content based on sediment depth so that sustainable management activities can be carried out.

METHODS

Place and Time of Research

The research was conducted in the Mangrove and Crab Conservation Area of Tarakan City from February to April to June 2021. Total nitrogen analysis was conducted at the Soil

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Laboratory of the Faculty of Agriculture, Borneo University, Tarakan. The research location is presented in Figure 1.

Tools

GPS, Biopore drill, Palintest Soil Test Kit SKW 500, Petri dish, Analytical balance, Oven, Cool box, Funnel, Grinder, Filter paper, DO meter, Water thermometer, Hand Refractometer, pH meter, Aluminum foil, Measuring cup, Sieve, Pipette, Beaker, Palintest tube.

Materials

Sediment, Aquades, Palintest nitricol N tablets, Nitratest N powder, N powder extraction, H2O2, Na4P2O7.

Research Methods

The method used in this study is quantitative descriptive. Determination of the location of sampling points for sampling using the purposive sampling method. Sediment sampling was carried out at 3 station points, namely the Pamusian River basin, the watchtower area and the area near the residential area. Sampling using a biopore drill with three repetitions at each station with a plot size of 10 x 10 meters with a distance of 10 meters between each plot. Sampling was carried out at different substrate depths, namely at depths of 10 cm, 20 cm, and 30 cm and was carried out at low tide (Nugroho, 2013).

Data Analysis

The results of the sediment sample test will then be analyzed using the calculation of total Nitrogen content to determine the results of total nitrogen.

Calculation:

$$\text{Total Nitrogen (\%)} = (\text{Abs} \times 25/10) \times \text{Fk}/100$$

N = Nitrogen
Abs = sample absorbance
25/10 = dilution
Fk = correction factor / moisture content value

The results of the sediment sample test will then be analyzed using the calculation of total nitrogen content to determine the results of total nitrogen which will then be tabulated in the form of tables and figures.

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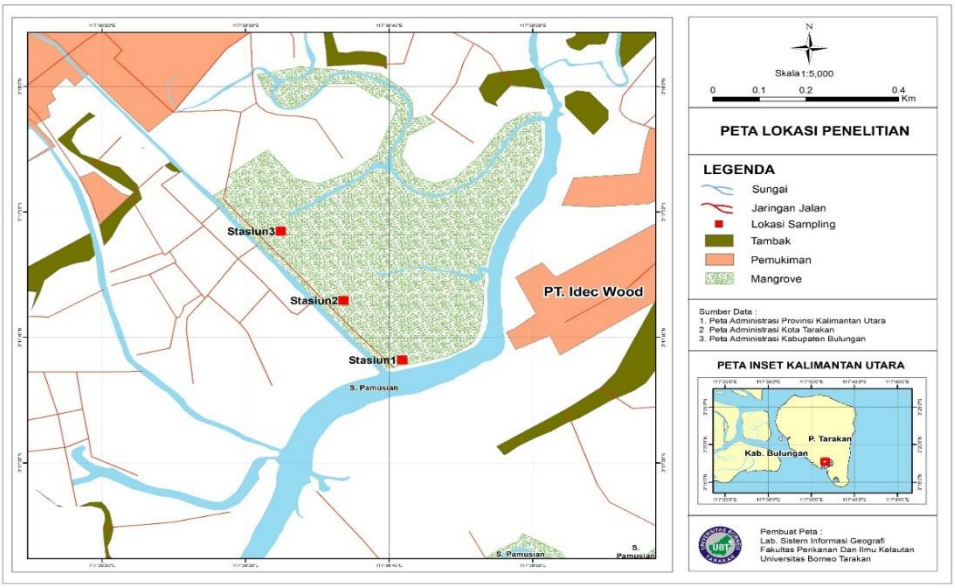

Figure 1. Research Location Map

RESULT

Total Nitrogen Content in Sediments in Mangrove and Crab Conservation Areas

This study was conducted to test the amount of total nitrogen contained in sediments with different depths, namely 10acm, 20acm, and 30acm. The results of the analysis of total nitrogen content that have been carried out can be presented in Figure 2.

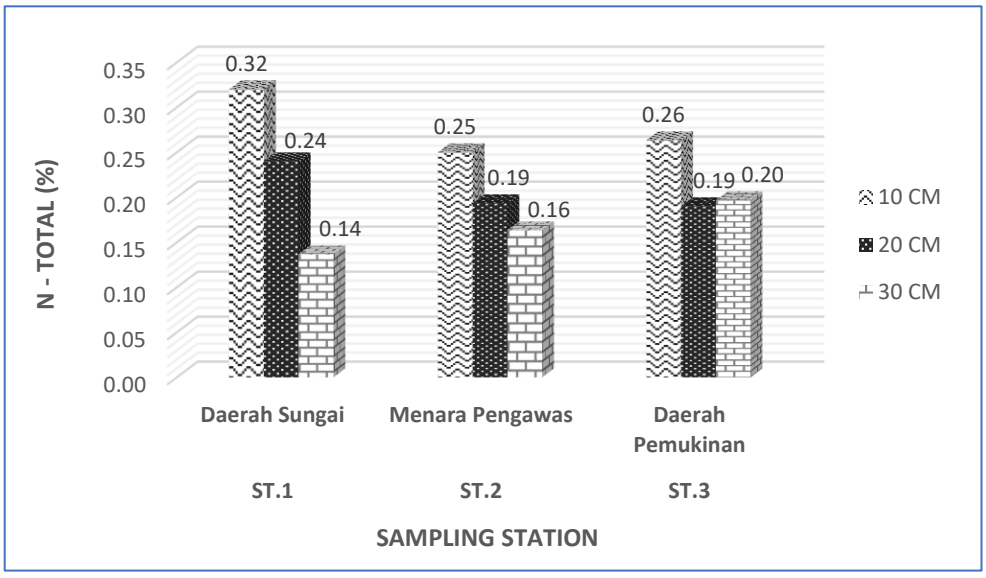

Figure 2. Graph of Nitrogen Content in Sediment

DISCUSSION

Nitrogen is the main nutrient that plays a role in growth and is generally needed for the growth or formation of plant parts such as roots, stems, and leaves (Wiyantoko et al., 2017). The nitrogen content in mangrove sediment is influenced by various factors such as microbial activity, sediment composition and environmental conditions. The highest total nitrogen content at station 1 was at a depth of 10 cm, which was 0.32% and the lowest nitrogen content was at a depth of 30 cm, which was 0.14%. Luo et al., (2021) stated that biological nitrogen

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fixation activity and diazotrophic communities showed significant variations based on sediment depth. At shallower depths, there were higher concentrations of nitrogen-fixing bacteria that contributed to the availability of nitrogen for mangrove vegetation. Furthermore, the presence of nitrogen-fixing and nitrifying bacteria with higher nitrogen concentrations was found in shallower sediment layers which played an important role in maintaining water fertility and supporting mangrove growth (Das et al., 2022). The high nitrogen content in this area can be suspected because it is located close to the river flow so that it gets input of suspended materials from the sea carried by the tides and settles in the mangrove area. This is in line with the results of research conducted by Yahya (2018) in the Mamburungan Mangrove Forest, Tarakan City, which obtained the highest total nitrogen content value in the river estuary area at a depth of 10 cm with a value of 1.69%. This is in accordance with the statement of Rizal et al., (2017) that the estuary area is influenced by sedimentation, causing the movement of organic material transport in the estuary area to continue to occur and indirectly making the estuary area a nutrient trap area from rivers and oceans. Furthermore, Swales et al., (2015) stated that sediment accumulation in the estuary area which is influenced by tidal dynamics can increase the nitrogen content in mangrove sediments.

The highest total nitrogen content at station 2 was at a depth of 10 cm, which was 0.25% compared to depths of 20 cm and 30 cm. The lowest total nitrogen content was at a depth of 30 cm, which was 0.16%. The high total nitrogen content at this station is thought to be due to being located in a mangrove planting area, resulting in an increase in mangrove vegetation. Komalasari et al., (2022) stated that the higher the mangrove density, the higher the nitrogen content in the sediment. Station 2 also has a type of dusty clay substrate with a fine texture, where this type of substrate is one of the types of substrate preferred by several types of mangroves, especially Rhizophora mucronata. In line with the statement of Mahmud et al., (2014) that sediment with a clay texture has a larger surface area so that it provides high nutrients compared to sandy soil and is able to retain water. This is supported by research by Piranto et al., (2019) which states that the finer the sediment texture, the greater the ability to trap nutrients. The total nitrogen content at station 2 is lower than the nitrogen content in mangrove sediments in the Mangrove and Bekantan Conservation Area of Tarakan City which ranges from 0.31% to 0.55% (Yulma et al., 2018).

The highest total nitrogen content at station 3 was at a depth of 10 cm, which was 0.26%. The results obtained were thought to be because this area had a moderate to high level of mangrove density compared to other stations, so that litter production increased. High mangrove density can increase the accumulation of organic matter which in turn contributes to an increase in nitrogen content in the sediment. Lailatussyifa et al., (2020) stated that the denser the mangrove area, the higher the litter produced, thus contributing to the decomposition process and increasing nitrogen content in the sediment. Komalasari et al., (2022) using simple linear regression analysis found that mangrove density had a positive correlation with sediment nitrogen content (R = 100%). Furthermore, Kanti et al., (2019) in their research found that the highest density of Rhizophora mucronata was 4.20 Ind/m2 with an average total nitrogen value of 0.052%, the highest compared to other stations. This is supported by Nugroho's statement (2013) that high density will produce more litter which will then be decomposed by microorganisms so that the nutrient content is higher.

The total nitrogen content in sediments based on different depths in the Mangrove and Crab Conservation Area was highest at a depth of 10 cm, namely at station 1 which is the Pamusian River watershed with sandy clay sediment texture characteristics. The high Nitrogen content in this area can be suspected because the river flow receives input sources from the sea and the decomposition process of mangrove litter by microorganisms. According to Irham et al., (2020) that sediments in the mangrove area have a fairly high nutrient content due to the

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mixture of fallen and decomposed mangrove leaf litter and sediments originating from the sea which contain a lot of minerals. The results of this study are in line with the results of Yahya's study (2018) in the Mamburungan Mangrove Forest, Tarakan City, which obtained the highest total nitrogen value at a depth of 10, namely 1.69%. Research conducted by Saibi & Tolangara (2017) found that the depth of 10 cm had the greatest influence on the rate of decomposition of Avicennia lanata litter, which was 0.29-0.39 grams/day. This is due to differences in the types and numbers of microorganisms so that this condition can affect the rate of decomposition of litter and the nutrients produced.

Chrisyariati et al., (2014) in their research stated that the Nitrogen content is included in the low category if it ranges from 0 - 0.20% and is included in the moderate/sufficient category if it is in the range of 0.21 - 0.40%. Based on this statement, the Nitrogen content in the sediment in the Mangrove and Crab Conservation Area, Pamusian Village is included in the sufficient category. Several descriptions of the Nitrogen content in sediment at different mangrove locations can be presented in Table 1.

Table 1. Nitrogen content in sediments in several mangrove areas

Lokasi Penelitian	Kandungan Nitrogen (%)	Sumber
Mangrove and Proboscis Monkey Conservation Area (KKMB) Tarakan City	0,03 – 0,33 %	(Taqwa, 2010)
Penunggul Village, Nguling District, Pasuruan Regency, East Java	0,16 – 0,20 %	(Sumiyati, 2011)
Mangrove Area of Bedono Village, Sayung District, Demak Regency	0,27 - 0,46 %	(Nugroho, 2013)
Mangrove Area of Mangunharjo Village, Tugu District, Semarang City	0,27 - 0,45 %	(Chrisyariati *et al.*, 2014)
Mangrove and Proboscis Monkey Conservation Area (KKMB) Tarakan City	0,31 - 0,55 %	(Yulma *et al.*, 2018)
Mamburungan Mangrove Forest, Tarakan City	0,61 - 1,69 %	(Yahya, 2018)
Maron Mangrove Education Park, Semarang	0,004-0,074 %	(Kanti, 2019)
Mangrove and Crab Conservation Area, Pamusian Village	0,14 - 0,34 %	(Penelitian ini, 2021)
Mangrove Area of Pagatan Besar Village, Tanah Laut Regency, South Kalimantan	0,11 – 0,20 %	(Anliany, 2024)

The total nitrogen content in sediments in the Mangrove and Crab Conservation Area ranges from 0.14 - 0.34%. This can be suspected because the research allocation is close to the Pamusian River flow so that it gets input of suspended materials containing many nutrients, but also gets input of household waste from the mainland. The results obtained at this research location are lower than the research conducted by Yahya, (2018) in the Mamburungan

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Mangrove Forest, Tarakan City which ranges from 0.61 - 1.69%. This location has a high value because the mangrove area is close to the river mouth and fish farms so that organic matter is high which comes from waste from fish farming activities in the river flow. However, when compared to the research conducted by Taqwa (2010) and Yulma et al., (2018) in the Mangrove and Bekantan Conservation Area (KKMB) of Tarakan City, there was an increase in Nitrogen content, allegedly due to the expansion of the mangrove area and increased anthropogenic activities that produce waste. Overall, the total nitrogen content in mangrove sediments can vary due to differences in location, density, type and age of mangroves.

CONCLUSION

The total nitrogen content in the sediment in the Mangrove and Crab Conservation Area is highest at a depth of 10 cm, which is around 0.25 - 0.32%, at a depth of 20 cm it is around 0.19 - 0.24%, and at a depth of 30 cm it is around 0.14 - 0.20%.

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