DECOMPOSITION RATE OF *Sonneratia alba* MANGROVE LEAF LITTERS IN THE COASTAL AREA, KARIMUN REGENCY KEPULAUAN RIAU PROVINCE

Sofia Wanda Rizki[1*], Afrizal Tanjung[1], Irvina Nurrachmi[1]

[1]Department of Marine Science, Faculty of Fisheries and Marine, Universitas Riau
Kampus Bina Widya KM. 12,5, Simpang Baru, Kec. Tampan, Kota Pekanbaru, Riau 28293
*sofiawanda.2209@student.unri.ac.id

ABSTRACT

Mangroves are plants that have an important role in providing very complex and potential food components for the life of various things at there and terrestrial biota. Mangrove's high productivity is obtained from litter. This study aims to determine the rate of litter decomposition and the percentage of the leaf decomposition of *Sonneratia alba* mangroves in the Coastal area. This research was conducted from August to September 2021. The method used in this study was an experimental method, where mangrove leaf fall was taken and observed the decomposition rate of *S.alba* mangrove leaf litter in the field for 28 days, and then dried the mangrove leaf. *S.alba* at the Marine Chemistry Laboratory, Faculty of Fisheries and Marine, Universitas Riau. Based on observations, it can be seen that the average temperature value ranges from 29.7 to 30.7°C. The temperature at station I is relatively low compared to the other two stations. The measurement of the degree of acidity (pH) obtained the same results at each station, namely 7. For the measurement of salinity, the average obtained ranged from 34.3-35 ppt. The highest salinity known to be at station III is 35 ppt. In the measurement of Dissolved Oxygen (DO) the average value was obtained, which ranged from 4.60-5.89 mg/l. The decomposition process of *S.alba* leaf dregs which was carried out for 28 days showed that of rate of decomposition of *S.alba* mangrove leaf litter between stations, the highest rate of decomposition, is at station II an average of 3.92 g/day with a percentage of decomposition. 81.9% while at station III the average decomposition rate obtained was 3.35 g/day with a decomposition percentage of 75.8% and at station I is the station with the lowest rate of decomposition, which has an average of 3.25 g/day with a decomposition percentage of 67.0%.

Keywords: Litter, Decomposition Rate, Percentage of Decomposition.

I.   INTRODUCTION

The coastal area is functionally an area with a variety of interrelated and interacting ecosystems. These ecosystems form an ecological system making this region have abundant natural resources. Mangrove ecosystems are ecosystems that are abundant in coastal areas. One of the mangrove ecosystems in the Riau Archipelago Province is the Coastal Area, Karimun Regency, Kepulauan Riau, which is currently experiencing damage to its mangrove ecosystem.

Mangroves have an important role in providing a very complex and potential food component for the life of various marine and terrestrial biota. The high productivity possessed by mangroves is obtained from litter donations. Mangroves also play an important role in maintaining

soil fertility by contributing organic matter, namely litter that is decomposed by fungi and bacteria [1].

Mangroves have litter which has a very important function for the mangrove ecosystem, including maintaining forest soil fertility. Fertility of soil and plants depends on the productivity and rate of litter decomposition. Litter will decompose, contribute organic matter to forest soil, and become a food source for fauna in the mangrove ecosystem.

As a dynamic process, the process of destroying litter also has a speed dimension that may differ from time to time depending on the factors that influence it, the factors that affect the rate of decomposition include physical factors such as temperature, salinity, brightness, current speed. chemical factors such as pH, DO, and biological factors such as macrobenthos.

Macrobenthos is one of the early decomposers that destroys/chops the remains of leaves which are released again as dirt and followed by fungi and bacteria to decompose organic matter into protein [2].

The rate of decomposition of litter is a process of destruction for organisms that occurs gradually so that the structure is no longer complex, but has decomposed into carbon dioxide, water and mineral components [3]. The amount of litter produced in each type of mangrove is different because it is caused by interrelated factors, differences in the amount of litter affect productivity, soil fertility and density. Decomposition is an important process of ecosystem function. Decomposition of mangrove litter, especially leaf litter, contributes most of the nutrients in the surrounding waters. Based on this, research on the rate of decomposition of mangrove litter is very important, because litter is the largest contribution of mangrove ecosystems to estuaries and water fertility.

Based on this, it is necessary to conduct research on the rate of decomposition of *Sonneratia alba* mangrove leaf litter in the Coastal Area. Because this has never been done in this area and there is still a lack of information about *S.alba* leaf litter

2.   RESEARCH METHOD
Time and Place

This research was conducted in August-September 2021 in the Coastal Area of Karimun Regency, Riau Islands Province (Figure 1).
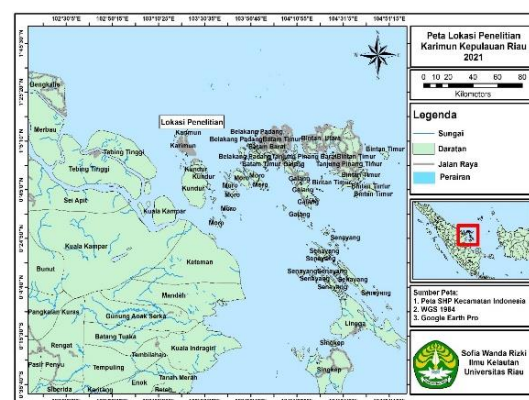

Figure 1. Map of Research Locations

Method

The research stations were determined using a completely randomized design (CRD), where this study was conducted at 3 research stations (Figure 2).
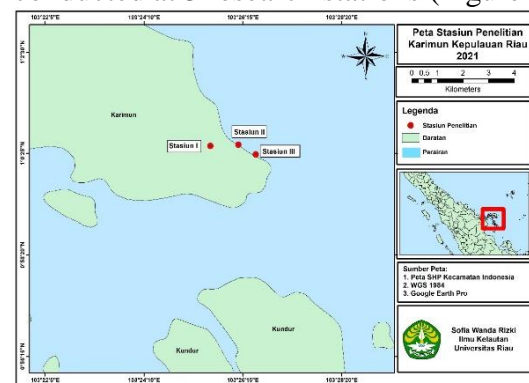

Figure 2. Research Station Map

Research Procedure

Water quality parameters measured were salinity, temperature, degree of

acidity (pH), and dissolved oxygen (DO). In this study, 3 research locations were taken in the Coastal area. The study was conducted for 28 days. Each station contained 12 litter bags taken on day 7, day 14, day 21 and day 28 [4]. The total litter bags used were 36 bags.

Mangrove leaves are collected by picking up *S.alba* mangrove leaf litter under the mangrove tree and collecting it under a tree stand [5]. As for the leaves that have been taken and selected which are already yellow in color because it is assumed that the water content in the leaves is the same, the dried leaves are weighed as much as 20 g which is the initial weight. At each observation station, there are 12 litterbags.

Before the mangrove leaf litter is weighed, the mangrove leaf litter is dried first in the sun because the mangrove leaves have been exposed to seawater. After drying, the mangrove leaf litter is weighed and put in a litterbag, and then the litterbag is tied under the *S.alba* mangrove tree so that decomposition occurs in the mangrove leaf litter. After the observation day arrived, the litterbags were taken at each observation location on the 7th, 14th, 21st, and 28th days. The litter bags used are 30 cm x 40 cm in size with a 1 mm mesh, large enough to allow the entry of water and existing organisms [4].

Samples of leaf litter in litter bags were brought to the laboratory. Furthermore, the sample was removed from the litterbag, placed on a tray, and drained to measure its weight. Then the litter was dried using an oven for 24 hours at 80˚C until the weight was constant (Aston in [6]), then weighed to obtain the dry weight.

Data Analysis
Mangrove Leaf Litter Decomposition Rate

The rate of litter decomposition uses the formula (Boonruang in [6]), namely:

$$R = \frac{Wo-Wt}{T}$$

Information:
R = Decomposition Rate (gr/day)
Q = Observation time (days)
Wow = dry weight of initial sample (g)
Wt = dry weight during the t-th observation (g)

Percentage of Decomposition of Mangrove Leaf Litter

The percentage of litter decomposition uses the formula (Boonruang in [6]), namely:

$$Y = \frac{Wo-Wt}{Wo} \text{ X } 100\%$$

Information:
Y = Percentage of litter that has decomposed
Wow = dry weight of initial sample (g)
Wt = dry weight during the t-th observation (g)

Analysis of Variance of Randomized Block Design

Model the equation of analysis of variance is as follows [7]:

$Yijk = \mu + \alpha i + + \varepsilon ij$

Information:
Yij = Observation value in the I-th treatment and j-th repetition
μ = The true mean
αi = The effect of the 1st treatment
εij = Experimental error on treatment the I and the jth repetition.

The data obtained during the research is presented in the form of tables and graphs and discussed statistically. To find out the difference in the rate of decomposition of *S.alba* mangrove leaf litter between one-way ANOVA test stations, if there is a significant difference then LSD testing is carried out at a level of 5%.

3.   RESULT AND DISCUSSION
Water Quality Measurement

Water quality parameters were measured at each research sampling point for 3 (three) repetitions. The results of water quality measurements in the Coastal Area can be seen in Table 1.

**Table 1**. Average water quality in the Coastal Area

No	Parameter	Unit	Station		
			I	II	III
1	temperature	˚C	29,7	30,7	30,3
2	pH	-	7	7	7
3	Salinitas	‰	34,3	34,7	35
4	Do	mg/L	4,60	5,89	5,89

The temperature that has been measured at this research location ranges from 27-30˚C, this indicates that the conditions are still good. Based on the research results, the temperature obtained is still in the good range for the decomposition process of *S.alba* leaf litter. The average temperature of the tropics suitable for the life and production of mangrove leaves is 26- 32˚C and the range of temperatures measured at each observation station is included in this range, so it is concluded that the temperature at the study site is still supportive for the life of the mangrove ecosystem. In accordance with the Quality Standards in the Decree of the Minister of Environment No. 51 of 2004, which states that, the ideal seawater temperature for mangroves is 28˚C-32˚C [8].

This is in accordance with the statement of [9] the decomposition process starts from the process of destruction/fragmentation or breakdown of the physical structure that occurs when litter falls and is trapped in the mangrove ecosystem and it can also be suspected that it is due to environmental factors such as physical and chemical parameters of the waters which also vary every day causing the presence of decomposer organisms and microorganisms in the area.

Decomposition rate of Mngrove *S.alba* leaf litter

The results of the decomposition rate of *S.alba* mangrove leaf litter in the Coastal Area, Karimun Regency, Kepulauan Riau Province, for 28 days did not show that the litter was completely decomposed. As for the data from observations made on the decomposition rate of Sonneratia alba mangrove leaf litter, namely by treating the mangrove leaf litter, where the mangrove leaf litter is dried first so that the water content in mangrove leaves that have been exposed to sea water can be the same as before being exposed to seawater. sea water or by collecting it using a net under a mangrove tree. The results of drying mangrove leaf litter from drying on the 7th, 14th, 21st and 28th days can be seen in Figure 3.
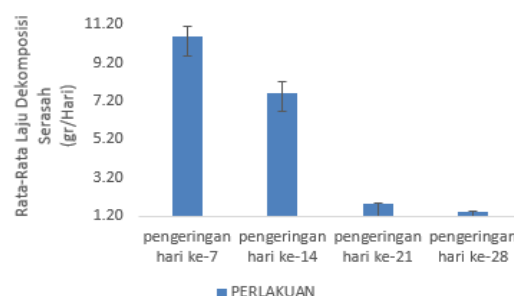
Figure 3. Graph of *S.alba* Mangrove Leaf Litter Decomposition Rate

In Figure 3, it was found that drying on the 7th day was the highest drying of mangrove leaf litter, namely 10.58 g/day, while drying of mangrove leaf litter on day 28 was the lowest drying, namely 1.43 g/day. For comparison of the decomposition rate of Sonneratia alba mangrove leaf litter between stations, where station I is the station with the highest decomposition rate, which has an average of 3.92 g/day, while station I is the station with the lowest decomposition rate, which has an average an average of 3.25 g/day.

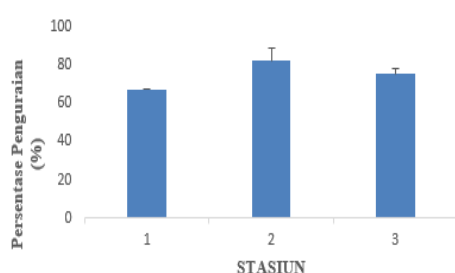The process of decomposition of *S.alba* mangrove leaf litter on the 7th, 14th,

21st, and 28th days of observation in the Coastal Area, showed that the decomposed *S.alba* leaf litter underwent a change in shape with the appearance of the leaf litter. which over time changes shape into fine particles such as leaves that were originally whole to decompose.

This is in accordance with the results of [10] where the highest decomposition rate was Sonneratia and then Avicennia, Bruguiera, and the lowest was Rhizophora. Based on research by [11] the rate of decomposition reached a value of 0.96 – 0.54 g/day, and in [12] the rate of decomposition of litter was 0.22 – 0.26 g/day while in [13] the rate of litter decomposition was found to be 0.27 – 0.09 g/day.

Percentage of *S.alba* Mangrove Leaf Litter Decomposition

Percentage of *S.alba* mangrove leaf litter decomposition in the Coastal Area, Karimun Regency, Kepulauan Riau Province. The difference in the average percentage of *S.alba* mangrove leaf litter decomposition can be seen in Figure 4.

Figure 4. Graph of the Percentage of Decomposition of *S.alba* Mangrove Leaf Litter.

Figure 4 shows that the average percentage of *S.alba* mangrove leaf litter decomposition in the Coastal Area, Karimun Regency, Kepulauan Riau Province is highest at station II, namely 81.9%, and lowest at station I, namely 67.0%. It can be concluded that the percentage of *S.alba* mangrove leaf litter decomposition in the Coastal Area, Karimun Regency, Kepulauan Riau Province at each station was not significantly different. The highest percentage of *S.alba* mangrove leaf litter decomposition was at station II and the lowest was at station I.

This is in accordance with the statement of [14] that in water areas the decomposition process is also assisted by physical mechanisms, namely the movement of tidal currents and longer inundation by seawater. Mechanism of loss of soluble materials from litter caused by rain or running water. According to Mason in [2], the erosion of litter can also cause the decomposition of litter by wave movement. The condition of the water substrate that is more humid than the land also plays a role in decomposing litter, a pH value of 7-8 indicates an environment that is always alkaline and humid, and the value causes the process of decomposition of litter quickly. Macrobenthos play an important role in the decomposition of litter when it is decomposed, so that in areas where there are many macrobenthos, the rate of decomposition is fast.

4. CONCLUSION

Based on the results of the study, it was found that the comparison of the decomposition rate of *S.alba* mangrove leaf litter between stations, where station II had the highest decomposition rate, which had an average of 3.92 g/day, while station I had the lowest rate. Its decomposition is that it has an average of 3.25 g/day. The average percentage of *S.alba* mangrove leaf litter decomposition in the Coastal Area, Karimun Regency, Kepulauan Riau Province was the highest at station II, namely 81.9%, and the lowest at station I, namely 67.0%.

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