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# Decomposition Rate of Mangrove Litter in Kuala Indragiri Coastal

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**ABSTRACT**

This study was conducted in the mangrove forest located in the Kuala Indragiri coastal areas (Riau province–Indonesia) from January to February 2015. Mangrove litter leaf is organic substance that affects the fertility of mangrove ecosystem, and support the life of organisms within that forest. The mangrove represent as nursery ground, feeding ground, and spawning ground for various fish type, prawn and other marine organisms. This forest is also produce detritus that can be used as main foods source in marine ecosystem. The objectives of this research is to understand the decomposition rate of mangrove litter in the Kuala Indragiri mangrove forest. Data were analyzed by calculating the mean dry weight of the litter and decomposition rate was counted using an exponential rank function or absolute decomposition percentage of litter leaf per day. The highest rate of litter decomposition was found in station V 44.902% with a residence time 15, 930 days. The mean coefficient of litter decomposition rate was 0.058 with residence time 19, 571 days.

***Keywords:*** *Decomposition, Litter, Mangrove, Kuala Indragiri.*

## INTRODUCTION

Kuala Indragiri has an area of 24, 334 hectares of mangrove forest. The type of soil is dominated by peat, stream sediment and marsh. This area has a wet tropical climate with somewhat humid air. The highest rainfall occurs in February and the lowest in September. Mangrove forest is a forest that grows in coastal areas, usually located in the area bays and estuaries with trait: not influenced by climate, there is the influence of the tide, sea water flooded soils, low soil beach, do not have a canopy structure, and has a tree species typical. Land in the mangrove forest is dominated by the mud of the order entisols. Land submerged in brackish water and without oxygen the unique root system, like the roots of breath.

Mangroves are critical ecosystems due to their ecological roles, as well as to their economic and social importance (Matos et al., 2012)). They grow in tropical and subtropical coastal regions, mainly in sheltered areas such as estuaries, bays and lagoons, and are among the most productive ecosystems in the world (Alongi, 2009; Kathiresan & Bingham, 2001).

Decomposition is one of the most important stages in the cycling of nutrients and it is ruled, mainly by three groups of variables: the nature of the community in decomposition (diversity and abundance of macro and micro organisms), the characteristics of the organic material that determine its degradability (the substrate quality), and the physical-chemical

conditions of the environment, which are controlled by the climate and by sediment characteristics of the site (Matos et al., 2012; Chapin III, 2003).

## MATERIALS AND METHODS

This litter collection using litter traps made of the net with a mesh size of 2 x 2 mm. Litter traps placed on the observation plots under mangrove tree stand on any station 2 units. Litter obtained is then dried in an oven at a temperature of 700 C within 48 hours, or until its weight is constant, then weighed weight to the nearest 0.05 g tools. Litter decomposition rate is calculated by putting as much

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as 10 g of leaf litter in the bag litter (litter bag) measuring 20 x 30 cm is made of nylon with a mesh size of 2 mm. After the pouch bag tied around the base of the stem or roots of mangrove vegetation so as not to drift or tidal currents swept away. Litter taken as much as 2 bags of each station after 15 days, 30 days, 45 days. This observation time based on some research has been done that the process of litter decomposition has occurred between 7-15 days. The total decomposition of leaves, is known, which is 30-45 days (Sa'ban et al., 2013). Litter left in the bag is cleaned of mud still attached, then dried again in the oven at 700 C for 4 days or until its weight remains.

Weight used to determine the decomposition rate is a weighted average of the two bags were measured. Litter decomposition rate was obtained using the formula of Olson (Mahmudi et al., 2008; Sony et al., 2011; Andrianto et al., 2015).

**$Xt = Xo.e^{-kt}$**
**$\ln(Xt/Xo) = -kt$**
The determination of the length of litter there are (resiedence time) use the formula: **1/k**

Xt : dry weight of litter after time to t (g)
Xo : initial litter dry weight (g)
e : Numbers logaritme (2.72)
k : litter decomposition rate
t : Time of observation (day)

## RESULTS AND DISCUSSION

Changes in litter decomposition is physically and chemically simple by soil microorganisms (bacteria, fungi, and other soil animals) or also known as mineralization, namely the destruction of organic materials derived from animals and plants into simple organic compounds (Gultom, 2009). Data observation depreciation litter dry weight listed in Table 1

**Table 1.** Dry Weight Depreciation Mangrove Litter

| No | Station | Replay | Initial weight (gram) | Final weight day-to | | |
|---|---|---|---|---|---|---|
| | | | 0 | 15 | 30 | 45 |
| 1 | I | 1 | 10 | 7.420 | 4.051 | 2.980 |
| | | 2 | 10 | 8.505 | 4.607 | 3.559 |
| | | 3 | 10 | 8.730 | 6.712 | 5.002 |
| | Mean | | 10 | **8.218** | **5.123** | **3.847** |
| 2 | II | 1 | 10 | 7.050 | 4.374 | 3.008 |
| | | 2 | 10 | 7.342 | 5.007 | 3.619 |
| | | 3 | 10 | 8.331 | 6.526 | 4.062 |
| | Mean | | 10 | **7.574** | **5.302** | **3.563** |
| 3 | III | 1 | 10 | 5.612 | 3.796 | 0.704 |
| | | 2 | 10 | 6.865 | 4.733 | 1.877 |
| | | 3 | 10 | 7.622 | 5.071 | 3.003 |
| | Mean | | 10 | **6.700** | **4.533** | **1.861** |
| 4 | IV | 1 | 10 | 6.045 | 3.403 | 0.772 |
| | | 2 | 10 | 6.533 | 3.883 | 2.003 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | 3 | 10 | 7.817 | 6.415 | 2.855 |
| | Mean | | 10 | **6.798** | **4.567** | **1.877** |
| | | 1 | 10 | 5.086 | 2.620 | 0 |
| 5 | V | 2 | 10 | 5.532 | 2.906 | 0.831 |
| | | 3 | 10 | 6.381 | 4.019 | 2.007 |
| | Mean | | 10 | **5.666** | **3.182** | **0.946** |

The decomposition process is influenced by environmental conditions and substrates. Factors that cause rapid litter decomposition occurs at station III, IV, and V are the characteristics of the substrate and puddles. V station locations that are closer to the ocean (estuaries Indragiri) causes the substrate longer flooded because of the influence of the tides and is dominated by mud. According to research Siahaan et al (2012) the abundance of microbial/decomposers numerous in areas bersubstrat river estuary mud that contains a lot of organic material.

Based on data from the dry weight of depreciation determined litter decomposition rate (k) an the length of litter on the forest floor (residence time), which are listed in Table 2

**Table 2.** Litter Decomposition Rate of Mangrove

| Station | Day to_ | The Rate of Decomposition | | | The Decomposition Rate Coefficient (k) | *Residence Time* (1/k) |
|---|---|---|---|---|---|---|
| | | Gram | Gram/Day | % | | |
| | 15 | 1.782 | 0.119 | 11.878 | 0.054 | 18.519 |
| I | 30 | 4.877 | 0.325 | 32.511 | 0.044 | 22.727 |
| | 45 | 6.153 | 0.410 | 41.020 | 0.027 | 37.037 |
| Mean | | | | **28.470** | **0.042** | **26.094** |
| | 15 | 2.426 | 0.162 | 16.171 | 0.053 | 18.868 |
| II | 30 | 4.698 | 0.313 | 31.318 | 0.045 | 22.222 |
| | 45 | 6.437 | 0.429 | 42.913 | 0.034 | 29.412 |
| Mean | | | | **30.134** | **0.044** | **23.501** |
| | 15 | 3.300 | 0.220 | 22.002 | 0.093 | 10.753 |
| III | 30 | 5.467 | 0.364 | 36.444 | 0.062 | 16.129 |
| | 45 | 8.139 | 0.543 | 54.258 | 0.048 | 20.833 |
| Mean | | | | **37.568** | **0.068** | **15.905** |
| | 15 | 3.202 | 0.213 | 21.344 | 0.092 | 10.870 |
| IV | 30 | 5.433 | 0.362 | 36.220 | 0.066 | 15.152 |
| | 45 | 8.123 | 0.542 | 54.156 | 0.043 | 23.256 |
| Mean | | | | **37.240** | **0.067** | **16.426** |
| | 15 | 4.334 | 0.289 | 28.891 | 0.045 | 22.222 |
| V | 30 | 6.818 | 0.455 | 45.456 | 0.096 | 10.417 |
| | 45 | 9.054 | 0.604 | 60.360 | 0.066 | 15.152 |
| Mean | | | | **44.902** | **0.069** | **15.930** |

Table 2 shows the average rate of mangrove litter decomposition in a row that the first station 28, 470% / day with a residence time 26.094. At the station II 30 134% / day with a residence time

23.501. At the third station 37.568% / day with a residence time 15.905. At station IV 37.240% / day with a residence time 16.426. At station V 44.902% / day with a residence time 15.930. Research Andrianto et al (2015) the rate of mangrove litter decomposition in Batu Menyan Pesawaran with a mean residence time 14, 768. According to Setiawan (2012) the rate of litter decomposition is different at each level of salinity. The decomposition rate is highest at 25 ppt salinity level.

Other relevant research conducted by Matos et al (2012) the rate of litter decomposition in the coastal mangrove Paraíba do Sul River Rio de Janeiro, Brazil showed the average residence time of litter mangrove 17.138.

Another thing that affects the rate of decomposition of litter decomposers oxygen required to decompose the organic material in which a very big role decomposers light that enters the water level will affect the growth of bacteria and fungi. Tide also participate in decompositin litter through the water currents that break the leaves so that it becomes smaller (Hossain & Hoque, 2008; Dewiyanti, 2013).

Events tidal assist the process of decomposition through weathering. Together salinity and sunlight, slow tides destroy the organic materials. The tides would hinder the development and activity of makrobentos (decomposers). Ups and downs associated with salinity, tidal frequency level extremely participate in determining the change in salinity. The more frequent ups and downs, sallinitas level is increasing. Effect of salinity on density makrobentos (decomposers) occurs indirectly, ie through the density of trees resulted in an allowance for the increase in density makrobentos. The density of trees able to reduce or neutralize the increase in salinity. Decreased levels of salinity are also caused by the dilution of water in the soil at low tide (Matos et al., 2012).

## CONCLUSIONS

The highest rate of litter decomposition found in station V 44.902% with a residence time 15, 930 days. The mean coefficient of litter decomposition rate of mangrove in coastal areas Kuala Indragairi was 0.058 with residence time 19, 571 days.

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