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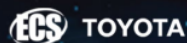
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Investigation of total organic matter [TOM] content during high and low water in inter-tidal zone sediment at Teluk Penyu Coast, Cilacap, Indonesia

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Abstract: Sediment is composed of organic and inorganic particles. Accumulation of organic particles in the sediments is known as organic matter. The present of sediment in the tidal zone and the existence of organic matter accumulation in sediment is influenced by oceanographic pattern. Tide is an important influence as transporting the sediments in the coastal waters, the tides can generate currents that move a mass of water and carry suspended solid material, and become as one of the factors that play a role of organic matter transfer, both to sediment transport and sediment deposition. The purpose of this study is to determine the content and differences of Total Organic Matter [TOM] in sediments during high and low water in a tidal area at Teluk Penyu Cilacap, Indonesia. The LOI (Loss On Ignition) method is carried out to analyze the content of [TOM] in the sediment. The average content of [TOM] in 100 g of sediment during high water was obtained 3.72% and 5.86% when low water. Statistically, tidal patterns at the time of the study were not cause to the difference of the TOM content [$p < 0.05$]. Existence of organic matter in tidal zone sediment plays and important role as a food source for bacterial decomposing organism.

1. Introduction

The global budget of carbon is important as a nutrient, the nutrient as the decomposing process of organic matter [OM] to the mineral. OM in a tidal zone as the sedimentary environment and as an ecosystem on Earth have the most productive [1]. Another importance of OM from marine sediment association is release O_2 [2]. Organic Matter characteristics contained in sediments and sedimentary rocks are an important issue for many different issues of biological, geological, and environmental scientists [3]. Decomposing of mangrove litter is decomposed within one year and the decomposed litter could be incorporated into the underlying soils [4]. Variability of OM in sedimentary input is influenced by terrestrial organic content [5] directly and the size of grain sediment as part of OM. The OM is a micro-environment [6] and as part of a microorganism to decompose the OM.

Tidal areas as sedimentary environments are the most productive ecosystems on Earth [1]. Tidal zone as the land-ocean margin is a vital ecological service, provide nutrient filtration, and the nutrient for support habitat and nursery areas of marine species [7]. The tidal zone provide a burial area for sediment



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and the marine sediment along the continental margin is incorporate with Organic Matter [OM] [8]. The OM is initialized from land [7] and is accumulated, ¹⁷tributed by runoff from the rivers to the sea [9] by tidal pattern. Composition and organic contents are essentially constant within individual sediment cores and varied consistently with location [10].

Tidal zone of Cilacap coast as part of Penyu Bay and the source of sediment is supplied from Eastern of the coast by some river that estuary at the coastal, namely Serayu, Bodo, Mandiraja, and Kalisabuk [SBMK] rivers. The Serayu river is the longest [300 km] river if compared to those of the three rivers [(BMK)] and the sediment supply is dominated by sand. The sediment from BMK estuaries is dominated by mud. At the south of the coastal is connected by two canals to the Segara Anakan lagoon. The lagoon is known to have experience of very high sedimentation and the dominant type of sediment is mud. The variability of OM content is important to know, especially the relation of the effect of tidal pattern to disposition the OM during high and low water of the existence of river estuaries at the coastal to support the OM.

2. Method and Materials

Sediment as the source of OM was collected from 8 stations at the Cilacap coast. Sediment sampling was carried out using core sediments made from PVC pipe with a diameter of 2.5 inches and a length of 20 inches [11]. In Figure 1 the surface sediment was collected 3 times from each station in March 2019 during high and low tides.



Figure 1. Tidal area site research stations at Teluk Penyu, Cilacap-Indonesia

²¹ Sediment ⁵ samples were collected in the top 30 cm from the seabed profile in the tidal zone. All sediment samples were dried at 50°C for 24 h and ground to pass a 2-mm sieve ⁶. Soil organic matter content was determined using the loss on ignition method [12, 13]. The method to estimate the amount of TOM in a sediment sample ¹⁴ measured the weight lost by an oven-dried (105°C) sediment sample when it is heated to 400°C; the 'loss on ignition', essentially the organic matter is burnt off. The formula to weigh the analysis of OM is based on [14]. The relation of OM content during high and low tides is analyzed based on software SPSS 20.

¹³
$$LOI = \left[\frac{\text{Sediment weight after combustion} - \text{oven-dry sediment weight}}{\text{oven-dry soil weight}} \right] \times 100. \quad (1)$$

3. Result and Discussion

3.1. Total Organic Matter Content

The sediment bulk volume is the sum of self-packing volumes of OM and mineral components [15]. A key component of any ecosystem is OM [16] in sediment. The variation in its abundance is profound effects on many of the processes that occur in the system. The content of OM is determined by the depth and the highest concentration of OM is obtained in the upper layer as thick as 20 cm (15-20%). The climatic factor is important to the accumulation of TOM in sediment, those are temperature, and rainfall. The more cold areas are found higher of organic matter level. Based on the results in **Figure 2**, that the location of the sampling stations is divided into two regions, namely stations 1, 2, 3, 4, and 5 are located in the western part of the Serayu estuary, while stations 6, 7, and 8 is located in the eastern part of the river estuary. The different content of TOM at each station is due to the presence of sediment and TOM input that flows through the Serayu river and empties downstream of the Serayu River. TOM and sediment are supplied from the eastern of coast by some river [SBMK] that estuary at the coastal rivers during low water. TOM content during low water in station 5 is found highest than another station and the average content during high tide higher than the lower water. The western part of the coast has a lower TOM content during low water than the eastern part of the coast. The composition of OM is primarily controlled by the type of agricultural crops and vegetation in the drainage basin of the river [17] and [18] found mineralization as process decomposing of OM is different in spacial and mainly due to differences in the liability of the OM.

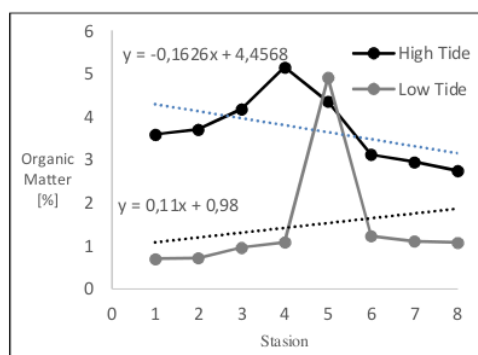


Figure 2. Organic Matter [OM] at stations

Eastern part of the coast (station 6, 7 and 8) as agricultural field and more of existence of vegetation, during high water, is obtained TOM content higher than low water. The condition is indicate the TOM in sediment flows from the river to coast during low water. The TOM during high water is distributed to western of the coast and as result the content of TOM in western part [high stations] become lower than high water. Important controls that impact on the degradation and subsequent preservation of organic matter in aquatic sediments are the chemical nature of the organic substrate; the potential influence of matrix on preservation; the role of redox effects in degradation; and the effects of physical mixing of sediments [19].

TOM ratio **Figure 3** at stations during low and high water is obtained to decrease from western to eastern of the coast. Cilacap district is protected from the influence of the Indonesian ocean by

Nusakambangan island [20]. The existence of Segara Anakan lagoon at the southern coast as a source of OM and sediment has a low impact on the TOM content at the coast. The tidal pattern during low water is flow to the Southeast via the Nusakambangan strait. Based on the tidal flow during low water, we assumed the TOM accumulation in sediment from Segara Anakan Lagoon is the low impact of TOM content in sediment at the Penyu bay. Organic matter in sediment is interacted with mineral matrices and is critical to the preservation of soil and sediment organic matter [21].

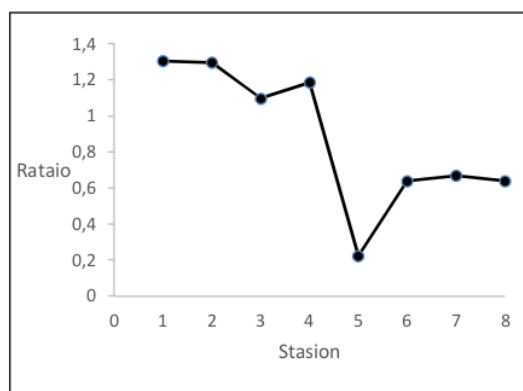


Figure 3. Total Organic Matter [TOM] Ratio at stations during high and low water.

3.2. The Difference of Total Organic Matter

The function of OM is an environmental control, especially on the production of the OM in the biosphere, ecological, and sediment processes. Which control the deposition and distribution of biochemical, geomicrobiology factors [22]. Another function is the mineralization of OM by the decomposing organism that important to the mineral circle [23]. [24] stated that decomposition rate is constant from 0.2 to 7 yr⁻¹ and towards the seaward end of the estuary is decrease and OM as the source of carbon in inter-tidal sediment is found 85% from total carbon. On another side [25] states that the accumulation of OM in deep-sea sediment and burial is attributed to aggregation mechanisms and hydrodynamic sorting. Kruskal-Wallis analysis of the TOM of each station during low and high water was found $P_{(0.05)} < 0.372$. Statistically of TOM content during high and low waters was found 0.372, the value indicates that the TOM content in inter-tidal sediment of Penyu bay coast during low and high water is found not differ.

7 Conclusion

The total concentration of organic matter in 100 g of sediment during high water and low water was obtained 0.93 g (3.72%) and 1.47 g (5, 86%). Kruskal-Wallis test results of total organic matter concentration in sediment during high water and low water $P(0.05) < (0.372)$, indicates that there is no difference in the total organic matter concentration in Teluk Penyu inter-tidal sediments when high water and low water.

Acknowledgment

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