Proximate Content of “Klekap” (Microphytobenthos and Their Associated Meiofauna) from Milk-Fish Pond

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Abstract. Microphytobenthos and their associated meiofauna (“klekap”) have important role in milkfish pond ecosystem especially traditional fish pond. Microphytobenthos and their associated meiofauna not only consists of unicellular microalgae from class Bacillariophyceae, Cyanophyceae, Chlorophyceae but also a lot of meiofauna such as Nematoda, Annelida, Mollusc, Arthropoda, etc. Microphytobenthos and their associated meiofauna inhabit in the upper most surface sediment layer. They also have important role in the primary and secondary productivity. This research has purpose to investigate the composition of proximate in the microphytobenthos and their associated meiofauna. Microphytobenthos and their associated meiofauna were taken from three milkfish ponds in Pati area, Central of Jawa, Indonesia. Samples were taken directly by hand core from 3 stations with 3 replications. The research result showed that the value of protein content had range 6.9±0.33 - 7.73±0.37 %, the value of carbohydrate content had range 10.44±1.2 - 12.59±0.15 %, the value of lipid content had range 0.86±0.07 -0.96±0.07 %. It concluded that the third station has higher value of protein, lipid and carbohydrate compared than the first and the second station.

Keywords: Microphytobenthos, Meiofauna, Proximate

1. Introduction

Microphytobenthos consists of unicellular eukaryotic algae and Cyanobacteria that grow within the upper several millimeters of illuminated sediment, typical appearing only as a subtle bownish or greenish shading [1] [2]. The microphytobenthos not only inhabit a thin, horizontal and time-varying region at the sediment-water interface, but they also grow in habitat ranging from wave-swept beaches to detritus-laden backwater lagoon, and includes habitat such as salt marshes, submerged aquatic vegetation beds, intertidal sand and mud flats and subtidals, illuminated sediment. They also are found at the surficial layer of the sediment that in the zone of intense microbial and geochemical activity and considerable physical reworking.

The ecology of the microphytobenthos is highly complex since light penetration into the sediment is no greater than 2 mm [3], only the diatoms in that sediment layer play a role in the fixation of inorganic carbon during photosynthesis. Furthermore, mechanism studies of microphytobenthos primary production and the coupling of primary and secondary production, are complicated by the large variability over small (mm) vertical scales and the patches over somewhat larger (cm to m) horizontal scales associated with variation in the texture and relief of the sediment surface [4].
In the benthic ecosystem, microphytobenthos has an important role as primary producer not only in the estuarine, shore water but also in the milkfish pond. In traditional milkfish pond, microphytobenthos can grow faster. Microphytobenthos and their associated meiofauna (in Indonesian language is mentioned as “Klekap”). Milkfish can grow well and faster in pond where a lot of klekap (microphytobenthos). Milkfish likes to eat klekap (microphytobenthos and their associated meiofauna). Klekap becomes good natural feeding for milkfish. Klekap (microphytobenthos and their associated meiofauna) is consisted of some microalgae and benthic fauna such as Oscillatoria, Phormidium, Lyngbya, Spirulina, Navicula, Nitzschia, Amphora, Odontella, Cocconeis, Achnanthes, Pleurosigma, Protozoa (Zoothamnium, Vorticella, Epistylis, Acineta), bacteria, Rotifera, Annelida, etc. [5] [6]. As autotrophic organisms, the value of primary production by microphytobenthos in some estuaries range from 27 – 234 g cm\(^{-2}\) / year [1] [2]. This primary and secondary production drive a rich food web, making estuaries and fish pond ecologically important areas and crucial importance for shore birds and fisheries. Besides serving as the primary food source for higher trophic level, microphytobenthos and their associated also play a very important role in sediment dynamics. Some microphytobenthos such as diatoms are important stabilizers of sediment through the excretion of extracellular polymeric substances [8].

As phytoplanktivorous fish such as milkfish also use resuspended microphytobenthos and their associated meiofauna and thus transfer benthic production into the pelagic food web in the fish pond, estuaries, shore water and etc. In fact, a lot of klekap (microphytobenthos and their associated) in the fish pond can make milkfish grow faster and better water quality. Therefore, this research has a purpose to investigate the proximate value content of microphytobenthos and their associated ("Klekap"). The information about proximate content in the klekap (microphytobenthos and their associated meiofauna) is important for necessary requirement to make artificial food for marine organisms especially sea cucumber.

2. Material and Methods

a. Material

Sample of microphytobenthos and their associated were collected by hand core (diameter 7.5 cm) from milk-fish pond where was located at Pati, Semarang, Indonesia. Samples microphytobenthos and their associated were taken from one of milk-fish ponds in Pati, Central of Jawa, Indonesia. There were position 3 stations with 3 replications for each station.

b. Methods

The analyses of proximate (moisture, ash, fibers, crude fat, protein and carbohydrate) of all the samples were determined. Measuring the moisture and ash were determined using weight difference method. The nitrogen value which is the precursor for protein of substance was determined by micro Kjeldahl method[9]. Carbohydrate content was determined by Luff-Schoorf method[10].

3. Result and Discussion

According to the research result, the value of ash is higher than the other proximate compositions. The average value of ash has range 73.74±0.65 – 76.80±0.65 %-dw. The average value of fiber crude for three station is 0.7 %-dw. (Table 1.) The average value of protein content in microphytobenthos and their associated as showed in Fig.1., have range between 6.9±0.33 - 7.73±0.37 %-dw. Furthermore, the value of carbohydrate has range between 10.44±1.2 - 12.59±0.15 %-dw. According the statistical analyse, carbohydrate and protein composition for microphytobenthos and their associated meiofauna did not show any significant differences (p > 0.05) between station 1, 2 and 3.
Table 1. Proximate Analysis of Microphytobenthos and Their Associated from Milk-Fish Pond.

| No. | Station | Protein (%-dw) | Lipid (%-dw) | Water Content (%-dw) | Ash (%-dw) | Fibre crude (%-dw) | Carbohydrate (%-dw) |
|-----|---------|---------------|-------------|---------------------|-----------|------------------|---------------------|
| 1.  | 1-1     | 7.23          | 0.83        | 4.86                | 75.47     | 0.63             | 10.98               |
| 2.  | 1-2     | 6.9           | 0.94        | 7.34                | 75.05     | 0.7              | 9.07                |
| 3.  | 1-3     | 6.57          | 0.8         | 4.71                | 75.88     | 0.77             | 11.27               |

| No. | Station | Protein (%-dw) | Lipid (%-dw) | Water Content (%-dw) | Ash (%-dw) | Fibre crude (%-dw) | Carbohydrate (%-dw) |
|-----|---------|---------------|-------------|---------------------|-----------|------------------|---------------------|
| 4.  | 2-1     | 7.1           | 0.95        | 2.84                | 77.53     | 0.68             | 10.9                |
| 5.  | 2-2     | 7.27          | 0.86        | 3.27                | 76.55     | 0.75             | 11.3                |
| 6.  | 2-3     | 6.8           | 0.82        | 4.47                | 76.31     | 0.66             | 10.94               |

| No. | Station | Protein (%-dw) | Lipid (%-dw) | Water Content (%-dw) | Ash (%-dw) | Fibre crude (%-dw) | Carbohydrate (%-dw) |
|-----|---------|---------------|-------------|---------------------|-----------|------------------|---------------------|
| 7.  | 3-1     | 8.15          | 1.03        | 3.77                | 73.68     | 0.72             | 12.65               |
| 8.  | 3-2     | 7.6           | 0.94        | 3.71                | 74.41     | 0.63             | 12.71               |
| 9.  | 3-3     | 7.45          | 0.9         | 5.35                | 73.12     | 0.76             | 12.42               |

![Figure 1](image_url) **Figure 1.** The value of protein and carbohydrate content in microphytobenthos and their associated (meiofauna)

The average value of lipid was exhibited in Fig 2. has range between 0.86 ± 0.07 - 0.96 ± 0.07 %-dw. The smallest proximate composition was fibre crude and then followed by lipid. The highest proximate composition was reached by ash has value between 73.74 ± 0.65 - 76.80 ± 0.65 %.-dw. According the research result, the value of phosphate for 3 stations had range 0.0125 - 0.0201 mg/L. The value of Nitrate for 3 stations had range 1.715 - 1.8235 mg/L result of measuring ammonia for 3 stations had range 0.1089 - 0.2951 mg/L (Table 2.) The value of salinity and temperature were high for 3 stations. The value carbohydrate content has range between 10.44 ± 1.2 - 12.59 ± 0.15 %. This value fit with the result that the proportion of carbohydrate for various microalgae have value 2 – 23%[12]. Comparing with the value of protein, value carbohydrate content is higher than value of protein (Table 1). High carbohydrate content in the microphytobenthos and their associated, because carbohydrate is one of a major part of the EPS (Extracellulose Polymeric Substrate) secreted by diatoms[13]. The EPS is consist of not only carbohydrate but also protein, lipid and nucleid acids[14].
Table 2. Parameters measured on 3 stations and 3 replicates at site of milk-fish pond, Pati, Central of Jawa, Indonesia.

| No. | Station | Phosphate (mg/L) | Nitrate (mg/L) | Amoniak (mg/L) | Salinity (ppt) | Temperature (°C) | pH | DO (ppm) |
|-----|---------|------------------|----------------|----------------|---------------|-----------------|-----|----------|
| 1   | 1-1     | 0.0227           | 1.8314         | 0.1275         | 63            | 36.8            | 8.5 | 8.1      |
| 2   | 1-2     | 0.012            | 1.9686         | 0.0996         | 62            | 36.7            | 8.5 | 8.3      |
| 3   | 1-3     | 0.0029           | 1.6706         | 0.0996         | 64            | 36.4            | 8.5 | 8.0      |
|     | Average | 0.0125           | 1.8235         | 0.1089         | 63            | 36.63           | 8.5 | 8.13     |
| 4   | 2-1     | 0.0046           | 1.8627         | 0.3063         | 65            | 38.1            | 8.5 | 6.4      |
| 5   | 2-2     | 0.0415           | 1.7647         | 0.2696         | 66            | 38.2            | 8.5 | 6.5      |
| 6   | 2-3     | 0.0141           | 1.8157         | 0.3093         | 64            | 38              | 8.5 | 6.6      |
|     | Average | 0.0201           | 1.8144         | 0.2951         | 65            | 38.10           | 8.5 | 6.5      |
| 7   | 3-1     | 0.002            | 1.6745         | 0.1246         | 62            | 39              | 8.5 | 5.3      |
| 8   | 3-2     | 0.0083           | 1.698           | 0.1914         | 63            | 39              | 8.5 | 5.2      |
| 9   | 3-3     | 0.0297           | 1.7725         | 0.1884         | 61            | 38.9            | 8.5 | 5.3      |
|     | Average | 0.0133           | 1.7150         | 0.1681         | 62            | 38.97           | 8.5 | 5.27     |

Figure 2. The value of total lipid and fibre crude in microphytobenthos and their associated (meiofauna).

The value of lipid content in the microphytobenthos and their associated was lower (between 0.86±0.07-0.96±0.07 %-dw.). The lower of lipid content because the temperature (36.63 – 38.97 °C), in the water was enough high which did not provide the possibility of carbohydrate to deposit or convert as lipid. High or low temperature in the water could reduce microalgae lipid production [12][13]. The highest cyanobacteria biomass when sediment temperature was low (5.3 °C) [15].

High value of ash composition in the microphytobenthos and their associated was (73.74±0.65 – 76.80±0.65 %-dw), because the ash is consisted organik matter and inorganic element. Microphytobenthos and their associated were living in the sediment and some of microphytobenthos attached in sand (episammic), living and moving in the sediment (epipelic) and epiphytic. The ecological condition was shown by the present of a lot of sand and mud in the sample of microphytobenthos. [6][14].
According the result, in the third station, the value of carbohydrate, lipid and protein content were highest than station 1 and 2. Whereas, the value of phosphate, nitrate and amoniak in the water column showed that the third station was lower than the first and the second station. It’s approved that microphytobenthos used the nutrient phosphate and nitrate for growth microphytobenthos which had influent to increase the value of protein, lipid and carbohydrate content. Some previous studies found high Phosphate concentration in the Santa Cruz[15]. Phosphorus present rapid and dynamic process[15]. The high salinity value (62- 65 ppt) which found in the three station influent the abundance of benthic organism. This condition is not fullfill the requirement of microphytobenthos and their associated. Some microphytobenthos species can acclimatized according to their respective conditions[16].

4. Conclusion

In the conclusion, the average value of protein and carbohydrate in microphytobenthos and their associated have range 6.9±0.33 to 7.73±0.37 % dw and 10.44±1.2 - 12.59±0.15 % dw. The average value of lipid content in the microphytobenthos and their associated meiofauna was lower (between 0.86±0.07-0.96±0.07 % dw.). There are carbohydrate content and protein content in “klekap” (the microphytobenthos and their associated meiofauna) is good for making artificial food from “klekap” for marine organisme specially sea cucumber. According to research there are no differences lipid, carbohydrate and protein composition for microphytobenthos and their associated meiofauna did not show any significant differences (p > 0.05) between station 1, 2 and 3. Microphytobenthos has important role in the bentic ecosystem of milk-fish pond.

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