Effect different sampling times of *Ulva* *sp* on polysaccharide sulfate content

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Abstract. *Ulva* *sp* seaweed generally still harvested from nature, not cultivation. Therefore, guarantee to availability of its seaweed conducted storage in the warehouse. The purpose of this study was to determine the effect of sulfate polysaccharide content on the sampling times of *Ulva* *sp*. The sampling time of seaweed raw materials is freshly harvested seaweed, and other has been stored for 4 months. Dried *Ulva* *sp* and freshly *Ulva* *sp* obtained from Gunung Kidul. The testing parameters include ash content, polysaccharide content, sulfate content, and its yield. The results showed that the highest yield and total polysaccharides were obtained from freshly harvested seaweed, while the sulfate content was similar. Based on the polysaccharide extract test results obtained, storage affects the yield and it content of polysaccharides.

1. Introduction

The green alga, *Ulva* *sp*, is a functional food parts of the world. *Ulva lactuca* is nutritious with high vitamins, trace elements and dietary fibers, making *Ulva* one of the most popular edible seaweeds worldwide [1][2]. Additionally, Green seaweed is also known as source sulfated polysaccharide so it has a lot of bioactivities. The constituents of Ulvan are L-rhamnose (Rha), D glucuronic acid (GlcA), L-iduronic acid (IdoA), D-xylose (Xyl), and sulfate groups [3]. Polysaccharides are polymers of monosaccharide units that are linked with glycosidic bonds. The polymers present in the macroalgae cell walls are differentiated based on glycosidic bonds, monosaccharide constituents, degree of polymerization, and the order of sugar residues. The major component of these polysaccharides consists of galactose, rhamnose, fucose and/or glucose linked sulfate esters [4][5]. In India marine waters, several types of seaweed such as *Enteromorpha linza*, *E. prolifera*, *Caulerpa taxifolia*, *Sargassum johnstonii* and *Ulva fasciata* fact nutrition were studied. The obtained information that *Ulva fasciata* in normal levels low lipid but a high level of protein and fiber. For humans still are on a carbohydrate diet, it is suitable to eat *Ulva lactuca* because it is rich in protein and low in energy. The amino acid content of seaweed has been assessed and evaluated. Information was obtained that there are seventeen essential amino acids present in seaweed from eighteen species of algae that are hydrolyzed, including *Ulva lactuca*. There were significant variations in the composition of amino acids for the different genus of algae [6].

Marine biological resources that have the potential to have high nutritional value are seaweed. *Ulva lactuca* can be used as food, energy, and medicine based on its morphology and biochemical composition. Morphologically of *Ulva lactuca* (L.), commonly known as “sea lettuce, it has color variations from green to dark green depending on its occurrence i.e., underwater or at the beach. It forms irregular, but round ruffled edge shaped translucent soft sheet fronds (leaf blades) from slight yellowish
to blackish green. Fronds are attached to rocks with the help of holdfast. *U. lactuca* is harvested from beaches in the world every year in huge quantity [7]. The high-water content of the seaweed (60% to 94%), causes it to be easily damaged without any outside interference. Therefore, the application of preservative methodology is necessary to maintain the shelf life of the product and to maintain its nutrition, organoleptics, and bioactivity. The drying method is most applied in the seaweed industry by dehydrating it so that it has a long shelf life. In addition, seaweed is also often treated with non-thermal treatments, namely freezing and salting, which can inhibit the growth of microorganisms and lipid oxidation events by lowering the temperature or encouraging osmotic dehydration through the use of table salt (sodium chloride), respectively. [8]. Hence this study, the aim of the present work was to understand the effect of storage time about four months with fresh *Ulva lactuca* towards of polysaccharide content.

2. Methods

2.1. Materials

The green seaweed *Ulva lactuca* was obtained from the coastal Gunung Kidul, Yogyakarta, May 2019. The chemical ingredients were using K₂SO₄ (Merck, 99,98%), BaCl₂·2H₂O (Merck, 99,98%) from the chemical store.

2.2. Methods

Fresh *Ulva lactuca* seaweed is cleaned under running seawater, then rinsed and cleaned with distilled water, and dried in the sun. The dried seaweed is floured using a grinding machine to produce seaweed flour. Before the chemical analyzed, the powder seaweed packaging and stored in desiccators at room temperature. Then, *U. lactuca* has been storage time about four months obtained from farmer seaweed near the location growth. The moisture content of *U. lactuca* was determined by drying the seaweed samples at 105°C to constant weight. Then the moisture content was calculated by subtracting the final weight from the initial weight of the sample.

This assay was based on Kumar [9]. Briefly, the fresh seaweed was oven dried at 60°C to constant weight and then samples the dehydrated seaweed powder weight value from the wet weight.

Ash determination. The determination of the ash content was performed based on gravimetrically after heating at 550°C for 18h in a muffle furnace [10].

The polysaccharides content of analysis using methods Dubois, 1956 [11]. BaCl₂-gelatin method using K₂SO₄ as a standard after hydrolyzing the polysaccharides in 0.5 N HCl at 105 °C for 5 h [12].

Statistical analysis, the data were presented as mean ± standard deviation. Analysis of variance (ANOVA) run for unpaired values. Values of p < 0.05 were considered statistically significant.

3. Results and discussion

The seaweed *Ulva lactuca* from Gunung Kidul sea waters was studied for morphological, proximate, and sulfate content analysis. The drying of *U. lactuca* fresh seaweed by aerating. The time needed was around 2-3 days. The moisture content of fresh seaweed was around 80-90% and after drying, the moisture content became 15.31% shown in Table 1. The morphological performance of *U. lactuca* early as shown in Figure 1. The mean percentages (dry weight basis) of carbohydrates, fat, protein, ash, sulfate content and moisture in *U. lactuca* as shown in Table 1.

In this study, the moisture content was 15.31% for fresh seaweed and 18.49% after storage four months. The moisture in this study was higher than previous research ranges 0.95%–14.57% Khairy & El Shafay 2013) [14] however, most similar to study Rasyid about 16.19% [6]. The high moisture can accelerate microorganism’s growth, moisture content is an important parameter to determine the lifetime and characteristic of seaweed [13]. The ash content in *U. lactuca* fresh was analyzed in this research, 27.37% lower than storage for 4 months, 37.63%. This result was higher than reported Rasyid was 11.2%, and Khairy and El-Shafay (2013) was range 17.56–24.49% [13]. The ash content of *U. lactuca* is high in this study related to indicated high mineral content by source from the habitat of seaweed as
well high salinity. The protein content in *U. lactuca* seaweed fresh was examined in this study, 15.23% higher than *U. lactuca* after storage 4 months was 8.06%. The storage of seaweed *U. lactuca* indeed affects its protein content. The cause of differences in protein content in *U. lactuca* may be due to enzymatic changes during storage. The protein content in U.lactuca fresh higher than the protein content was reported Rasyid [6].

![Figure 1. Morphological performance of *U. lactuca*: (a) fresh (b) storage for four months.](image)

**Table 1.** Result analysis of chemical composition of *Ulva lactuca*

| Parameters          | Seaweed *U.lactuca* |
|---------------------|----------------------|
|                     | Fresh               | Storage for 4 months |
| Moisture content w/w (%) | 15.31± 0.31         | 18.49 ± 0.19          |
| Ash w/w (%)         | 27.37 ± 0.36        | 37.63 ± 1.12          |
| Fat (g/100g)        | 0.76 ± 0.01         | 1.33± 0.27            |
| Protein (g/100g)    | 15.23 ± 0.13        | 8.06 ± 0.08           |
| Carbohydrate (g/100g) | 38.21± 0.4         | 31.24 ± 0.14          |
| Sulfate w/w (%)     | 8.23 ± 0.01         | 8.34± 0.09            |

Originally seaweed fat content *U. lactuca* low content. The fat content *U. lactuca* fresh was examined in this study 0.76% and similar with *U. lactuca* storage for 4 months was 1.33% not differently significant. The very low-fat content in *U. lactuca* is excellent for human health also, seaweed its safe for consumption in large quantities and the utilization can be developed as one of the constituent materials major foods on a low-fat diet. Generally, the fat content in seaweed is composed of poly acids unsaturated fats (PUFA) especially PUFA C18, which is an unsaturated fatty acid that the body really needs [14].

For processes of respiration and another metabolism, an important supply of energy is needed, including polysaccharides. Polysaccharides were the main component in the proximate composition of *U. lactuca* in this study. The polysaccharides in *U. lactuca* fresh in this study was 38.21% higher than *U. lactuca* storage, 31.24%. The storage causes a decrease carbohydrate content in seaweed. The content of carbohydrates in seaweed is generally like fibre that is not can be digested by digestive enzymes so that it only provides a small intake of calories.

Sulfate content in *U. lactuca* fresh similar with *U. lactuca* storage for 4 months were 8.23 % and 8.34%, respectively. Sulfate content *U.lactuca* from Gunung kidul lower than *U. pertusa* 17.1%[7].
Sulfate content affects the type of species. The sulfate content also affects its bioactivity [15] [16]. Furthermore, variation seasonal influence composition chemical in seaweed [17].

4. Conclusions
The results showed that the highest yield and total polysaccharides were obtained from freshly harvested seaweed, while the sulfate content was similar. Based on the polysaccharide extract test results obtained, storage affects the yield and it content of polysaccharides. The U. lactuca fresh has high protein 15.23% so it is potential as a functional food with high nutrient.

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