

Chemical composition of seaweed (*Sargassum* sp.) based on the different drying methods

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Abstract. Seaweed *Sargassum* sp. which is not used for food or (for sale) is usually waste and it has the potential as animal feed stuff especially as mineral source. This study aimed to evaluate the chemical composition of seaweed (*Sargassum* sp.) based on different drying methods. Seaweed *Sargassum* sp. was obtained from Sepanjang Beach in Gunungkidul District, Yogyakarta. The seaweed was cleaned from dirt and other materials before drying process. The drying process for seaweed was divided into two methods. The first method was sun-dried base for three days started from 07:00 Am to 14:00 PM, the second method was oven-dried base at temperature of 55°C for four days. All of the seaweed were grinded, then analysed using proximate analysis. Data obtained were examined by t-test. The results indicated that different drying process (sun-dried and oven-dried) did not have significant effect on the dry matter (90.07±3.73% vs. 89.72±0.54%), ash (41.77±7.30% vs. 46.56±2.01%), organic matter (58.23±7.30% vs. 53.44±2.01%), crude protein (7.56±1.32% vs. 8.77±0.61%), and crude fat (0.78±0.25% vs. 0.62±0.24%) content.. Thus, the sun-dried method can be used optimally to preserve seaweed *Sargassum* sp. without affect the chemical composition.

1. Introduction

Seaweed is one of the potential biological resources. Indonesia is an archipelago with more than 17,000 islands and 81,000 km of coastline and is the second longest coastline in the world after Canada [1]. Indonesia's coastal area is 6,846,000 km² [2]. The condition of the Indonesian coastal waters support the production of seaweed. There are 3 types of seaweed in the world based on color pigments namely red seaweed (*Rhodophceae*), brown seaweed (*Phaeophyceae*) and green seaweed (*Chlorophyceae*) [3]. *Sargassum* sp. is one of the brown seaweed species [4]. *Sargassum* sp. Seaweed lives in temperate, sub-tropical and tropical waters throughout the world [5].

Non-consumed *Sargassum* sp. or unsold products contain macronutrients such as carbohydrates, protein, fiber, fat as well as micronutrients (such as minerals and vitamins) that are suitable for animal feed [4]. *Sargassum* sp. also contains very good vitamins, fiber, minerals and protein [6]. Fresh seaweed contains 75 to 85% of water and 15 to 25% of organic and mineral components [7]. Fresh *Sargassum* sp. Seaweed is easily spoiled after several days of harvesting. The high water content in *Sargassum* sp. post-harvest, before the evaluation of nutrient content or industrial processing must be dried. The purpose of drying is to reduce water activity and to inhibit microbial growth as well as to help maintain quality and reduce storage volume [8] Low water content is very good during storage to

prevent the growth of bacteria and fungi so that the material is not spoiled [9]. Drying of seaweed is very important in the process of producing gel [10].

The post-harvest handling of seaweed is done on drying, i.e. oven-dried and sun-dried. However, research that has been carried out solely to see the effect of sun drying or oven drying. Research on sun drying of seaweed *Sargassum* sp. has been carried out by Carrillo et al. [11] and oven-dried in West Florida by Hamdy and Dawes [12]. Oven-dried has advantages over sun-dried, which is more stable and easily controlled [10]. Research to compare the method of sun-drying and oven-drying from Seaweed *Sargassum* sp. towards the chemical composition in the Sepanjang Beach, Gunungkidul Yogyakarta has never been done. This current study expected to provide information about chemical composition based on the methods of sun drying and oven drying of seaweed *Sargassum* sp. from Sepanjang Beach in Gunungkidul District, Yogyakarta.

2. Material and methods

2.1. Material

Seaweed *Sargassum* sp. was obtained from Sepanjang Beach in Gunungkidul district, Yogyakarta and was then cleaned from dirt and other materials.

2.2. Methods

The drying process for seaweed was divided into two methods. The first method by sun-dried for three days started from 07:00 to 14:00 h. The second method was by oven-dried at temperature of 55°C for four days. All of the seaweed *Sargassum* sp. were grinded, then analysed using proximate analysis according AOAC [13] including were dry matter, ash, organic matter, crude protein, and crude fat.

2.2.1. Dry matter. Two (2) gram of seaweed *Sargassum* sp samples were put in a crucible and dried in a hot air oven at 105°C to constant.

2.2.2. Ash. Five (5) gram seaweed *Sargassum* sp. samples were burnt and ashed in a muffle furnace at 550°C overnight until constant weight was obtained.

2.2.3. Crude protein. The crude protein content of seaweeds *Sargassum* sp. was determined according to the Kjeldahl method. Approximately two (2) g seaweeds *Sargassum* sp. sample was weighed into a digestion flask together with a combined catalyst of 5 g potassium sulphate (K₂SO₄) and 0.5 g of copper (II) sulphate (CuSO₄), and 15 ml of concentrated sulphuric acid (H₂SO₄) and then shaken gently. Digestion was performed until clear blue/green solution was obtained. Digested samples were cooled for 10 to 20 minutes. Distillation was then performed before titration using 0.02 N hydrochloric acid (HCl) solution to determine the nitrogen content of the samples in percentage. A conversion factor of 6.25 was used to calculate the crude protein content from the nitrogen content.

2.2.4. Crude fat. The crude fat was determined according to the Soxhlet method described by AOAC [13]. The crude fat was extracted from five (5) gram of seaweeds *Sargassum* sp. samples using the Soxhlet apparatus with petroleum ether as the solvent. The crude fat content was determined gravimetrically after oven-drying (80°C) the extract overnight.

2.2.5. Statistic. Differences in the composition of dry matter, ash, organic matter, crude protein, and crude fat for both sun-dried and oven dried were tested using t-test.

3. Results and discussion

The results showed that the different drying methods had no significant effect on dry matter, ash, organic matter, crude protein and crude fat (Table 1). This may be due to the principle of drying which is removing water that does not affect macronutrients in calculations based on dry matter [14]. Drying

causes the shrinkage of the material to dry, making it easier for grinding into flour to analyze its chemical composition. Oven-dried at 55°C for 4 days while sun-dried with an average temperature of 32°C for 3 days. The drying temperature is ideal for drying feed ingredients to analyze their chemical composition

Table 1. Chemical composition of *Sargassum* sp. Seaweed based on different drying methods

Parameters (%)	Sun-dried	Oven-dried
Dry matter ^{ns}	90.07 ± 3.73	89.72 ± 0.54
Ash ^{ns}	41.77 ± 7.30	46.56 ± 2.01
Organic matter ^{ns}	58.23 ± 7.30	53.44 ± 2.01
Crude Protein ^{ns}	7.56 ± 1.32	8.77 ± 0.61
Fat ^{ns}	0.78 ± 0.25	0.62 ± 0.24

ns: not significant

The dry matter composition obtained in this study, by sun dried was higher than previous research [10], (90.07% vs 87.6%). The difference could be caused by different drying time in sunlight. The sun-drying time of this research was shorter (three vs four days). Furthermore, the result of this study also found that dry matter composition of the oven-dried was lower than study of [10] (89.72 vs 92.4%). This might be due to the differences in oven temperature setting.

The ash composition for both sun drying and oven drying of this study was higher than that of study by [10] (41.77% vs. 19.6%) and (46.56% vs. 21.5% respectively). The difference in composition of the ash was due to the difference of environmental conditions, water temperature, salinity and light [4].

The crude protein composition in this study was lower than previous study [10], it was sun drying 7.56% vs 10.1% while oven drying 8.77% vs. 9.76%. This difference was caused by differences in species of *Sargassum* sp. Our study used seaweed *Sargassum* sp., while [10] was using seaweed *Sargassum* S. *hemiphyllum*. The crude fat content of this study was probably due to difference of drying duration. Sun-dried method was more practical, easy to done and economically cheaper than oven-dried method.

4. Conclusion

The difference drying methods have a similar effect on nutrient contents of *Sargassum* sp., both methods can be used for drying, however sun drying is more preferable for practical and economical reason.

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