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CHARACTERISTICS OF *Sargassum polycystum* AS AN ALGINATE RAW MATERIALBASED ON SNI 2346:2015

Karakteristik *Sargassum polycystum* Sebagai Sediaan Bahan Baku Alginat Berdasarkan Sni 2346:2015

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ABSTRACT

Seaweed of the genus Sargassum is generally a relatively large aquatic plant that grows and develops on firm substrate. Alginate is an essential compound widely required in various sectors, including food, non-food, and medical or pharmaceutical industries; however, the entire demand for alginate is currently met through imports. This study aims to characterize the quality of Sargassum polycystum as a raw material for alginate production based on the Indonesian National Standard (SNI) 2346:2015. The results showed that *Sargassum polycystum* had a sensory score of 8, moisture content of 12.75%, water absorption capacity (WAC) of 67.25%, and impurities content of 1.24%, meeting the Indonesian National Standard (SNI). *Sargassum polycystum* from Ujung Kulon has the potential to be used as a raw material for alginate production, with applications in nutraceutical, pharmaceutical, and various other industries.

Keywords: Brown seaweed; Clean Anhydrous Weed (CAW); sensory

ABSTRAK

Rumput laut Sargassum umumnya merupakan tanaman perairan yang berukuran relatif besar, tumbuh dan berkembang pada substrat dasar yang kuat. Alginat banyak dimanfaatkan dalam berbagai sektor industri, baik pangan, nonpangan, maupun bidang kesehatan dan farmasi, namun seluruh pasokannya masih bergantung pada impor dari luar negeri. Penelitian ini bertujuan mengkarakterisasi mutu *Sargassum polycystum* sebagai bahan baku pembuatan alginate berdasarkan SNI 2346:2015. Hasil penelitian ini ditemukan bahwa *Sargassum polycystum* didapatkan kadar air 12.75%, nilai sensori 8, CAW 67,25%; dan *impurities* 1,24% dan sesuai dengan standar nasional Indonesia (SNI). *Sargassum polycystum* dari Ujung Kulon berpotensi digunakan sebagai bahan baku pembuatan alginat yang dapat dimanfaatkan pada industri nutraseutika, farmaseutika, dan berbagai industri lainnya. Berdasarkan hasil analisis karakteristik, disimpulkan bahwa pemanfaatan rumput laut lokal ini dapat menjadi langkah

penting untuk mendukung kemandirian bahan baku industri sekaligus meningkatkan nilai tambah sumber daya pesisir Indonesia.

Kata kunci: *Clean Anhydrous Weed (CAW);* rumput laut cokelat; sensori;

INTRODUCTION

Seaweed has great potential for development due to its widespread use in various industries, particularly the food and beverage industry. In Asia, seaweed is generally used as a food ingredient, while in Western countries it is more widely used as a gelling and colloidal agent in the food, pharmaceutical, and cosmetic industries (Abdullah *et al.,* 2023; Peñalver *et al.,* 2020; Tiwari *et al.,* 2011). Some commonly used seaweed species are red seaweed (Euchema cottonii), (Euchema spinosum), and brown seaweed (Sargassum polycystum) (Merdekawati & Susanto, 2009; Nurcomariah *et al.,* 2021; Paulus Edison Plaimo, 2021; Peñalver *et al.,* 2020).

Sargassum polycystum is a type of brown algae belonging to the order Fucales. This species is widely distributed in tropical marine areas worldwide and is commonly found in shallow waters and coral reef areas (Priono, 2016). Sargassum polycystum contains various beneficial compounds such as phlorotannins, minerals, alginates, vitamin E (α-tocopherol), vitamin C, carotenoids, chlorophyll, fatty acids, sulfated polysaccharides, and amino acids. This marine plant has potential applications in the treatment of goiter and bladder disease, lowering cholesterol, as a raw material for the cosmetics industry, as a source of alginate, and as an antioxidant (Gazali *et al.,* 2018; Lee *et al.,* 2022; Mansauda M *et al.,* 2018). To increase added value, seaweed needs to be processed first into semi-finished products such as agar, alginate, and carrageenan (Lee *et al.,* 2022).

Alginate is a compound that plays an important role in industry and commerce, with primary uses as an additive, emulsifier, stabilizer, and gel former in various sectors such as food, pharmaceuticals, cosmetics, textiles, paper, paint, ceramics, and insecticides (Prasetyaningrum & Purbasari, 2017). Alginate is generally known as a salt of alginic acid found in all types of algae in the class Phaeophyceae, although levels vary between species (Fransiska *et al.,* 2020). Salts of alginic acid include ammonium alginate, propylene glycol alginate, potassium alginate, and sodium alginate. Sodium alginate has the molecular formula $(C_6H_7O_6Na)_n$. (Yunizal, 2004). In general, alginate gels produced through the calcium alginate pathway have lower strength compared to gels obtained through the alginic acid extraction pathway. (Husni *et al.,* 2012).

However, although the potential of Sargassum polycystum as a source of active ingredients and alginate has been widely reported, information regarding the quality characteristics of Sargassum polycystum raw materials, particularly those originating from certain waters in Indonesia, particularly in Ujung Kulon, remains limited. This is despite the fact that raw material quality significantly determines the yield, quality, and effectiveness of the resulting alginate product. Quality characterization based on SNI 2690:2015, with parameters such as water content, sensory parameters, impurities (imethyl paraben), and clean anhydrous weed (CAW), is crucial to ensure consistency and effectiveness in industrial use. Therefore, this study was conducted to assess and characterize the quality of Sargassum polycystum as a raw material for alginate production, in order to obtain the basic information necessary for its development and optimal utilization in various industries.

RESEARCH METHODS

Tools and Materials

The tools used in this study included a ruler, digital scale, analytical balance, pH meter, homogenizer, viscometer, oven, glassware (Pyrex), stirrer, blender, aluminum foil, counter,

Bunsen burner, spray bottle, sterile plastic, hot plate, water bath, Erlenmeyer flask, serological pipette, mask, and gloves.

The main material used in this study was Sargassum polycystum seaweed collected from Indonesian waters. Ingredients needed to make the gel preparation include methyl paraben, alcohol, aloe vera extract, glycerin, and fragrance. Materials used for analysis included distilled water, NaCl, 96% ethanol, CaO, Plate Count Agar (PCA), Potato Dextrose Agar, and 70% alcohol.

Sample Collection and Preparation

The research was conducted at the Chemistry and Microbiology Laboratory of the Fisheries Business Academy, Jakarta. The raw material used in this study was dried seaweed of the Sargassum polycystum type obtained from Ujung Kulon. Approximately 10 kg of wet seaweed was air-dried for approximately 14 days. The yield of the dried seaweed was calculated. The quality of the raw material was tested in accordance with the SNI 2346:2015 standard, which includes water content, sensory characteristics, impurities (imethyl parabens), and clean anhydrous weed (CAW).

Sensory Analysis

Sensory testing refers to SNI 2346:2015. The parameters tested are thallus appearance and texture. The values for sensory testing are 1, 3, 5, 7, and 9. The standard sensory requirements for dried seaweed refer to SNI 2690:2018, a minimum of 7.

Water content

Porcelain crucibles were dried in an oven at 100±5ºC for 30 minutes, then cooled in a desiccator to maintain relative humidity (RH) and weighed. Next, ±2 g of sample was added to the crucible, weighed, and dried in an oven for 24 hours at 100±5ºC (SNI-2690:2015). The analysis results were calculated using the formul:

$$\text{Water content (\%)} = \frac{B-C}{B-A} \times 100\%$$

Information:
A : Weight of empty cup (g)
B : Weight of cup + sample before drying (g)
C : Weight of cup + sample after drying (g)

Clean Anhydrous Weed (CAW)

Clean Anhydrous Weed (CAW) testing refers to SNI 8168:2015. Clean dried seaweed is carried out by washing 20 g of seaweed with 2000 mL of water in a baker glass 3 times in a row for 7 minutes each until clean, then drying it in an oven at 60ºC for 18-20 hours.

Impurities

Impurities, namely identifying the type of impurities in question (salt, mud, sand, soil, snails, plastic pieces, coral and other grass. Impurities testing refers to SNI 8169:2015.

Analysis Data

The analysis conducted was descriptive and comparative. Data were obtained based on tables and figures, and explained the things the author observed during the practice according to the problem limitations, then analyzed and processed, and then reviewed with references according to the objectives and problem limitations that were set. Comparing the results of

observations quantitatively and then linked to literature, sources or other similar observations, to see whether there were similarities or differences in the results of observations with the material. The data that had been obtained was then processed to be evaluated and summarized by conducting a comparative study between theory and the reality in the field during the practice, so that conclusions would be obtained.

RESULT

The quality of dried seaweed raw materials is regulated by SNI 2690:2015 concerning dried seaweed. The seaweed standards used in the alginate manufacturing process use the requirements for dried seaweed raw materials. Raw materials that meet the standards will produce alginate products that are expected to meet the quality standards for raw materials for application in various industries. In this study, 10,388 kg of wet seaweed (Figure 1) were air-dried for ±14 days and 1,847 kg of dried seaweed was obtained, resulting in a yield of 17.7%. The characteristics of the alginate raw material based on the SNI can be seen in Table 1.

Figure 1. Sargassum polycystum

The seaweed Sargassum polycystum used in this study was obtained from Ujung Kulon. It is characterized by a brown thallus, short stems, and dense primary branches at the tips (Figure 1).

Table 1. Characteristics of Sargassum polycystum

Parameter	Average value	Standard (SNI)
Sensory	8	Minimum 7
Water content	12.75%	Maximum 15%
CAW	67.25%	Minimum 50%
Impurities	1.24%	Maximum 3%

DISCUSSION

Sensory

Sensory testing is the initial stage of product assessment by panelists utilizing the five human senses (Putra *et al.,* 2021). The raw material for Sargassum polycystum seaweed has a minimum standard sensory value of 7 according to SNI 2690:2015. The sensory test results obtained a value of 8 for the raw material of Sargassum polycystum seaweed. This result indicates that the raw material has met the SNI 2690:2015 standard with a minimum sensory standard of 7. This is because the raw material used was sourced directly from the location with proper handling and a sufficient drying process. After harvesting, the seaweed was washed with

seawater to remove any adhering dirt, then weighed to determine its wet weight. Next, the seaweed was placed in plastic bags and taken to the drying location. The drying process was carried out for 4–5 days, with special care being taken to prevent the seaweed from being exposed to rainwater during the process. The drying process was carried out in a way that was not directly exposed to sunlight.

Water content

The results of the water content test for seaweed raw materials in Table 1 show that the value still meets the standard when compared to the SNI standard, namely <15%, respectively, the results of the water content test carried out in duplicate were 11% and 14.5% with an average of 12.75%. Water content is closely related to water activity through water absorption isotherms at certain temperature and humidity conditions (Vera Zambrano *et al.,* 2019). Several studies on dried seaweed show that the water content of Sargassum sp. (Danu Subagan *et al.,* 2020; Gazali *et al.,* 2018), S. hystrix (B. B *et al.,* 2014), S. polycystum (Hartono *et al.,* 2021), and S. plagyophyllum (Dolorosa *et al.,* 2017) were 10.54±0.25%, (9.86±0.04% – 13.74±0.03%), 14.33%, 14.00%, and 16.71%, respectively. The presence of free water content on the surface causes a greater drying rate at the beginning of the process. The drying treatment process for dried seaweed also affects the water content of the seaweed, if the drying process is good, the water content will be lower (Irianto *et al.,* 2023). Drying is carried out to reduce the water content of Sargassum sp. because the quality of Sargassum sp. The better with a lower water content (Djaeni *et al.,* 2012). In addition, the drying rate can be controlled by the diffusion of water content from the inside to the surface of the material so that the water content in seaweed fluctuates (Deshmukh et. al., 2014). Water content plays an important role in influencing chemical changes, enzymatic reactions, and microbiology, as well as determining the physical properties of the product that impact its appearance, texture, and taste. The drying and heating processes can reduce the water content in the material, thereby extending the shelf life and increasing the durability or longevity of food products (Tuina *et al.,* 2013).

Clean Anhydrous Weed testing (CAW)

Clean anhydrous seaweed (CAW) is the percentage of the weight of pure dry seaweed to the initial weight. The remainder is water and other impurities such as other seaweed, sand, salt, and other materials attached to the seaweed (Fransiska *et al.,* 2020). Raw materials for Sargassum polycystum seaweed must have a minimum CAW test value of 50%. The results of the water content test carried out in duplicate were 69.07% and 65.42% with an average of 67.25%. The results of the seaweed quality test when compared to the SNI standard of at least 50% indicate that it has met the standard value for clean anhydrous weed (CAW) testing. In line with the research of Irianto *et al.,* (2023), the CAW content obtained was 69.32%. The CAW value reflects the level of purity of the seaweed, namely the extent to which the seaweed is free from attached impurities such as sand, coral, or a mixture of other types of seaweed. Clean anhydrous weed is the percentage of the weight of clean dry seaweed compared to the weight of the initial material. Based on the test results, Sargassum polycystum seaweed has a purity level of 67.25%, while the remainder consists of water and various impurities such as other types of seaweed, sand, salt, and other materials attached to its surface.

Impurity Testing

Sargassum polycystum seaweed raw materials must meet the maximum impurity standard of 3%. The results of duplicate water content tests showed values of 0.98% and 1.5% with an average of 1.24%. Based on these results, the seaweed quality has met the SNI (2015) standard regarding the maximum impurity limit of 3%. Impurities are a measure of the level of purity of the seaweed after being separated from the salt that sticks to it or that forms during

the drying process. When the water content reaches the optimal dryness level, the seaweed will naturally release salt through its thallus. The lower the water content, the more salt is released, so the impurity value will decrease (Nurdin *et al.,* 2024). The high salt content is a result of the inadequate drying process, resulting in high impurity levels. The high impurity levels are caused by the lack of a proper sorting process. This results in high levels of impurities and the presence of other types of seaweed in the mix (Fransiska *et al.,* 2020).

CONCLUSION

Sargassum polycystum seaweed from Ujung Kulon has characteristics that comply with SNI 2346:2015, including sensory 8; water content 12.75%; CAW 67.25%; and impurities 1.24%. This seaweed has the potential to be used as a raw material for alginate production, which can be utilized in the nutraceutical, pharmaceutical, and various other industries.

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