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REVIEW ARTICLE "ALGINATE EXTRACTION METHOD"

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food, non-food, quality, acid path, Microwave Assited Extraxtion path

ABSTRACT

Alginate in the form of natirum alginate is needed for the food and non-food industries. This article aims to review the methods of extraction of alginate from seaweed sargassum sp and the quality of alginate. Based on the results of the literature study obtained information that alginic extrcation from seaweed sargassum sp can be done with 3 methods, namely the acid path method, the calcium path method and the Microwave Assited Extraxtion method. The quality of alginate according to the Food Chemical Codex (FCC) is a yield of > 18%, Water Content <15%, Ash Content 18-27%, Viscosity (Cps) 10-5000, pH 3.5-10, and brightness level 50-80.

MAIN PAPER STARTS HERE...

INTRODUCTION

Alginate is one of the main components of the cell wall, a polysaccharide extracted from brown seaweed such as *Sargassum sp*. and *Turbinaria sp*. Many are found in the waters. An anionic polysaccharide compound, which is a polymer in the brown algae cell wall matrix in the range of 8-40%, consists of linear polymers β D-mannuronate and α-L guluronate. Alginate is found in the cell walls of brown algae as calcium, magnesium and sodium salts of alginic acid. The main physical, chemical and biological properties of alginate as a functional component of food, in addition to good thermal stability, the unique ability to form gels at low temperatures, make alginate ideal for use as thickeners, stabilizers and restructuring agents. Alginate is widely used in the food and non-food industries as an additional ingredient to stabilize emulsion, thickening, and gelling systems (Torres et al., 2007; Hernandez-Carmona, 2013). This article aims to

review the methods of extraction of alginate from seaweed sargassum sp and the quality of alginate.

Sargassum sp

Sargassum sp is a genus of brown seaweed. Sargasum sp is a material used to extract its alginate content. Classification of sargassum sp taxonomy according to Blankehorn (2007) as follows:

Kingdom : Plantae

Class : Phaeophyceae

Ordo : Fucales

Family : Sargassacea

Genus : Sargassum

Species : *Sargassum sp.*

Figure 1. Seaweed sargassum sp (Source: https://en.wikipedia.org/wiki/Sargassum#/media/File:Sargassum_weeds_closeup.jpg).

Sargassum sp is a type of algae that comes from the phaeophyceae class. Sargassum morphology has a high-level plant-like shape, since its thallus can be distinguished between roots, stems and leaves. According to Triastinurmiatiningsih et.al (2011), sargassum sp has a cylindrical cauloid form, except in the type of Sargassum binderi which has a cauloid gepeng shape. In general, sargassum sp has a brown thallus. The length of the main thallus can reach 3 m. Each branch of the thallus has air bubbles (vesicle) that always appear on the surface of the water (Kadi, 2005). Sargassum sp can grow in impacted and choppy waters with a depth of 0.5 - 10 m. and is a microalgae attached to the substrate at the bottom of the water.

Availability of Sargassum sp in Indonesia

Indonesia is a country that has a long coastline, therefore Indonesia has abundant natural resources, one of which is seaweed. Brown seaweed as a raw material for extracting alginate is widely found in Indonesia. In Indonesia, many alginat-producing seaweeds are found to come from the sargassum clan. In Inonesia there are 15 types of sargassum seaweed and several types of tubirina seaweed that spread widely ranging from waters in Aceh to waters in Papua (Subaryono, 2011) The potential of seaweed production in Indonesia is very abundant, but the use of seaweed in Indonesia is still lacking, even in some areas seaweed has not been utilized at all (Laksanawati, et.al.2017) although the potential of seaweed producing alginate in Indonesia has a high potential, however, alginate-producing seaweed is still not optimally utilized, this is due to alginate extraction methods that are still not running optimally in the country (Husni et.al, 2012). Until now the production of alginate-producing brown seaweed is still exported in dry form and has not been processed into domestic products.

Alginate Extraction Methods

Extraction of alginate by acid pathway method (conventional method) (Diharningrum IM and Husni A, 2018)

The method of extraction of alginic acid pathways is as follows: seaweed sargassum sp dry that has been preoccupied as much as 100 grams soaked in a 1% HCl solution (1:30) for 1 hour. The purpose of this immersion "opens" the cell wall of the sargassum. Furthermore, washing is carried out with running water up to neutral pH. After that, the acidification sargassum is then extracted using Na2 CO3 2% (1:30) at a temperature of 60-70o C for 2 hours. The next stage is

done filtering with a vibrator size 150 mesh. After that the obtained liquid is purified by adding a 4% NaOCl solution then stirred and let stand for 30 minutes, the resulting filtrate color becomes ivory yellow. The next stage is carried out the alginic acid deposition process by adding little by little HCl 10% and stirring slowly until it forms an alginic acid precipitate with a pH ranging from 2.8-3.2. After the precipitate is obtained, filtration is carried out to separate alginic acid and residues and deposits are washed thoroughly with aquifers. Alginate is converted to sodium alginate using 10% Na2 CO3 until the pH becomes neutral, then the separation of sodium alginate by pouring little by little filtrate into isopropyl alcohol in comparison (1:2). Sodium alginate that has been obtained is dried in the sun for ±12 hours until the sodium alginate water content is less than 12%. The dried alginate is then filtered with a size of 60 mesh.

Extraction of alginate by calcium pathway method (Diharningrum IM and Husni A, 2018)

Another method of extraction of alginate is the calcium pathway method. This method has a longer stage than the alginic acid pathway method (Husni et al. 2012). The extraction stage is as follows: Seaweed sargassum sp that has been dried and made powder as much as 100 grams soaked in formalin 0.4% for 6 hours. Finished soaking, then washed three times to clean the formalin attached to the seaweed powder sargassum sp. Then soaking with a 1% HCl solution for 1 hour in comparison (1:30). Furthermore, washing is carried out again using running water after up to a neutral pH. The next stage is extracted using Na2 CO3 2% with a ratio of 1:30 (b/v), temperature 60-70 °C for 2 hours, every 15 minutes once stirring. After that, filtering is done with blacu cloth (nylon substitute), to separate the filtrate with dregs and continue with the filtration process. Filtration is carried out after the filtrate is obtained and separated by the pulp. Filtration is carried out for 3 hours and the clear part is removed, then deposited by adding CaCl2 0.5 M until calcium alginate fiber is formed and continued with the preparation using technical NaOCl, The color obtained is not as deep brown as the color of filtrate, but the color obtained after the yellowish-white speech. The alginic calcium formed is converted to alginic acid with a solution of HCl 0.5 M in 3 stages, with a time per stage of 12 hours. This conversion is carried out for 1.5 days, with a change of HCl 0.5 per 12 hours, after conversion, then pressed to a moisture content of about 25%, followed by conversion to sodium alginate using sodium carbonate powder of about 2.5 g and stirred evenly and then into a paste, soaked in technical ethanol to remove sodium alginate, the last step is that sodium alginate is dried in the sun until the water content is less than 12%. The dried alginate is then filtered with a size of 60 mesh.

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Alginate extraction by Microwave Assisted Extraction (MAE) (Amir A et al., 2016)

Extraction by mae method is utilizing microwave radiation. The purpose of using this micro-mbong is to accelerate selective extraction through fast and efficient heating of solvents. The MAE method has the advantage of reducing extraction time and using fewer chemical solutions so that the extraction cost becomes cheaper. Basically the stages of the MAE method are the same as the acid method. The stages of the MAE method are as follows: Seaweed sargassum sp is dried and drunk. Then as much as 100 grams of sp sargassum powder is soaked in a 0.4% formalin solution for 6 hours. After that soaked kembalu with a 1% HCl solution for 1 hour. Finish soaking then washed with aquades until pH neutral. Furthermore, a 2% Na2CO3 solution is added in a ratio of 1:30 (w/v) and heated (extracted) with a microwave temperature of 60-70°C for 2 hours, every 15 minutes once stirring is then filtered. Filtrate obtained, added HCl 10% (up to pH 2-3). Then the assessment is carried out with technical NaOCl diluted with 1:1 to white water. It is then converted to sodium alginate by adding 20 g of Na2CO3 powder and stirring in a mixer. The resulting solution is then dripped with ethanol so that sodium alginate fiber is formed. Then the filtering is done and the resulting paste is soaked in technical ethanol and dried in the sun for 12 hours until the water content is 12%. Next grinded until sodium alginate flour is obtained.

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Alginate Quality Standards

Commercially, specifications vary based on industrial usage. Alginates used in the food and pharmaceutical industries must meet the requirements free of cellulose whose color is pale white or light. Pharmaceutical grade, usually also free of cellulose that is pale in pure white color. In addition, industrial grade allows only a few parts of cellulose, with granule colors varying from brown to white. Alginate quality standards in the Food Chemical Codex (FCC) which is a standard related to the purity and identity of alginate content that has been recognized internationally and has been used as a reference between suppliers and industry. While in Indonesia itself has not set a complete alginate quality standard. The international quality standards of sodium alginate that have been established in accordance with the Food Chemical Codex (FCC) are yield > 18%, Water Content <15%, Ash Content 18-27%, Viscosity (Cps) 10-5000, pH 3.5-10, and brightness levels 50-80.

Conclusion

Based on the results of the literature study obtained information that alginic extrcation from seaweed sargassum sp can be done with 3 methods, namely the acid path method, the calcium path method and the Microwave Assited Extraxtion method. The quality of alginate according to the Food Chemical Codex (FCC) is a yield of > 18%, Water Content <15%, Ash Content 18-27%, Viscosity (Cps) 10-5000, pH 3.5-10, and brightness level 50-80.

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