Characteristics of *Gelidium* sp seaweed and its agar from Lampung Waters

Subaryono and Ellya Sinurat
Research Centre for Marine and Fisheries Product Processing and Biotechnology, Jakarta Indonesia

Email: yono_ipn@yahoo.co.id

Abstract. Research on the characteristics of seaweed *Gelidium* sp from Lampung waters and its agar has been done. This study aims to look at the characteristics of *Gelidium* sp seaweed harvested by seaweed collectors and its agar produced. Seaweed is wild harvested from the main *Gelidium* producing area in Lampung, Krui. The seaweed quality parameters observed were moisture content, impurities and clean anhydrous weed (CAW) as well as the agar yield. While the parameters of agar quality were moisture content, gel strength, gelling point and melting point. The results showed that *Gelidium* sp has an average of moisture content 15.53%, impurities 20.80%, CAW 38.13% and agar yield 8.21%. The results of agar quality observations showed moisture content of 10.15%, gel strength of 674 g/cm², gelling point 31.5°C and melting point 80°C. These results indicate that *Gelidium* sp is potentially used as a raw material for agar extraction.

1. Introduction
Lampung is one of the seaweed producing areas in Indonesia. One type of seaweed produced in this area is *Gelidium* sp, which is a source of agar. *Gelidium* sp is one of the important seaweeds in Indonesia because of its high agar quality, so it is often used as a mixing material for other types of lower quality such as *Gracilaria* sp.

*Gelidium* sp seaweed has not been cultivated in Lampung, but it is still obtained from harvesting seaweed by seaweed collectors from nature. The characteristics of *Gelidium* seaweed from the collection in Lampung have not been done much, and this is very important as supporting information for its use as raw material for extraction. The purpose of this study was to determine the characteristics of *Gelidium* sp seaweed from lampung, especially from the waters around Krui beach, which is the main *Gelidium* producing area in Lampung.

2. Methodology
Samples in the form of dried seaweed taken from the results of natural collection by seaweed collectors in the waters of Krui Lampung. Seaweed is packed in plastic bags and taken to the BBRP2BKP laboratory for quality analysis. The seaweed quality parameters observed were moisture content, impurities and clean anhydrous weed (CAW) as well as the agar yield. While the parameters of agar quality were moisture content, gel strength, gelling point and melting point. Moisture content was analyzed by gravimetric methods [1]. Impurities and CAW were analyzed by gravimetric methods according to Dharmawan et al, 2017 [2]. Agar yield was calculated as percentage of agar obtained from the raw material used according to Murdinah et al 2008 [3].
The quality of agar derived from this seaweed were analyzed including moisture content, gel strength, gelling point and melting point. Moisture content of agar was analyzed using gravimetric method [4]. Gel strength, gelling point and melting point were analyzed using methods according to Marine colloids, 1978 [5].

3. Result and Discussion

3.1. Seaweed quality.
The quality of seaweed observed including moisture content, impurities, clean anhydrous weed (CAW) and agar yield. The moisture conten, impurities and CAW of *Gelidium* sp. seaweed from Lampung waters were showed in Figure 1. The moisture content of this seaweed was 15.53 ± 2%. According to Indonesian Standard for dried seaweed SNI 2690:2018 the moisture content of *Gelidium* sp seaweed should was not more than 18% [6]. From this data, it can be seen that the moisture content of this seaweed still does not meet the Indonesian national standard. This is probably due to the incomplete drying process or the absorption of water from the environment during the seaweed storage process. As it is known, the humidity conditions around the sea where seaweed is stored are generally high, so the transfer of water from the air to the seaweed is likely to occur. This is also in line with previous research which shows that the water content of *Gracilaria chilensis* seaweed cultivated in Lampung also has a fairly high water content of around 19.36% [4].

The impurities of *Gelidium* sp seaweed was 20.80 ± 6%. According to Indonesian Standard for dried seaweed SNI 2690:2018 the impurities of *Gelidium* sp seaweed should was not more than 3 % [6]. These impurities are still high, maybe because the post-harvest process has not been good so that the content of coral, sand and other impurities is still not completely removed from the seaweed. The drying process of the seaweed directly spread bare on the sand also contributes to the high impurities in the seaweed. Methods and drying techniques are believed to have a very large effect on the quality of dried seaweed. Research on different drying methods on Sargassum seaweed resulted in differences in the quality of the dried seaweed and its alginate content [7].

CAW of *Gelidium* sp seaweed from Lampung waters is 38.13 ± 4%. According to the Indonesian national standard (SNI 2690:2018) the minimum CAW content of dry *Gelidium* seaweed is 40% [6].

From this data it was still seen that the caw content of dry *Gelidium* sp from Lampung waters does not meet the standard. This indicates that postharvest handling of *Gelidium* sp seaweed resulting from wild collection was still inadequate. This is due to the high water content and impurities in the dried seaweed, so that the CAW levels are low. Some improvement of post-harvest techniques such as adequate drying and cleaning of seaweed were needed to improve the quality of dried seaweed.

Agar yield of *Gelidium* sp from Krui waters was 8.21 ± 2%. The yield of agar is influenced by several factors such as the type of seaweed, age, location and the way of handling or extraction carried out [8]. The yield of agar in this study is close to what Murdina et al reported (2008) that the yield of agar from *Gelidium rigidum* was 8.9 - 13.2% [3]. The yield of agar from this seaweed is still lower when compared to the content of seaweed *Gracilaria chilensis* that containing agar 17.32 - 20.21% [8].
3.2. Agar quality.

Observation of the quality so that the extraction results from *Gelidium* sp from Lampung waters include moisture content, gel strength, gelling point and melting point. Agar quality of *Gelidium* sp from Lampung is presented in Table 1. The moisture of agar from *Gelidium* sp. was 10.15 ± 0.20, and according to the Indonesian National Standard (SNI 2802:2015), the maximum permissible moisture content in agar flour is 22%, so that this value still meets the SNI requirements [9].

Gel strength of this agar was 674 ± 18.55 g/cm² higher than that reported from *Gracilaria chilensis* 98.57-112.14 g/cm² [8]. The gel strength value of the results of this study is in line with that reported by Murdinah et al. (2008) who reported that *Gelidium rigidum* gel strength values ranged from 115.8–670.72 g / cm² [3]. Gel strength is an important parameter for agar because of its main use as a gelling agent. Agar is widely used as a gelling agent in bacterial media in laboratories and as a gelling agent in various food and non-food products so that the gel strength parameter is very important [10]. Generally, the higher the gel strength, the better it will be used as a gelling agent [10].

| Parameters                        | Value         |
|-----------------------------------|---------------|
| Moisture content (%)              | 10.15 ± 0.20  |
| Gel strength (g/cm²)              | 674 ± 18.55   |
| Gelling point (°C)                | 31.5 ± 7.80   |
| Melting point (°C)                | 80 ± 2.82     |

Gelling point of this agar was 31.5 ± 7.80 °C. Gelling point is the temperature at which agar will begin to change from the sol to gel phase [11]. Generally, agar has a gelling point between 32-47 °C and is greatly influenced by agar concentration [11]. Gelling point as an important parameter because it affects the agar application. The lower the temperature of the gelling point or the greater the difference with the melting point, the wider the agar application.

Agar has the property to form a gel when cooled and will melt back when heated. Melting point is the temperature at which agar will begin to change from the gel to sol phase [11]. Agar of *Gelidium* sp from Lampung waters has melting point 80 ± 2.82 °C. According to US Pharmacopoeia, melting point of agar 80–85 °C suggesting possible applications for food and pharmaceutical industry, especially for products that require sterilization. The melting point of this research in line with what that reported by Montaño et al (1999) [11].
4. Conclusion
This research showed that *Gelidium* sp from Lampung water was potential to be used as a raw material for agar extraction. The seaweed of *Gelidium* sp has average of moisture content 15.53%, impurities 20.80%, CAW 38.13% and agar yield 8.21%. Agar from this seaweed has the following qualities parameters; moisture content of 10.15%, gel strength of 674 g/cm$^2$, gelling point 31.5$^\circ$C and melting point 80$^\circ$C.

References

[1] Sari D K, Kustiningsih I and Lestari R S . 2017 Effect of Temperature and Drying Time on Dried Seaweed Quality *J. Tek.* 3 43–50

[2] Utomo B S B and Mulia R A Y 2013 The quality of alkali treated cottonii (ATC) made from Eucheuma cottonii collected from different regions in Indonesia *Squalen Bull. Mar. Fish. Postharvest Biotechnol.* 8 117–27

[3] Murdina, Fransiska D and Subaryono 2019 Making a bactoagar from Gelidium rigidum seaweed for microorganism growing media *J. Postharvest Mar. Fish. Biotechnol.* 1 79-88.

[4] Subaryono and Murdina 2011 The Quality of agar from Gracilaria chilensis seaweed that cultivated in Lampung. *Pros. Forum Teknol. Akuakultur* 1153 - 1158.

[5] Marine Colloids 1978 Raw Material Test Laboratory Standart Practise. Marine Colloids FMC Corp. (New Jersey: Springfield)

[6] Nasional B S 2015 *Dried Seaweed* (Jakarta, Indonesia: Badan Standardisasi Nasional)

[7] Masduqi A F, Izzati M and Prihastanti 2014 *The Effect of Drying Methods on Chemical Content in Sargassum polycystum Seaweed* (Buletin Anatomi dan Fisiologi)

[8] Utomo B S B . and Satriyana N 2006 Physical-Chemical Properties of Agar from Gracilaria chilensis Seaweed Extracted with Different Amount of Water *J. Ilmu-ilmu Perair. dan Perikan. Indones.* 13 45–50

[9] Badan Standardisasi Nasional 2015 *Agar flour* (Jakarta, Indonesia: Badan Standardisasi Nasional)

[10] Armisen A and Galatas F 2009 . *Agar in Handbook of Hydrocolloid (second edition)* (United States: Science Publishers, Inc)

[11] Montaño N E, Villanueva R D and Romero J B 1999 Chemical characteristics and gelling properties of agar from two Philippine Gracilaria spp. (Gracilariales, Rhodophyta) *J. Appl. Phycol.* 11 27–34