

Study the Effect of Agar Extraction Time on its Yield and Physical Properties of Syrian Alga *Pterocladia Capillacea*

Dr. Hamed Mayhoob* Dr. Assef Abbas**Ali Mahmood***¹

* Professor, Department of Botany, Faculty of Sciences, Tishreen University, Lattakia, Syria.

** Assistant Professor, Department of Botany, Faculty of Sciences, Tishreen University, Lattakia, Syria.

***PHD Student, Department of Botany, Faculty of Sciences, Tishreen University, Lattakia, Syria.

3- It shows another properties for the agar produced out of Syrian algae *Pterocladia capillacea* and defining its commercial quality and uses fields with its future industries uses as well.

II RESEARCH METHODS AND MATERIALS .

A). Samples Collecting.

Pterocladia capillacea samples were collected from Jabla coast during March and April months of 2014. the algae were moved up to directly to laboratory with in plastic freights, The samples were washed with freshwater, cleaned of extraneous matter and dried in an oven at 60°C the stability of weight [15].

B). Native Extraction (Native Agar)

35g of dried agae *Pterocladia capillacea* was put in 1750 ML of distilled water, later on 8 experiments had been made (each one been repeated 3 times) in endother 100 °C and in a different time (1,2,3,4,5,6,7,8 hours) the extract filtered by a piece of cloth diameter holes 10 microns. in the next day, leaving the solution until it gelling and then placed in a temperature of (- 10) °C. in the next day, the frozen agar extract was put in room temperature for melting water them and containing some of the undesirable impurities such as dyes and cellulose and proteins, then the out put to be put in (10-) °C Lemperature. And so on repeatedly to 4 or 5 times in order to be hydrated and to get the agar in a powder form. This technique is called freezing – thawing method [14].

Measuring melting and gelling temperature agar according to the followed method with ([16], [17], [18]).

III RESULTS AND DISCUSSION

A). Agar yield

Table 1 shows that native agar yield is between 11 and 35.46 % and it is the same on Venezuela 32.1 – 12. 4% [19].

Brazil 5 - 37% ([20]; [21];[22]) and Hawaii 31.1- 28.9 [22] Spain 29.9 – 15% [23] and Syria 36- 12% [24] Taiwan 37.2 -5.1 % [25] but higher than in Barbados (Caribbean island) 15.3% [26] in Egypt 27-

Abstract

A study made about time effects of the native extraction on the yields and properties of the produced agar from (*Pterocladia capillacea*). Agar yields increases with the extraction time rise, where as the highest yields of agar 35.46% at time of 4 hours, and it get gelling temperature 31 °C, melting temperature 83 °C, and gel strength 436 g/cm². Then , the yield and properties decreases with time increasing over that where as it rises at 8 hours to 17 %. gelling temperature 27 °C, melting temperature 70°C and gel strength 170 g/m².

Key words: *Pterocladia capillacea*, agar yields, gel strength, viscosity, Gelling and melting temperature

I INTRODUCTION

Some of (Rhodophyta) as *Glacilaria*, *Gelidium*, *Gelidiella*, and *Pterocladia* are considered the main sources for commercial agar production in each one of these countries Chillie – Japan – China – India – Spain – Morocco newzeland –Egypt – Brazil, and Italy ([1]; [2]; [3]; [4]).

Agar-agar is a term referring to a family of linear galactan polysaccharides, and it consists of long chanins of agraose and agaropectine ([5]; [6]), and many studies showed that agar yield is changing accorcling to algae species [7] growing season, ([8]; [9]) environment conditions ([10]; [11]) extraction method ([12]; [13]).

Some of agar properties as agar gelling temperature, Melting temperature and gel strength are the most important factors in deciding the best use, where as the agar is used in various application such as: food industries, pharmaceutical, medicals. Cosmetics, biotechnologies, microbiology laboratories) [14].

Significance and aims of the research

- 1- Extraction agar from *Pterocladia capillacea*.
- 2- Studying the extract time effect on the agar yields and its physical properties.

41% [28] and 44% in Hawaii [26].

14% [27] while it was less than of what was in florida

Table -1- The Time Extraction Method and the Physical Properties of the Product Agar

Gel Strength g/m ²	Gelling Temperature °C	Melting Temperature °C	Yield %	Time
895	28	83	11	1
717.5	29	85	25.82	2
645	30	85	27.28	3
436	31	83	35.46	4
320	30	81	31	5
225	27	75	29	6
198	25	74	22	7
170	21	70	17	8

C). The Temperature Of Melting And Gelling Agar

The time extraction is not affected by time difference (8-1) hours, Table 1 shows agar Gelling Temperature between 21-31°C and melting temperature from 70- 85 °C. Then it decreases by extraction time over produced agar Gelling Temperature is primnesses for agar uses in the food and pharmaceutical industries and and as mactive mediums of seeding germ and auto typing for commercial agar specifications (metting temperature 85 t 5 Gelling Temperature 34 +31) where as it decreases by extraction time over above 5 hours . Table 1 shows The extraction time iceasing comes negatively on some of the physical specifications of the agar where as the gelling and melting temperature and Gel Strength is down which is because of the chains breaks of agar and molecular weight decrease ([29]; [30]; [31]).

RESULTS AND RECOMMENDATIONS

- Agar yield increases with extraction time increase till 4 hours then it decreases after that.
- Agar quality decreases with extraction time over from 1-8.
- (*Pterocladia capillacea*) is natural resource for agar production so it is necessary to be protected and formed and to be commercially exploited in the future in view of its economical medical importance.

REFERENCES

[6] W. YAPHE, "Properties of Gracilaria agars". Hydrobiologia, 116/117, 171–186, 1984.

[7] E. MARINHO-SORIANO, "Biomass and agar yield of Gracilaria bursapastoris in Mediterranean lagoon." Seaweed Res.Util, 21, 1–8, 1999.

[8] A. CHIRAPART, and M. OHNO, "Seasonal variation in the physical properties of agar and biomass of Gracilaria sp. (chorda type) from Tosa Bay, southern Japan." Hydrobiologia, 260/261 , 541–547, 1993.

[9] Y. FREILE-PELEGRIN, and D. ROBLEDO, "Influence of alkali treatment on agar from Gracilaria cornea from Yucat_an," Mexico. J. Appl. Phycol, 9, 533–539, 1997a.

[10] R. VILLANUEVA, N. MONTANO, J. B. ROMERO, A. AIIGGANG, B. ENRIQUEZ, "Seasonal variations in the yield, gelling properties, and chemical composition of agars from Gracilaria euchumoides and Gelidiella acerosa (Rhodophyta) from the Philippines". Bot. Mar, 42, 175–182, 1999.

[11] J. B. ROMERO, R. D. VILLANUEVA, N. M. MONTAO, "Stability of agar in the seaweed Gracilaria euchumatoides

[1] M. GLICKSMAN, "Food Hydrocolloids. ed. Martin Glicksman, CRC Press Inc. Boca Raton, Florida, vol. 2, 74–83, 1983

[2] E. A. WASSEF, A. M. EL SAYED, K. M. KANDEEL, H. A. MANSOUR, E. M. SAKR, " Effect of Feeding Pterocladia and Ulva meals in diets for gilthead bream Sparus aurata. Cahiers Options Méditerranéennes, 63 and Paper presented at the 10th International Symposium on Nutrition and Feeding in Fish, Rhodes(Greece) 2002; p.28.

[3] L. M. SILVA, V. LIMA, M. L. HOLANDA, P. G. PINHEIRO, J. A. G. RODRIGUES, M. E. P. LIMA, N. M. B. BENEVIDES, "Antinociceptive and Anti-inflammatory Activities of Lectin from Marine Red Alga Pterocladia capillacea. Biol. Pharm. Bull. 33: 830-835, 2010.

[4] A. BOTTALICO, C. I. D. FOGLE, M. FANELLI, "Growth and reproductive phenology of Pterocladia capillacea (Rhodophyta: Gelidiales) from the southern Adriatic Sea." Botanica Marina. 51: 124-131, 2008.

[5] C. ARAKI, "Some recent studies on the polysaccharides of agarophytes." Proc. Int. Seaweed Symp, 5, 3–19, 1966.

The output direvnce because of the extraction time difference the best Yield was fulfilled (35, 46%) in 4 hours and in 100°C and the lowest Yield was 12% in 1 hour .

tables (1) shows that the factor which is the extraction time plays positively in extracted agar yield where as it is in a direct proportion way with extraction time which is related due to the extraction near total of agar from the cell wall when the time of (1-4) (4-1([29]; [30]; [31])). then it decreases of crash of the agar molecular chains and exits with water because of its incap ability to frost during agar refining by freezing and thawing method because of extraction overtime [12].

B). Gel Strength

The agar gel strength decreases (Table 1) from 895 to 170 g/cm² indirectly with time extraction which is less than the listed gel strength (1350 g/cm²) for the same kind in Egypt and Hawaii (1174 g/cm²) ([27]; [26]) and the results obtained from the same kind in Taiwan [25] and [24] in Syria by native extraction method and higher than in floridae [28] while it was lower than the results of each of [19] in Venezuela and [23] in the Spain water and [24] in the Syria by alkaline extraction the reason for this is difference the method of extraction and concentration of sodium hydroxide and harvest location [32].

- Aquaculture. Calif. Sea Grant College Program, Institute of Marine Resources, Univ. Calif., La Jolla, Calif.: 123-129 & 200-201, 1980.
- [23] Y. FREILE-PELEGRIN, ROBLEDO, D. R. ARMISN, G. GARCIA-REINA, "Seasonal changes in agar characteristics of two populations of *Pterocladia capillacea* in Gran Canaria, Spain." *Journal of Applied Phycology* 8:, 239-246, 239. 1996.
- [24] A. ABBAS, Contribution to Study of Agar Extraction from the Syrian Marine Alga *Pterocladia capillacea*. *Tishreen University Journal for Research and Scientific Studies - Biological Sciences Series Vol. (32) No. (3) 2010*.
- [25] M. K. LAI , and C. LII. Effects of Extraction Conditions on Structural and Rheological Characteristics of Agar from *Pterocladia capillacea* and Carrageenan from *Grateloupia filicina* , *Botanica Marina Vol. 41*, pp. 223-234, 1998.
- [26] G. SANTOS, and M. S. DOTY, Agar from some Hawaiian red algae. *Aquatic Botany*, 16, 385 – 389. 1983.
- [27] A. V. RAO, and I. A. BEKHEET, Preparation of Agar-Agar from the Red Seaweed *Pterocladia capillacea* off the Coast of Alexandria, Egypt. *Applied and environmental microbiology*. Oct, p. 479-482, 1976.
- [28] G. L. COTE, and D. M. HANISAK, Production and properties of native agars from *Gracilaria tikvahiae* and other red algae. *Bot. mar.* 29:, 359-366, 1986.
- [29] J. CRAIGIE, Cell walls. In Cole KM, Sheath RG (eds), *Biology of the Red Algae*, Cambridge University Press, Cambridge , 221–257. 1990
- [30] R. I. MONTOLALU, T. YURI.; S. MATSUKAWA, H. OGAWA, 'Effects of extraction parameters on gel properties of carrageenan from *Kappaphycus alvarezii* (Rhodophyta). *J Appl Phycol* DOI 10.1007/s10811-007-9284-2, , pp. 1-6. 2007
- [31] F. PEREIRA-PACHECO, D. ROBLEDO, RODRIGUEZ – L. CARAVAJAL, FREILE-PELEGRIN. "Optimization of native agar extraction from *Hydropuntia cornea* from Yucatan, Mexico. *Bioresource Technology*, 98, 1278–1284, 2007.
- [32] M. D. HOYLE, Agar studies in two *Gracilaria* species (*G. bursapastoris* (Gmelin) Silva and *G. coronopifolia* J. Ag.) from Hawaii. II. Seasonal aspects. *Bot. Mar.*, 21, 347–352, 1978.
- (Gracilariales, Rhodophyta) during postharvest storage." *Bioresource Technology*, 99, 8151–8155, 2008.
- [12] V. KUMAR, and R. FOTEDAR, "Agar extraction process for *Gracilaria cliftonii* (Withell, Millar, & Kraft, 1994). *Carbohydrate Polymers*, 78, 813–819, 2009.
- [13] A. M. M. SOUSA, V. D. ALVES, S. MORAIS, C. DELERUE-MATOS, M. P. GONCALVES, "Agar extraction from integrated multitrophic aquacultured *Gracilaria vermiculophylla*: Evaluation of a microwave-assisted process using response surface methodology." *Bioresource Technology*, 101, 3258–3267, 2010.
- [14] R. ARMISEN, and F. GALATAS, "Agar. In G. O. Phillips & P. A. Williams (Eds.), *Handbook of hydrocolloids*, Cambridge." England. CRC Press, , pp. 21–40, 2009.
- [15] E. MARINHO-SORIANO, T. S. F. SILVA, and W. S. C. MOREIRA, "Seasonal variation in biomass and agar yield from *Gracilaria cervicornis* and *Hydropuntia cornea* from Brazil." *Bioresource Technology*, 77, 115-120, 2001.
- [16] R. ARMISEN, and F. GALATAS. Production and properties and uses of agar. In: (D. S. McHugh, ed.) *Production and Utilization of Products from Commercial Seaweeds* FAO, pp. 1-57, 1987.
- [17] Y. FREILE-PELEGRIN, D. ROBLEDO. "Effects of season on the agar content and chemical characteristics of *Gracilaria cornea* from Yucatan, Me'xico." *Bot. Mar.*, 40, 285–290, 1997b.
- [18] J. PRAIBOON, CHTRAPART, AKAKABE, O. BHUMIBHAMOND, and T. KAJIWARAC, "Physical and Chemical Characterization of Agar Polysaccharides Extracted from the Thai and Japanese Species of *Gracilaria*. *ScienceAsia* 32 Supplement, 1, 11-17, 2006.
- [19] A. LEMUS, K. BIRD, D. KAPRAUN, F. KOEHN, "Agar yield, quality and standing crop biomass of *Gelidium serrulatum*, *Gelidium floridanum* and *Pterocladia capillacea* in Venezuela. *Food Hydrocolloids*, 5, 469-480. 1991.
- [20] E. OLIVEIRA, R. M. SAITO, J. F. SANTO NETO, M. C. GAROFALO, "Temporal and spatial variation in agar from a population of *Pterocladia capillacea* (Gelidiales, Rhodophyta) from Brazil. *Hydrobiologia*, 326/327, 501-504. 1996
- [21] E. C. OLIVEIRA, & F. A. S. BERCHEZ, Resource biology of *Pterocladia capillacea* (Gelidiales, Rhodophyta) populations in Brazil. *Hydrobiologia* 260/261: 255-261, 1993.
- [22] G. SANTOS, "Quality of carrageenan and agar. In: Abbott IA, Foster MS, Eklund LF (eds), *Pacific Seaweed*