

Pakistan Journal of Marine Sciences, Vol. 26(1&2), 67-71, 2017.

ALKALI BASED AGAR EXTRACTION BY *GRACILARIA CORTICATA* FROM THE PAKISTANI COAST

Sofia Qaisar, Asma Tabassum, Fareeha Pervaiz, Sidra Nadeem, Aijaz Panhwar and Aliya Rehman

Pakistan Council of Science and Industrial Research (PCSIR), Karachi (SQ, AP);
Department of Botany University of Karachi, Karachi, Pakistan (AT, FP, SN, AR).
email: sofiaqaisar@hotmail.com

ABSTRACT: *Gracillaria corticata* is abundantly found upon coast line of Pakistan during the months of July to September and it is naturally available rich source of polysaccharides which have commercial importance. In this study different alkalies were sorted out in a combination with physiochemical based agar extraction. The open vessel and steam boiler were studied in a comparison for suitability of NaOH, KOH and NH₄OH, duration of heat treatment and NaOH concentration were also optimized. Maximum agar production, 12gm at wet condition was achieved through 1.5 hours heat treatment through steam boiler by the use of 5% NaOH.

KEYWORDS: Alkali based, agar extraction, *Gracilaria corticata*, Pakistan coast.

INTRODUCTION

Agar is a polysaccharide which forms gel with prolong heating, seaweeds like *Gelidium* and *Gracilaria* are the natural sources of agar production. *Gracilaria corticata* is abundantly found on Pakistani coast hence posing an opportunity for agar manufacturing industry. Pakistan import agar from abroad to fulfil its need. However, agar consumption is increasing day by day as hydrocolloids from *Gracilaria* are an important ingredient in different industries like food, beverages cosmetics, and pharmaceuticals.

The open vessel type is the simple technique practiced for extraction of agar. Steam boiler technique is sophisticated one and many agar production factories are using this technique with some modifications for the specific quality of agar. Production process effects agar yield in terms of quality, quantity energy and its labour cost, Rath, and Adhykary 2004.

Many researches have been made to obtain optimum production of agar from native marine algae Baono et al, 2011. The *Gelidium* species are usually extracted by hot water treatment and the other agar producing species recommended to use acid base pretreatments to soften the cell wall to ease agar production process (Zainab et al, 2015).

The aim of this study was to extract agar from the native *Gracilaria corticata*. The study was done to optimize alkali treated applicable methodology for the agar production.

MATERIALS AND METHOD

Gracilaria cortica was collected from Karachi coast, washed thrice with water to remove impurities and salts, dried and stored at 20 °C. 50 gm sample was used and

experiment was repeated for six time (n=6) and mean with standard deviation (\pm S.D) were used to interpret results.

All the used chemicals were of analytical grade by Sigma Aldrich Company. Open vessel (OV) and steam boiler (SB) methods were optimized for agar production from wild *Gracilaria corticata*.

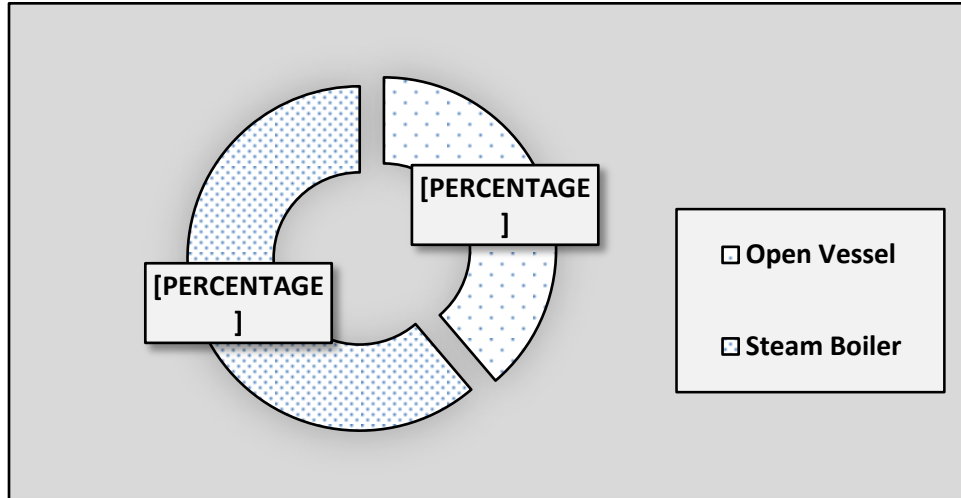


Fig. 1. Steam boiler and open vessel techniques for agar production by *Gracilaria corticata*. (Means \pm S.E. n = 6).

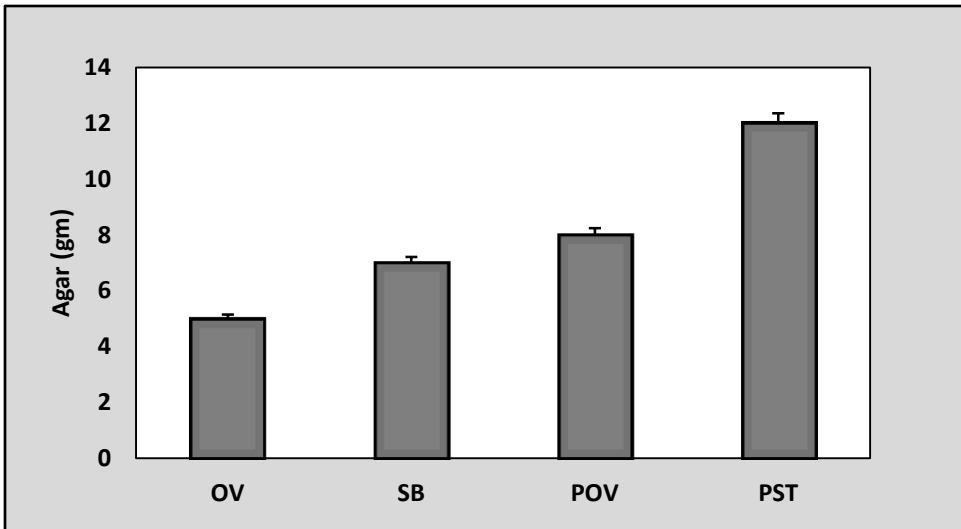


Fig. 2. Steam boiler and open vessel techniques in comparison with pretreated *Gracilaria corticata*. (Means \pm S.E. n = 6). (Steam boiler = SB, Open vessel = OV, Pretreated steam boiler = PST, Pretreated open vessel = POV).

RESULTS AND DISCUSSION

The steam boiling method resulted in 61 % higher agar yield then compared with the open vessel method which was 39% (Fig. 1). Moreover, the period of time for agar production also showed a comparable difference of 30 minutes and the agar quantity was 7.3 gm in open vessel in comparison to the 12 gm in steam boiling (Table.1). Tonon in 2008, indicated the steam boiler method as energy and labour efficient process.

Table: 1. Features of steam boiling and the open vessel techniques.

Technique	Sample	Temperature	Time	Agar
Steam Boiler	50 gm	100 ^o C	1.5 Hours	12 g
Open vessel	50 gm	100 ^o C	2.0 Hours	7.3 g

Alkali treatment before agar extraction of wild *Gracilaria* was carried out by soaking 50 gm sample in 1liter water which enhanced yield both in open vessel and steam boiler methods, open vessel pre-treated sample achieved best results in comparison to the rest of the treatment (Fig. 2). Arvizu-Higuera *et al*, 2008, optimized 2 hours alkali soaking treatment for the *Gracilaria vermiculophylla*. The soaking time period directly influence the quality of agar gel, Sousa *et al* 2010. To optimize the time period the pretreated samples were boiled for the range of time between 30-120 minutes and found 90min as optimum time (Fig. 3).

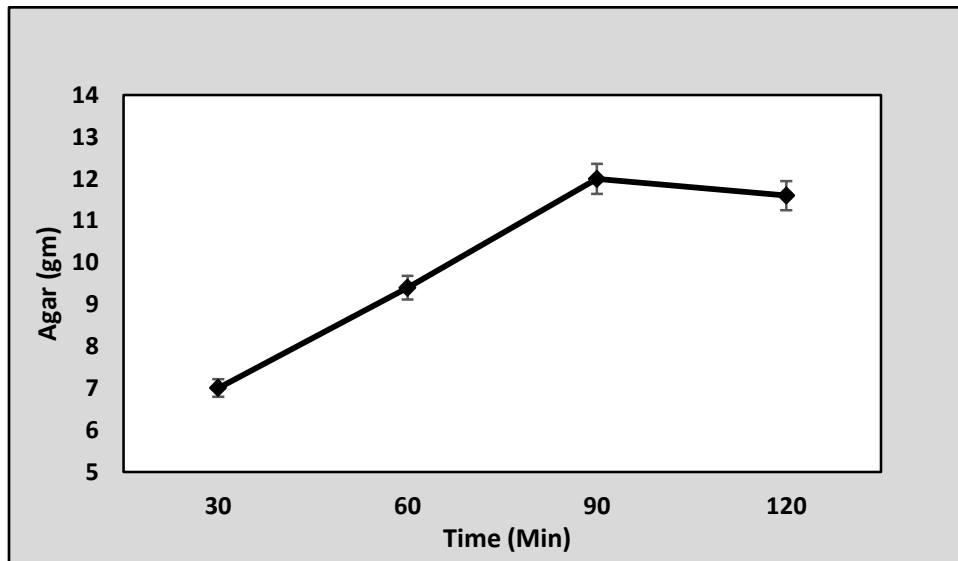


Fig. 3. Optimization of the soaking time for the agar production. (Means \pm S.E. n = 6).

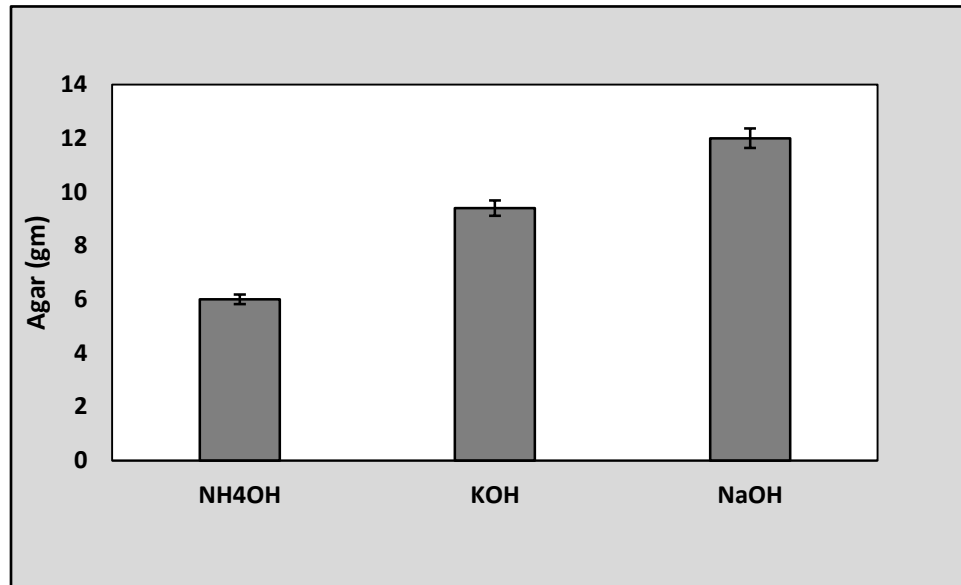


Fig. 4. Acid selection for the agar production. (Means \pm S.E. n = 6).

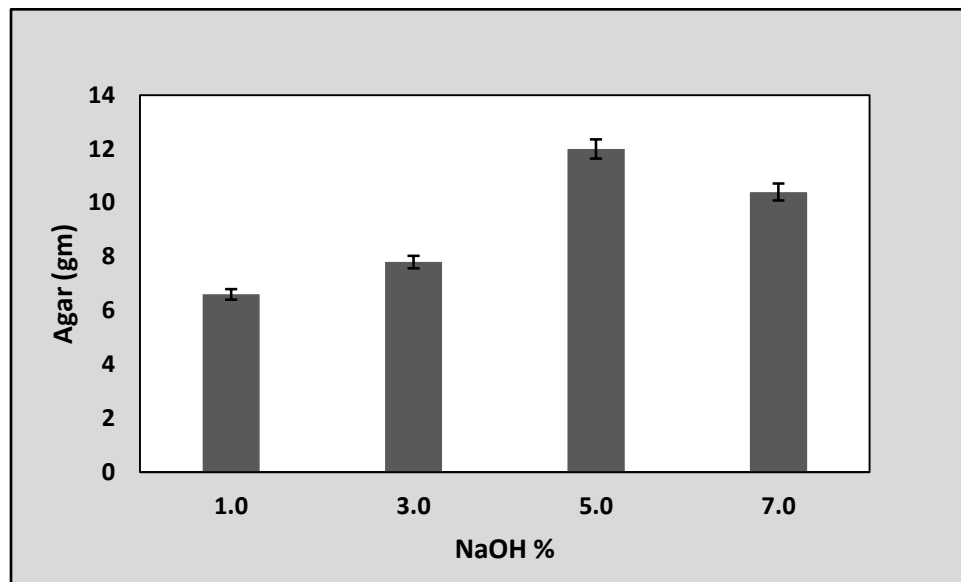


Fig. 5. Optimization of NaOH % for the agar production. (Means \pm S.E. n = 6).

For the suitability of alkali, the NH₄OH, KOH and NaOH, was used. The NaOH treatment was resulted in optimum yield of agar in comparison of rest of other two alkalies (Fig. 4). NaOH was experimented with 1.0%, 3.0%, 5.0% and 7.05, found 5.0%

as the optimum percentage of NaOH for the agar production (Fig. 5). The viscosity of the agar decreased with the NaOH treatment which favor its usage in the poultry feed industry, McHugh, 2003.

Nowadays the agar extraction methods are undergoing experimentation with different modifications due to the advancement in equipment technology and the use of agar in multiple industries, (Jayasinghe *et al.* 2016).

REFERENCES

- Arvizu-Higuera, D.L., Y.E. Rodriguez-Montesinos, J.I. Murillo-Alvarez, M. Munoz-Ochoa and G. Hernandez-Carmona. 2008. Effect of alkali treatment time and extraction time on agar from *Gracilaria vermiculophylla*. *J. Applied Phycol.* 20: 515-519.
- Bono, A., Y.Y. Farm, S.M. Yasir, B. Arifin and M.N. Jasni. 2011. Production of fresh seaweed powder using spray drying technique. *J. Applied*
- Jayasinghe P.S., V. Pahalawattaarachchi and K.K.D.S. Ranaweera. 2016. Effect of Extraction Methods on the Yield and Physicochemical Properties of Polysaccharides Extracted from Seaweed Available in Sri Lanka. *Poult. Fish. Wild. Sci.* 4: 150.
- McHugh, D.J. 2003. A guide to the seaweed industry. FAO Fisheries Technical Paper No. 441, FAO, Rome, Italy, pp: 61-105.
- Rath, J. and S.P. Adhykary. 2004. Effect of alkali treatment on the yield and quality of agar from red alga *Gracilaria verrucosa* (Rhodophyta, Gracilariales) occurring at different salinity gradient of Chilaka lake. *Ind. J. Mar. Sci.* 33(2): 202-205.
- Sousa, A.M., V.D. Alves, S. Morais, C. Delerue-Matos and M.D. Gonçalves. 2010. Agar extraction from integrated multitrophic aquacultured *Gracilaria vermiculophylla*: evaluation of a microwave-assisted process using response surface methodology. *Bioresource technology.* 101(9): 3258-67.
- Tonon, R.V., C. Brabet and M.D. Hubinger. 2008. Influence of process conditions on the physicochemical properties of acai (*Euterpe oleraceae* Mart.) powder produced by spray drying. *J. Food Eng.* 88: 411-418.
- Zainab, M.N., A. Ahmed, M. Insaaf and Z. Ali. 2015. Optimization of Yield and Chemical Properties of Agar Extracted from *Melanothamnus Somalensis* from Oman Sea. *J. Environ. Sci. Eng.* 4: 302-314.