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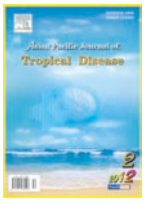

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Antioxidant properties of sequential extracts from brown seaweed, *Sargassum plagiophyllum, C. Agardh*

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ABSTRACT

Objective: To study the antioxidant properties of sequential extracts of *Sargassum plagiophyllum*. **Methods:** *Sargassum plagiophyllum* subjected to sequential extraction using acetone, acidic, alkaline and neutral water. Antioxidant properties of each extract were done. **Results:** Maximum yield was observed in alkaline water extraction with 26% and lowest yield was observed in Acetone extraction with nearly 2%. Among the various extracts, acetone extract was found to possess the higher antioxidant potential than other sequential extraction products. **Conclusions:** In this study, it was observed that the all the four extracts have notable antioxidant property that can be potentially exploited as an important ingredient in food processing industries.

1. Introduction

Brown algae possess potential antioxidant activity through its various classes of polysaccharides including, fucoidan, laminarin and alginic acid[1-3]. According to Kim et al. (2007) The sulphated polysaccharides of *Sargassum fulvellum* (Phaeophyceae), is more potent NO_2 scavenger than commercial antioxidants such as BHA and α-tocophorol. Present study is an attempt to study the antioxidant properties of different extracts of *Sargassum plagiophyllum*.

2. Material and methods

Sargassum plagiophyllum (fresh weight) was collected along the coast of Mandapam (Lat.09° 17′N; Long.79° 08′E), Palk Bay, Tamil Nadu, India in November 2009. After thoroughly washing with the seawater and manual sorting to remove the epiphytes, the fresh biomass was exhaustively washed first with tap water and then with distilled water. The seaweeds were then shade dried and ground to pieces of about 1 mm. Sequential extraction procedure was followed as represented in Figure.1. In vitro antioxidant activity was ascertained following the methods such as, Lipid Peroxidation[5] Hydroxyl radical peroxidation[5] DPPH Scavenging activity[7] and Super oxide Scavenging activity[8].

3. Results

Steps involved in the Sequential extraction were given in Fig. 1. Maximum extraction was observed in alkaline water extraction with about 26% and lowest yield was observed in Acetone extraction with approximately 2%. Each extract was analyzed for its antioxidant properties (Table.1). Among the extracts, acetone extract had high antioxidant potential than other sequential extraction products. In this study, lowest antioxidant capacity was observed in alkaline water extract. However, when compared to standard antioxidants such as ascorpic acid and catechin, sequential extraction products had less antioxidant activity.

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Table 1.
Antioxidant effect of sequencial extraction products from the brown seaweed ,Sargassum plagiophyllum

Extract	Lipid Peroxidation	Hydroxyl radical peroxidation	DPPH Scavenging activity	Super oxide Scavenging activity
Acetone (IC50mg/mL)	1.819 ± 0.2	1.05 ± 0.3	0.910 ± 0.1	2.25 ± 0.3
Neutral water (IC50mg/mL)	3.9 ± 0.5	4.6 ± 0.4	4.8 ± 0.3	7.0 ± 0.2
Acidic water(IC50mg/mL)	4.0 ± 0.2	3.15 ± 0.1	3.33 ± 0.3	4.5 ± 0.2
Alkaline water(IC50mg/mL)	6.0 ± 0.3	4.8 ± 0.4	11.07 ± 0.2	7.5 ± 0.3
Ascorpic acid(IC50mg/mL)	–	–	0.015 ± 0.05	0.054 ± 0.03
Catechin(IC50mg/mL)	0.400 ± 0.1	0.835 ± 0.2	–	–

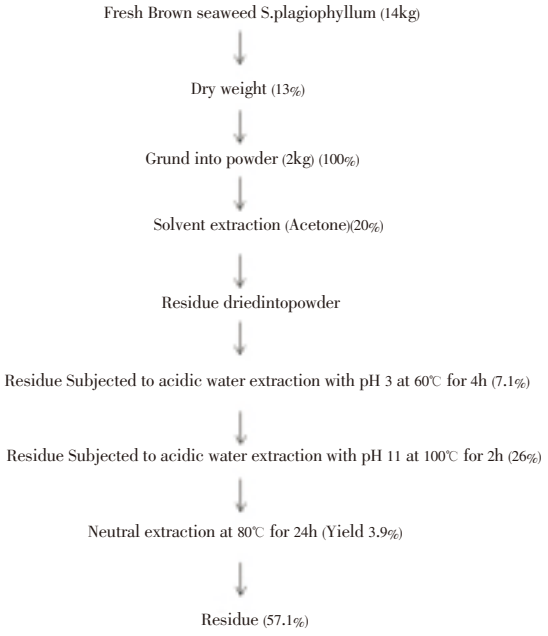

Figure 1. Schematic representation of sequential extraction from Sargassum plagiophyllum.

4. Discussion

Recently, there is a considerable interest in the food industry as well as pharmaceutical industry for the development of antioxidants from natural sources, such as marine flora and fauna. Among them, marine algae represent one of the richest sources of natural antioxidants [8,2]. The sequential extraction procedure was an efficient process to recover various products based on the differential solubility, molecular mass and charge distribution of polysaccharides from brown seaweeds. Laminarins are soluble in warm waters and therefore extracted at 80℃. Fucans were extracted with diluted hydrochloric acid, whereas alginates were extracted with sodium carbonate. Alginates form insoluble precipitates with bivalent calcium at acid pH, and are stable in solution between pH 6 and 9. Based on this, it could be presumed that the acetone extract could have pigments and secondary metabolites, acidic water extract could have fucoidan, alkaline water extract could have alginic acid and neutral water extract could have laminarin as main content of each extract[10]. In the present study, all the four extracts are found to have antioxidant properties might be due the presence of fucoxanthin, secondary metabolites, fucoidan, laminarin and alginic acids. Several classes of sulphated polysaccharides have been demonstrated to show antioxidant activity too. The compounds tested included laminarin, alginic acid, fucoidan and other unidentified macromolecules present in the extracts [1,2,9].

In this study, we found that the all the four extracts as excellent antioxidants. Accordingly, the extracts can be recommended for its application as a safe antioxidant in food processing industry. Furthermore, as the isolation of these antioxidant metabolites involves a few inexpensive and easy steps, it will be of an added advantage.

Conflict of interest statement

We declare that we have no conflict of interest.

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References

[1] Rocha de Souza, Marques MC, Dore CT, C. Ferreira da Silva MG, Leite, EL. Antioxidant activities of sulphated polysaccharides from brown and red seaweeds. *Journal of Applied Phycology* 2007; **19**: 153-160.

[2] Ruperez P, Ahrazem O, Leal A. Potential antioxidant capacity of sulphated polysaccharides from the edible marine brown seaweed Fucus vesiculosus. *Journal of Agricultural and Food Chemistry* 2002; **50**: 840-845.

[3] Wang J, Zhang,Q, Zhang Z, Li Z. Antioxidant activity of sulphated polysaccharide fractions extracted from Laminaria japonica. *International Journal of Biological Macromolecules* 2008; **42**: 127-132.

[4] Kim, S. Choi H, Athukorala DS, Jeon Y, Senevirathne, M, Rha, CK. Antioxidant activity of sulfated polysaccharides isolated from *Sargassum fulvellum*.*Journal of Food Science and Nutrition* 2007; **12**: 65-73.

[5] Ohkawa H, Ohishi N , Yagi K. Assay for lipid peroxides in animal

tissues by thiobarbituric acid reaction; Anal. *Biochem*.1979; **95**: 351-358.

[6] Aquino R, Morelli S, Lauro MR, Abdo S, Saija A, Tomaino A (2001). Phenolic constituents and antioxidant activity of an extract of Anthurium versicolor leaves. *J. Natl. Prod*.2001; **64**: 1019-1023.

[7] McCord J M and Fridovich I. Superoxide dismutase: An enzymic function of erythrocuprein (hemocuprein); *J. Biol. Chem*. 1969; **244**: 6049-6055.

[8] Mayer, AMS, Hamann MT. Marine Pharmacology in 1999: compounds with antibacterial, anticoagulant, antifungal, anthelmintic, anti-inflammatory, antiplatelet, antiprotozoal and antiviral activities affecting the cardiovascular, endocrine, immune and nervous systems, and other miscellaneous mechanisms of action. *Comparative Biochemistry and Physiology Part C* 2002; **132**: 315-339.

[9] Wang J, ZhangQ, Zhang Z, Song H, Li P. Potential antioxidant and anticoagulant capacity of low molecular weight fucoidan fractions extracted from Laminaria japonica. *International Journal of Biological Macromolecules* 2010; **46**: 6-12.

[10] Chattopadhyay N, Ghosh T, Sinha S, Chattopadhyay K, Karmakar P, Bimalendu Ray . Polysaccharides from Turbinaria conoides: Structural features and antioxidant capacity. *Food Chemistry* 2010; **118**: 823-829.