**IJP (2017), Vol. 4, Issue 3** **(Research Article)**

Received on 27 December 2016; received in revised form, 21 January 2017; accepted, 23 February 2017; published 01 March 2017

# ANTIOXIDANT ACTIVITIES OF SULFATED POLYSACCHARIDE OBTAINED FROM RED ALGAE *CORALLINA OFFICINALIS*

Z. Benattouche *, G. Bachir Raho, F. Sahnouni, A. Hariri, G. Bouhadi and M. Benchohra

Laboratory of Bioconversion, Microbiology Engineering and Alimentary Security, Department of Biology, Mascara University - 29000, Algeria.

**Keywords:**

*Corallina oficinalis*, Sulphated Polysaccharide, Extraction, DPPH method

**Correspondence to Author:**
**Benattouche Zouaoui**

Laboratory of Bioconversion, Microbiology Engineering and Alimentary Security, Department of Biology, Mascara University- 29000, Algeria.

**E-mail:** benattouche_22@ yahoo.fr

**ABSTRACT:** Sulfated polysaccharides (SP) were extracted from *Corallina officinalis* marine red algae seaweed by using hydrothermal processes at 100 °C. The antioxidant activity of *C. officinalis* sulfated polysaccharide was determined using the (2,2-diphenyl-1-picrylhydrazyl, DPPH) method, showing that this polysaccharide has a moderate effect in inhibiting the formation of those radicals. This study demonstrates that sulfated polysaccharide obtained from marine red algae have the potential for use as natural antioxidants in industrial food applications.

**INTRODUCTION:** The natural products of seaweed and other marine organisms represent one of the new frontiers in the exploration of bioactive compounds. However, the Algerian marine biodiversity remains partially unexplored. In the last years, the sulfated polysaccharides (SP) found in marine seaweed are known to have many physiological and biological activities, including anticoagulant, anti-viral, anti-tumor, anti-inflammatory and antioxidant effects [1]. Marine algae contain a high concentration of SP, which are heterogeneous and complex macromolecules that are important for algal physiology; these molecules perform ionic, mechanical and osmotic functions and are components of the extracellular matrix [2].

QUICK RESPONSE CODE

DOI: 10.13040/IJPSR.0975-8232.IJP.4(3).88-91

The article can be accessed online on www.ijpjournal.com

DOI link: http://dx.doi.org/10.13040/IJPSR.0975-8232.IJP.4(3).88-91

Antioxidant activity has become a 'hot' topic and the subject of intensive investigations due to the ever-increasing demand by the food and pharmaceutical industries to develop natural bioactive anti-aging and anticarcinogenic compounds that demonstrate measurable health benefits. Antioxidative substances obtained from natural sources have already been investigated [3-4].

However, there are very few studies in the literature on antioxidant activity associated with sulfated polysaccharides from seaweeds. Food industry consumes a wide range of algae [5] and considers a good antioxidant that compound that efficiently inhibits lipid peroxidation, a process that causes rancidity in foodstuff. Until recently, several synthetic antioxidants, including butylated hydroxyanisole (BHA), butylated hydroxytoluene (BHT), propyl gallate (PG) and t-butyl hydroquinone (TBHQ), were commonly used in the food industry. However, the use of these products has been restricted because they are now suspected of having carcinogenic effects [6].

As a result, interest in naturally occurring antioxidants from bioresources, such as seaweeds, has received considerable attention during the last few years, as they are generally believed to be good candidates for the production of safe biologically active substances [7-9].

The aim of the present study was to investigate the antioxidant activity of a sulfated-polysaccharide (PLS) fraction extracted from the marine red algae *Corallina officinalis* in the west coast of Algeria.

## MATERIALS AND METHODS:

**Algal Source:** The red algae *Corallina officinalis* were collected from Arzew gulf (West of Algeria) during March 2015. The identification of the investigated marine algae was verified by Prof. ELKHIATI Laboratory of Biology and Plant Physiology Casablanca- Marocco.

**Extraction of Soluble Polysaccharide:** Specimens of the red algae *Corallina officinalis* were collected in August 2015 from the Arzew gulf (West of Algeria). After collection, the algae were cleaned of epiphytes, washed with distilled water, and stored at −20 °C. To enable extraction of polysaccharide, 5 g of dried *C. officinalis* tissue was ground into a fine powder and incubated in stirring distilled water (25% w/v) for 2 h at 100 °C. After filtration and concentration of the solution, the polysaccharide was precipitated with ethanol absolute (1:3 v/v) and centrifuged at 10,000 rpm to pool it and evaporated under vacuum at 60 °C in rotary evaporator according to Asker *et al.* [10] The precipitate was dried at 30 °C, to yield brownish powder crude sulfated polysaccharides [11] and kept for analysis.

**Antioxidant Activity Assays:** In order to determine the antioxidant activity of the sulfated fucans, solutions were prepared by solubilizing these polysaccharides in distilled water to acquire 1.5 mg/ml, 0.75 mg/ml, 0.35 mg/ml and 0.15mg/ml Then, the total antioxidant activity of these polysaccharides solutions was estimated by the methods described below.

**Radical Scavenging Activity by DPPH Method:** [12] The DPPH scavenging activity was determined by measuring the ability of the samples to scavenge the free radical DPPH. For the reaction, 50 mL of sample was added to 2950 mL of a 60 mM methanolic DPPH solution, and the mixture was shaken and incubated in darkness at ambient temperature for 30 min. Then, the absorbance at 517 nm was determined. Vitamin C was used as a positive control in parallel. The DPPH radical scavenging activity was expressed as the inhibition percentage using Eq. (1):

$$\% \text{ inhibition of DPPH} = (1 - AS/AC) \times 100 \quad (1)$$

Where AC and AS is the absorbance of the control and the absorbance of the sample solution, respectively.

**Statistical Analysis:** All analytical determinations were performed in triplicate, and the results are presented as average values ± Standard deviations. Data were analyzed using one-way analysis of variance (ANOVA) and the Tukey multiple comparison tests was used to determine significant differences ($p<0.05$) between mean values.

**RESULTS AND DISCUSSION:** In the present study, the antioxidant activity of the sulfated polysaccharide isolated by using aqueous extraction at 100 °C from *C. officinalis* were evaluated by DPPH method and compared with standard antioxidant. The DPPH radical scavenging activity is depicted in **Fig. 1**. To determine the antioxidant activity of the sulfated polysaccharides, the samples were dissolved to provide four different concentrations (0.1825 mg/ml, 0.375 mg/ml, 0.75 mg/ml and 1.5 mg/ml),

The DPPH free radical-scavenging model is widely accepted as a tool for estimating the free radical-scavenging activities of antioxidants. In this method, the absorbance decreases as a result of a color change as the radical is scavenged by antioxidants through the donation of hydrogen to form the stable DPPH–H molecule [13].

In the present study, the highest DPPH radical-scavenging effects were observed for the sulfated polysaccharide samples obtained by red algae, with an inhibition value of 52% at a concentration of 1.5 mg/ ml **Fig. 1** which ascorbic acid exhibited 74.64% scavenging effect at a concentration of 1.5 mg/ml. The half-maximal inhibitory concentration ($IC_{50}$) value for *C. officinalis* was 1.3 mg/ml; Ascorbic acid exhibited 50% scavenging ability at a concentration of 0.14 mg/ml.

In the present examination, sulfated polysaccharides from all the three algae exhibited a dose-dependent increase in the scavenging of DPPH radical.

Previous studies have reported the antioxidant activity of the extracts from the red algae of the *Corallina officinalis* [14].

As a comparison, vitamin C showed stronger scavenging activity for DPPH radical than the sulfated polysaccharides ($P<0.05$).

Several works have demonstrated that the presence of sulfate groups in seaweed polysaccharides is responsible for numerous types of biological activities, such as antioxidant activities [15- 16].

The bioactivities of polysaccharides can be affected by many factors including chemical components, molecular weight, structure, conformation, even the extraction and isolation methods. Zhao *et al.*, [17] mentioned that low molecular weight sulfated polysaccharide has the potential ability to stop free radical reactions from the start and to inhibit the damage induced by excess free radical. However, the relationship between the structure of algal polysaccharides and antioxidative mechanisms has not yet been elucidated [18].

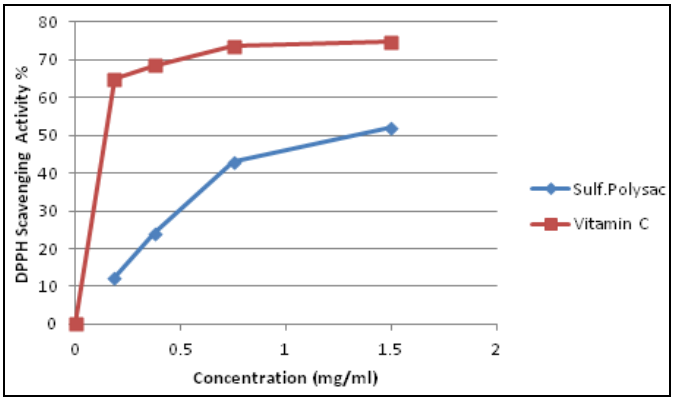


**FIG. 1: ANTIOXIDANT ACTIVITY (DPPH ASSAYS) OF SULFATED POLYSACCHARIDE EXTRACTED FROM *CORRALINA OFFICINALIS* AND STANDARD VITAMIN C**

**CONCLUSION:** Sulfated polysaccharides extracted with hot water process from *Corallina officinalis* red algal exhibited the antioxidant effect. Red seaweeds *Corallina* could be considered as a potential source of bioactive molecules that may be useful for the development of new pharmaceutical agents.

**ACKNOWLEDGEMENT:** The authors thank the Management of Mascara University for providing lab biochemistry facilities and constant encouragement for this research work.

**CONFLICT OF INTEREST:** Nil

**REFERENCES:**

1. Silva RO, dos Santos GM, Nicolau LA, Lucetti LT, Santana AP, Chaves LS, Barros FC, Freitas AL, Souza MH and Medeiros JV: Sulfated-polysaccharide fraction from red algae *Gracilaria caudata* protects mice gut against ethanol-induced damage. Mar Drugs 2011; 9: 2188-2200.
2. Pomin VH and Mourão PAS: Structure, biology, evolution, and medical importance of sulfated fucans and galactans. Glycobiology 2008; 18: 1016-1027.
3. Fujimoto K, Ohmura H and Kaneda T: A Screening test for antioxygenic compounds from marine algae and fractionation from *Eisenia bicyclis* and *Undaria pinnatifida.* Bull Jpn Soc Fish 1985; 46: 1125-1130.
4. Gordon GC, Yen P, Duh D and Tsai CL: Relationship between antioxidant activity and maturity of peanut hulls. J Agric Food Chem 1993; 41: 67-70.
5. Cardozo KHM, Guaratini T, Barros MP, Falcão VR, Tonon AP, Lopes NP and Pinto E: Metabolites from algae with economical impact. Comparative Biochemistry and Physiology 2007; 146(1-2): 60-78.
6. Kumar KS, Ganesan K and Rao PVS: Antioxidant potential of solvent extracts of Kappaphycus alvarezii (Doty) Doty – edible seaweed. Food Chemistry 2008; 107(1): 289-295.
7. Cornish ML and Garbary DJ: Antioxidants from macroalgae: potential applications in human health and nutrition. Algae 2010; 4(25): 155-171.
8. Ganesan K, Kumar KS and Rao PVS: Comparative assessment of antioxidant activity in three edible species of green seaweed, Enteromorpha from Okha, Northwest coast of India. Innovative Food Science and Emerging Technologies 2011; 12(1): 73-78.
9. Souza BWS, Cerqueira MA, Martins JT, Quintas MAC, Ferreira ACS, Teixeira JA and Vicente AA: Antioxidant potential of two red seaweeds from the Brazilian coast. Journal of Agricultural and Food Chemistry 2011; 59(10): 5589-5594.
10. Asker MSM, Mohamed SF, Ali FM and El-Sayed OH: Chemical structure and antiviral activity of water-soluble sulfated polysaccharides from *Surgassum latifolium.* J Appl Sc Res 2007; 3: 1178-1185.
11. Berovic M, Habijanic J, Zore I, Waber B and Hodzer D: Submerged cultivation of *Ganoderma lucidum* biomass and immunostimulatory effects of fungal polysaccharides. J Biotech 2003; 103: 77-86.
12. Khalaf NA, Shakya AK, Al-Othman A, El-Agbar Z and Farah H: Antioxidant activity of some common plants. Turk J Biol 2008; 32: 51-55.
13. Hu FL, Lu RL, Huang B and Ming L: Free radical scavenging activity of extracts prepared from fresh leaves of selected Chinese medicinal plants. Fitoterapia 2004; 75: 14-23.
14. Yang Y, Liu D, Wu J, Chen Y and Wang S: *In-vitro* antioxidant activities of sulfated polysaccharide fractions extracted from *Corallina officinalis.* Int J Biol Macromol 2011; 49: 1031-1037.

15. Qi H, Zhao T, Zhang Q, Li Z and Zhao Z: Antioxidant activity of different molecular weight sulfated polysaccharides from *Ulva pertusa* Kjellm (Chlorophyta). Journal of Applied Phycology 2005; 17: 527-534.
16. Wang J, Zhang Q, Zhang Z, Zhang J and Li P: Synthesized phosphorylated and aminated derivatives of fucoidan and their potential antioxidant activity *in-vitro*. International Journal of Biological Macromolecules 2009; 44(2): 170-174.
17. Zhao X, Xue CH, Li ZJ, Cai YP and Liu HY: Antioxidant and hepatoprotective activities of low molecular weight sulfated polysaccharide from *Laminaria japonica*. J Appl Phyco 2004; 16: 111-115.
18. Yim JH, Kim SJ, Ahn SH, Lee CK and Rhie KT: Antiviral effects of sulfated exopolysaccharide from the marine microalgae *Gyrodinium impudiucum* strain $KGO_3$. Marine Biotechnol 2004; 6: 17-25.

**How to cite this article:**
Benattouche Z, Raho GB, Sahnouni F, Hariri A, Bouhadi G and Benchohra M: Anioxidant activities of sulfated polysaccharide obtained from red algae *Corallina oficinalis*. Int J Pharmacognosy 2017; 4(3): 88-91. doi link: http://dx.doi.org/10.13040/IJPSR.0975-8232.IJP.4(3).88-91.