Available online www.jocpr.com

Journal of Chemical and Pharmaceutical Research, 2014, 6(7):133-137

Research Article

ISSN : 0975-7384
CODEN(USA) : JCPRC5

Biochemical composition of brown marine alga *Spatoglossum asperum*

Pandithurai M. and Murugesan S.

Unit of Algal Biotechnology and Bionano Technology, PG and Research Dept. of Botany, Pachaiyappa's College, Chennai, India

---

ABSTRACT

The macroalgae showed varied quantities of biochemical constituents like total carbohydrate, total protein and total lipid. Studies were conducted to evaluate biochemical composition of Spatoglossum asperum. Fatty acid, vitamins and minerals composition were carried out by using gas chromatography method and flame atomic absorption spectrophotometry method respectively. Among biochemical content total protein is present in high amount, 11.03 ± 0.06%, total carbohydrates is 6.55 ± 0.14% and total lipid is 3.14± 0.14%. Among the 7 identified fatty acid, Linoleic acid (29.41± 0.01%) and stearic acid (21.99 ± 0.01%) are found to be the major components. Among vitamins, vitamin C (15.60 ± 0.00 mg/100gm) and Niacin (10.86 ± 0.02 mg/100gm) are present in major quantities. Macro minerals such as Potassium (203.38 ± 0.02 mg/100gm), Sodium (145.50 ± 0.10 mg/100gm) and Calcium (134.51 ± 0.01mg/100gm) were identified in higher amount.

Keywords: Brown algae, *Spatoglossum*, amino acids, fatty acids, vitamins and minerals.

INTRODUCTION

Seaweeds have been widely used for human consumption in many parts of the world. They have been used since ancient times as food, fodder, fertilizer and as source of medicine. Today seaweeds are the raw material for many industrial productions like agar, algin and carrageenan but they continue to be widely consumed as food in Asian countries (Mishra, *el al.*, 1993). They are nutritionally valuable as fresh or dried vegetables, or as ingredients in a wide variety of prepared foods (Robledo, D. and Y.F. Pelegrin, 1997). Marine algae can serve as a source of minerals, vitamins, free amino acids and polyunsaturated fatty acids. Seaweeds have been consumed in Asian countries since ancient times. Further, marine algae have been utilized in Japan as raw materials in the manufacture of many seaweed food products, such as jam, cheese, wine, tea, soup and noodles and in the western countries, mainly as a source of polysaccharides for food and pharmaceutical uses (Indegaard M. and Minsaas J. 1991; Mabeau et al., 1993). The essential minerals and trace elements needed for human nutrition are present in seaweeds and it constitutes nearly 8-40% (Fleurence, 1999; Ruperez *et al*.,2001). This wide range in mineral content, not found in edible land plants, it is related to factors such as seaweed phylum, geographical origin and seasonal, environmental and physiological variations (Mabeau *et al*., 1993).

EXPERIMENTAL SECTION

2.1 Collection and processing of Seaweeds :

The experimental marine brown alga *Spatoglossum asperum* was collected from Mandapam, southeast coast of India. Collected seaweeds were washed thoroughly with seawater to remove all the unwanted impurities, adhering sand particles and epiphytes. Finally the sample was washed thoroughly using sterilized sea water. The water was drained off and the seaweed was spread on blotting paper to remove excess water. The washed seaweeds were shade dried and powdered, and then the following test was carried out.

2.1.1 Carbohydrate Estimation: The total carbohydrate was estimated by following the Phenol-sulphuric acid method (Dubois et al., 1956).

2.2.2 Protein Estimation: The total protein was estimated using the Biuret method (Raymont *et al*., 1964).

2.2.3 Lipid Estimation: The extraction of lipid was done by the chloroform-methanol mixture method (Folch *et al*., 1956).

2.3.4 Estimation of Fatty acids: Fatty acids in the sample were identified and quantified methyl esters in NEON II gas chromatography instrument following the procedure outlined by Niller and Berger (1985).

2.3.5 Estimation of vitamins : An Agilent 1100 chromatographic system (AOAC, 1995) was used for the analysis and quantification of vitamins in the algal samples.

2.3.6 Mineral analysis: The mineral composition of experimental algae was determined by atomic absorption spectrophotometer (Perkin–Elmer model 303). Samples were subjected to acid digestion and analyzed according to the procedure described by Farias *et al*., (2001).

RESULTS AND DISCUSSION

The proximate compositions of the brown alga *Spatoglossum asperum* such as biochemicals, fatty acids, vitamins and minerals are expressed on a dry weight basis in Tables 1, 2, 3, and 4 respectively. Carbohydrates, proteins and Lipids, are the most important biochemical components present in the studied algal biomass. Carbohydrate is one of the important components for metabolism and it supplies the energy needed for respiration and other most important processes (Bligh *et al*., 1959). In the present study the carbohydrate content of *Spatoglossum asperum* was found as 6.55 ± 0.14% (Table.1). The results of the present study coincide well with that of carbohydrate contents reported by earlier studies of Reeta (1993), who has studied the carbohydrate content in *S.wightii*. The decrease in carbohydrates may be observed due to extensive growth of thallus of algae (Dhargalkar, 1979).

Proteins have crucial functions in all the biological processes. Their activities can be described by enzymatic catalysis, transport and storage, mechanical sustentation, growth and cellular differentiation control (S¨ukran Dere et al., 2003). In the present study the protein content was estimated as 11.03 ± 0.06%. Roslin (2003) reported that in Phaeophyceae, the maximum protein content was shown by *S.ilicifolium* (28.2%) and *S.wightii* (28.2%). In the present study the protein content was lower than that of the earlier study.

Lipids are rich in -C = O- bonds, providing much more energy in oxidation processes than other biological compounds. They constitute a convenient storage material for living organisms. In general the total lipid content was always found less than 4% (Herbreteau et al., 1997) in almost all the seaweeds so far. Falling in the same line, the lipid content of *Spatoglossum asperum* was 3.14± 0.14%, this is further supported by the finding of Reeta (1993) in *S.wightii* (0.159 to 1.551%).

Table. 1 Biochemical content of *Spatoglossum asperum*

S. No	Biochemicals	Composition (%)
1	Total carbohydrates	6.55 ± 0.14
2	Total proteins	11.03 ± 0.06
3	Total lipids	3.14± 0.14

Table.2 Fatty acid profile of *Spatoglossum asperum*

S. No	Name of Fatty acids	Composition (%)
Saturated Fatty Acids		**(31.83%)**
1	Palmitic acid (16:0)	9.84± 0.01
2	Stearic acid (18:0)	21.99 ± 0.01
Mono Unsaturated Fatty Acids		**(19.48%)**
3	Oleic acid (18:1)	19.48 ± 0.00
Poly Unsaturated Fatty Acids		**(48.69%)**
4	Linoleic acid (18:2)	29.41± 0.01
5	Alpha linolenic acid (18:3)	11.38± 0.01
6	Morotic acid (18:4)	7.90± 0.01

Table: 3 Vitamin contents of *Spatoglossum asperum*

S. No	Name of Vitamins	mg/100gm Mean ± SD
1	Vitamin A	0.03 ± 0.00
2	Vitamin B1	0.26 ± 0.00
3	Vitamin B2	0.34 ± 0.00
4	Vitamin B6	0.50 ± 0.00
5	Vitamin B12	0.11 ± 0.00
6	Vitamin C	15.60 ± 0.00
7	Vitamin D	0.004 ± 0.00
8	Vitamin E	1.47 ± 0.02
9	Vitamin K	0.35 ± 0.02
10	Niacin	10.86 ± 0.02
11	Folic acid	2.36 ± 0.02
12	Pantothenic acid	3.48 ± 0.03

Table: 4 Mineral contents of *Spatoglossum asperum*

S. No	Name of Minerals	(mg/100gm) Mean ± SD
1	Potassium	203.38 ± 0.02
2	Calcium	134.51 ± 0.01
3	Phosphorous	13.46 ± 0.02
4	Iodine	25.63 ± 0.01
5	Sodium	145.50 ± 0.10
6	Magnesium	45.60 ± 0.01
7	Zinc	3.43 ± 0.01
8	Iron	1.34 ± 0.00
9	Copper	0.88 ± 0.00
10	Chromium	0.84 ± 0.00
11	Manganese	0.0015 ± 0.00

Lipids represent only 1-5% of algal dry matter and show an interesting polyunsaturated fatty acid (PUFA) composition particularly omega 3 and omega 6 acids which play a role in the prevention of cardiovascular diseases, osteoarthritis and diabetes. Although seaweeds are not a conventional source of energy, their polyunsaturated fatty acid contents are high when compared to terrestrial vegetables (Darcy-Vrillon, 1993). In the present study PUFA were dominating (48.69%) over saturated fatty acids (31.83%) and Monounsaturated fatty acids (MUFA) 19.48%. Variation in fatty acid contents are due to both environmental and genetic differences (Sanchez-Machado et al., 2004a). In this work six fatty acids were identified. The fatty acid composition of *S.asperum* is shown in table 2. It was found that the highest amount is Linolenic acid (18:2) 29.41± 0.01% and Stearic acid (18:0) 21.99 ± 0.01% and lowest amount is Morotic acid (18:4) 7.90± 0.01% and Palmitic acid (16:0) 9.84± 0.01%, it also contained MUFA, Oleic acid (18:1) 19.48 ± 0.00% and the essential fatty acid, Alpha linolenic acid (18:3) 11.38± 0.01%.

Vitamins are defined as organic micronutrients that must be obtained in the human diet. Seaweeds have been a popular food additive in almost all parts of the world. Vitamins were calculated on the basis of 100g in dry weight of seaweed powder and their values were represented mg/100gm in table 3. Vitamin C 15.60 ± 0.00 mg, Niacin 10.86 ± 0.02 mg, Pantothenic acid 3.48 ± 0.03 mg, Folic acid 2.36 ± 0.02 mg and Vitamin E 1.47 ± 0.02 mg are rich in the brown alga *S.asperum.* Generally, seaweeds are rich in vitamins A_1, B_1, B_2, B_6, B_{12}, C, E and K which can keep the body healthy and strong enough to fight against many types of diseases. Seaweeds are an important unconventional source of vitamins (liposoluble and hydro soluble), commonly consumed fresh or dried in many coastal areas, especially in the Pacific coast of South America (Sanchez-Machado *et al*., 2004b). Seaweed vitamins are important not only due to their biochemical functions and antioxidant activity but also due to other health benefits such as decreasing of blood pressure (vitamin C), prevention of cardiovascular diseases (β-carotene), or reducing the risk of cancer (vitamins E and C, carotenoids).

The mineral content of S. *asperum* is presented in table 4. Among the minerals Potassium 203.38 ± 0.021 mg, Sodium 145.50 ± 0.100 mg and Calcium 134.51 ± 0.010 mg are rich. Here the Na and K content is high but low in iron, which can help in balancing Na/K ratio diets and reduce hypertension risk as described in the studies of the red and brown seaweeds by Rupérez (2002). The sum of macro elements (Na+K+Ca+Mg in % D wt) in this study fall within the range already reported for seaweeds (Rupérez, 2002; Hong and Chen, 2007) and was higher when compared to land vegetables (USDA, 2001) ranging from 11.48 to 29.91. Similarly, the results of the present study are also consistent with reports by other authors: Ruperez and Saura-Calixto (2001); Selvaraju (2002); Khroemip Amgao (2006) and Rajasulochana *et al*., (2010). Mineral content varies according to seaweed species, oceanic residence time, geographical place of harvest, wave exposure, seasonal and annual environment physiological factors, type of processing and method of mineralization (Mabeau and Fleurence, 1993).

CONCLUSION

From the above results, it was observed that the experimental alga *S.asperum* are rich in protein content, polyunsaturated fatty acids, vitamin C, niacin, folic acid, vitamin E and macro mineral (i.e., Na, K, Ca and Mg) contents, which concluded that the seaweed *S.asperum* being used as food supplements to improve the nutritional value for the human diet and animal feed.

REFERENCES

[1]. AOAC. **1995**. Official methods of analysis, 16^{th} ed. Association of Official Analytical Chemists.
[2].Bligh, SE. G, W. J. Dyer. **1959**. *Can. J. Biochem. Physiol*. 37, 912- 917.
[3].Darcy-Vrillon, B., **1993**. *Int. J. Food Sci. Nutr.* 44: 23-35.
[4].Dhargalkar, V. K. **1979**. Biochemical studies on *Ulva reticulata* Forsskal. Proc. Int. Symp. Marine algae of Indian Ocean region, CSMCRI, Bhavnagar, 40.
[5].Dubois, M., K.A. Giles, J.K. Hamilton, P.A. Rebors and F. Smith, **1956**. *Analytical Chemistry*, 28: 350-356.
[6].Farias, W.R.L., Nazareth, R.A and Mourao, P.A.S. **2001**. *Thromb. Haemost.* 86: 1540-1546.
[7].Fleurence J. **1999**. *Trends in Food Science and Technology*. 10: 25-28
[8].Folch, J., M. Lees and G.H. Solane Stanley, **1956**. *J. Biological Chemistry*, 226: 497-509.
[9].Herbreteaeu, F., L.J.M. Coiffard, A. Derrien and Y. De Roeck-Holtzhauer, **1997**. *Botanica Marina*, 40: 25-27.
[10].Hong, J and Chen, C. **2007**. *Nanotechnology* 18:105–104.
[11].Indegaard M. and Minsaas J. **1991**. Animal and human nutrition. In: M.D. Guiry and G. Bluden (Eds.). Seaweed resources in Europe: uses and potential. Chichester, John Wiley and Sons. pp. 21-64.
[12].Khroemip Amgao, **2006**. Antiviral potential of two marine red algae. Doctoral Thesis. University of Madras.
[13].Mabeau S. and Fleurence J. **1993**. *Trends in Food Science and Technology*. 4: 103-107.
[14].Mabeau, S and Fleurence, J. **1993**. *Trends in Food Science and Technology* 4: 103-107.
[15].Mishra, V.K., F. Temelli, P.F. Ooraikul Shacklock and J.S. Craigie, **1993**. *Botanica Marina*, 36 (2): 169-174.
[16].Niller, S and Berger, T .**1985**. Bacteria identification by GC Hewlet Packard Application note oo. 228-241.
[17].Rajasulochana, P., Dhamotharan, R and Krishnamoorthy, P. **2010**. *J. Agri. Biol. Sci*. 5 (5): 1-12.
[18].Raymont, J.E.G., J. Austin and E. Lineford, **1964**. *J. Cans. Perm. Emplor. Mer*., 28: 354-363.
[19].Reeta, J., **1993**. *Seaweed Res. Utilin.*, 16: 13-16.
[20].Robledo, D. and Y.F. Pelegrin, **1997**. *Botanica Marina,* 45: 58-65.
[21].Roslin, S., **2003** *Seaweed Res. Utilin.*, 25: 77-86.
[22].Ruperez P. and Saura-Calixto F. **2001**. *European Journal of Food Research and Technology*. 212: 349-354.
[23].Rupérez, P. **2002**. *Food Chemistry.*79: 23-26.
[24].S¨ukran Dere, Nurhayat Dalkıran, Didem Karacaoˇglu, Gamze Yildiz, Egemen Dere. **2003**. *Oceanologia* 45(3), 453-471.
[25].Sanchez-Machado D.I., J. Lopez-Cervantes, J. Lopez-Hernandez and P. Paseiro-Losada. **2004a**. *Food Chemistry*. 85: 439-444.

[26].Sanchez-Machado, D.I., Lopez-Hernandez, J., PaseiroLosada, P and Lopez-Cervantes, J. **2004b**. *Biomed. Chromatogr*. 18: 183-190.
[27].Selvaraju, S. **2002**. An investigation on the bioactive principle of *Hypnea musciformis* (Wulf.) Lamouroux and *Laurencia obtusa* (Hudson) Lamouroux with respect to antimicrobial and biofertilizer properties. Doctoral Thesis. University of Madras.
[28].USDA. **2001**. Agricultural Research Service. Nutrient Database for Standard Reference, Release 14.