LIPID CONTENT OF SOME MARINE MACRO ALGAE FROM GULF OF MANNAR COASTAL REGIONS, INDIA

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ABSTRACT

The present study was carried out to determine the seasonal variation in Lipid content of 40 species of marine macro algae belonging to the classes viz., chlorophyceae, phaeophyceae and Rhodophyceae collected from the different stations in Gulf of mannar coastal region, India during April 2018 to March 2019. The percentage of lipid was maximum (5.3±0.62 % of DW) in *Ulva lactuca* in pre-monsoon season and minimum (0.03±0.01 % of DW) in *ulva intestinalis* during summer season. In summer season the percentage lipid content of seaweeds varied from 0.03±0.01 to 5.20±0.08 % of DW. The maximum values was observed in *Gracilaria verrucosa* and the minimum content was observed in *Ulva intestinalis*. The lipid content of seaweeds varied from 0.76±0.01 to 5.3±0.62 % of DW during pre-monsoon season. The maximum values was observed in *Ulva lactuca* and the minimum content was observed in Padina gymnospora. In monsoon season the lipid content of seaweeds varied from 0.29±0.01 to 4.72±0.61% of DW during monsoon season. The maximum values was observed in *Gracilaria corticata var. corticata* and the minimum content was observed in *Hypnea musciformis.* The lipid

content of seaweeds varied from 0.17±0.01 to 4.9±0.12 % of DW during post-monsoon season. The maximum values was observed in *Sargassum myriocystum* and the minimum content was observed in *Ulva intestinalis*.

Keywords: Marine Algae, Lipid, Gulf of Mannar, Seasonal Variations.

1. Introduction

Seaweeds are one of the most important marine resources of the world and being used as human food, animal food and raw material in seaweed based industries. Seaweeds are rich in minerals, proteins, carbohydrates, aminoacids, lipids, antibiotics, auxins, gibberellins and vitamins which enhance the yield and quality of crops, seed germination, enhance the yield and quality of crops, seed germination, resistance to frost, fungal and insect attacts. Seaweeds generally accumulate small quantities of fatty acids and lipids. A variety of pharmacological properties have been attributed to seaweeds which include the bioactive molecules. Lipids and fatty acids are constituents of all plant cells. Commercial importance of marine microalgae studied by V.S. Krishnamurthy et al., 2013. Studies on the biochemical constituents such as protein, carbohydrates and lipid in green and brown marine algae have been carried out from different parts of Indian coast Kaliaperumal et al., 1994; Ganesan and Kannan 1994; Selvaraj and Sivakumar, 1998). Studies on the chemical composition of seaweeds have shown that these are good sources of minerals, trace elements (Pillai, 1956; Manivannan et al; 2009, karthikadevi et. al., 2009; Anantharaman et al; 2010). Consumption of seaweeds can increase the intake of dietary fibre and (lower the occurrence of some chronic diseases (diabetes, obesity, heart diseases). Lipid extraction and production of biodiesel from marine diatom studied by Shailesh Upadhyay et al., 2016. The total lipid, protein, ash and individual fatty acid contents of edible seaweeds that had been canned (Saccorhiza Polyschides and Himanthalia elongata) or dried were determinal by Machado et al; (2004). Application of marine micro algae in agriculture studied by Venkataraman Kumar et al., 2015. The chemical composition (Protein, Carbohydrates, lipids, fiber, ash and nitrogen) of two seaweeds (Gracilaria Cervicomis and sargassum vulgare) from Northeast Brazil was investigated by Soriano et al; (2006) in order to evaluate their potential nutritive value. The exploitation of marine algae for nutritional purpose is primarily based on the bio-chemical constituents. Some of the marine macro algae have been reported to be good sources of carbohydrates, proteins, lipids, vitamins, minerals and fattyacids. An attempt was made to study the seasonal changes in the percentage composition of lipid contents of 40 species of marine macroalgae for one year from April 2018 to March 2019.

2. Materials and Method

Estimation of Lipid

The lipid was estimated by using chloroform methanol mixture as described by Folch et al., (1956). Dried powder sample of 0.100g was taken in a test tube and 5ml of Chloroform; Methanol (5:2) mixture was added. The mixture was incubated at room temperature for 24 hours after closing the mouth of the test tube with aluminum foil. After the incubation, the mixture was filtered using whatman No.1filter paper. The filtrate was collected in a weighed test tube, which was kept in an oven at 60^0c. The chloroform – methanol mixture was evaporated leaving a residue at the bottom of test tube. The test tube with the residue and the weight of the empty test tube were calculated to know the weight of the lipid present in the sample using the formula given below.

Percentage of lipid = $\frac{Amount\ of\ lipid\ in\ the\ sample}{Weight\ of\ sample} x100$

3. Result and Discussion

The samples of the 40 species of marine macro algae species were collected from the different stations (Pamban, Mandapam, Seeniappa Dargha, Kilakarai, Ervadi, Valinokkam, Tharuvikulam and Tuticorin) of same seasons were pooled together species wise to meet the required quantity seaweed for biochemical analysis for four season (summer, pre-monsoon, monsoon, post-monsoon) during the period April 2018 to March 2019. Seasonal Variation in lipid content are presented in Table – 1 and Fig – 1. The percentage of lipid was maximum (5.3$\pm$0.62 % of DW) in *Ulva lactuca* in pre-monsoon season and minimum (0.03$\pm$0.01 % of DW) in *ulva intestinalis* during summer season. In summer season the percentage lipid content of seaweeds varied from 0.03$\pm$0.01 to 5.20$\pm$0.08 % of DW. The maximum values was observed in *Gracilaria verrucosa* and the minimum content was observed in *Ulva intestinalis*. The lipid content of seaweeds varied from 0.76$\pm$0.01 to 5.3$\pm$0.62 % of DW during pre-monsoon season. The maximum values was observed in *Ulva lactuca* and the minimum content was observed in Padina gymnospora. In monsoon season the lipid content of seaweeds varied from 0.29$\pm$0.01 to 4.72$\pm$0.61% of DW during monsoon season. The maximum values was observed in *Gracilaria corticata var. corticata* and the minimum content was observed in *Hypnea* *musciformis.* The lipid content of seaweeds varied from 0.17±0.01 to 4.9±0.12 % of DW during post-monsoon season. The maximum values was observed in *Sargassum myriocystum* and the minimum content was observed in *Ulva intestinalis*.

Lipids are very wide spread in nature among all vegetables and animal matter and serves as a storage material in living organisms. Oxidation of lipid produces more energy. Fat contents of seaweeds were recorded within the range of 1-6g/100g DW with high concentrations of long-chain polyunsaturated fatty acids (Darcy – Vrillon, 1993; Ortiz et al, 2006). The percentage of lipid was maximum (5.3±0.62 % of DW) in *Ulva lactuca* in pre-monsoon season and minimum (0.03±0.01 % of DW) in Enteromorpha intestinalis during summer season (Table - 1 and Figure-1). The result obtained is slightly similar with the earlier works from Mandapam coast by Manivannan et al. (2008) in his studied the lipid content varied from 1.33±0.20 to 4.6±0.17 which is similar to the present investigation. In a contradictory Rameshkumar et al.(2013) observed maximum lipid content upto 19.1% in *Caulerpa racemosa* which is four times higher than the present investigation. Carmona et al. (2009) studies the lipid content (0.64±0.02 %) in *Eisenia arborea* which is similar to when compared to present investigation. McDermid and Stuercke (2003) also recorded maximum lipid content (20.2±0.01 %) which is also four times higher than that of the present study.

Lipids represent only 1-5% agal dry matter and show an interesting poly unsaturated fatty acid composition particularly regarding with omega 3 and omega 6 acids which play a role in the prevention of cardio-vascular diseases, osteoarthritis and diabetes. The green algae show interesting levels of alpha linolenic acid (w3c18:3) The red and brown algae are particularly rich in fatty acids with 20 carbon atoms; eicosapentanoic acid (EPA, W3 C20:5) and arachidonic acid (AA, w6 C20:4) Lipidic extracts of some edible seaweeds showed antioxidant activity and synergistic effect with the tocopherol.

In comparison to other chemical constituents, lipid content was in very low quantity; because of seaweed usually accumulate smaller quantities of fatty acids and lipids. Lipids provide much more energy in oxidation processes than other biological oxidation (Meenakshi et al; 2010)

Figure -1

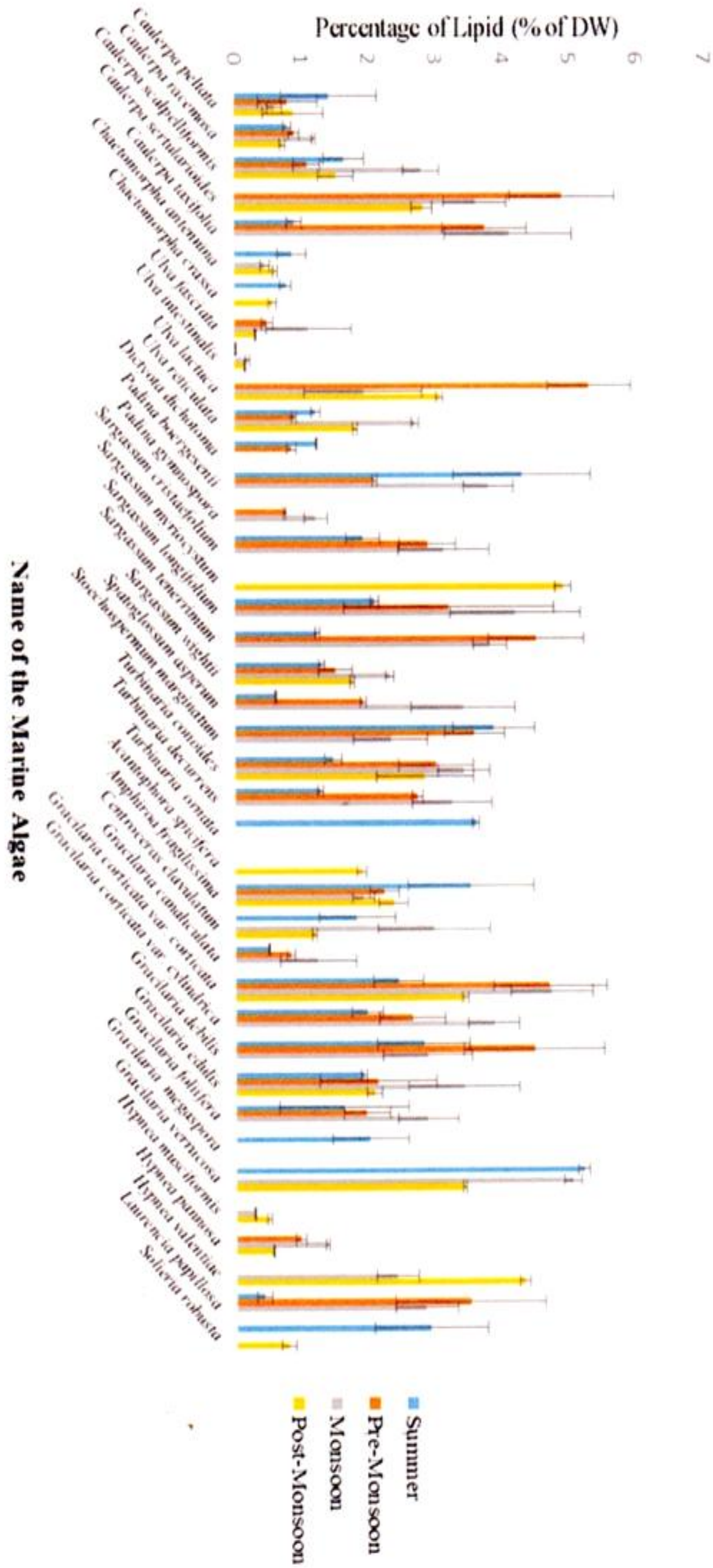
Percentage of Lipid (% of DW)
0
1
2
3
4
5
6
7
Name of the Marine Algae
Summer
Pre-Monsoon
Monsoon
Post-Monsoon

Table-1

Percentage lipid content of marine algae studied in Gulf of Mannar region during April 2018 to March 2019 (% of DW)

S.No	Name of the Species	Summer	Pre-Monsoon	Monsoon	Post-Monson
	Chlorophyceae				
1.	Caulerpa peltata	1.42±0.71	0.81±0.44	0.61±0.11	0.89±0.45
2.	Caulerpa racemosa	0.8±0.06	0.9±0.08	1.2±0.02	0.73±0.04
3.	Caulerpa scalpelliformis	1.65±0.3	1.1±0.2	2.8±0.26	1.52±0.27
4.	Caulerpa sertularioides	-	4.9±0.78	3.6 ±0.47	2.81±0.16
5.	Caulerpa taxifolia	0.9±0.11	3.75±0.63	4.1±0.95	-
6.	Chaetomorpha antennina	0.87±0.21	-	0.46±0.07	0.62±0.03
7.	Chaetomorpha crassa	0.78±0.09	-	-	0.58±0.06
8.	Ulva fasciata	-	0.5±0.08	1.12±0.64	0.32±0.01
9.	Ulva intestinalis	0.03±0.01	-	0.21±0.03	0.17±0.01
10.	Ulva lactuca	-	5.3 ±0.62	1.93±0.88	3.07±0.05
11.	Ulva reticulata	1.22±0.07	0.9±0.03	2.7±0.05	1.81 ±0.03
	Phaeophyceae				
12.	Dictyota dichotoma	1.23±0.01	0.86±0.07	-	-
13.	Padina boergesenii	4.3±1.02	2.1±0.04	3.8±0.37	-
14.	Padina gymnospora	-	0.76±0.01	1.22±0.17	-
15.	Sargassum cristaefolium	1.92±0.25	2.89±0.42	3.12±0.68	-
16.	Sargassum myriocystum	-	-	-	4.9±0.12
17.	Sargassum longifolium	2.1±0.06	3.2±1.57	4.19±0.97	-
18.	Sargassum tenerrimum	1.24±0.03	4.5±0.71	3.81±0.25	-
19.	Sargassum wightii	1.3±0.04	1.5±0.25	2.31±0.06	1.76±0.03
20.	Spatoglossum asperum	0.61±0.01	1.92±0.04	3.41±0.78	-

21.	Stoechospermum marginatum	3.86±0.61	3.58±0.45	2.33±0.55	-
22.	Turbinaria conoides	1.47±0.13	3.00±0.56	3.42±0.39	2.84±0.72
23.	Turbinaria decurrens	1.28±0.04	2.73±0.08	3.25±0.59	
24	Turbinaria ornate	3.6±0.05	-`	-	
	Rhodophyceae				
25.	Acantophora spicifera	-	-	1.72±0.03	1.90±0.07
26.	Amphiroa fragilissima	3.52 ±0.94	2.23±0.21	1.92±0.16	2.37 ±0.22
27.	Centroceras clavulatum	1.82±0.57	-	2.97±0.83	1.19 ±0.03
28.	Gracilaria canaliculata	0.51±0.01	0.83±0.06	1.24±0.57	-
29.	Gracilaria corticata var. corticata	2.43±0.37	4.7±0.84	4.72±0.61	3.44 ±0.04
30.	Gracilaria corticata var. cylindrical	1.97±0.23	2.64±0.49	3.86±0.38	-
31.	Gracilaria debilis	2.81±0.69	4.46±1.05	2.87±0.66	-
32.	Gracilaria edulis	1.92±0.04	2.13±0.87	3.41±0.83	2.07±0.11
33.	Gracilaria foliifera	1.62±0.96	1.96±0.34	2.87±0.66	-
34.	Gracilaria megaspore	2.01±0.57	-	-	-
35.	Gracilaria verrucosa	5.20±0.08	-	5.03±0.13	3.42±0.03
36.	Hypnea musciformis	-	-	0.29±0.01	0.5±0.04
37.	Hypnea pannosa	-	0.97±0.08	1.37 ±0.03	0.56±0.01
38.	Hypnea valentiae	-	-	2.41±0.31	4.31±0.08
39.	Laurencia papillosa	0.42±0.11	3.5±1.12	2.84±0.47	-
40.	Solieria robusta	2.91 ±0.84	-	-	0.78±0.11

4. Conclusion

Percentage of lipid was recorded maximum (5.3±0.62 % of DW) in Ulva lactuca in pre-monsoon season and minimum (0.03±0.01 % of DW) in Ulva intestinalis during summer season. The lipid content was very negligible in most of the seaweeds and the seaweeds mostly accumulate the smaller quantities of fatty acids and lipids. This could perhaps be attributed to the habitat growth, development of reproductive structure and physiology of the thallus.

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