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Bio accumulation of organic compounds by seaweeds from seawater polluted by industrial effluents at veraval, Gujarat coast

Abstract

Seaweeds are used as food and feed in many parts of the world. Seaweeds are very good bioaccumulator of organic compounds. Seaweeds are primary producers and rich in carbohydrates (50 – 60 % on dry weight basis) and contain high percentage of minerals (sometime as much as 30 %) and vitamins. Seaweeds are easily collected in abundance at many coastal localities and readily accumulate compound present within the waters of their environment. Veraval located at Lat.21° 35'N; Long 69° 36'E. The coast is famous for seaweeds diversity (Chloropyceae-21 species, Pheophyceae-14 species, Rhodophyceae-32 species, Ilza unpublished). The coastal water of Veraval is polluted by discharge of two industries effluents, 1. Chemical industry effluent & 2. Fish processing industry effluents. Fish processing industry effluent is eutrophic in nature while Chemical industry effluent is toxic. The distance between two industries is about 10 km and located at opposite direction to each other. Seaweeds collected from different distance of discharge point.

The present investigations were carried out at Veraval situated at Lat.21° 35'N; Long.69° 36'E. It is one of the important port cities located along the western coast of Gujarat in India. The effluents generated by both industries are discharged in the sea. Protein, carbohydrate and lipid content due to impact of discharge of these two industries. It was observed that protein, carbohydrate and lipid content in *Enteromorpha compressa*, *Sargassum tenerrimum* and *Gracilaria corticata* where high near discharge of Fish processing industry effluent in these seaweeds. The causative factor responsible for high organic content is discussed in this paper.

Keywords: Chemical industry, Fish processing industry, Seaweeds

Introduction

All marine pollution must originate from one or the two sources, either the land or the sea. Of course, marine pollution is defined as a human activity and humans are land inhabitants and so it might be scientifically correct to assert a land base origin for all marine pollution. The coastal areas are under pressure since they have become an ultimate dumping place for all the treated and untreated wastes from surrounding areas. Gujarat has longest seashore in India. Veraval is one of the important ports located along the western coast of Gujarat. There are some huge industrial units are located near the Veraval coast like, Chemical industries, Fisheries industries etc. The untreated effluent of these industries and factories is directly discharged into the harbor and the nearby coast is causing pollution in the aquatic environment of area. The main activities performed at Veraval coast, includes fish processing and export of fish that provide significant source of economy to its residents. Seaweeds are important source of food as they are rich in micronutrients and vitamins (Araski nad Araski ; 1983). The nutritional value of seaweeds may be affected considerably by the impact of industrial effluents. The effect of industrial effluent on the macro algae has been studied in various part of the world (Golubic, 1968; NielandBuda, 1976; Hellenbrand, 1978; Tewari and Joshi, 1988). The effect of such effluent on the growth and biochemical composition of seaweeds have also been studied (Hang et al 1974; Bohm, 1979; Wong et al 1979; Sivalings, 1980).

These studies were confined mostly to the laboratory with analytical studies on selected species of seaweeds. The present study was carried out to find effect of industrial effluent on algae.

Materials and Methods

The present study was carried out at Veraval region of Gujarat by collecting marine algae from various sites of two industries. The seaweeds were washed with sea water and rinsed with fresh water. Epiphytes were removed and the seaweeds were dried on plastic sheets under open air condition of the coast. The algal materials were kept at 60° in oven. Now power was made by mixture of oven dried algal material and then used for biochemical analysis.

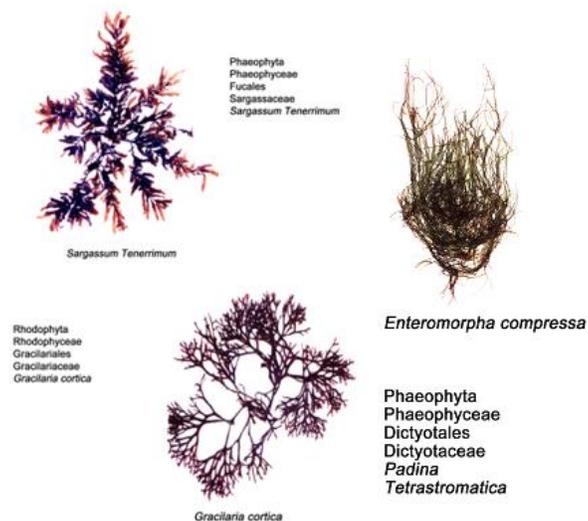
- Carbohydrate was determined by Phenol sulphuric acid method (Kochart, 1978)
- Protein was determined by Folin Lowry's (1951)
- Lipid was determined by Folch et al. (1957)



Reference Locality exposed during Low Tide



Seaweed flora at Reference Locality



Result and Discussion

The effect of the effluent on the organic constituents of the *Enteromorpha compressa*, *Sargassum tenerrimum* and *Gracilaria corticata* are shown in graph. The carbohydrate, protein and Lipid concentration was more or less unaffected due to impact of tide or increase in distance from the both industries discharge point with compare to Reference locality site (Pollution free site) However, a considerable difference was observed. The concentration of Carbohydrate, Protein and Lipid were lowest at Chemical industry discharge point and increasing at 400 m away from discharge point. There was increase in concentration of carbohydrates, protein and lipid in the seawater away from the Chemical discharge point. This suggests that Carbon and Nitrogen metabolism in these three species are inhibited near the discharge of Chemical industry effluent. The effect of Chemical Industry effluent on some of the organic constituents of *Enteromorpha compressa*, *Sargassum tenerrimum* and *Gracilaria corticata* are shown in graph. The least growth was observed near outfall.

The concentration of Carbohydrate, Protein and Lipid were highest at Fish processing industry discharge point and decreasing at 400 m away from discharge point. There was increase in concentration of Carbohydrate, Protein and Lipid near the discharge point of Fish processing industry it can be considered as an organic and inorganic nutrient, mainly nitrogen and phosphorus, complex waste. However, excessive amount of wastes in the water create biological, aesthetic or recreational problems. Excess plant growth and biomass production in response to added nutrients is termed eutrophication. The water body affected is said to be eutrophic or hypertrophic (Gerlach, 1982). In the present study Fish processing industry effluent was growth stimulatory.

Nutrients are major limiting factor for seaweeds growth and distribution. All algae require essential nutrients. Most of species appear to have been eradicated from the study site due to the long term effect of industrial effluent discharge Disappearance of seaweeds due to long term pollution has also been reported by Munda (1980) and Hirose (1978). However, the above workers have clearly shown that differences in biomass are primarily due to pollutants and the effects of their parameters are secondary in nature.

PROTEIN in (% Dry weight)

CHEMICAL INDUSTRY

	A	B	C
Reference locality	19	11.5	3.31
0 Meter	17.04	7.5	1.92
400 Meter	18.98	10.94	3

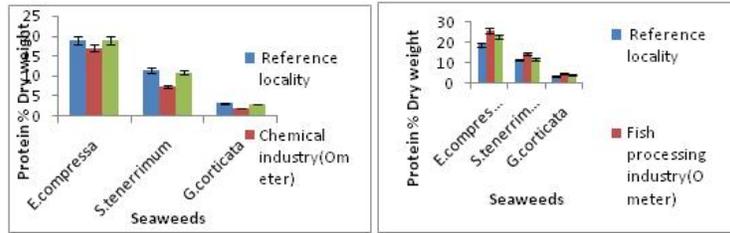
FISH PROCESSING INDUSTRY

	A	B	C
Reference locality	19	11.5	3.31
0 Meter	25.98	14.58	5.02
400 Meter	23.02	11.96	4

A:- *Enteromorpha compressa*

B:- *Sargassum tenerrimum*

C:- *Gracilaria corticata*



CARBOHYDRATE in (% Dry weight)

CHEMICAL INDUSTRY

	A	B	C
Reference locality	44.4	30.5	9.66
0 Meter	37.8	23.47	7.88
400 Meter	42	28.64	8.22

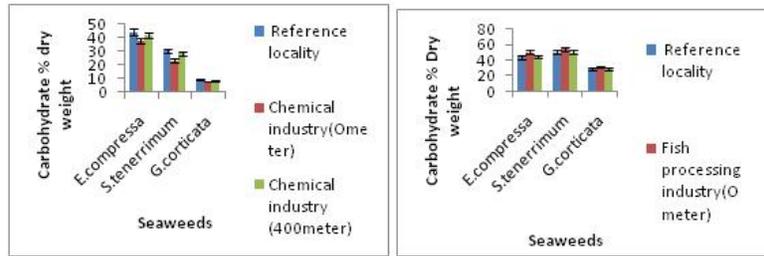
FISH PROCESSING INDUSTRY

	A	B	C
Reference locality	44.4	30.5	9.66
0 Meter	50.26	33.89	10.87
400 Meter	44.5	30.76	9.32

A:- *Enteromorpha compressa*

B:- *Sargassum tenerrium*

C:- *Gracilaria corticata*



LIPID in (% Dry weight)

CHEMICAL INDUSTRY

	A	B	C
Reference locality	0.4	0.3	0.45
0 Meter	0	0	0.02
400 Meter	0.29	2.02	0.35

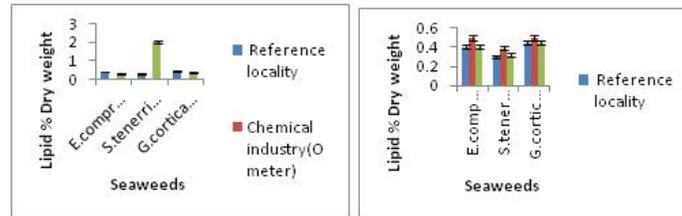
FISH PROCESSING INDUSTRY

	A	B	C
Reference locality	19	11.5	3.31
0 Meter	0.5	0.39	0.5
400 Meter	0.4	0.32	0.45

A :- *Enteromorpha compressa*

B :- *Sargassum tenerrium*

C :- *Gracilaria corticata*



Conclusion

- The study was carried out at veraval (Lat. 21°35' N: Long 69° 36'E) On Gujarat coast.
- Biochemical composition of three seaweeds, e.g., *Enteromorpha compressa*, *Sargassum tenerrium* and *Gracilaria corticata* were determined.
- The concentration of organic content is low in seaweeds near effluent discharge point of Chemical industry. However, the concentration of organic content in seaweeds at 400m distance from effluent discharge point was almost equal to that at reference locality.
- The concentration of organic content is high in seaweeds near effluent discharge point of fish processing industry. However, the concentration of organic content in seaweeds at 400m distance from effluent discharge point was almost equal to that at reference locality.
- This suggests that Carbon and Nitrogen metabolism in these species are inhibited near the discharge of Chemical industry effluent was growth stimulatory it indicated water is eutrophic in nature.

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