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Bio Accumulation Capacity of Some Sea Weeds from Thoothukudi Coast, Tamil Nadu, India

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Abstract: Seaweeds have great potential as biological monitors of metal contamination in aquatic environments because of their ability to concentrate metal from dilute aqueous solutions. As indicators of metal contamination, marine algae gather a number of advantages over water or sediment analysis while satisfying many basic requirements for a suitable biological indicator. Accumulation of cadmium, copper and mercury were determined in algal species *(U. lactuca, S. wightii, P. tetrastromatica)* collected from Tuticorin coast. The concentration of the heavy metals is significantly varied significantly in between among different species and also in different locations. The results showed that the accumulation of heavy metals were below the permissible levels and this coastal biotope is still suitable for the luxurious growth of seaweeds which are indicators of pollution.

Key words: Pollution · Heavy metal · Biological monitors

INTRODUCTION

The heavy metals have been recognized as one of the major pollutants of the aquatic environments. Metals are being termed as conservative pollutants because once added to the environment they prevail forever. The production of heavy metals has increased rapidly since the industrial revolution [1]. Algae in metal contaminated localities tend to concentrate metals from ambient waters and pass them on to higher trophic levels [2]. The variations in the concentrations of metals in algae often are taken to reflect the metal concentration in the surrounding water. Keeping in view the importance of seaweeds as indicators of pollution the present study has been carried out on the bioaccumulation capacity of different species of seaweeds from four different locations of Tuticorin coast, TamilNadu, India.

MATERIALS AND METHODS

Study Area and Sampling Stations: [Plate1 & 2] Tuticorin is an important seaport in Tamil Nadu with an extensive coastal area of about 600Kms including the various islands around situated in the Gulf of Mannar. The study areas are:

Manapad: Which is about 80Kms from Tuticorin characterized by variety of substrata.

Tharuvaikulam: Sandy shore which is about 15kms from Tuticorin.

Harbour: 9kms away from Tuticorin this has a sandy substrata.

The Hare Island: About 12 kms away from Tuticorin with about 58.85 hectares of land area characterized by variety of substrata.

Sampling Procedure: After handpicking the seaweeds (two species of Phaeophyceae and one speices of Chlorophyceae) were collected from the study areas cleaned with seawater and were taken to the laboratory in polythene bags. They were washed thoroughly in freshwater three to four times to remove the associated fauna, then dried in shade and powdered using electric grinder.

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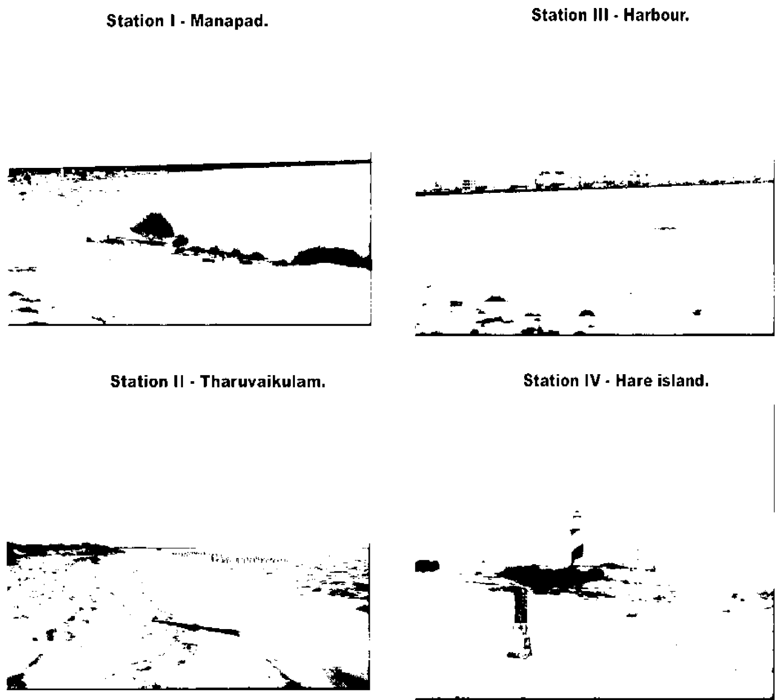

Plate 1:

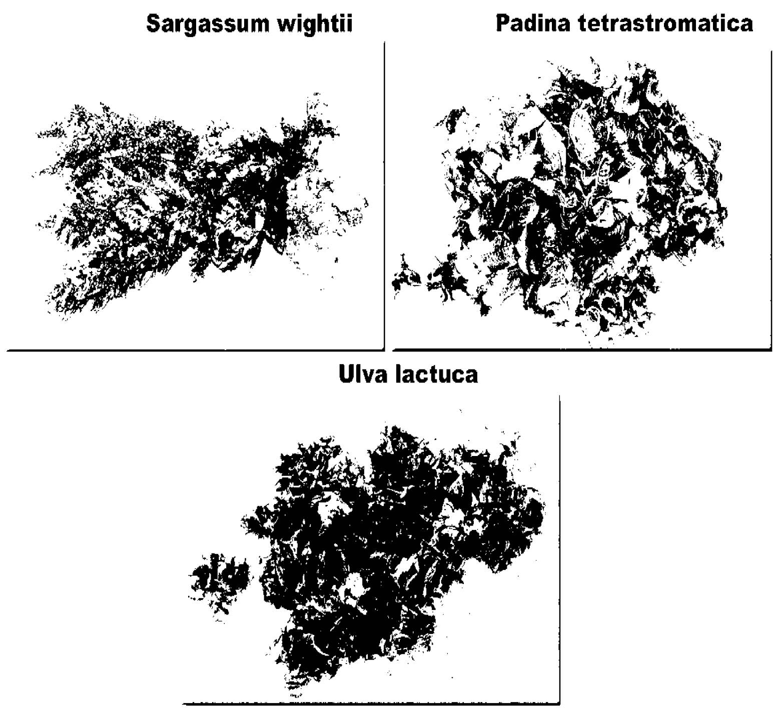

Plate 2:

Analysis of Copper and Cadmium: Digestion of samples: The samples were subjected to acid digestion following the method of FAO [3]. Total copper and cadmium were estimated by using Atomic absorption spectrophotometer (GBC Avanta ver 2.02) The instrument was caliberated using standards.

Analysis of Mercury: The mercury content in seaweeds was determined by using mercury analyzer (ModelMA 5800A).

Table 1: Bimonthly (February) Variation Of Cu (μg/G) In The Different Species Of Seaweeds Collected In Four Different Stations.

	Station - I		Station - II		Station - III		Station - IV	
Name of the sps.	15	30	15	30	15	30	15	30
Sargassum	0.714	3.99	0.36	0.424	0.962	0.348	0.634	0.608
Ulva	0.218	0.109	0.65	0.004	1.176	0.628	0.692	0.866

Bimonthly (March) Variation Of Cu (μg/G) In The Different Species Of Seaweeds Collected In Four Different Stations

	Station - I		Station - II		Station - III		Station - IV	
Name of the sps.	15	30	15	30	15	30	15	30
Sargassum	0.224	0.22	0.226	0.184	0.386	0.634	0.204	0.128
Ulva	0.344	1.56	0.588	0.554	0.77	0.736	0.402	0.682
Padina	0.320	0.161	0.294	0.227	0.832	1.890	0.740	0.280

Bimonthly (April) Variation Of Cu (μg/G) In The Different Species Of Seaweeds Collected In Four Different Stations

	Station - I		Station - II		Station - III		Station - IV	
Name of the sps.	15	30	15	30	15	30	15	30
Sargassum	0.232	0.170	0.224	0.386	0.298	0.228	0.336	0.234
Ulva	0.184	0.278	0.382	0.372	0.452	0.748	0.21	0.306
Padina	0.386	0.904	0.434	2.972	1.866	0.386	0.752	0.200

Table 2: Bimonthly (February) Variation Of Cd (μg/G) In The Different Species Of Seaweeds Collected In Four Different Stations

	Station - I		Station - II		Station - III		Station - IV	
Name of the sps.	15	30	15	30	15	30	15	30
Sargassum	0.442	0.258	0.392	0.246	0.352	0.244	0.358	0.282
Ulva	0.304	0.288	0.308	0.276	0.276	0.284	0.292	0.366

Bimonthly (March) Variation Of Cd (μg/G) In The Different Species Of Seaweeds Collected In Four Different Seasons

	Station - I		Station - II		Station - III		Station - IV	
Name of the sps.	15	30	15	30	15	30	15	30
Sargassum	0.364	0.322	0.326	0.358	0.392	0.314	0.402	0.334
Ulva	0.400	0.314	0.382	0.276	0.336	0.298	0.308	0.272
Padina	0.410	0.296	0.428	0.274	0.456	0.316	0.442	0.312

Bimonthly (April) Variation Of Cd (μg/G) In The Different Species Of Seaweeds Collected In Four Different Stations

	Station - I		Station - II		Station - III		Station - IV	
Name of the sps.	15	30	15	30	15	30	15	30
Sargassum	0.31	0.366	0.356	0.356	0.374	0.332	0.386	0.322
Ulva	0.4	0.206	0.358	0.276	0.398	0.238	0.382	0.274
Padina	0.442	0.350	0.482	0.332	0.440	0.38	0.444	0.308

Table 3: Variation Of Mercury (μg/100g) In Sargassum Collected In Four Different Station During The Experimental Period

Name of the sps.	Month	Station - I	Station - II	Station - III	Station - IV
Sargassum	January	18.42	12.49	19.83	19.95
	February	15.96	12.93	17.45	16.5
	March	19.89	25.98	10.97	25.98

RESULTS

The seasonal variation of three heavy metals (Cu, Cd and Hg) in the different species of sea weeds selected are presented in the Tables 1, 2 and 3.

Bimonthly (February) variation of Cu in *S.wightii* showed the maximum concentration of 3.99 μg/g (Station I) against the minimum of 0.34 μg/g. (Station III). *U. lactuca* showed the maximum concentration (1.176 μg/g) of Cu at Station III and minimum (0.004μg/g) at

Station II. The maximum concentration of Cu (Bimonthly) in March among the three different algal species was found in the following ascending order.

S. wightii < U.lactuca < P. tetrastromatica

In the month of April, among the three species of seaweeds *S.wightii* showed the maximum concentration of 0.386 μg/g (Station II) against a minimum of 0.17 μg/g. (Station I) *U. lactuca* showed the maximum of 0.748μg/g in Station III against a minimum of 0.184 μg/g in Station I. The concentration of Cu in *P. tetrastromatica* ranged from 0.20μg/g (Station IV) to 2.972 μg/g (Station II).

The concentration of Cd in the different species of seaweeds collected in four different stations are shown in the Table 2.

The concentration of Cd in (February) *S. wightii* and *U. lactuca* did not show much variation. In March the concentration of Cd ranged from 0.314μg/g (Station III) to 0.402 μg/g (Station IV) in *S. wightii* and 0.272μg/g (Station IV) to 0.40μg/g (Station I) in U.lactuca and 0.274μg/g (Station II) to 0.456μg/g (Station III) in *P. tetrastromatica*. In April not much variation was noticed in the concentration of Cd content in *Sargassum* species. *U.lactuca* recorded a maximum concentration of 0.4 μg/g (Station I, I phase) and a minimum of 0.206 μg/g. (Station I, II phase). The Cd content of *Padina* in the four different stations could be arranged in the following descending order.

Station I > Station II > Station II > Station IV

The concentrations of mercury in *S. wightii* collected in four different stations are shown in Table -3. Maximum concentration of 19.95 μg/100g was observed in Station IV against the minimum of 12.49 μg/100g in Station II during February. The mercury content (March) in the four different stations could be arranged in the following order.

Station III > Station IV > Station I > Station II

The concentration of mercury during April varied from 10.97 μg/100g (Station III) to 25.98 μg/100g (Station II).

DISCUSSION

Study on the concentration of heavy metals on a particular alga at different stations recorded different values in this present study. This could be attributed to the fact that the most important factor that determine the biological availability of a metal is its physico-chemical state [4]. Heavy metals are known to distrupt the physiological processes in all groups of algae [5] even at low concentration.

Copper is an essential micronutrients but at toxic levels it depresses growth, pigment content, photosynthesis and respiration states. (Table 1). A total loss of lipid bodies could be used as a good indicator of Cu toxicity. [6,7]. Their loss from the cell could be due to excess binding with copper leading to their dissolution. In the present investigation Cu was not detected in large amounts and it is almost in the same concentration in two species except *Padina.*

Satya and Balakrishnan [8] have reported that Cadmium even at very low concentration can cause physiological disturbance like variation in protein, carbohydrate and pigment concentration. In the present study the Cd content was more in *P.tetrastromatica* during post monsoon season and low in *U.lactuca* during summer season.

Macroalgae can be used as indicators of metal pollution because their metal contents are directly related to the metal concentrations in the water [9]. The contamination of coastal sea water by mercury from chloralkali plant effluent was reported by Seritti *et al*, [10]. Different species of seaweeds have been reported to accumulate mercury from sea water polluted by industrial effluents. Reports are also available on the influence of effluents from the Chloralkali industry on the growth and nutritive value of seaweeds [11]. Velayutham [12] studied the levels of mercury in *Sargassum* species collected from Tuticorin, Tiruchendur and Koothankuzhi coastal areas. In the present study the mercury content was observed in *S.wightii* during post monsoon but it was well below the maximum permissible limit prescribed for sea foods for human consumption 0.4-1ppm fresh weight in various countries. [13,14].

Different species of algae revealed considerable differences in metal concentrations, even when taken from the sampling site [4]. Similar differences were observed in this study of green and brown algae and this might be regarded as species dependent variations with respect to heavy metal incorporation.

Bioaccumulation of the elements in seaweeds depends on the habitat proximity to heavily populated or industrial area, surrounding seawater, geographical area, age of the plant and the period of collection. [15]. The present study is in conformity with the observations of the above in the fact that the same species showed fluctuating values in their metal content.

CONCLUSION

In conclusion, the results showed that the accumulation of heavy metals were well below the permissible levels and also proved that in spite of pollution threat looming large in this coastal biotope the extent of damage is not very alarming and is still suitable for the luxurious growth of seaweeds which are indicators of pollution.

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