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Distribution of Iodine in Egyptian Marine Algae

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ABSTRACT. Thirty-two species of Egyptian marine algae of Chlorophycophyta, Phaeophycophyta and Rhodophycophyta collected from the Mediterranean (17 spp.) and Red (15 spp.) Seas has been analyzed for their content of iodine.

Distribution of iodine in Egyptian marine algae showed noticeable local differences. The highest values were obtained in the species collected from the Mediterranean Sea.

Iodine contents of the investigated species exhibited significant differences according to the species and showed characteristics in relation to the division. Much higher levels of iodine were observed in brown species than in red and green species. Iodine contents in the red species were of moderate levels.

Dictyota dichotoma, D. divaricata, Dilophus fasciola and *Gelidium latifolium* were found to have considerably higher levels of iodine indicating that these species, rather than the others are potentially a better source of iodine.

Iodine was accumulated selectively by various organs of *Sargassum salicifolium* and *S. subrepandum*. Generally speaking, the leaves of two species of *Sargassum* had higher content of iodine that did the stipes. In contrast, *Turbinaria triquetra* exhibited no well marked differences in iodine levels between leaves and stipes.

Seasonal variations in iodine content were determined for the red alga *Gelidium latifolium* and brown alga *Sargassum salicifolium*. In *G. latifolium* there were well marked maximum and minimum contents of iodine. The iodine level of *S. salicifolium* showed little variation with season of the year.

Introduction

According to Vernadsky (1954), the biosphere is permeated with atoms of dispersed

After elimination of epiphytes and stones, the algal samples were thoroughly washed with running water and rinsed many times in distilled water. The samples were then dried in an oven at 105°C. Dried samples were ground and stored in stoppered bottles at room temperature.

Estimation of Iodine

Iodine was estimated by wet ash method of Borst Pauwels and Van Wesemael (1962). Wet ashing is, in general, the best approach for determination of iodine in most media in which it is difficult to determine iodine without destruction or at least partial destruction (Zak, 1978).

In this method, 200 mg of oven-dried algal sample is transferred to a 50-ml flask. 7.5 ml Neumann acid (sulfuric acid-nitric acid, 1:1) and 1 ml perchloric acid is then added. The mixture is heated on a hot plate for 1 hr at 160-190°C, and the temperature then raised to 275°C until the solution turns yellow. The digest is cooled and diluted (dilution solution, 3.0 N sulfuric acid) to 40 ml, and 1 ml arsenite solution is then added (in sequence, 9.8 arsenious oxide is dissolved in 14 ml 10 N sodium hydroxide, 600 ml water added and the solution is neutralised with 10 N sulfuric acid, – 42 ml concentrated sulfuric acid added and diluted to 1 liter). The solution is allowed to stand at room temperature for one to two days and 5 ml aliquots placed in colorimeter tubes containing 0.4 ml arsenite solution. The equilibrium mixture is then incubated in a 30°C water bath, and 1 ml ceric ammonium sulfate solution added (5 g ceric ammonium sulfate dissolved in 70 ml 5 N sulfuric acid by heating gently, then filtered and diluted to 100 ml with distilled water. 25 ml diluted to 100 ml with 3.5 N sulfuric acid) to each tube and the absorbance measured at 420 nm at 30 sec and 20 min.

The iodine concentration is then determined against a standard calibration curve using standards carried through the same procedure in amounts of 0-0.5 ml of the standard iodate solution (1 mg as iodide per litre of water). Absorbance is measured using spectronic 20 D, Milton roy company spectrophotometer.

Results

Iodine contents of Egyptian marine algae from the Mediterranean and Red Seas are given in Tables 1 and 2 respectively.

As shown in Table 1, the concentrations of iodine in green species of the Mediterranean Sea were quite different and ranged between 0.004 and 0.070% of dry weight. All species of order Ulvales examined here contained high amounts of iodine. The highest amount of it was found in *Ulva lactuca* (0.070%). In this connection, we should mention that no obvious differences in iodine concentrations could be distinguished in samples of *Ulva rigida* taken from different locations. In general, a lower iodine content was measured in *Cladophora dalmatica.*

The levels of iodine in the brown algae taken from the Mediterranean coast varied between 0.080 and 0.290%. In general, the brown species had high iodine content as

served in *Caulerpa serrulata*. It is interesting to notice that level of iodine in members of order Ulvales here were much lower than that reported for members of Ulvales taken from the Mediterranean coast (Tables 1 & 2).

TABLE. 2. Concentrations of iodine (% of dry wt) in marine algae of the Red Sea. Data are means of 3 replicates.

Algal species	Site of collection	Concentration (%)
Chlorophycophyta		
Enteromorpha clathrata (Roth) Grev.	Ghardaka	0.0045
Ulva lactuca L.	Ghardaka	0.0057
Caulerpa serrulata (Forsk.) Borg.	Abu Shaar	0.0230
Halimeda opuntia (L.) Lamour.	Safaga	0.0191
Cladophora heteronema (C. Ag.) Kütz	Safaga	0.0060
Phaeophycophyta		
Dictyota divaricata Lamour.	Ghardka	0.203
Padina boryana Thivy	Safaga	0.079
Hydroclathrus clathratus (C. Ag.) Howe	Ghardaka	0.069
Hormophysa triquetra (C. Ag.) Kütz.	Ghardaka	0.076
Turbinaria triquetra (J. Ag) Ag.	Ghardaka	0.084
Sargassum subrepandum (Forsk.) C. Ag.	Safaga	0.127
Rhodophycophyta		
Actanthophora najadiformis (Delile) Papenfuss	Sharm El Naga	0.053
Digenea simplex (Wulfen) C. Ag.	Ghardaka	0.116
Laurencia obtusa (Huds.) Lamour.	Safaga	0.017
Hypnea musciformis (Wulfen) Lamour.	Safaga	0.032

Statistical analysis showed that no standard deviation exceeded 10%

The results listed in Table 2 indicated that iodine content of the brown species ranged from 0.069% to 0.203%. *Dictyota divaricata* and *Sargassum subrepandum* were characterized by having high amount of iodine (0.203 and 0.127% respectively). As shown in species from the Mediterranean Sea, the brown species of Red Sea had much higher amounts of iodine than red and green species.

As regard to red species, the level of iodine varied between 0.017 and 0.053% in all species except in *Digenea simplex* where it was found in comparatively large amount (0.116%).

Comparison of Leaf and Stipe

Iodine concentrations in different parts of *Sargassum salicifolium, S. subrepandum* and *Turbinaria triquetra* are compared in Table 3.

A comparison of iodine amounts in different parts of the two species of *Sargassum* showed higher values in the leaves compared to stipes. In other studies, leaves had

tained by Young and Langille (1958), Koppanna and Rao (1962) and Khalil and El Tawil (1982). These results contrast with those reported for seaweeds of Goa region of India by Solimabi (1977) who found that lower iodine contents were observed in the brown algae than in the red and green algae. Solimabi used caustic potash method for determination of iodine.

Dictyota dichotoma, D. divaricata, Dilophus fasciola and *Gelidium latifolium* were found to have considerably higher levels of iodine, indicating that these species, rather than other species, are potentially a better source of iodine. In this connection, it may be mentioned that moderate amounts of iodine were notable in *Cystoseira barbata, Sargassum subrepandum, Colpomenia sinuosa, Digenea simplex* and *Hypnea musciformis*. This finding is in general agreement with that of Khalil and El Tawil (1982).

The results summarized in Table 5 indicated that percentage of iodine varied greatly from site to site. With regard to the Chlorophycophyta and Rhodophycophyta species, the iodine concentrations in the species from the Mediterranean Sea tended to be much higher than in the species from the Red Sea, and this also applied to the brown species but exhibited no well marked differences. These variations may be connected with the influence of environmental factors and characteristic features of algal species. In addition to being a taxonomical feature of some species, iodine contents are subjected to modification due to ecological factors (Vinogradov, 1953; Kovalsky, 1974).

TABLE 5. The mean value of iodine (%) in the algal divisions occurring in the Mediterranean and Red Seas.

Location	Algal division		
	Chlorophycophyta	Phaeophycophyta	Rhodophycophyta
Mediterranean Sea	0.0471 ± 0.009	0.1433 ± 0.034	0.0770 ± 0.025
Red Sea	0.0117 ± 0.004	0.1063 ± 0.021	0.0545 ± 0.025

Although *Sargassum salicifolium, S. subrepandum* and *Turbinaria triquetra* belong to the same family (Sargassaceae), the variations in iodine content of different parts of thallus were more pronounced in the two species of *Sargassum* than in *Turbinaria triquetra*. This is probably a result of difference in the morphological and anatomical structures. *Sargassum* shows a high degree of morphological differentiation (Prince and O'Neal, 1979; Dawes, 1981). This differentiation extends to anatomical features as well, and ultrastructural features can be quantitatively correlated with physiological aspects of various tissues (Fagèrbeg *et al.*, 1979)

Iodine was shown to be accumulated selectively by various organs of *Sargassum* spp., with maximum concentrations in the leaves. In *Turbinaria triquetra* slightly

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علاقة كل السيتات الخيسوم في أسماك (المستخلص العربي

مقارنة بين تأثير التعر لتركير تحت قاتله من الأنزارين على نساط الأسنيل كولين مخ وبلازما اسماك القط الأفر (المستخلص العر

الدين عاصم إيمان الصعيدي

التغيرات الحيو في إنزيم الأديموسـ اي فوسفاتار وحجم خلايا العضلات كير الأيونات في بلازما خلايا العضلات يض اسماك القط الأفريقي لتركير مختلفه تحت قاتله من الحشائش الأنزارين الحشرات (المستخلص

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