

## CHEMICAL COMPOSITION OF *COLPOMENIA SINUOSA* AS INFLUENCED BY SEASONAL VARIATION

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A study on the effect of seasonal changes on the chemical composition of the brown algal species *Colpomenia sinuosa* showed that the variations of protein and amino acid content correspond with that of ash and its constituents. The maximal content of total lipids and mannitol were noted in April and November, respectively. The presence of the free monosaccharides glucuronic acid, galactose and xylose was observed in all seasons investigated. The maximum and minimum contents of these low-molecular weight carbohydrates were observed in November and April, respectively. Acid hydrolysates of the algal material, collected in different seasons, contained mannuronic, guluronic, glucuronic acids and their respective lactones as well as galactose, glucose, mannose, xylose and fucose. The proportions of these sugar residues in the algal material differed according to the season of collection.

### INTRODUCTION

Marine brown algae have been studied for their constituents of economic importance, like alginic acid, mannitol and laminaran. The effect of seasonal changes on such algal components have been reported by many investigators [1-5].

The present work was undertaken to investigate the composition of the local brown algal species *Colpomenia sinuosa* as influenced by seasonal variation.

### MATERIALS AND METHODS

*Collection and Pretreatment of the Alga.* *Colpomenia sinuosa* was collected periodically in 1974-1975 from the same place in Roushdy, Alexandria. The alga was thoroughly washed with water, air dried and milled. The values were calculated on a dry weight basis.

*Analysis of the Algal Samples.* The algal materials, collected in different seasons, were analysed for determination of their contents of ash, Ca, Mg, Na, Mn, Zn, Cu, total phosphorus, total lipids, mannitol and other low-molecular weight carbohydrates, combined sugars, crude proteins and amino acids. This was done by applying the same methods previously described [5] for analysis of *Padina pavonia*.

### RESULTS AND DISCUSSION

The data recorded in Tables 1 and 2 showed that there

are significant seasonal variations in several algal components. In accordance with the results of Black [6] and Hussein *et al.*, [5] seasonal fluctuations of protein content appeared to correspond with those of ash. In April, the alga showed the highest content of Ca, Mg, Na, P, K, Zn, and Cu in addition to the maximum amounts of the bound amino acids: threonine, phenylalanine, serine, glutamic acid, isoleucine, arginine, tyrosine, methionine, valine, cysteine, lysine, histidine and proline. On the other hand, in November *Colpomenia sinuosa* contained the least amounts of Na, K, Mn, and the minimum contents of the bound amino acids phenylalanine, glutamic acid, leucine, isoleucine, alanine, arginine, histidine, proline and tryptophane. These results follow the same pattern as reported on *Padina pavonia* by the present authors [5].

In contrast to the results of Abdel-Fattah and Hussein [4] and Hussein *et al.*, [5] for four of other brown algae, the maximum content of total lipids in *C. sinuosa* was noted in April instead of August.

The change in the amounts of mannitol is less extreme than those of the other algal constituents, and this result is similar to that obtained in the previous works [4,5]. The alcohol extracts of *C. sinuosa*, collected in different seasons, were found to contain, in addition to mannitol, the free monosaccharides: glucuronic acid, galactose and xylose. Visual examination of the chromatographed sugars indicated that galactose was the major one whereas xylose was the minor. The maximum and minimum contents of these



low-molecular weight carbohydrates were attained in November and April, respectively. These results are, to some extent, in accordance with those of Hussein *et al.* [5].

The acid hydrolysates of the algal material, collected in different seasons, contained mannuronic acid, guluronic acid, glucuronic acid, and their respective lactones as well as galactose, glucose, mannose, xylose and fucose. Mannuronic and guluronic acids were identified as the components of alginic acid, while glucuronic acid, glucose, fucose, mannose, galactose and xylose were derived from the fucoidan-like, acid-extractable polymers [7]. The data recorded in Table 1 showed that *C. sinuosa* was generally characterized by its relatively higher content of uronic acids and glucose and lower content of galactose, mannose, xylose, and fucose. Furthermore, each of the aforementioned sugar residues showed seasonal variation in its percentages. Thus the maximum contents of uronic acids, fucose, mannose and

Table 1. Composition of *Colpomenia sinuosa* as influenced by seasonal variation.

	Date of collection			
	August 1974	Nov. 1974	Jan. 1975	April 1975
Total ash (%)	25.82	34.62	36.82	37.19
Ca (%)	1.95	1.12	0.97	4.20
Mg (%)	2.49	0.74	0.66	2.55
Na (%)	0.85	0.25	0.27	1.73
P (%)	0.22	0.63	0.65	0.82
K (P.P.M.)	298.50	68.30	104.90	1185.50
Mn (p.p.m.)	230.00	138.00	220.00	169.00
Zn (p.p.m.)	130.00	35.00	37.00	186.00
Cu (p.p.m.)	52.00	35.00	14.00	90.00
Crude protein (%)	20.13	20.72	26.91	28.31
Total lipids (%)	10.38	8.08	6.74	13.36
Mannitol (%)	1.53	2.09	1.80	1.41
Combined uronic + acids (%)	11.60	9.11	10.15	9.66
Combined glucose (%)	6.58	6.83	4.21	7.74
Combined fucose (%)	3.70	2.23	0.88	2.08
Combined mannose (%)	3.22	1.94	2.75	2.52
Combined galactose (%)	2.42	1.85	0.88	1.72
Combined xylose (%)	1.88	1.56	1.29	1.48
Total combined sugars (%)	29.40	23.52	20.16	25.20

+ Determined as glucuronic acid.

Table 2. The amino acid pattern of algal material in different seasons.

Type of amino acid	Date when collected			
	August 1974	Nov. 1974	Jan. 1975	April 1975
Glycine	23.50	23.80	30.40	28.50
Threonine	15.50	14.90	14.60	16.30
Phenylalanine	15.70	13.70	15.20	18.70
Serine	12.60	13.40	20.80	23.80
Aspartic acid	12.40	18.50	22.10	18.00
Glutamic acid	10.74	10.00	10.90	15.50
Leucine	12.50	10.00	14.70	14.40
Isoleucine	11.20	11.00	11.60	12.30
Alanine	7.20	6.40	8.30	7.40
Arginine	6.30	6.00	6.50	11.00
Tyrosine	8.90	10.10	10.50	10.60
Methionine	9.20	10.10	9.00	10.50
Valine	8.80	8.10	8.00	9.90
Cysteine	2.90	2.50	2.40	4.10
Lysine	1.80	1.40	1.60	2.90
Histidine	1.70	1.60	1.60	2.70
Proline	1.40	1.50	1.50	2.50
Tryptophane	1.70	1.00	1.70	1.00
Total amino acids	164.00	174.00	191.00	210.00

galactose units were observed in August when the content of total combined sugars was also maximum. In April the alga showed its maximum contents of combined glucose and xylose. On the other hand, the minimum percentages of glucose, fucose, galactose and xylose residues were recorded in January when the content of total combined sugars was also minimum. Furthermore, the content of uronic acids and mannose residues reached its minimum value in November.

The present observations can be, collectively, attributed to the changes in the environmental conditions, such as temperature and light intensity, which affect the metabolic processes of the alga.

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