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CHARACTERIZATION OF ELEMENTAL AND BIOMOLECULAR COMPOSITION OF *CHARA ZEYLANICA*

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ABSTRACT

Chara zeylanica Willdenow is an aquatic alga which forms *Chara* forest in favourable freshwater environments. If harvested periodically that would save the aquatic environment for further recharge. It can be used as such or in dried or processed form for socioeconomic benefits. Analytical search has revealed the presence of phytochemicals in significant quantities. Phosphorus and potassium contents were observed in significant levels in the plant material and reported as 757.56ppm and 134.67ppm respectively. Other elements found in appreciable levels were sodium 755.6ppm, calcium 356.7ppm, magnesium 89.9ppm, manganese 34.45ppm, zinc 34.3ppm and copper 13.4ppm. The vital biomolecules reported were amino acid 18.5mg/gm, protein 253.66mg/gm, carbohydrate 23.22mg/gm and lipid 66mg/gm.

Key Words: *Chara Zeylanica; Chara Forest; Analytical Search; Phytochemicals*

INTRODUCTION

Efforts have been made in different countries to find uses of algae as food, feed, medicine or fertilizers (Nicol, 1992). High inorganic elemental composition of a mixture of freshwater algae has been reported (Ahmed *et al.*, 1992). *Chara zeylanica* Willdenow is a freshwater Macroalga which flourishes well in the coastal line freshwater water bodies of Kanyakumari District and their basis for phytochemicals and their bio-manure and pesticide and insecticide potential have not been systematically evaluated. So the present investigation aims to do an analytical research on this freshwater weed.

MATERIALS AND METHODS

Specimen Collection

Collection accessories such as bags, plastic vials, formalin, pH papers, hand lens, brush, needles, white sheets, blotters, camera etc were used in the collection process. Collections were made manually by hand. The plant material was thoroughly washed and excess water was absorbed using blotters and carried in bag.

Sample plant specimen was preserved in plastic vials for further observations and analysis. The plant specimen has been got identified from Women's Christian College, Nagercoil. The fine and delicate plants with spreading branches were kept afloat onto a paper to study the macroscopic features.

Phytochemical Analysis

The plant material was dried in shade, ground and stored in clean plastic vials for further study. Element analysis was done to evaluate the composition of macro and micronutrients. Phosphorus was determined by colorimetric method.

Using Flame photometer potassium, calcium, and magnesium were determined. Zinc, copper and iron were analyzed by Atomic Absorption Spectrophotometry. Laboratory analysis was carried out in fresh plant material for qualitative and quantitative assay of phytochemicals. Aminoacid (Ninhydrin method), Protein (Lowry *et al.*, 1951), carbohydrate (Mac Creedy *et al.*, 1950) and lipid contents (Bligh and Dyer, 1959) were estimated.

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RESULTS AND DISCUSSION

The characterized elemental constituents of *Chara zeylanica* plant material in dried powder form are shown in Table 1. These are essential elements and form the basic components of biomolecules such as nucleic acid, protein, carbohydrate and other organic molecules. Some are cofactors of vital enzymes. In the present analysis of the plant material, significant levels of phosphorus and potassium contents were noted as 757.56ppm and 134.67ppm respectively. The finding corroborates with the findings of Lohani (2005); Rakshil *et al.*, (2008) and Ansari (2009). They have reported high NPK content from the aquatic weeds used vermicompost. Charophyte biomass total phosphorus highest average value (225mg/ m²) was detected in November 1996, whereas the lowest value (33.8 mg/ m²) was found in April 1997 (Catarina and Carlos, 2008). According to Bueno *et al.*, (2008) total phosphorus concentration, values varied from 0.26-1.60 mg/g DW. Blindow (1992) registered 0.63-0.8 mg/g DW for *Chara tomentosa* in Swedish lakes, whereas Palma-Silva *et al.*, (2004) approached the Charophytes as a nutrient and energy reservoir and reported 5- 0.85 mg/g DW for Charophytes in the Imboassica lagoon, state of Rio de Janeiro, Brazil. Nitrogen and Phosphorus concentrations in Charophytes may vary considerably even within the same species. Such variability probably reflects differences in nutrient abundance in natural habitats since some *Chara* species are able to increase their nutrient content in response to increased nutrient availability. This was demonstrated for *Chara aspera* (Kufel and Ozimek, 1994).

Other elements in appreciable levels were sodium 755.6ppm, calcium 356.7ppm, magnesium 89.9ppm, manganese 34.45ppm, zinc 34.3ppm and copper 13.4ppm. The present findings are in agreement with the report of Kostecka and Kannuezak (2008) in duckweed used vermicompost. Similar observations were also made from duck weed (Wong *et al.*, 1977). The plants of *Chara* are of great ecological value as they are covered with calcium carbonate deposit and hence they deposit a lot of calcium in the bottom of lake. Calcium concentrations in charophytes vary considerably even within the same species. Such variability reflects differences in nutrient abundance in natural habitats (Krolikowska, 1997).

Table 1: Elemental composition in *Chara zeylanica*

parameters	Quantity	unit
Carbon	12.44	Gm/100gm
Hydrogen	5.46	Gm/100gm
Phosphorus	787.56	ppm
Potassium	134.67	ppm
Sodium	755.6	ppm
Calcium	356.7	ppm
Magnesium	89.9	ppm
Sulphur	4.69	ppm
manganese	34.45	ppm
Iron	3.454	ppm
Boron	1.454	ppm
Zinc	34.3	ppm
Copper	13.4	ppm
Molybdenum	In traces	ppm
Chloride	0.456	Gm/100gm
Silicon	0.0034	Gm/100gm
Aluminium	15.6	ppm

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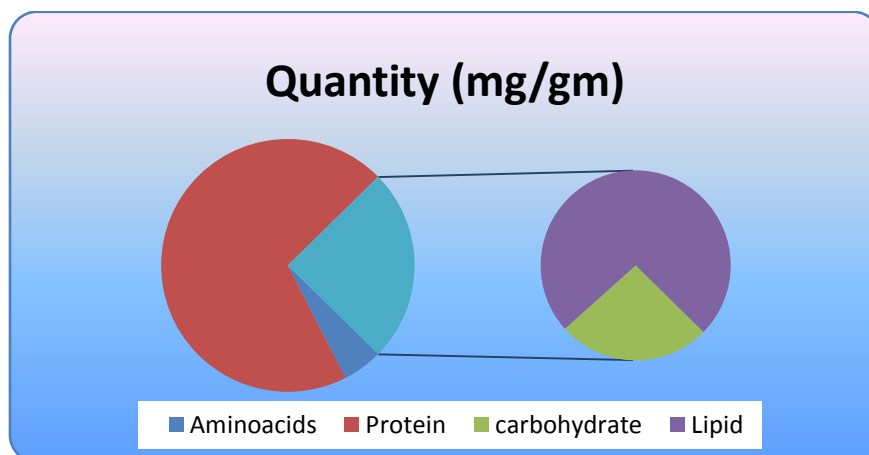


Figure 1: Biomolecule contents in *Chara zeylanica*

The vital biomolecules were estimated in fresh plant and found in appreciable quantity, amino acid 18.5mg/gm, protein 253.66mg/gm, sugar 23.22mg/gm and lipid 66mg/gm (Figure 1). Aftab (2006) reported the presence of carbohydrates which included disaccharides and polysaccharides in *C. zeylanica*. *Chara zeylanica* is a freshwater alga which forms dense vegetation forming *Chara* forest particularly when the bottom is sandy. *Chara zeylanica* produced maximum standing crop under the low light conditions of the station. The observation was in agreement with the report of Saito *et al.*, (1978) and Grimshaw *et al.*, (2005). Under favourable conditions charophytes form dense meadows which are probably efficient nutrient traps. Biomass and nutrient content in such beds are comparable or even higher than in beds of vascular aquatic macrophytes. They have been reported to decompose slower than their vascular counterparts prolonging nutrient storage in plant biomass (Kufel and Kufel, 2002). Advantages of algal biotechnology are many including useful biochemicals such as nutraceuticals, pharmaceuticals, biofertilizer etc from the algal biomass. The quantitative and qualitative micro, macro elements and heavy metals concentrated in four algae *Chara vulgaris*, *Cladophora fracta*, *Spirogyra weberi* and *Oscillatoria subbrevis* were analysed. Significantly high calcium contents were found in these algae as compared to other elements. The amount of K, P, Ca, Fe, Cl, S, Mn, Si, and Zn was high in green algae than in blue green algae (Zaidi *et al.*, 1999). *Chara vulgaris* showed highest range of all elements including heavy metal contents but these values were within the recommended limits given in Food and Nutrition Board of USA, 1988. Significantly high calcium (10.92%) comparable to calcium found in marine algae was detected from *Chara vulgaris* (Hussain *et al.*, 1977). The analytical study carried out on *Chara zeylanica* revealed the presence of micro and macro elements and also the major biomolecules.

Conclusion

The freshwater macroalga *Chara zeylanica* Willdenow is available in plenty and grows in many coastal ditches of Kanyakumari District. The sample specimen was collected from koottumangalam coastal ditch of Kalkulam taluk. The plant material analysis showed the presence of appreciable quantity of phytochemicals. They are phosphorus 757.56ppm, potassium 134.67ppm, sodium 755.6ppm, calcium 356.7ppm, magnesium 89.9ppm, manganese 34.45ppm, zinc 34.3ppm and copper 13.4ppm, amino acid 18.5mg/gm, protein 253.66mg/gm, carbohydrate 23.22mg/gm and lipid 66 mg/gm.

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