

A STUDY OF MINERALS IN THREE SPECIES OF GENUS CAULERPA – MARINE GREEN ALGAE FROM MANDAPAM COASTAL REGIONS, TAMIL NADU, INDIA

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ABSTRACT

The three green algal seaweeds are namely *Caulerpa racemosa*, *Caulerpa scalpelliformis*, and *Caulerpa taxifolia*, were collected from Mandapam, south East Coast of India during September 2017. The mineral contents of the selected three species of *Caulerpa* were qualitatively and quantitatively analyzed. The *Caulerpa* species showed different minerals such as Aluminum (Al), Boron (B), Cadmium (Cd), Cobalt (Co), Chromium (Cr), Copper (Cu), Iron (Fe), Magnesium (Mg), Manganese (Mn), Nickel (Ni), Lead (Pb) and Zinc (Zn). The triplicates results values were expressed in mean \pm standard deviation.

KEYWORDS: Marine green algae, Mineral, Mandapam.

INTRODUCTION

Seaweeds researches currently are being flourished, for valuable resources for human welfare in many countries mainly Japan, China and Korea, Vietnam, Indonesia, Taiwan, and India. Traditionally, people of Asian countries above aforementioned are being added and consumed some of the marine algal seaweeds in the form of either freshly or dried ingredients in their foods^[1,2] for its trace metals and minerals. Ortiz et al.,^[3] reported that the Japanese are taking 15 to 30% of seaweed as their food such as sushi wrappings, seasonings, condiments and vegetables. Marine algae are naturally having the highest content of proteins than higher plants.^[4] Even now, in Indian, the studies of mineral constituents of marine algae

are higher than plants and animals^[1,5,6] for example, the seaweeds are a rich source of K (from 3781.35 to 9316.28 mg/100 g), Mn (from 8.28 to 1.96 mg/100 g), Na (from 1836.82 to 4575.71 mg/100 g) and Ca (from 984.73 to 1160.27 mg/100 g).^[7] In the present study, mineral compositions of three species of *Caulerpa* – marine green algae were carried out.

MATERIALS METHODS

Sample Collection

The samples of three species of seaweeds namely *Caulerpa racemosa*, *Caulerpa scalpelliformis*, and *Caulerpa taxifolia* were collected in polythene bags from the intertidal and sub-tidal regions during low tide from Mandapam, Rameshwaram coastal regions. The samples were immediately washed thoroughly with seawater and carried to laboratory. Then they were again washed thoroughly with normal water for 2 to 3 times to remove the attached epiphytes, debris and adhered dirt/sand particles from the seaweeds. All the samples were dried at room temperature for two days until constant weight was obtained. Then these samples were powdered and kept in sealed plastic bags at room temperature. The powdered samples were analyzed to study the mineral components.

Estimation of Minerals

The marine green algal powdered samples were used and prepared for elemental analysis as per Farias *et al.*,^[8] Elements were analyzed by using Inductively Coupled Plasma Spectrophotometer – Perkin Elmer Optical Emission Spectrophotometer Optima 3400 PV (ICP-OES).

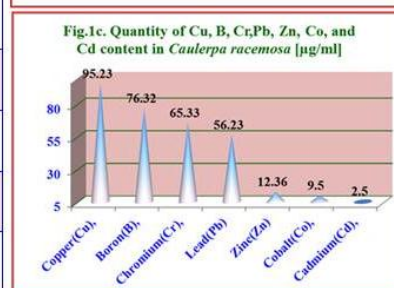
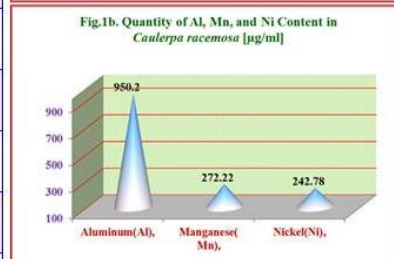
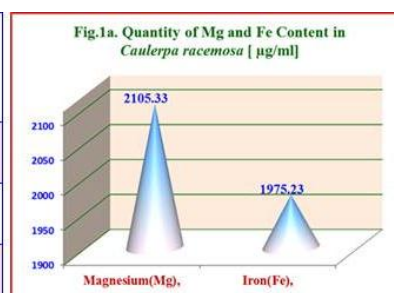
Statistical Analysis

Triplicates were taken for each sample for maximum accuracy and data represented on dry weight basis as mean values (Mean \pm Standard Deviation).

RESULTS AND DISCUSSION

The element composition such as Aluminum (Al), Boron (B), Cadmium (Cd), Cobalt (Co), Chromium (Cr), Copper (Cu), Iron (Fe), Magnesium (Mg), Manganese (Mn), Nickel (Ni), Lead (Pb) and Zinc (Zn) were studied in *Caulerpa racemosa*, *Caulerpa scalpelliformis*, and *Caulerpa taxifolia*, and the results are expressed in $\mu\text{g/ml}$ of dry weight. There elemental composition was varied from species to species. The result of different mineral compositions is as follows.

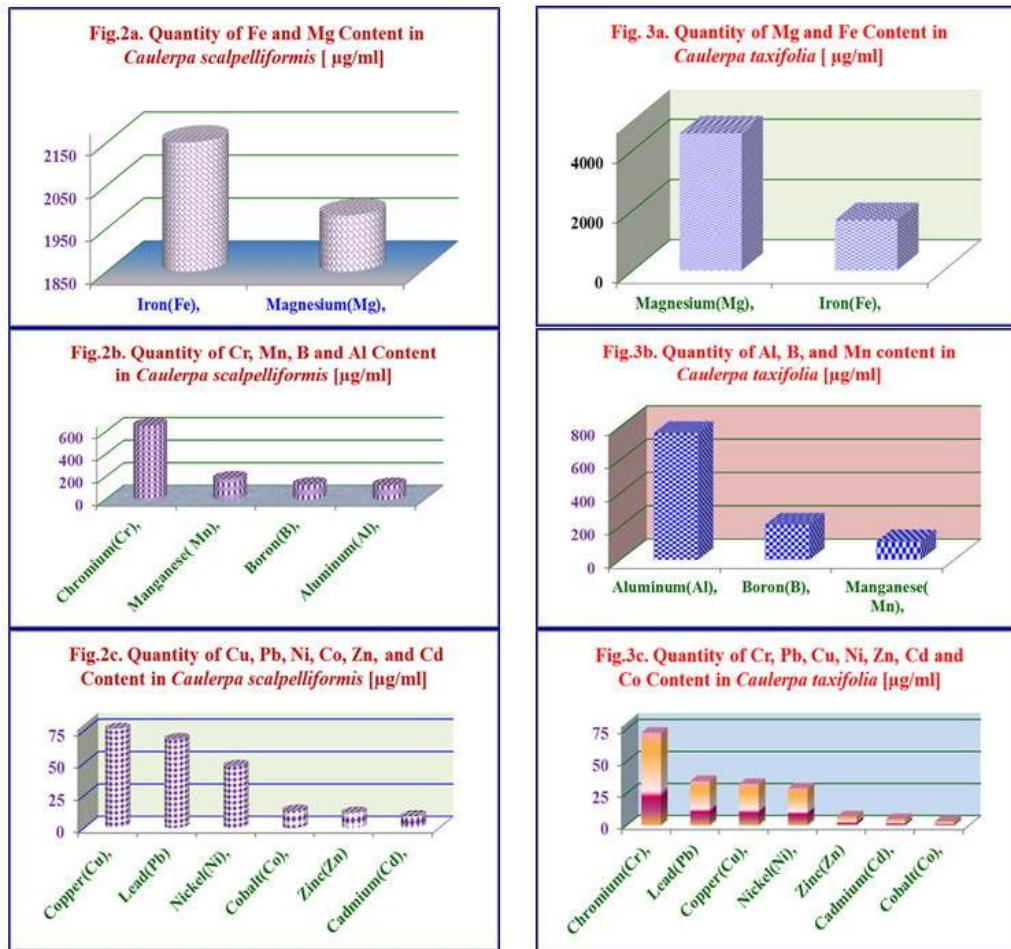
S.No.	Elements	<i>Caulerpa racemosa</i> [µg/ml]	<i>Caulerpa scalpelliformis</i> [µg/ml]	<i>Caulerpa taxifolia</i> [µg/ml]
1	Aluminum(Al)	950.2 ± 0.05	125.6 ± 0.05	760.23 ± 0.03
2	Boron(B)	76.32 ± 0.02	130.12 ± 0.05	210.01 ± 0.02
3	Cadmium(Cd)	2.5 ± 0.03	8.7 ± 0.08	4.9 ± 0.11
4	Cobalt(Co)	9.5 ± 0.22	13.2 ± 0.35	3.2 ± 1.33
5	Chromium(Cr)	65.33 ± 0.65	55.23 ± 0.47	72.36 ± 0.02
6	Copper(Cu)	95.23 ± 0.23	76.32 ± 0.33	32.23 ± 0.22
7	Iron(Fe)	1975.23 ± 0.11	2150.78 ± 0.23	1675.44 ± 0.25
8	Magnesium(Mg)	2105.33 ± 0.11	1980.58 ± 0.45	4555.66 ± 0.21
9	Manganese(Mn)	272.22 ± 0.02	183.84 ± 0.45	110.02 ± 0.64
10	Nickel(Ni)	242.78 ± 0.02	47.56 ± 0.89	28.98 ± 2.36
11	Lead(Pb)	56.23 ± 0.02	68.23 ± 0.4	34.56 ± 0.91
12	Zinc(Zn)	12.36 ± 0.22	11.56 ± 0.3	6.98 ± 0.04



The *Caulerpa racemosa* showed the maximum of 950.2 ± 0.05 µg/ml of aluminium element and *Caulerpa taxifolia* had 760.23 ± 0.03 µg/ml, and least amount of aluminium was presented in *Caulerpa scalpelliformis* 125.6 ± 0.05 µg/ml. (Table -1; Figures – 1b, 2b & 3b). Boron content was observed the maximum in *Caulerpa taxifolia*, and the minimum of 76.32 ± 0.02 µg/ml in *Caulerpa racemosa* and medium of 130.1 ± 0.05 µg/ml in *Caulerpa scalpelliformis*. (Table -1; Figures – 1c, 2b, & 3b).

Cadmium was seen to observed maximum in *Caulerpa scalpelliformis* (8.7 ± 0.08 µg/ml) and found minimum in *Caulerpa racemosa* (2.5 ± 0.03 µg/ml). (Table -1; Figures – 1c, 2c & 3c). Cobalt was found to the maximum in *Caulerpa scalpelliformis* (13.4 ± 0.35 µg/ml) and minimum in *Caulerpa taxifolia* (3.2 ± 1.33 µg/ml), (Table -1; Figures – 1c, 2c & 3c).

Chromium was observed maximum in *Caulerpa taxifolia* (72.36 ± 0.02 µg/ml) and minimum in *Caulerpa scalpelliformis* (55.23 ± 0.47). (Table -1; Figures – 1c, 2b & 3c). Copper was observed maximum in *Caulerpa racemosa* (95.23 ± 0.23 µg/ml) and minimum in *Caulerpa taxifolia* (32.23 ± 0.22 µg/ml), (Table -1; Figures – 1c, 2c & 3c).



Iron showed the maximum in *Caulerpa scalpelliformis* ($2150.78 \pm 0.23 \mu\text{g/ml}$) and minimum was observed in *Caulerpa taxifolia* ($1675.44 \pm 0.25 \mu\text{g/ml}$), (Table -1; Figures – 1c, 2c & 3c). Magnesium was found maximum $4555.66 \pm 0.21 \mu\text{g/ml}$ in *Caulerpa taxifolia* and minimum $1980.58 \pm 0.45 \mu\text{g/ml}$ in *Caulerpa scalpelliformis*. (Table -1; Figures - 1a, 2a & 3a).

Manganese was found maximum in *Caulerpa racemosa* ($275.22 \pm 0.02 \mu\text{g/ml}$) and minimum in *Caulerpa taxifolia* ($110.02 \pm 0.64 \mu\text{g/ml}$). (Table -1; Figures – 1b, 2b, & 3b). Nickel was found maximum in *Caulerpa racemosa* ($242.78 \pm 0.02 \mu\text{g/ml}$) and minimum in *Caulerpa taxifolia* ($28.98 \pm 2.36 \mu\text{g/ml}$). (Table -1; Figures – 1b, 2c & 3c).

Lead content was found maximum in *Caulerpa scalpelliformis* ($68.23 \pm 0.4 \mu\text{g/ml}$) and minimum in *Caulerpa taxifolia* ($34.56 \pm 0.91 \mu\text{g/ml}$), (Table -1; Figures – 1c, 2c & 3c). Zinc was found to maximum in *Caulerpa racemosa* ($12.36 \pm 0.22 \mu\text{g/ml}$) and minimum in *Caulerpa taxifolia* ($6.98 \pm 0.04 \mu\text{g/ml}$), (Table -1; Figures – 1c, 2c & 3c).

A few elements are namely As, Cd, Cu, Pb, Hg, Cr, Ni and Zn are an immediate concern due to their potential toxicity for living organism. Phaneuf *et al.*,^[9] and Honya and Kinoshita^[10] reported that the permissible daily dosage of seaweed intake for different toxic elements, before its recommendation as dietary supplement. The mineral content of the seaweed varied from place to place and also varies with season, species, wave pattern and exposure, environmental and physiological factors and the type of processing and methods of seaweeds mineralization.^[11-14] Mabeau and Fleurence^[15], Rupérez^[16], MacArtain *et al.*,^[17] are stated that the mineral content in macroalgae is higher compared to that of higher plants and animal products. The seaweed minerals were the richest source of iron content compared to the terrestrial plants and more calcium than milk Nascimento.^[18] Seaweeds are the richest source of vitamins like B12, C, D, E and K.^[18] The highest and lowest level of copper was reported in the brown algae *Colpomenia sinuosa* (0.51 mg/100 g) and *Sargassum ilicifolium* (0.28 mg/100 g)^[19] which are quantitatively lesser than the present study of *Caulerpa* species. In this present study mineral composition varied between the species of same locality. A few works have been carried out and it is consumed in East Asian countries. Researches for food and industrial supplements from seaweeds are in need of developing country like India. The present work has been done for food supplements as nutrition from Tamil Nadu coastal regions.

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