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Research Article

MINERAL ANALYSIS OF*ACANTHOPHORA SPECIFERA* COLLECTED FROM GULF OF MANNAR,TAMILNADU, INDIA

[1*]R.RAJESHKUMAR AND [2]K.JEYAPRAKASH

[1]Research Scholar, Department of Biochemistry, Rajah Serfoji Govt. College (Autonomous), Thanjavur-613005, Tamilnadu, India.
[2]Head, PG and Research of Department of Biochemistry, Rajah Serfoji Govt. College (Autonomous), Thanjavur-613005, Tamilnadu, India.

*Corresponding Author

Abstract

Acanthophora specifera is a species of marine red seaweed and in the family Rhodomelaceae. They were freshly collected from Mandapam Coastal Area, Rameswaram Tamilnadu, India and rinsed in seawater and packed in aseptic bags for further proceedings to laboratory. Seaweeds are potential renewable resources in the marine environment. It has been used as antioxidant and antimutagen. Hence, the present study was carried out to exhibit the preliminary Mineral analysis of *Acanthophora specifera*. The red seaweed was analyzed to determine its proximate chemical composition, minerals constituents. The results of the present study revealed the presence of Calcium, Iron, magnesium, Sodium, Potassium, boron. It showed the reasonable amount of protein content (5.84%), Phosphate (0.003%), moisture (4.62%), Calcium (1.94%) and Ash (45.60%).

Keywords: Red Seaweed, Minerals*, Acanthophora specifera,* Elemental analysis.

Introduction

The Seaweeds are used as animal and human food, soil manure, salt extraction, colloid production, cosmetics and pharmaceuticals. These represent an important economical resource mostly in the South East Asia countries where they are not only largely harvested but also intensively and largely employed in the human nutrition. [1]

Marine micro algae are one of the living renewable sources of oceans with potential food applications. Beneficial nutrients in seaweeds include vitamins, trace minerals, lipids, amino acids and dietary fibers all of which form a part of a healthy diet. [2]

These properties confer on seaweeds the potential to be used as low calorie food which might be important in body weight control as well as cardiovascular health. [3]

To address various types of seaweed as an appropriate candidate of potential food or nutritional supplement, a comprehensive comparison of nutritional values with global nutritional standards and conventional food should be conducted. In a view of this need, there is a growing interest in mineral content of seaweeds, which is higher than that of many land plants and animal products. [4]

Human as well as animal studies originally showed that optimal intakes of elements such as sodium, potassium, magnesium, calcium, manganese, copper, zinc and iodine could reduce individual risk factors for many health conditions. [5]

Seaweeds are potential renewable resources in the marine environment. It is generated enormous amount of bioactive compounds with immense medicinal potential. Nowadays, the uses of antibiotics have increased due to infections. [6]

The first investigation antibiotic activity carried out by Pratt *et al*., (1944) [7]. Since algae have been used in traditional medicine for a long time and also some algae have bacteriostatic, bactericidal, antifungal, anti viral and anti tumor activity, they have been extensively studied by several researchers. Seaweed is rich in antioxidants such as carotenoids, pigments, polyphenols, and enzymes. Seaweeds are the most excellent source of Vitamin A, B1, B12, C, D and E [8].

The mineral nutrient present in seaweeds are diverse and the main elements being magnesium, sodium, potassium, calcium and iron. The chemical composition of seaweeds varies with species, habitat, maturity and environmental conditions [9].

Among the different compounds with functional properties, antioxidants are the most widely studied. Antioxidants are the substances, which can defend serious human diseases including melanoma, cardiac disorders, diabetes, cancer, inflammatory that explain their potential use in increasing shelf life of food and as medicine [10].

Free radical induced oxidation is one of the major reasons in deterioration of nutritional quality and other physical attributes of food items under storage. Previous studies in animal models and cell culture have suggested that seaweed phytochemicals have the potential to inhibit progression of carcinoma formation [11].

Although thousands of bioactive compounds have been discovered, the need for novel therapeutic compounds is still urgent in concern of number of new diseases and resistant strains of micro organisms. Therefore, the present study was carried out to demonstrate the Proximate Chemical Composition and minerals contents of *Acanthophora specifera*.

Materials and Methods

Collection of Seaweeds

Acanthophora specifera were collected from Gulf of Mannar, Rameswaram, Tamilnadu, India. The collected samples were cleaned well with sea water to remove all the extraneous matter such as epiphytes, sand particles, pebbles and shells and brought to the laboratory in sterile bags. Then the samples were washed with tap water and distilled water and spread in the dark room for drying, after which the dried samples were powdered and subsequently stored at 4°C.

Estimation of Ash Content

Homogenized seaweed sample of 25g was taken and it was made to undergo drying in a thermo regulated incubator at 70°C overnight. Removal of the organic matter was carried out by means of incinerationinahightemperaturefurnaceat550°Candthenmaintained20huntil a white ash was obtained. Ashes were quantified gravimetrically.

Mineral Content by Atomic adsorption

Spectrophotometer and ICP-OES

Ash was dissolved in 2ml of trace grade nitric acid and 2ml of trace grade hydrochloric acid and kept in hotplate for few minutes to dissolve. Then filter the sample with whatmann no 41 paper and made up the sample in standard measuring flask. Macro elements like Na, K, Ca, Mg were determined by flame photometer (Systronics) and microelements Fe, Zn, Mn, Cu were determined by means of anatomic absorption spectrometer (Varian AA240), equipped with hollow cathode lamps and trace metals and toxic metals were determined by Inductive coupled plasma optical emission spectrometer (ICP-OES Varian 720ES).

Calcium, Potassium and Sodium

Calcium, Potassium and Sodium were estimated by flame photometer. Take5g of wet tissue samples, mixture of hydrochloric acid, nitric acid and perchloric acid (HCl, HNO_3,$HCLO_4$) at a ratio of 10:5:1 was added for digestion at 300°C.The digests were filtered suitably and aspirated in flamephotometer (Systronics and Compressor Unit).

Flame photometry

The following methods are based on the measurement of intensity of spectral lines emitted by elements such as sodium, potassium, calcium, etc. The substance containing the element is dissolved in an appropriate solvent (usually water)and subjected to excitation in a flame of appropriate temperature and composition.

Results and Discussion

The chemical composition including protein , Ash, moisture contents of tested seaweed is given in Table-4.The total protein contents in this study was 5.84% and ash was most abundant component of dried material 45.60%.There were high levels of calcium, potassium, sodium and iron detected in *Acanthophora specifera* mentioned in Table-1. For microelements like copper, chromium, zinc, nickel, manganese, selenium were detected at low concentration mentioned in Table -2.Toxic metals like mercury, arsenic, Hexavalent chromium, lead, cadmium were not present in *Acanthophora specifera.*

Quantitative determination of Mineral contents
Macro Elements

S.No	Elements	Results
1	Boron as B	0.13%
2	Calcium as Ca	1.94%
3	Iron as Fe	0.70%
4	Magnesium as Mg	0.64%
5	Sodium as Na	5.25%
6	Potassium as K	0.50%

Table-1: Macro elements- B,Ca,Fe,Mg,Na,K

Micro Elements

S.No	Elements	Results
1	Manganese as Mn	253 mg/kg
2	Zinc as Zn	14.88 mg/kg
3	Molybdenum as Mo	1.05 mg/kg
4	Aluminium as Al	65.20 mg/kg
5	Barium as Ba	8.62 mg/kg
6	Copper as Cu	10.90 mg/kg

Table-2: Micro elements- Mn,Zn,Mo,Al,Ba,Cu

S.No	Elements	Results
1	Nickel as Ni	1.22 mg/kg
2	Chromium as Cr	1.02 mg/kg
3	Selenium as Se	0.11 mg/kg
4	Tin as Sn	0.65 mg/kg
5	Cadmium as Cd	0.18 mg/kg
6	Cobalt as Co	0.35 mg/kg

Table-3: Micro elements- Ni,Cr,Se,Sn,Cd,Co

Proximate Analysis

S.No	Parameters	Results
1	Protein	5.84%
2	Sulphate as SO_4	0.050%
3	Phosphate as PO_4	0.003%
4	Carbonate	0.320%
5	Ash	45.60%
6	Moisture	4.62%
7	Acid insoluble Ash	20.12%
8	Chloride	1.12%
9	Nitrate as No_2	0.003%

Table-4: Proximate analysis

Trace Metals and Toxic Metals

S.No	Elements	Results
1	Berilliyum as Be	Nil
2	Bismuth as Bi	Nil
3	Palladium as Pd	Nil
4	Ruthinium as Ru	Nil
5	Iridium as Ir	Nil
6	Platinum as Pt	Nil
7	Osmium as Os	Nil
8	Rhodium as Rh	Nil
9	Silver as Ag	Nil
11	Zirconium as Zr	Nil
12	Niobium as Nb	Nil
13	Vanadium as V	Nil
14	Mercury as Hg	Nil
15	Antimony as Sb	Nil
17	Arsenic as As	Nil
19	Lead as Pb	Nil
21	Gold as Au	Nil
22	Hexavalent Chromium as Cr6+	Nil

Table-5: Trace Metals and Toxic Metals

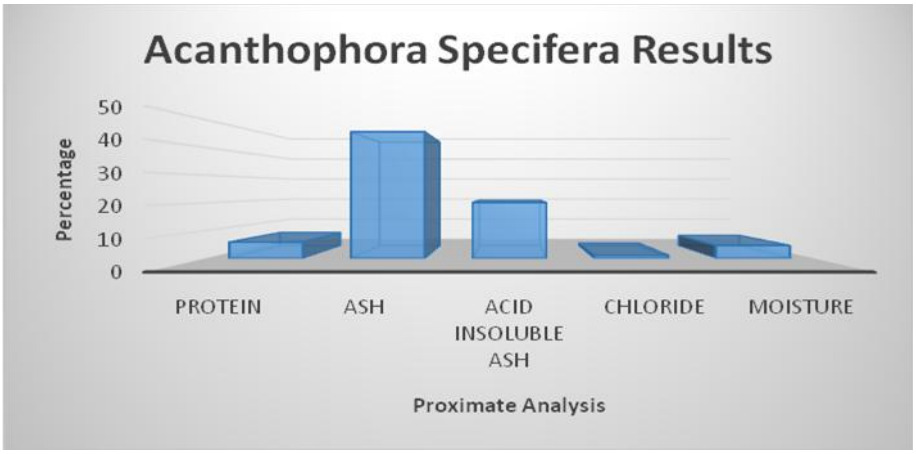

Figure:1-Proximate Analysis-Protein, Ash, Acid insoluble Ash, Chloride, Moisture
Values were expressed as Mean ± SD for triplicates

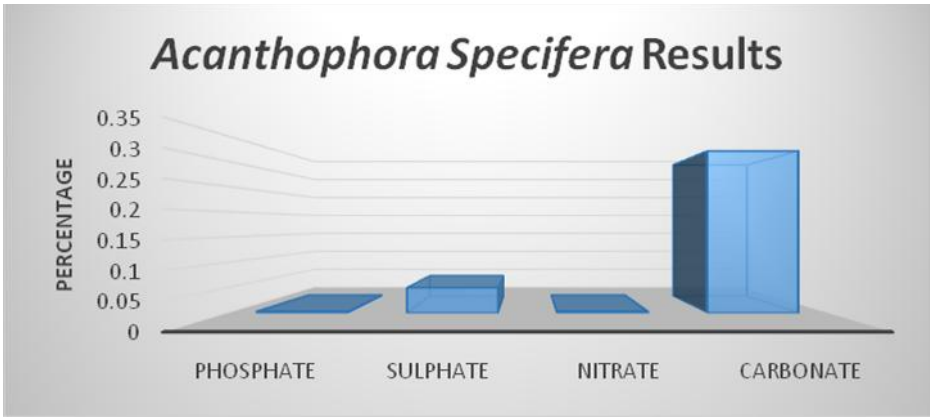

Figure:2-Proximate Analysis-Phosphate, Sulphate, Nitrate, Carbonate
Values were expressed as Mean ± SD for triplicates

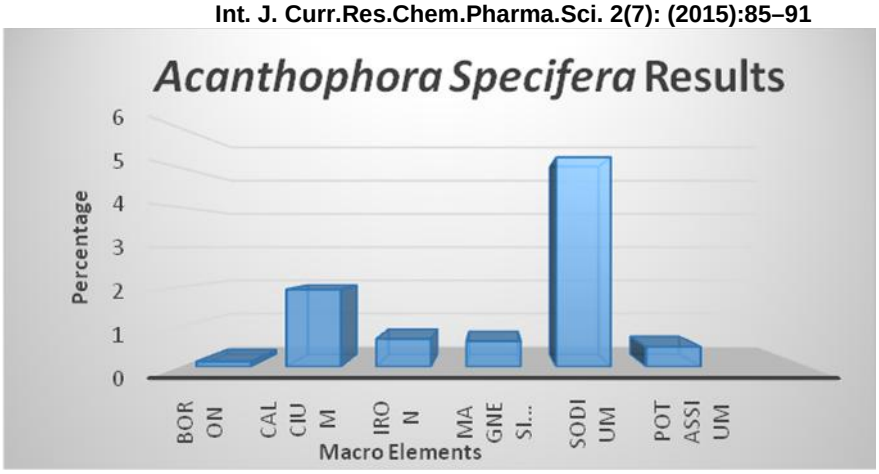

Figure:3-Macro Elements-B, Ca, Fe, Mg, Na, K
Values were expressed as Mean ± SD for triplicates

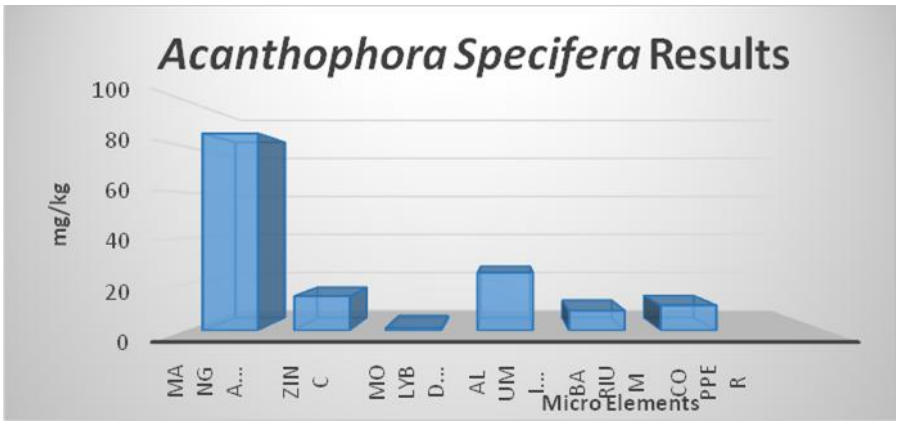

Figure: 4-Micro Elements-Mn, Zn, Mo, Al, Ba, Cu
Values were expressed as Mean ± SD for triplicates

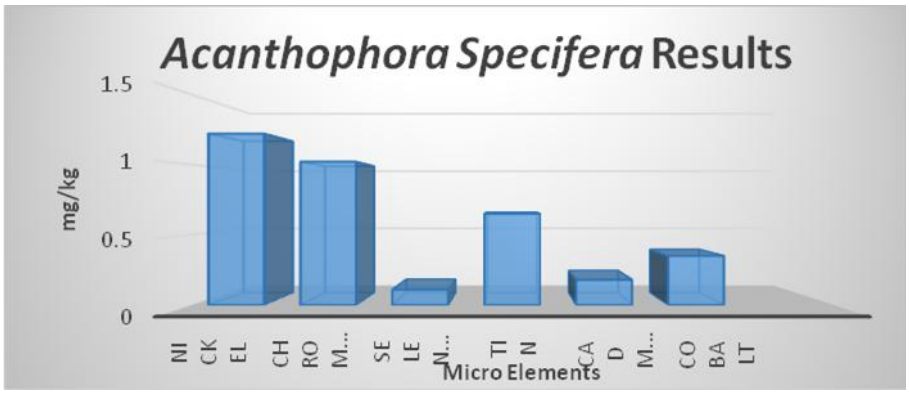

Figure: 5-Micro Elements-Ni, Cr, Se, Sn, Cd, Co
Values were expressed as Mean ± SD for triplicates

Zinc enhances the catalytic, structural and regulatory functions, stabilizes membranes, hormones and nucleic acids. Copper acts as a cofactor in multiple enzymes, connective tissue formation, blood clotting, energy conversion, pigment of hair, skin and eyes. Chromium regulates the functions of insulin and affects lipid metabolism. Most of the seaweeds showed that calcium, magnesium and potassium at elevated values. Calcium strengthens the bones, teeth structure and muscle contractions. It acts as a cofactor for extra cellular enzyme and proteins. Sodium and potassium acts as electrolyte balance. [12]

Seaweeds are potentially good sources of proteins, polysaccharides and fibre. Studies on the biochemical constituents such as protein, carbohydrate and lipid in green and brown marine algae have been carried out from different parts of Indian coast studied the seasonal variation in chemical constituents of *S. wightii* with reference to alginic acid content has been reported [13]. Amino acids in free and combined state have been quantitatively estimated in three species of green algae viz., *Halimeda tuna*, *Spongomorpha indica* and *Udotea indica* collected from Okha Port by Dave and Parekh[14]. Some biochemical investigations on economically important species have been carried out [15-18].

The vitamin and mineral contents of edible seaweeds make them nutritionally valuable [19, 20]. Biochemical investigation on protein, nucleic acids, distribution of amino acids, fats and lipids, carbohydrates, fatty acids, sterols, acrylic acid, crude fibre, pigments and carotenoids and inorganic elements of green alga, *Enteromorpha* from Okha have been reported by Parekh *et al*. [21]. Twenty–nine genera comprising forty–two species of red algae of Gujarat coast were analyzed for protein content by Dave *et al*. [22].

Seaweeds are known as an excellent source of vitamins and minerals, especially sodium and iodine, due to their high polysaccharide content which could also imply a high level of soluble and insoluble dietary fiber[23]. Muthuraman and Ranganathan [24] selected six species of marine macro algae viz., *Caulerpa scalpelliformis, Cladophora vagabunda, Enteromorpha compressa, Halimeda macroloba, Ulva fasciata* and *Chaetomorpha antennina* to investigate protein, amino acids, total sugars and lipid contents. Venkatesalu *et al*. [25] investigated fatty acid composition in *Ulva lactuca, Caulerpa chemnitzia, Padina tetrastromatica, Sargassum longifolium, Acanthophora spicifera* and *Gelidium micropterum* collected from Mandapam coast. The present study coincide the earlier investigation of same area but different species.The earlier investigation contrast to our present investigation here the studies only concentrated on mineral composition accordance with specific species.

Conclusion

Our present investigation have demonstrated the mineral analysis and proximate chemical composition of *Acanthophora specifera* (Red seaweed) collected from the Mandapam Coastal Area, Rameswaram, Tamilnadu, India. The findings of the present study revealed the use of *Acanthophora specifera* as a natural nutritional supplements.

Conflict of interest

The authors declare that there are no conflicts of interest. The research received no specific grant from any funding agency in the public, community, or non-for profit sectors.

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