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Biochemical Composition of Seaweeds from Okha Coastal Regions Along Saurashtra Coast of Gujarat, India

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Abstract

Marine algae, often known as seaweed, are small photosynthetic organisms that live in seawater. Seaweeds are harvested along the coast and utilized for a variety of purposes such as feed, fertilizer and as a source of raw material for industrial production of photochemicals of commercial importance. In this study, six seaweed species were identified viz., red seaweed species *Corallina berteroi* and *Laurencia obtusa*, Green seaweed species *Ulva lactuca* and *Caulerpa racemosa* and Brown seaweed species *Sargassum prismaticum* and *Dictyota ciliolata*. The biochemical composition of those species were studied for Chlorophyll content, Carotenoides, Total Soluble Sugar, Reducing Sugar and Protein, content. The values of biochemical composition were varies from; Chlorophyll a content: 0.01 to 4.11 mg/g, Chlorophyll 'b' content: -0.04 to 9.62 mg/g, total Chlorophyll: -0.03 to 9.54 mg/g, Carotenoides: -0.001 to 0.732 µg/g, total soluble sugar: 0.05 to 1.29 µg/ml, reducing sugar: 0.32 to 4.56 µg/ml, protein: -0.10 to 2.41 mg/g, moisture content: 91.52 to 95.82 %, which represents these available seaweed resources in future could become one of the supreme important resource and in future utilization of seaweed was goes on increasing, not only along the India, but also from all over the world.

Keywords: Seaweed, Biochemical composition, Protein, Sugar

I. Introduction

In Comparison to other states like Maharastra, Karnataka and Kerala of west coast of India, Gujarat has the longest shoreline (1600km), which is made up of a diversified seaweed flora. Seaweed is abundant in the Okha, Dwarka, Porbandar, Veraval, Diu and Gopnath areas of the Gujarat Coast. Port Okha coast, which is known for its luxuriant growth of a diverse assemblage of seaweeds on Saurashtra coast, is found to have abundant quantities of seaweeds being drifted and washed ashore every year. Seaweeds are one of the most important marine resources of the world. Seaweeds are isolated into three gatherings of Chlorophyceae (green), Rhodophyceae (red) and Phaeophyceae (dark colored). They are one of the ecologically and economically important living resources of the world oceans. As a rich source of valuable chemical components; seaweeds are used in various other industries like cosmetics, Fuel, water treatment etc. Being a plant of unique structure and biochemical composition, seaweed could be used highly for its multi-functional properties in the form of food, energy, medicine and cosmetics. The nutritive value of seaweeds is found to be mainly in its Vitamins and minerals. Seaweeds contain nitrogen, potassium, phosphorus and various micronutrients. Apart from these, plant growth regulators such as auxin, cytokinin and gibberellin are also present (Tay et al., 1987; Patier et al., 1993; Duan et al., 1995; Sekar et al., 1995; Perez-Sanz et al., 1996; Stirk et al., 1997a, b; Moller et al., 1998a,b; 1999).

II. Materials and Methods

A. Site selection for Study

The seaweed samples were collected during 2021-2022. Different seaweed species of *Corallina berteroi* Montagne ex kutzing, *Laurencia obtusa* (Hudson) J.V. Lamouroux, *Ulva lactuca* Linnaeus, *Caulerpa racemosa* (J. Agardh) Borgesen, *Dictyota ciliolata*Kutzing,

Sargassum prismaticum (Turner) C. Agardh, from belonging to Rhodophyceae, Chlorophyceae and Pheophyceae families were collected from Okha coast is situated at $22^0$28'7.3272 N & $69^0$4'11.3664 E in the "Gulf of Kutch" on the north-western most part of Saurashtra in Gujarat, India. After collection of seaweeds, its washed immediately with seawater to remove other debris, other epiphytes and sand particles. Then it was transferred in laboratory and washed thoroughly with simple water up to 3 to 4 times for removal of extra salts on the surface. After that seaweed were shade dried followed by oven drying at 60^o C for 6-10 hours according to the species. The dried sample was grounded with blender to get fine powder and it was stored for future use.

B. Biochemical Analysis

(1) Estimation of Chlorophyll (Mackinney, 1941). Chlorophyll is an organic compound macromolecules generally present in the green parts of the plants which dissolve in the organic solvents acetones. This dissolved chlorophyll molecules in acetone are measured at different nm wavelength of light.

Chlorophyll a (mg/g) =

$$\frac{12.7 \times A663 - 2.69 \times A645}{1000 \times \text{weight of the sample}} \times \text{Volume of Extract}$$

Chlorophyll b (mg/g) =

$$\frac{22.9 \times A645 - 4.68 \times A663}{1000 \times \text{weight of the sample}} \times \text{Volume of Extract}$$

Total Chlorophyll (mg/g) =

$$\frac{20.2 \times A645 + 8.02 \times A663}{1000 \times \text{weight of the sample}} \times \text{Volume of Extract}$$

Carotenoides (µg/g) = A480 + (0.114 x A663) – (0.638 x A645)

(2) Estimation of Total Soluble Sugar(Anthrone Method).Quick and suitable method for the determination of Hexoses, aldopentose and hexurionic acids either free or present in polysaccharides carried out by the anthrone reagent. Dehydration of carbohydrates done by concentrated H2SO4 to form furfural condenses with anthrone. It gives blue-green color which is measured colorimetrically at 630nm.

(3) Estimation of Reducing Sugar (Nelson-Somogyi method).The reducing sugars when heated with alkaline copper tartrate reduce the copper from the cupric to cuprous state and thus cuprous oxide is formed. When cuprous oxide is treated with arsenomolybdic acid, the reduction of molybdic acid to molybdenum blue takes place. The blue color developed is compared with a set of standards in a colorimeter at 620 nm.

(4) Estimation of Protein (Lowry Method). Protein reacts with Folin – Coicalteu reagent (FCR) to give a blue colored complex. The color formation is occurring due to the reaction between of alkaline $CuSO_4$ and protein. The intensity of the blue color is measured by colorimetric method at 660nm.

(5) Estimation of % Moisture content Moisture content was measured using following formula:

$$\% \text{ Moisture content} = \frac{\text{Fresh weight} - \text{Dry weight}}{\text{Fresh weight}} \times 100$$

III. Results

The proximate composition of Red seaweeds species *Corallina berteroi*&*Laurencia obtusa*, Green seaweed species *Ulva lactuca*&*Caulerpa racemosa* and Brown seaweed species *Sargassum prismaticum*&*Dictyota ciliolata* is shown in the Table 1. Results of the analysis revealed the major components of seaweeds *Caulerpa racemosa* with Chlorophyll a, chlorophyll b, total chlorophyll and carotenoids 4.1123±0.02, 9.6242±0.01, 9.5433±0.02 and 0.7321±0.02 respectively. Total soluble sugar component of seaweeds was obtained in amount with *Dictyota ciliolata* (1.1179±0.01), Reducing sugar (1.4235±0.02) in *Dictyota ciliolata* and Protein (2.413±0.01) in *Caulerpa racemosa* and Moisture content (95.82±0.01%) in *Caulerpa racemosa*.

Table 1: Biochemical Composition of Seaweeds

Seaweed Name	Chloro phyll 'a'	Chloro phyll 'b'	Total Chlorophyll	Carotenoides	Total Soluble Sugar	Reducing Sugar	Protein	% Moisture content
Corallina berteroi	0.0140±0.01	-0.0469±0.01	-0.0384±0.01	-0.0786±0.01	0.05655±0.01	0.365±0.02	-0.10925±0.02	92.53±0.01
Laurencia obtusa	0.6101±0.02	0.7888±0.01	0.8476±0.01	0.0050±0.01	0.2813±0.01	0.6205±0.02	1.7765±0.01	93.83±0.02
Ulva lactuca	0.2265±0.01	0.0222±0.02	0.4824±0.02	-0.0018±0.02	0.3277±0.01	0.949±0.01	1.064±0.01	91.52±0.01
Caulerpa racemosa	4.1123±0.02	9.6242±0.01	9.5433±0.02	0.7321±0.02	0.53215±0.01	1.0585±0.01	2.413±0.01	95.82±0.01
Dictyota ciliolata	2.6810±0.01	3.1558±0.02	3.4488±0.01	0.0079±0.02	1.1179±0.01	1.4235±0.02	1.197±0.01	92.59±0.01
Sargassum prismaticum	1.2268±0.02	1.7825±0.02	1.8791±0.01	0.0175±0.02	0.61045±0.02	0.3285±0.01	1.8905±0.01	91.58±0.01

(Mean± std)

IV. Discussion

Seaweeds were reported to contain significant quantities of proteins, lipids, carbohydrates, minerals and vitamins (Kumar and Kaladharan 2007; Manivannan et al., 2008; Thinakaran and Sivakumar, 2012). Burtin (2003) reported that the protein content of green, red and brown seaweed are generally ranging 10 to 30%, 10 to 20% and 5 to 15% respectively. The protein content of 12.56±0.03% (*G. corticata*), is similar to those obtain by Chithra and Chandra (2013). In this present study highest majority biochemical components present in *Caulerpa racemosa* followed by *Dictyota ciliolata*. whereas 16.59±0.03% (*H. musciformis*) also similar to those obtain by Parthiban et al. (2009)., *U. reticulata* (12.21±0.01%) is similar to those obtained in *Ulva spp*. by Manivannan et al. (2009) but higher than those obtained by Manivannan et al. (2008). In *U. reticulata* the ash content (26.64±0.04%) and moisture content (6.53±0.02) are comparatively higher and similar to those obtained in *Ulva spp*. by Rohani-Ghadikolaei et al. (2012), whereas in *Sargassum cinctum* ash (21.86±0.02%) and moisture (6.59±0.05%) contents are comparatively lower than *Sargassum spp*.

V. Conclusion

The Biochemical composition of seaweed in port okha coastal region is very different in all collected species. All of the collected seaweed species, Chlorophyll content, Protein and % Moisture content highest obtained in *Caulerpa racemosa* followed by *Dictyota ciliolata*. Sugar content highest in *Dictyota ciliolata*.

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