



SCREENING OF SOME MASS CULTURED CYANOPHYCEAN ALGAE FOR THEIR BIOCHEMICAL COMPOSITION

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Abstract:

Five taxa of blue green algae viz. *Nostoc coeruleum*, *N. entophyllum*, *Phormidium fragile* (Meneghini) Gomont, *Tolypothrix tenuis* (Kuetz.) Johs. Schmidt em. and *Spirulina platensis* (Nordst.) Geitler were mass cultured using nutrient medium in laboratory. The dried powder of these algal samples was analysed for their biochemical constituents like proteins, total carbohydrates, lipids and phenol content. The results obtained were expressed on percentage dry matter basis. The order of observed concentration amongst them was total carbohydrates > lipids > proteins > phenols except *Spirulina platensis* and *Phormidium fragile*. Proteins were ranged from 4.46 ± 0.27 to 44.1 ± 1.01 %, total carbohydrates 10.32 ± 0.59 to 28.24 ± 0.88 %, lipids 1.26 ± 0.26 to 19.05 ± 0.82 and phenols were varied from minimum of 0.068 ± 0.015 to 1.06 ± 0.108 %.

Keywords: Biochemical composition, mass cultured, blue green algae.

Introduction

The term algae cover a wide range from microscopic unicellular to a gigantic form of seaweed. Studies on taxonomy, ecology, physiology and other fundamental aspects were carried out by number of workers from time to time enriching our knowledge of algae. The abundance and diversity of algae have made them prime material for human use (Waaland, 1981). More than 213 species of algae are used as food in different countries of the world (Kiple, 2000).

A huge number of algal taxa are being used as human food from time immemorial. But the exploitation of marine and freshwater algae for nutritional and industrial purpose is primarily based on the biochemical constituents of these forms. Thus the biochemical composition of algae not only plays a key role in its metabolism but also decides its application. Studies on biochemical composition of several marine algae have been carried out from Indian coast as well as abroad by many workers as are used as food, fodder, phycocolloid production, fertilizer and so on. Like macroalgae, microalgae are also rich in proteins, carbohydrates, amino acids, trace elements and vitamins (Waaland, 1981). Some microalgae like *Spirulina*, *Chlorella*, *Nostoc*, *Anabaena* etc are rich source of proteins and trace elements and therefore have been used as a safe source of food for centuries in some countries. Namikawa (1906), Clement *et al.* (1967), Durand-Chastle (1980), Vargas *et al.* (1998) and Hantouch and Hreeb (2003) studied biochemical composition of blue green algae. However, reports on biochemical composition of blue green algae are scanty (Rathore and

Kumar, 1993; Becker and Venkataraman, 1984). In this context, we have undertaken investigation on biochemical composition of some mass cultured blue green algae.

Materials and Methods:

Nostoc coeruleum, *N. entophyllum*, *Phormidium fragile* and *Tolypothrix tenuis* were initially isolated from soils of Shirampur tahsil. While a pure strain of *Spirulina platensis* was procured from Krishi Vidhyan Kendra (Pyrens), Bahhaleshwar (Dist. Ahmednagar, M. S.) These forms were mass cultured using BG 11 medium under aseptic conditions in laboratory at $28 \pm 2^\circ\text{C}$ and illuminated with white fluorescent tubes. The best grown homogenous suspension of these algal mass was then filtered through Whatman filter paper, water drained material was then shade dried in the laboratory. Completely dried material was crushed with mortar and pestle to powder form. The fine powder of each alga was used for biochemical analysis.

Total protein content was determined with folin-ciocalteu reagent, with bovine albumen serum V as the standard by Lowry's method (Lowry *et al.*, 1951). The total carbohydrate content was estimated by using anthrone reagent as per the method described in Sadashivam and Manickam (1996) using D-glucose as standard. Lipids were extracted and estimated by the procedure of Folch *et al.* (1957). While total phenols were determined by the method of Farkas and Kirly (1962). Species identification was done with the help of Desikachary (1959).

Results and Discussion

The estimated concentrations of biochemical constituents were given in table -1. *Spirulina platensis* (28.24 ± 0.88 %) showed many folds greater total carbohydrate content than that of reported (9%) by Becker and Venkataraman (1984) and also more than the estimated value for *S. maxima* (16-18% and 13 – 17%) by Clement *et al.* (1967) and Durand-Chastel (1980), respectively. Total carbohydrate content of the two species of *Nostoc*, *N. coeruleum* and *N. entophyllum* varied greatly. Both the species revealed comparatively less total carbohydrate content as compared to the reported value from *N. phylloiderma* (59%) by Namikawa (1906). Similarly, the estimated total carbohydrate content (20.88 ± 0.97 %) in *Phormidium fragile* is not in agreement with the *P. tenue* (32%) by Namikawa (1908). The total carbohydrate content in all the studied blue green algae except *Nostoc coeruleum* follows the range of 16 % to 38% total carbohydrates by Vargas *et al.* (1998) for twelve strains of filamentous heterocystous, N₂ fixing blue green algae.

The highest 44.1 ± 1.01% protein content was recorded in *Spirulina platensis* and confirms the (46 to 50% proteins) findings of Becker and Venkataraman (1984). At the same time it appears less than that of (56 to 71 %) protein content from *S. maxima* by Clement *et al.* (1967) and Durand-Chastel (1980). Like total carbohydrates, protein content in two species of *Nostoc* also varied slightly. However, the protein content from two species of *Nostoc* is not in agreement with the estimated protein value (25%) from *N. phylloiderma* by Namikawa (1908). Whereas, the pragmatic value (9.29± 0.42 %) of protein content in *Phormidium fragile* is much closer to the reported value (11%) from *P. tenue* by Namikawa (1908). The protein content of only *Spirulina platensis* lies in the range of 37 to 53% proteins obtained for twelve strains of filamentous heterocystous, N₂ fixing blue green algae by Vargas *et al.* (1998), while all four

remaining forms revealed far less proteins than this range.

Lipid content amongst studied blue green algae varied from 1.26 ± 0.26 % in *Spirulina platensis* to a maximum of 19.05 ± 0.82 % in *N. coeruleum*. In the present study, anticipated lipid content in *S. platensis* is slightly less than that of value (3%) reported by Becker and Venkataraman (1984) in same species as well as Clement *et al.* (1967) from *S. maxima* (2-3%). However, it greatly varies than the value (6-7%) of lipid content noticed by Durand-Chastel (1980) from *S. maxima*. The lipid content noticed in both the two species was dissimilar and very much elevated than that of *N. phylloiderma* (1%) as studied by Namikawa (1908). While *P. fragile* exhibited (4.18±0.69 %) higher lipid content as compared with the results of Namikawa (1908) for *P. tenue* (1%). However, only *N. coeruleum* and *N. entophyllum* anticipated lipid composition that fits in the range of 8 to 13% reported by Vargas *et al.* (1998) from twelve filamentous, heterocystous strains of blue green algae.

The phenol content ranged from minimum of 0.068±0.015 % in *P. fragile* to a maximum of 1.06± 0.108 % in *S. platensis*. Phenol content of all four algal species except *S. platensis* was observed to be identical.

The gross chemical composition of algae under investigation was calculated by adding the values of estimated chemical constituents and shown graphically (Plate 1) The topmost 74.66% gross chemical composition was observed in *S. platensis* while all remaining four studied blue green algal species exhibited identical gross chemical composition comparatively very less than that of *S. platensis*.

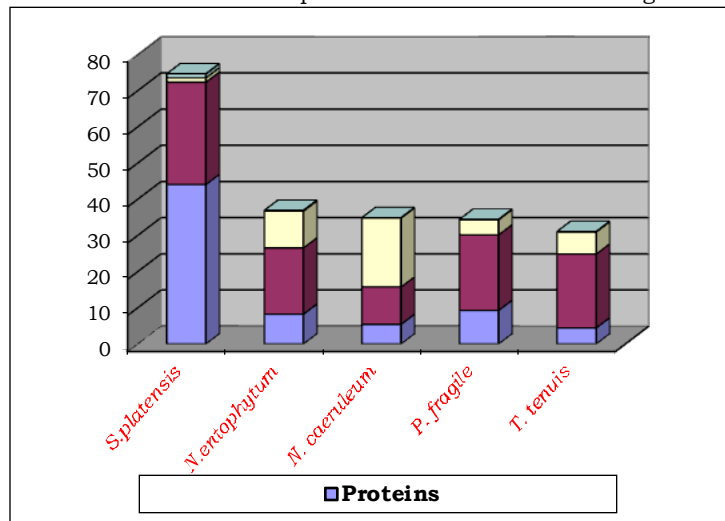
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Table 1. BIOCHEMICAL COMPOSITION OF BLUE GREEN ALGAE

Sr. No.	Name of the Alga	Proteins ± SE	Total Carbohydrates ± SE	Lipids ± SE	Phenols ± SE
1	<i>Spirulina platensis</i> (Nordst.) Geitler	44.1± 1.01	28.24 ± .88	1.26±0.26	1.06±0.108
2	<i>Nostoc entophyllum</i> Born et Flah	8.26 ±0.52	18.3 ± 0.79	10.2 ±0.61	0.15± 0.022
3	<i>Nostoc coeruleum</i> Lyngbye ex Born et Flah.	5.44 ±0.39	10.32 ±0.59	19.05±0.82	0.075± 0.009
4	<i>Phormidium fragile</i> (Meneghini) Gomant	9.29 ± .42	20.88 ±0.97	4.18 ±0.69	0.068± 0.015
5	<i>Tolypothrix tenuis</i> (Kuetz.) Johs. Schmidt em.	4.46 ±0.27	20.4 ± 1.27	6.1 ± 0.84	0.094± 0.018

All the values were expressed on % Dry weight basis.

Plate I - Gross chemical composition of mass cultured blue green algae

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