

J. Phytol. Res. 27 (1 & 2): 79-82, 2014

BIOCHEMICAL COMPOSITION OF SPIRULINA FUSIFORMIS CULTIVATED UNDER OUTDOOR CONDITIONS

ANURADHA DUBEY

Department of Botany, School of Science & Technology, Vardhman Mahaveer Open University, Kota, Rajasthan.

In the present research work *Spirulina fusiformis* was cultivated in outdoor conditions in extreme conditions of Rajasthan and its biochemical composition was analyzed in order to find its nutritional value. Results of the present study reveals that under these growing conditions nutritional value of the cyanobacterium *Spirulina fusiformis* was maintained suitably.

Keywords: Biochemical Composition; *Spirulina*; Temperature.

Introduction

Spirulina is a cyanobacterium, found in fresh water having spiral filamentous structure. These filaments harvest energy of sun and grow as a treasure of bio-available nutrients. This microalga is identified as protein novel source to prevent malnutrition¹. It is declared as the best food for tomorrow². It has higher food value than conventional any other crop plant. Looking to its nutritional value it is popularized as protein substitute³. Leading to its growing demand in food sector its mass cultivation encouraged in all over world and commercial production tends toward its cultivation in natural environment. Due to its high nutritional value, its bio-available nutrients and simple production method it is suggested as a most promising alga for using in unconventional sources^{4, 5}

In the present work *Spirulina fusiformis* is cultivated in outdoor extreme conditions of Rajasthan and its biochemical composition was analyzed in the reference of its nutritional value.

Methods and Materials

Spirulina fusiformis was cultivated in outdoor conditions of Rajasthan. The range of temperature was 32-35.5°C and light intensity range was 48-51.35 Klux. Biochemical composition of outdoor cultivated cyanobacterium was estimated by following suitable protocols for the particular constituent.

Chlorohpyll-a was estimated by the method of Mickiney⁶. Estimation of carotenoid was performed with the help of method proposed by Jensen⁷. Phycobiliproteins were estimated with the method suggested by Zhang and Chen⁸ & calculated by the series of equation given by Bennett and Bogorad ⁹.

Pure protein was estimated by the method of Lowry *et al.*¹⁰. Estimation of total carbohydrates was carried out by Anthrone Method suggested by Roe¹¹. Lipids were estimated by the method given by Dittmur

Dubey

S. No.	Parameters/Biochemical Constituents	Amount
1	Biomass	0.370 g/l
2	Chlorophyll a	0.768%
3	Caretenoids	0.197%
4	Total Phycobiliproteins	7.865%
5	Phycocyanin	4.430%
6	Allophycocyanin	2.095%
7	Phycoerythrin	1.34%
8	Lipid	7.0 %
9	Carbohydrates	10.5 %
10	Protein	58%
11	Amino acids	0.92%
12	Total nucleic acids	2.159%
13	DNA	0.684%
14	RNA	1.475%
15	Calcium	0.901 %
16	Magnesium	0.426 %
17	Sodium	0.88%
18	Potassium	1.1 %

Table-1 Biochemical Composition of Spirulina fusiformis cultivated in outdoor conditions

and Wells¹². Quantitative estimation of free amino acids was performed by the Method of Lee and Takahashi¹³. DNA and RNA were quantitatively estimated colorimetrically by the method of Jensen¹⁴.

Calcium and Magnesium were estimated titrimetrically by the method proposed by Golterman and Clymo¹⁵. Sodium and Potassium was determined with the help of method suggested by Trivedy and Goel¹⁶.

Results and Discussion

Outdoor cultivation of cyanobacterium analyzed performed and to study biochemical constituents. Data collected in present study revealed that on an average outdoor cultivation of Spirulina fusiformis vielded 0.370 g/l of biomass. Pigments were 0.768% Chlorophyll-a, 0.197% Caretenoids and 7.865% Biliproteins, out of which 4.430% was phycocyanin, 2.095% Allophycocyanin and 1.34% Phycoerythrin.

Lipid contents of the cyanobacterium ranged between 7.0%. Carbohydrates were detected to be 10.5 %. Protein contents of the cyanobacterium were recorded to be 58%. Aminoacids were 0.92%. Total nucleic acids recorded were 2.159%, which included 0.684 % DNA, while RNA was 1.475%, 0.901% Calcium, 0.426% Magnesium, 0.88% Sodium and 1.1% Potassium were registered in the cyanobacterium.

Biochemical composition proves that nutritional value of *Spirulina fusiformis* was maintained suitably in high temperature conditions of Rajasthan. As per findings of Vonshak¹⁷, different strain of *Spirulina* may differ for their optimal growth in different ranges of temperature in which it was exposed. Findings of Richmond¹⁸ are also in consonant, he suggested the optimal temperature for growth of different strains of *Spirulina* was 35-37⁰C. In present work *Spirulina fusiformis* strain was successfully cultivated in 35° C temperature with good biochemical constituents' levels. Findings of Rafiqul *et al.*¹⁹ revealed that *Spirulina fusiformis* at temperature between 25-37°C indicates high and stable protein content that establishes its more usefulness over other stains of *Spirulina*. These report favours outcome of present research work.

It may be concluded that outdoor cultivation of *Spirulina fusiformis* successfully carried out in the semi-arid environmental conditions of Rajasthan, where light intensity and temperature were controlled with the help of various simple means. Under these growing conditions nutritional value of the cyanobacterium *Spirulina fusiformis* was maintained suitably.

References:

- 1. Becker EW and Venkataraman LV 1984, Production and utilization of the blue-green alga *Spirulina* in India. *Biomass* **4** 105- 125.
- 2. Doshi F 1996, *Spirulina*: Nature's miraculous blessing for healthy living. *Chemical Weekly* 169-173
- 3. Cohen Z, Vonshak A and Richmond A 1987, Fatty acid composition of *Spirulina* strains under various environmental conditions. *Phytochemistry* **26** 2255-8.
- 4. Vonshak A and Richmond A 1988, Mass Production of the Blue-green Alga *Spirulina*: An Overview. *Biomass* **15** 233-247.
- 5. Belay A, Kato T and Ota Y 1996, *Spirulina (Arthospira)*: potential application as an animal feed supplement. J App Phycol. **8** 303-11
- Mickiney G 1941, Absorption of light by Chlorophyll solution. J. Biol. Chem. 140 315-322.
- 7. Jensen A 1978, Chlorophylls and carotenoids In: Handbook of

Phycological Methods, physiological and biochemical methods. Hellebust JA and Craige JS (eds.) Cambridge University Press, Cambridge, 59-70.

- 8. Zhang YM and Chen F 1999, A simple method for efficient separation and purification of C-Phycocyanin and Allophycocyanin from *Spirulina platensis*. *Biotechnol. Tecniques* **13** 601-603.
- 9. Bennett A and Bogorad L 1971, Properties of subunits and aggregates of blue green algal biliproteins. *Biochem.* **10** 3625-3634.
- 10. Lowry OH, Rosebrough NS, Farr AL and Randall RJ 1951, Protein measurement with Folin-Phenol Reagent. J.Bio.Chem. 193 265-275.
- Roe JH 1955, The determination of sugar in blood and spinal fluid with anthrone reagent. *J.Biol.Chem.* 21 (2) 335-343
- Dittmur JC and Wells M. 1969, Qualitative and quantitative analysis of lipids and lipid components. *Methods Enzymol.* 14 482-530.
- 13. Lee YP and Takahashi T 1966, An improved colorimetric determination of amino acids with the use of ninhydrin. *Am. Biochem.* **14** 17.
- Jensen WA 1956, On the distribution of nucleic acids in the root tip of *Viccia faba. Exp. Cells Res.* 10 222-226.
- Golterman HL and Clymo RS 1969, Methods for chemical analysis of fresh water. IBP Handbook No.8 Blcakwell Sci.Publ.Oxford.
- Trivedy RK and Goel PK 1984, Chemical and biological methods for water pollution studies. Deptt. G. environmental pollution Science College Karad. Environmental Publications, Karad (India). 62-77.

- Vonshak A 1997, Spirulina, Growth, Physiology and Biochemistry. In: Vonshak A (ed) Spirulina Platensis (Arthospira) Physiology, Cell biology and Biotechnology. London: Taylor and Francis pp. 43–66.
- 18. Richmond A 1992, Open system for the mass production of photoautotrophic microalgae outdoor:

physiological principles. J. Appl. Phycol. **4** 281.

19. Rafiqul IMd, Hassan A, Sulebele G, Orosco C and Roustaian P 2003, Influence of Temperature on Growth and Biochemical Composition of *Spirulina platensis* and *S. fusiformis. Iranian Int. J. Sci.* **4**(2) 97-106.

82