

Variations in Cellular Metabolites of *Spirulina maxima* Geitler Cultivated under Semi Arid Climatic Conditions of Agra

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Abstract—*Spirulina* is considered as a perfect nutrient for people of all ages; it has about sixty percent protein which is more than any other food. It contains all the essential amino acids. The only food with more usable protein than *Spirulina* is eggs. *Spirulina maxima* were cultivated under semi- arid climatic conditions of Agra to assess variations in cellular metabolites during different months. The cellular metabolites and physical parameters which were selected is protein, chlorophyll *a*, carotenoids, temperature, light intensity and pH. The maximum percentage of protein, chlorophyll *a* and carotenoids were 59%, 1.37%, 0.576% respectively while physical parameters i.e. temperature, light intensity and pH were 32, 1700 and 10.47 which is observed during the month of May. Minimum percentage of selected metabolites was recorded during the month of July.

1. INTRODUCTION

Spirulina; a micro-cyanobacterium possesses high value biochemical constituents that find application in areas like health foods and therapeutics, especially for its high protein content. The *Spirulina* protein is superior to all proteins including those from legumes and milk protein, because it contains many essential amino acids. Due to the presence of important chemical composition and fast rate of multiplicity, alga has attained a status of commercial enterprise. *Spirulina* species has been produced commercially all over the world due to its high contents of protein (up to 70%), pigments

(Phycocyanin), essential fatty acids (linolenic acid), Vitamin B12 and minerals (Cohen 1997). *Spirulina* was first time harvested from the Lake Texcoco, dried and sold for human consumption in a Tenochtitlán (Mexico City) market. Mass cultivation of any *Spirulina* species depends on many factors such as nutrients medium, temperature (surrounding and culture), light intensity, light period (D: N), hygiene and most important was agitation. *Spirulina* reproduces by mean of fragmentation. Environmental factors, mainly temperature (Van Eykelenburg, 1979), physical and chemical conditions may affect the helix geometry (Jeeji Bai and Seshadri, 1980). *Spirulina* is photoautotrophic alga so light affects its growth and there is also a huge chance of change in metabolite

production. Temperature is the most important climatic factor influencing the growth rate of *Spirulina*. Below 20°C, growth is practically nil, but *Spirulina* does not die. The present paper deals with Monthly variations in cellular metabolites of *Spirulina maxima* Geitler cultivated under semi arid climatic conditions of Agra.

2. MATERIALS AND METHOD

Test alga and *in vitro*

Spirulina maxima has been procured from Manjul *Spirulina* Samwardhan Sansthan Burchal Bassi Jaipur, Rajasthan and then slants sub-cultured in *Spirulina* Lab, Botany Department, Faculty of Science, Dayalbagh Educational Institute, Dayalbagh, Agra.

Culture media Various types of media are available for the cultivation of *Spirulina* but we use the CFTRI medium (Central Food Technological Research Institute - Venkataraman, 1983) for its production due to its easy availability and low cost value.

Assess the impact of climatic factors on yield during different months.

Spirulina maxima cultivation is a difficult task because it can get affected by environment and contaminated with the other foreign particles. The desired situations include a range of temperature suitable for its optimum growth as temperature may represent the main limitation for high biomass production rates, along with temperature, photoperiods and intensity of light is also necessary to provide energy for photosynthesis. *Spirulina maxima* are cultivated in PVC tubs.

There are so many factors that affect the growth and productivity of the *Spirulina* cultures. It involves the following factors:

Temperature Temperature is the most important climatic factor influencing the growth rate of *Spirulina*. Regular culture temperature has been taken through thermometer.

Light intensity As the alga is photoautotrophic so light is one of the most important growths regulating factor. *Spirulina* prefers diffused light for optimum growth. Light is an important factor but direct sunlight may not be the best rate of illumination, high light intensity during May June and July adversely affects its growth. To overcome this problem we have take certain measures to protect the *Spirulina* from direct sun light.

pH pH is another important factor for the proper growth of this alga if the pH get disturbed then the chances of contamination get increases.

Biochemistry of *S. maxima* cultured during different months.

Spirulina maxima were cultured by using CFTRI medium. All cultures were harvested by using fine nylon cloth. Further dried mass biomass was biochemically analyzed for metabolites such as proteins, chlorophyll *a* and carotenoids. Protein was estimated by the method proposed by Lowry *et al.* (1951), chlorophyll *a* by Parson and Strickland (1965), and carotenoids estimation were following Jensen (1978)

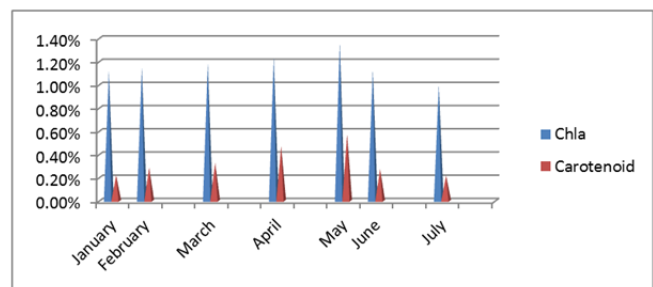
3. RESULTS AND DISCUSSION

Present research paper was concentrated on maximum production of *Spirulina maxima* and its biochemistry. *Spirulina maxima* were cultured and was biochemically analyzed. Biochemistry of *Spirulina maxima* showed the variation in the percentage of selected metabolites *viz.* proteins, chlorophyll *a* and carotenoids. The maximum percentage of - Protein, Chlorophyll *a* and Carotenoids were 59%, 1.37%, 0.576% respectively (as shown in Table. 1.) Observed during the month of May with temperature, light intensity and pH was 32°C, 1700 Lux and 10.47 respectively while the minimum Protein, Chl a and Carotenoids were found during the month of July i.e. 42%, 1.0% and 0.219% this is because of high temperature, high light intensity and low pH 36, 1900 and 8 (as mentioned in Table 1) which is found not suitable for the growth of *Spirulina maxima*.

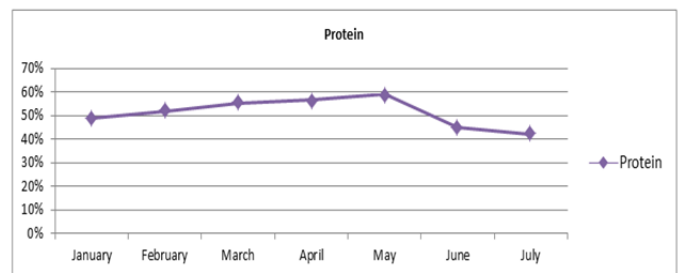
Number of studies has confirmed the interrelationships between temperature, pH, Light intensity and algal growth. Mehta *et. al* (2012) found that the pH ranges from 9.1 to 10.1 was suitable for the growth of *Spirulina* and increase in dry weight was noticed along with the age of culture.

Table 1: Cellular metabolites production during different months with respect to temperature, light intensity and pH

February	1.15 %	0.287%	52%	15	18	1500	9.77
March	1.19 %	0.327%	55%	20	21	1600	10.11
April	1.24 %	0.472%	56.5 %	22	29	1700	10.15
May	1.37 %	0.576%	59%	27	32	1700	10.47
June	1.13 %	0.274%	45%	18	34	1800	10
July	1.0%	0.219%	42%	10.75	36	1900	8



Graph 1: Shows the variation in Chl a and carotenoids with respect to months



Graph 2: Shows the variation in Protein with respect to months

4. ACKNOWLEDGEMENTS

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	Cellular Metabolites			Productivity (g/40 l)	Temperature (°C)	Light Intensity (Lux)	pH
	Chla	Carotenoid	Protein				
January	1.12 %	0.224%	49%	12	17	1100	9.15

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