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Potential of Different Light Intensities on the Productivity of *Spirulina maxima*

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ABSTRACT

The cultivation of photosynthetic microorganisms such as the cyanobacterium *Spirulina maxima* has been studied by researchers in many countries because these organisms can produce products with industrial potential. The growth of test alga *Spirulina maxima* a cyanobacterium is greatly affected by one of the most important climatic factor that is light. In the present study effect of different light intensities for the production of *Spirulina maxima* was studied. Productivity has been measured in terms of biomass (g/ml). At 5000 lux light intensity the dry weight of *Spirulina maxima* was 0.72g/500ml.

Key words: *Spirulina maxima*, Biomass, Light intensity.

INTRODUCTION

The cyanobacterium *Spirulina maxima* is composed of 50 to 70% protein, 5 to 10% lipid and 10 to 20% carbohydrate (Vonshak, 1997) as well as substances with anticarcinogenic, hypocholestero-lemic and antioxidant properties. Because of its high nutrient and complex organic molecule content, *Spirulina maxima* can be used not only in human and animal foodstuffs, but also in fine chemistry. In 1981, the Food and Drug Administration (FDA) decided that since *Spirulina* constitutes a source of proteins and contains several vitamins and minerals it could legally be sold as a food supplement (Estrada *et al.*, 2001; Belay *et al*., 1993).

Being photoautotrophic, the light is an important factor for the survival of the test alga, *Spirulina maxima,* so that it can make its own food in the presence of optimal light. But the requirement of light intensity for growth is different for different organisms. *Spirulina* also requires a specific range of intensity for its growth. (Samuel *et al*. 2010)

Zarrouks (1966) did the first detailed study on the response of S*pirulina maxima* to light. Khan and Srivastava (2003) determined the photoperiod for highest content of protein.

To produce high quality biomass, much attention must be paid to culture status. Generally, in cultivation of cells, dry cell weight has been used to obtain information on cell growth with respect to biomass productivity or specific growth rate.

The present study has been undertaken to demonstrate the appropriate light intensity to get maximum biomass of this valuable alga.

MATERIALS AND METHODS

Microorganism and culture medium

The strain of *Spirulina maxima* was obtained from School of Studies in Biotechnology Jiwaji University Gwalior M.P., which is previously maintained in Zarrouk's agar media slants in 4^{o}C. All the reagents used were of analytical grade, obtained from the Rankam Chemical Co.

Cultivation

Spirulina maxima was axenically grown in Zarrouk's medium. Cultures were incubated in a culture room at temperature of 30 ± 2^{o}C and illuminated with day- light fluorescent tubes. During the process of growth the flask was shaken 3 to 4 times per day. The experiments were run in duplicates. All manipulation involving the transfer of cultures in the liquid media or on agar plates were carried out under aseptic conditions in a laminar flow.

Filtration: - Cells were collected by filtration using filter paper 8 mm pore size (Screen printing paper).

Washing: - Cells were washed with buffer solution (pH 7), diluted to known volume and processed for further inoculation.

Shaking in cyaclomixture:- Diluted inoculum shaken in cyaclomixture for making homogenized mixture.

Analysis of variance (ANOVA) was used to compare the data during experiments.

Analytical methods

Biomass concentration (g/500ml) was calculated by measuring dry weight. For dry weight measurement homogenous suspensions of known quantity of Spirulina sample were filtered through screen-printing paper and oven dried at 75^{o}C for 4 to 6 hours. The dried filter paper containing Spirulina biomass were cooled and weighed. The difference between the initial and final weight were taken as the dry weight of *Spirulina* biomass. The dry weights were expressed in terms of g/500ml.

As light is important for the photosynthesis of Spirulina maxima, different light intensities such as 3000 lux, 4000 lux, 5000 lux and 6000 lux light were set for the light intensity test (The culture was prepared in flasks as explained before). The flasks were taken in triplet for each light intensity.

RESULTS AND DISCUSSION

All photoautotrophic organisms' i e photosynthetic bacteria, cyanobacteria and higher plants, are able to convert light energy into chemical energy by means of photosynthesis. But the requirement of light varies from organism to organism. High light intensity causes destruction to that culture whose optical density was less and normal growth was recorded at the same intensity when optical density was maximum, viz optical density of the culture is directly proportional to the light intensity i e higher the optical density higher requirement of light and low optical density, lower requirement of light. (Samuel *et al*. 2010)

Physico-chemical profiles of *Spirulina maxima* is describing the relationship between growth and

environmental factors especially irradiance flux, density and temperature which are important in the evolution of micro algae and cyanobacteria for biomass production, as well as their general characterization (Vonshak *et. al.* 2000).

The duration, intensity and quality of light are the most important factors in the success of photosynthetic organism. The synthesis of various cell components is known to be influenced by light intensity. Sorokin, *et al.*, 1965 had reported that an increase in light intensity first favors cell division then, after the optimal light intensity was attained, a further increase in light intensity inhibited cell division. Dubey, 2006 Reported moderate light intensity in the cultivation of *Spirulina,* suggesting low light intensity at the beginning to avoid photolysis. He also noted that exposing *Spirulina* to high light intensity photolysis them. Result suggests 5000 lux is optimum light for the growth of *Spirulina maxima*. At 5000 lux light intensity the average dry weight of *Spirulina maxima* was 0.72g/500ml. (Table 1).

Table 1- *Spirulina maxima* productivity at different light intensities

S. No.	Light Intensities	Dried Mass (g/500ml) 1st	Dried Mass (g/500ml) 2nd	Dried Mass (g/500ml) 3rd	Average Dried mass (g/500ml)
1	3000 lux	0.52	0.56	0.58	0.55
2	4000 lux	0.67	0.69	0.65	0.67
3	5000 lux	0.74	0.71	0.73	0.72
4	6000 lux	0.68	0.66	0.65	0.66

Growth Conditions:- Initial pH - 8.25; Inoculum (in fresh weight) - 1 g/500ml; Relative Humidity - 75%; Room Temperature - 30 ±2 ^{o}C; Incubation Time - 25 days

CONCLUSION

In the present course of investigation, we have optimized *Spirulina maxima* production in term of biomass and metabolites production. Production of *Spirulina maxima* was carried out *in vitro* cultivation. In this paper we investigate how different light intensities affect maximum production of biomass. The result may be useful in optimizing yield from this organism for commercial production.

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