Investigation of microalgae carotenoids as potential nutraceutical compounds

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ABSTRACT
Haemotococcus pluvalis is a microalgae specie which is recognized as a potential source of astaxanthin accumulation. By selecting two governing cultivation parameters in the form of illumination and initial phosphorous concentration, the optimum stage of accumulated astaxanthin quantity was observed during the experiment. The cultivation of microalgae was conducted for three experimental setups in photo-bioreactors under varied light intensities and initial phosphorus concentrations, with external aeration of constant rate. The biomass growth and accumulated astaxanthin content were evaluated by spectrophotometric method. As by results obtained, the maximum of astaxanthin quantity was observed under the light intensity of 3500Lux and phosphorous concentration of 1.75mM.

Keywords: Microalgae, Carotenoids, *Haemotococcus pluvialis*, astaxanthin

INTRODUCTION

Microalgae is known for a wide range of applications, where carotenoid synthesis is one of the major applications, because of its capability to induce carotenoids by varying the cultivation parameters. The potential of growing in diverse environmental conditions and the efficiency in induction of carotenoids enable the microalgae species such as *Haemotococcus pluvialis*, to be employed as a source of carotenoids. Astaxanthin is one of the carotenoids which has a high commercial gain due to its potential use as an anti-oxidant in cancer prevention and immunological actions in medical and pharmaceutical industries. The main focus of this research leads on optimization of the carotenoid induction in *Haemotococcus pluvialis* by stressing up its cultivation conditions in laboratory scale.

METHODOLOGY

Microalgae specie *Haemotococcus pluvialis*: obtained from UTEX, Culture collection of algae at the University of Texas, Austin, USA was cultivated in BBM (Bold's Basal Medium) using photo-bioreactors with external aeration at a constant speed. The initial phosphorus concentration was varied as 0.5mM, 1.75mM, and 3mM as full factorial method and the light intensity was varied as 2000lux, 3500lux and 5000lux per each phosphorous concentration. In order to facilitate the proliferation age, the reactors were maintained in 1800lux for a week before differentiating the illumination conditions. The cultivation of microalgae was conducted for 30 days of time, with the continuous monitoring of biomass growth per two days using spectrophotometric method (absorbency wavelength for biomass quantification: 750nm) (Katsuda, Shimahara, Hada, Lababpour, & Katoh, 2004).

$$Dry\ cell\ weight(gl^{-1}) = \left[-4.2 * \left\{\frac{(OD_{680}-OD_{750})}{OD_{680}}\right\} + 1.4\right] * OD_{680} \quad (1)$$

At the end of the cultivation, carotenoids were extracted using solvent extraction, modified with pretreatment methods (Passos, Carretero, & Ferrer, 2015), bead milling and heating prior to cell disruption. The extracted carotenoid was

examined for astaxanthin concentration, using spectrophotometric method at a 530nm absorbency (Katsuda, Shimahara, Hada, Lababpour, & Katoh, 2004).

RESULTS AND DISCUSSION

The results from this experiment showed that the optimum stage of astaxanthin productivity exists at the initial concentration of 1.75mM phosphate and the light intensity of 3500lux. Furthermore, the maximum biomass growth was observed at 1.75mM initial phosphate concentration and 5000lux of light intensity. The extreme points have relatively lower astaxanthin productivity than the centre point, implying an optimum range for the synergetic effect of phosphate depletion and light intensity for astaxanthin accumulation in H. pluvialis.

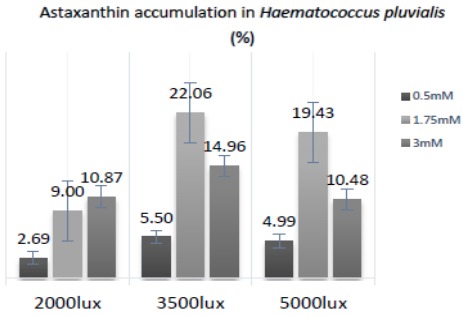

Figure 1: Accumulation of astaxanthin in *H. pluvialis*

CONCLUSIONS

Astaxanthin accumulation in *Haematococcus pluvialis* has been induced by phosphate depletion under reduced light intensities. Therefore, implementation of synergic effect of these two parameters will be beneficial for cost-effective cultivation.

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