Effect of glucose on the enhancement of biomass on microalgae *Nannochloropsis oculata* and *Isochrysis galbana*

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Microalgae are primary producers, which can convert light, nutrients and carbon dioxide into energy-rich cell molecules such as lipid, protein and carbohydrate and can be designated as a bio-factory of several high-value functional products, e.g., pigments (carotenoids and phycobiliproteins) and polyunsaturated fatty acids. They can grow under photoautotrophic, heterotrophic and mixotrophic growth conditions. Under natural conditions, phototrophic microalgae rely mostly on sodium bicarbonate and carbon dioxide as potential carbon sources with several reports stating the effects of different carbon sources on the growth and nutrient profile of various microalgae. In this study, glucose (as a carbon source) was used for the culture of two important microalgae namely, *Nannochloropsis oculata* and *Isochrysis galbana* to assess its impact on cell count during the heterotrophic and mixotrophic culture conditions.

Experimental trial was conducted with glucose at various concentrations of 10, 25, 50 and 100mM as the carbon source for *Nannochloropsis* and *Isochrysis* culture. Cultures were maintained with Convey and F/2 medium and light (autotrophic) was used as the control for *Nannochloropsis* and *Isochrysis* culture respectively. Heterotrophic (only carbon source) as well as mixotrophic (light and carbon source) cultures were studied with different glucose concentrations. Algal growth curve was determined by measuring the optical density of the culture at 750nm. The experimental treatments were maintained at optimum culture conditions of salinity, temperature and light intensity (30ppt, 19^0C and 2500 lux respectively).

In the *Nannochloropsis* culture in mixotrophic culture condition, the addition of glucose at various concentrations had the advantage of an overall increase in the cell count during the culture when compared to the control. The lag phase continued for 2 days in the treatment groups 0 and 10 mM and in the groups treated with 25, 50 and100mM glucose, the culture was already in the exponential phase. The *Nannochloropsis* cultured with 25mM glucose was steadily in exponential phase from 3rd day onwards while in the culture with 100mM glucose, the algal cells got into their logarithmic growth phases and reached the maximum cell count on 4^{th} day of inoculation, thereafter in the declining phase and followed by the stationary phase on 6^{th} day (Fig.1).

In the *Nannochloropsis* culture in heterotrophic culture condition, the lag phase continued for 2 days in the 25 and 50mM glucose treatments and only the 50mM group could enter into exponential culture till the 4^{th} day followed by stationary and declined phase. In comparison, in the 100mM glucose treatment group, the culture was in exponential phase on 2nd day itself and was progressing with minimum increase in cell count. The control culture, as well as the 10mM glucose treated culture, could not progress in the heterotrophic condition. However, compared to the mixotrophic culture of *Nannochloropsis*, there was not much improvement in cell count for the culture in heterotrophic conditions.

In the *Isochrysis* culture in mixotrophic culture condition, the addition of glucose at different concentrations had a synergistic effect with all the treated groups showing exponential phase from 2nd day onwards. 100mM treated group performed better with increased cell count with a maximum on the 4^{th} day of the culture. The 50mM glucose treatment also followed the same trend as that

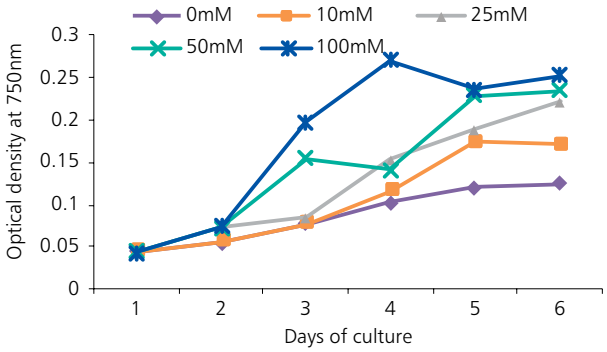

Fig. 1. *Nannochloropsis* culture in mixotrophic condition with different glucose concentration

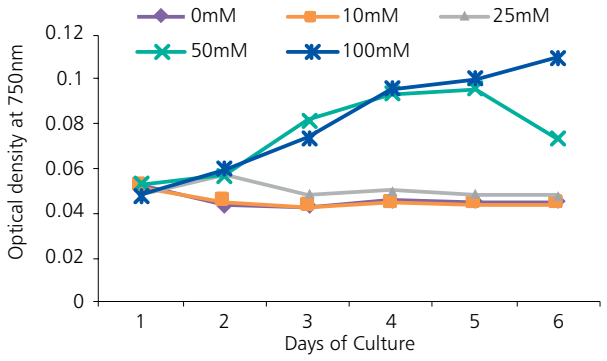

Fig. 2. *Nannochloropsis* culture in heterotrophic conditions with different glucose concentration

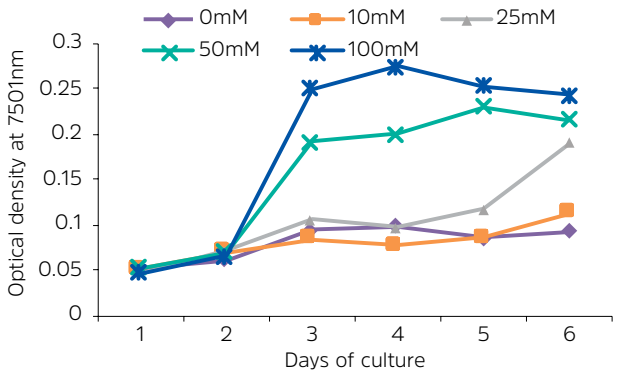

Fig. 3. *Isochrysis* culture in mixotrophic conditions with different glucose concentration

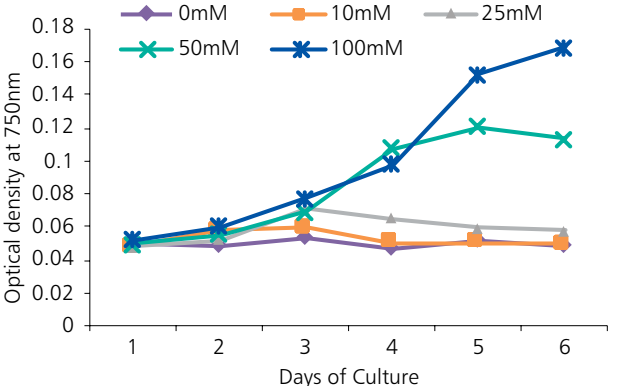

Fig. 4. *Isochrysis* culture in heterotrophic conditions with different glucose concentration

of 100mM, with less cell count. The culture with 25mM glucose exhibited a gradual increase during the culture period of 6 days.

Inclusion of 50mM and 100mM glucose only had an advantageous effect on *Isochrysis* culture during the heterotrophic condition. At 100mM glucose inclusion, the culture was progressing with improved cell count during the culture period (6 days). Whereas in the 50mM glucose treated group, the culture showed a slow increase in cell count compared to the 100mM glucose, with maximum cell count on the 5th day followed by the declining and stationary phase. The rest of the glucose treated groups were in a declining phase from 3rd day of the culture in heterotrophic culture conditions.

Conclusion drawn is that the inclusion of glucose at different concentrations ranging from 0 to 100mM had the advantage on improvement of cell count of both *Nannochloropsis* and *Isochrysis* culture during mixotrophic culture conditions and among the different glucose concentrations, the 100mM inclusion could perform better with improved cell count. There was not much benefit on microalgal culture during heterotrophic conditions over the mixotrophic condition.