

Construction of a tank in pilot scale for microalgae cultivation aiming lipid production

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Abstract

The cultivation of two microalgae species was conducted under mixotrophic conditions, followed by lipid extraction to evaluate possible applications. Monitoring its growth, it is possible to optimize this process to increase both biomass and lipid productions, and in the future, gradually scale up to the possible use of this study in a pilot or industrial scale.

Key words:

Microalgae, Scale up, lipid.

Introduction

Microalgae are photosynthetic organisms that present high productivity of biomass, and therefore their cultivation is an alternative for the industrial production of oils with different applications.

When studying the growth of microalgae, it is sought to optimize the process and analyze the best cultivation conditions. Biomass concentration was monitored, and the final oil content was quantified for the future scale-up process.

The genus of microalgae studied, *Botryococcus*, presents high lipid accumulation, besides an extracellular production. However, it has a low rate of cell growth.

Results and Discussion

1. PRELIMINARY STUDY (LABORATORY SCALE)

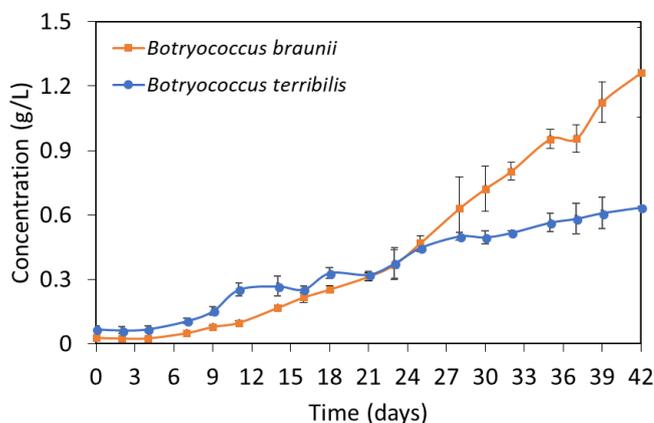


Figure 1. Growth for the autotrophic cultivation of both *Botryococcus* species (UV spectrophotometer).

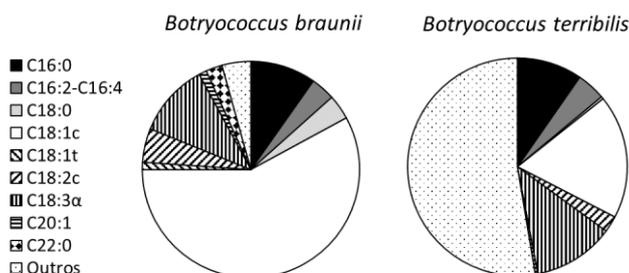


Figure 2. Fatty acids (FAs) profile for the autotrophic cultivation of both species.

Remarks:

- *B. braunii* showed higher growth rate and final biomass concentration;
- Other FAs in *B. terribilis* may have more than 24 carbons;
- Oleic acid is predominant in both species.

2. SCALE UP STUDY



Figure 3. First scale up from 250 mL to 2 L of microalgae cultivation, in Erlenmeyer.

Table 1. Initial (i) and final (f) biomass concentration and lipid content of *B. braunii*.

Volume / time	C _i (g/L)	C _f (g/L)	Lipids (%)
0,2 L / 6 weeks	0.03	1.26	30.0
2 L / 4 weeks	0.04	0.50	17.5

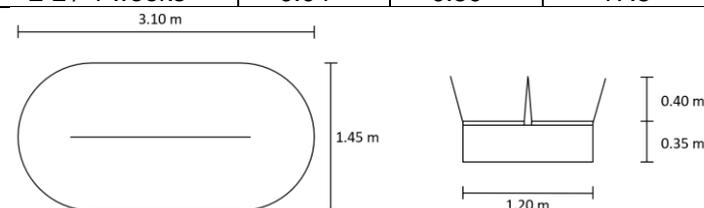


Figure 4. Sizing of an approximately 1,000 L tank.

Remarks and quotation:

- The tank (open pond) must have a maximum height of 40 cm, to guarantee light incidence;
- The culture must be on constantly circulation, for CO₂ capture and to avoid dead zones;
- In a specialized company of microalgae cultivation tank, the quotation was around USD\$13,000 without shipping and taxes (international company);
- The base of the tank can be obtained in glass fiber for USD\$640.00 but it requires further quotations to adapt this to an open pond, such as round the edges, add a 'wall' in the center, and a paddlewheel to circulate the water (national company).

Conclusions

- The scale up has many issues and this study aims to minimize this and optimize the process;
- From the FAs profile it is possible to select which microalgae to use, depending the application of the final product;
- Although the high cost, this process is an alternative sustainable method to concentrate biomass.

Acknowledgement

