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Influence of Culture Media on Indigenous Microalgae Growth, Biomass Productivity and Lipids Content for Promising Biodiesel Production

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ABSTRACT

Variation in the composition of the culture medium plays an important role in the biochemical composition of microalgae which can be valorized into products with high added value such as lipids for biodiesel production. Different media have varying concentrations of nutrients that can significantly alter the amount of cell growth and secondary metabolites accumulated during culture. In this work, the effect of culture medium on biomass production and lipids content was evaluated from an indigenous microalgae consortium. These microalgae strains have been isolated from freshwater source located in the northeast region of Algeria. For this purpose, three culture media as adapted for the cultivation of green microalgae were selected: Bold Basal's medium (BBM), modified Blue-Green (BG-11) and Zarrouk medium. The obtained results show that modified BG11 is the appropriate culture medium for the studied strains. In fact, microalgae consortium presented a high growth rate (1.22 d^{-1}) and significant biomass productivity (about 0.36g/L/d. In addition, the harvested biomass was valorized through its lipids content for biodiesel production. An appreciable average value of 46% was obtained in the case of modified-BG11 medium.

Keywords: microalgae; growth medium; photobioreactor; lipids; biodiesel.

1. Introduction

Recently, biodiesel has received great attention from researchers due to its low toxicity and biodegradable characteristics, also for the fact that it is derived from biological sources, especially vegetable oils and fats that make them renewable source for both energy production and low greenhouse gas emissions into the atmosphere [1]. Microalgae biomass potentially represents an ideal feedstock as fatty raw material for biodiesel production. Several works indicate that microalgae cultivation is interesting for its positive energy balance between production and power generation processes and also due to the high photosynthetic efficiency of these organisms [2]. Environmental conditions during microalgae cultivation influence directly the biomass productivity. In this way, lipid yield is also influenced by growth and/or stress conditions, as well as the culture medium used, which affect the quantity and quality of the fatty acids synthesized by microalgae [3]. The aim of this study was to evaluate the influence of three different media, BBM (Bold's Basal medium) [4], modified-BG11 (Blue Green medium) [5] and ZM (Zarrouk medium) [6], on growth rate, biomass productivity and lipids content of the indigenous microalgae consortium cultivated in a cylindrical photobioreactor under controlled conditions.

2. Experimental

The growth study was carried out by setting some operating parameters that can influence growth (incident light, air flowrate, temperature). The optimal values of these parameters were set according to previous experiments carried out in the laboratory. Microalgae are grown during 11 days in a closed photobioreactor maintained at 25 ± 1 ° C in controlled room, with 0.5L/min of supplying air and under continuous white light (8000 Lux).

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3. Results and Discussion

Figure 1 illustrates the daily evolution of the microalgae dry weight following the three culture media chosen. The observed values are satisfactory for the case of modified-BG11, with 1.22 d^{-1} biomass growth rate and 0.36 g/L/d biomass productivity (Table 1). Wong et *al.* [7] reported a growth rate value of 0.215 d^{-1} in the case of *Chlorella sp.* cultivation. At the end of cultivation, the biomass was harvested and lipids were subsequently extracted according to the Bligh and Dyer method [8]. A maximum value of lipids content (an average value of 46%) was obtained in the case of BG11 medium (Table 1). It clearly appears that the modified BG-11 culture medium is best suited for rapid growth and significant biomass production as well as a satisfactory lipid content, from the consortium of microalgae cultivated in a photobioreactor under controlled conditions.

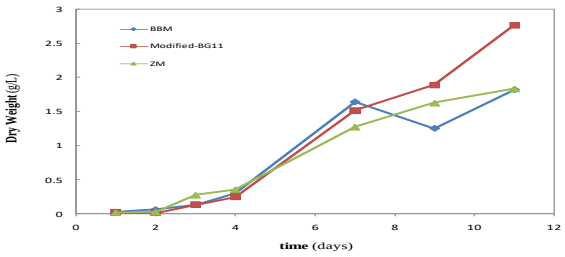

Figure 1: Growth of microalgae consortium

Table 1: Growth rate, biomass productivity and lipids content

Culture medium	Growth rate (d^{-1})	Biomass productivity (g/L/d)	Lipids content (%)
BBM	0,77	0,22	26,33
Modified-BG11	1,22	0,36	46,37
ZM	0,76	0,21	37,71

4. Conclusions

The results obtained clearly show that the optimum modified-BG11 medium adapts perfectly to invested indigenous microalgae for rapid growth, good biomass productivity and considerable lipid content for biodiesel production.

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