Microalgal biomass production: a novel carotenoid accumulating fast-growth *Dunaliella* mutant

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INTRODUCTION

Biomass production is the first step of a biotechnological process involving microorganisms. Recently, microalgal biomass has gained importance due to the commercial interest of its applications, including vitamins, pigments and biofuel production or CO_2 recovery/assimilation. Therefore, it is necessary to optimize the microalgal biomass production, operating about the parameters regulating the process, and to identify different strains characterized by a rapid growth.

Regarding this subject, the present work is aimed to determine the growth parameters of a *Dunaliella salina* mutant, obtained by means of ethyl metil sulfonate (mutagenic agent) and, to compare them with those of the mother strain. Besides, the existing differences between both cultures grown in laboratory and outdoor conditions are evaluated.

MATERIALS AND METHODS

The experiments have been performed using two strains belonging to Dunaliella genus; one of them obtained after incubation with a mutagenic agent (ethyl metil sulfonate) and an original strain.

In the assays carried out under lab conditions, disposable polietilen bags of 50 liters exposed to Photosynthetic Active Radiation (PAR; 100 $\mu E \cdot m^{-2} \cdot s^{-1}$) were employed to incubate cultures.

Figure 1. Polietilen bags containing several *Dunaliella* strains growing.

In the outdoor, the systems used to growth cultures have been paddle – reactors with 300 liters of capacity manufactured with polyester and glass fiber.

RESULTADOS

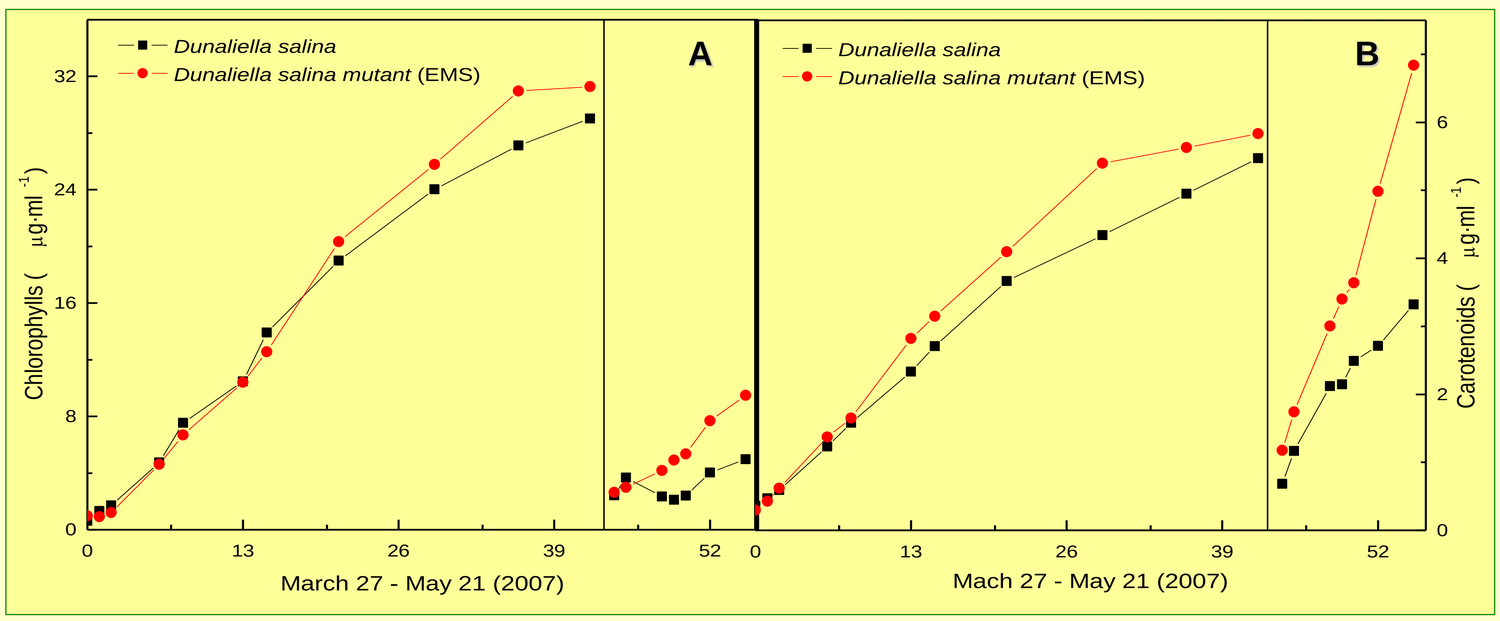

Figure 2. Evolution of total chlorophyll (A) and carotenoids (B) quantified from *Dunaliella* strains in both laboratory (to the left of the vertical line) and outdoor conditions (to the right of vertical line).

Strains	Growth rates (d^{-1})		
	Laboratory	*Outdoor (April/May)*	*Outdoor (July)*
Dunaliella salina	0.08	0.176	0.250
Dunaliella salina mutant (EMS)	0.11	0.215	0.543

Table 1. Growth rates calculated from cellular number for *Dunaliella* strains. Results exposed in both second and third column correspond to independent experiments.

Strains	Chlorophyll rates (d^{-1})	
	Laboratory	*Outdoor (April/May)*
Dunaliella salina	0.054	0.029
Dunaliella salina mutant (EMS)	-0.057	-0.105

Table 2. Chlorophyll rates calculated from both chlorophyll content (pg/ml) and cellular number (cel/ml) data for *Dunaliella* strains.

Strains	Carotenoids rates (d^{-1})	
	Laboratory	*Outdoor (April/May)*
Dunaliella salina	0.012	0.039
Dunaliella salina mutant (EMS)	-0.070	-0.063

Table 3. Carotenoids rates calculated from both carotenoid content (pg/ml) cellular number (cel/ml) data for *Dunaliella* strains.

Results showed in table 1 point out that laboratory growth rates are lower than those obtained in outdoor conditions.

Rates included in tables 2 and 3 have been calculated through the following expressions:

$$\mu_2 = \frac{Ln\left(\frac{\left(\frac{pg\ \text{Chlorophylls}}{\text{cellular nº}}\right)_{t_2}}{\left(\frac{pg\ \text{Chlorophylls}}{\text{cellular nº}}\right)_{t_1}}\right)}{t_2 - t_1}$$

$$\mu_3 = \frac{Ln\left(\frac{\left(\frac{pg\ \text{Carotenoids}}{\text{cellular nº}}\right)_{t_2}}{\left(\frac{pg\ \text{Carotenoids}}{\text{cellular nº}}\right)_{t_1}}\right)}{t_2 - t_1}$$

DISCUSIÓN

- From this work, a faster growth (about 30 %) has been observed in *Dunaliella salina* mutant both in laboratory and outdoor conditions.
- Also, a differential pattern in relation to the chlorophyll synthesis by cellular unit has been identified when results obtained from the mutant are compared with those from *Dunaliella salina* mother strain.
- It is necessary to continue developing works in this line to throw light on several aspects as both carotenoids and chlorophylls synthesis patterns by cellular unit detected in the mutant.

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