Production of lutein-enriched microalgal biomass

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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, in order to reduce biomass production costs, it is necessary to optimize the microalgal biomass production process, optimizing growth and process engineering parameters and identifying differents strains of rapid growth.

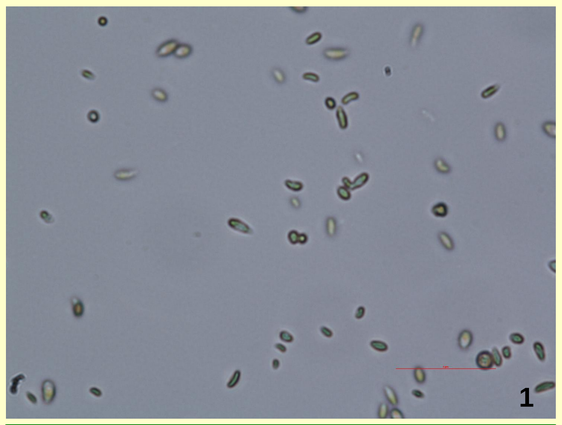

Figure 1. Optical microscopic image of *Chlamydomonas acidophila´s* culture.

Regarding this subject, the present work is aimed at determining the growth parameters of an extremophile strain of microalga, isolated by our group from the Tinto river (an acid river with extrems conditions for life in the south west of Spain), which is very promising for lutein production.

The aim of this work was to study the productivity of semicontinuous cultures of *Chlamydomonas acidophila* and its content of pigments (mainly lutein) as a function of the culture optical density, at high irradiance (saturation) and in air fluidized-bed bioreactors.

MATERIALS AND METHODS

Figure 2. Air fluidized-bed bioreactors used in the biomass productivity experiments.

Chlamydomonas acidophila **strain was grown on a F2 modified medium. The cultures were grown under lab conditions in 5 liters cylindrical air fluidized-bed bioreactors. The pH of the medium was 2.5. CO_2 (5% in air v/v) was used as the only carbon source.**

A photosynthetic active radiation irradiance of 900 $\mu E \cdot m^{-2} \cdot s^{-1}$ was provided by fluorescent lamps, and the temperature was 25ºC.

The growth was followed by using semicontinuous cultures process at different cell densities which were maintained by means of successive dilutions.

The subsequent growth rates were calculated from optical density data at 750 nm and biomass dry weigth data.

The pigment content of the microalgae was determined by UV-VIS spectrophotometer after extraction with organic solvent.

RESULTS

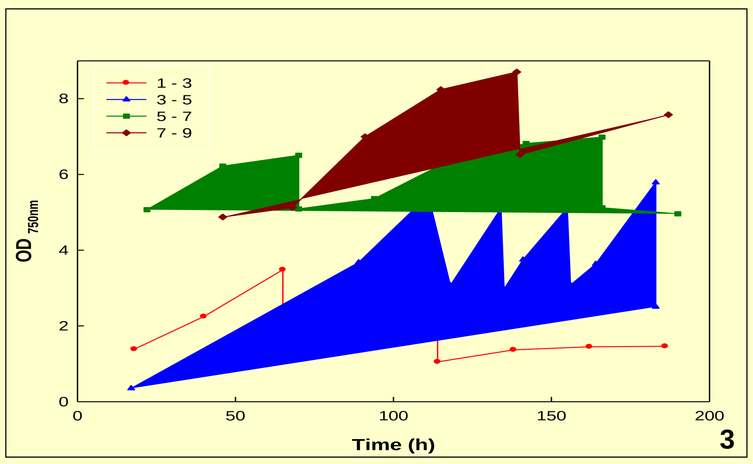

Figure 3. Effect of initial optical density on the growth of *Chlamydomonas acidophila.* Semicontinuous cultures were run under lab conditions and continuously illuminated with 900 $\mu E \cdot m^{-2} \cdot s^{-1}$ PAR.

OPTICAL DENSITY	*GROWTH RATE (d^{-1})*
1-3	0.396
3-5	0,871
5-7	0,180
7-9	0,132

Table 1. Growth rate of cultures incubated at different optical densities of *Chlamydomonas acidophila*.

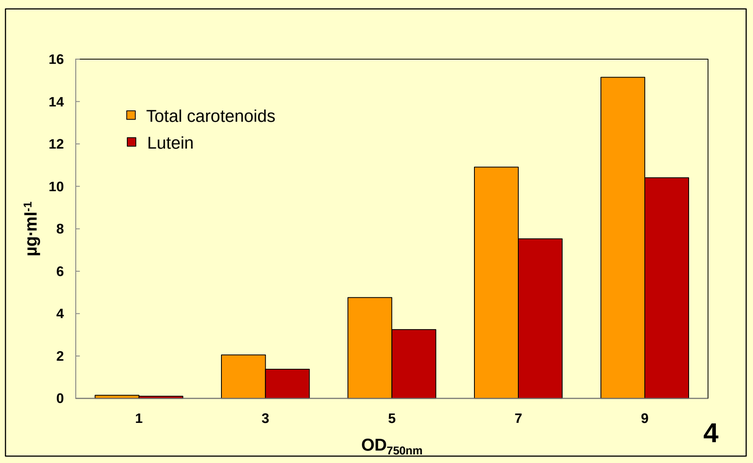

Figure 4. Maximun content of total carotenoids and lutein obtained from *Chlamydomonas acidophila* cultures incubated under lab conditions at different optical densities.

OPTICAL DENSITY	*VOLUMETRIC PRODUCTIVITY ($gr \cdot l^{-1} \cdot d^{-1}$)*
1-3	0.131
3-5	0.282
5-7	0.058
7-9	0.043

Table 2. Volumetric productivity of biomass calculated from the semicontinuous cultures at the different optical densities assayed.

DISCUSSION

- **Biomass of the microalga *Chlamydomonas acidophila* can be efficiently obtained by means of its semicontinuous culture in air fluidized-bed bioreactors.**
- **Cell density of the cultures greatly influences the growth rate and therefore the productivity (about 80 %) for saturating light.**
- **The large pigments content of the microalgal biomass suggests a possible use of this strain for commercial production of lutein.**

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