Biochemical profiles in *Pavlova lutheri*: combined effects of light intensity and temperature

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INTRODUCTION

It is widely accepted that microalgae yield specific metabolic responses to variations in their surrounding environment; however, the nature and extent of such interactions is not yet fully understood. In terms of physical parameters, incident light intensity and operating temperature are the main factors that affect overall biomass productivities in microalgal systems; consequently, it is useful to experimentally establish their interdependence, aiming at their optimization. Towards this purpose, the microalga *Pavlova lutheri* was cultivated according to an experimental factorial design encompassing those factors. The dynamics of the culture were monitored *via* characterization of its biochemical profile, generated in response to both the environmental conditions provided and the actual growth phase. In order to rapidly assess the status of the culture, relationships between biochemical indicators and physiological indices were also hypothesized and validated.

MATERIALS & METHODS

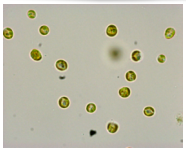


Figure 1 - *Pavlova lutheri* (SMBA 60)

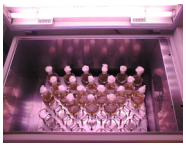


Figure 2

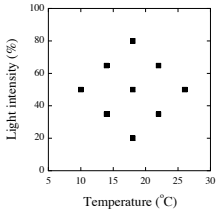


Figure 3 - Experimental design, in terms of light intensity (%) and temperature (°C). The relation between percentage values (X) and PAR radiation (Y) can be calculated *via* the empirical relationship Y=2.97X.

Microalgal cultures (Figure 1) were inoculated into Erlenmeyer flasks with ASW culture medium, modified as described elsewhere (Carvalho and Malcata, 2003). Culture flasks were incubated in a Gallenkamp orbital incubator (Figure 2), stirred at 100 rpm and submitted to the desired temperature and light regimes (Figure 3).

Analytical assaying

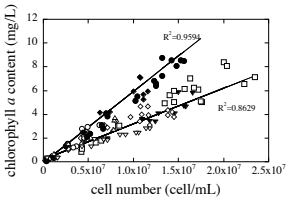
Biochemical composition

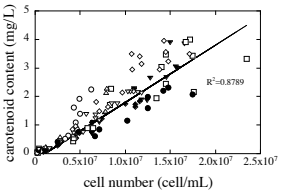
Total carbohydrates (Dubois et al. 1956)
Total protein content (Lowry et al. 1951)
Total lipids (Bligh and Dyer 1959)
Pigment contents (Jeffrey and Humphrey 1975)
Intracellular contents of carbon, nitrogen, phosphorus and sulphur (Elemental Analysis)

Biomass concentration

Cell numbers
Ash free dry weight

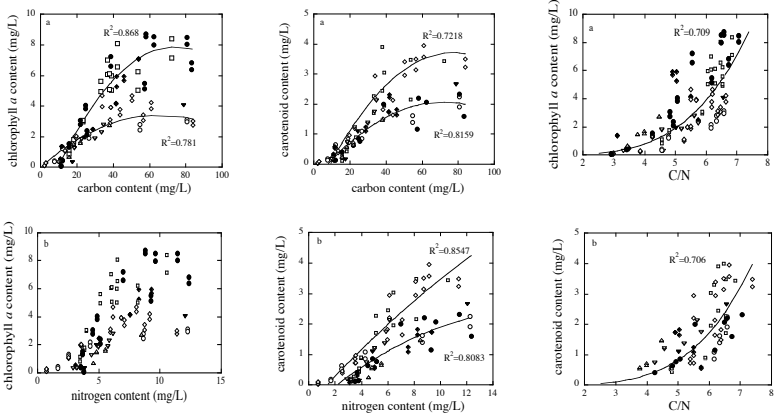
RESULTS & DISCUSSION





Chlorophyll *a* is not a suitable indicator of population biomass, since it depends on the actual light regime used: from the whole dataset generated, two linear behaviours may be pinpointed, one encompassing the data points pertaining to the experiments run at lower light intensities (R^2=0.959), and the other including the points obtained at the higher ones (R^2=0.863).

The mass content of extractable carotenoids increases linearly with cell number, irrespectively of the light-temperature regime followed; hence, this is a more accurate measurement when estimation of population biomass is sought.



Relationships between extractable carotenoid and carbon, and extractable chlorophyll *a* and nitrogen, previously reported to be linear in certain conditions, suggested that the dependence of pigment content on the internal nutrients seems to be influenced by environmental conditions.

LITERATURE

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