



Light regulating metabolic responses of *Cyanobium* sp. (Cyanobacteria)

Fernando Pagels^{1, 2, *}, José Bonomi Barufi³, Julia Vega⁴, Roberto Abdala-Díaz⁴, Vitor Vasconcelos^{1, 2}, A. Catarina Guedes¹ and Félix L. Figueroa⁴

With 6 figures and 2 tables

Abstract: Cyanobacteria are an important group of microorganisms of significant economic interest due to, for example, the antioxidant capacity of their metabolites. *Cyanobium* sp. LEGE 06113 is a marine cyanobacterium poorly studied, but with promising future applications. The aim of this study was to optimize the light conditions (both source and irradiance) and nutrient (N and P) concentration for *Cyanobium* sp. production as a source of high-valued compounds. The optimization of the processing parameters was performed using two different light sources (fluorescent and low-pressure sodium lamp), four irradiances (50, 100, 200 and 300 $\mu\text{mol photons m}^{-2} \text{s}^{-1}$) and two variations of BG11 medium (BG11 and BG11+, with the second containing double amounts of phosphates and nitrates). The effects of the three factors were evaluated on the biomass production, photosynthetic activity, biochemical composition and antioxidant capacity. A synergistic effect between the light source, light intensity, and medium was observed for all measured parameters, with the greatest impact of light irradiance on the metabolism of *Cyanobium* sp. The combination of the SOX lamp, BG11+ medium, and a light irradiance of 200 $\mu\text{mol photons m}^{-2} \text{s}^{-1}$ was optimal for the cultivation of *Cyanobium* sp. This work reports the tools for the production of *Cyanobium* sp. as a source of high-value products, thus increasing its biotechnological potentials.

Keywords: antioxidant capacity; carotenoids; cyanobacteria; phenolic compounds; photosynthetic activity; phycocyanin

Introduction

Cyanobacteria, also known as blue-green algae, are a group of photosynthetic prokaryote microorganisms of great economic interest mainly due to their capacity to synthesize multiple high-valued compounds that find application in the nutraceutical, cosmetics, and pharmaceutical industries (Graham et al. 2016).

Industrial production of cyanobacteria is usually focused on a single product, and the diversity of cyanobacteria contributes to the use in different kinds of applications (e.g. feed, food, cosmetic and pharmaceutical products). In addition, the right combination of cultivation conditions is essential for its applicability. Moreover, the plasticity of cyanobacterial metabolism makes it favourable for production; it is possible to

Authors' addresses:

¹ CIIMAR – Interdisciplinary Centre of Marine and Environmental Research, University of Porto, Novo Edifício do Terminal de Cruzeiros de Leixões, Avenida General Norton de Matos, s/n, 4450-208 Matosinhos, Portugal

² FCUP – Faculty of Science, University of Porto, Rua do Campo Alegre, s/n, 4169-007 Porto, Portugal

³ Botany Department, Federal University of Santa Catarina, Campus de Trindade, Florianópolis, 88040-970 Santa Catarina, Brazil

⁴ Universidad de Málaga, Instituto de Biotecnología y Desarrollo Azul (IBYDA), Departamento de Ecología, Campus Universitario de Teatinos, 29071, Málaga, Spain

* Corresponding author: fernandopagels@gmail.com