

P025-S

Determination of light distribution profile and microalgae cells flow pattern in column photobioreactors

B. D. Fernandes¹, A. Mota¹,
J. L. Oliveira¹, A. Ferreira¹, G. Dragone¹,
J. A. Teixeira¹, A. A. Vicente¹

¹ *Centre of Biological Engineering, University of Minho, Braga, Portugal, e-mail: brunofernandes@deb.uminho.pt*

The slow development of microalgal biotechnology is mainly due to difficulties in designing large-scale photobioreactors (PBR) where light energy is efficiently utilized. Due to the light gradient inside the reactor, and depending on the mixing properties, cells are subjected to light/dark cycles where the light period is characterized by a light gradient. These light/dark cycles will constitute the cells' light history; they determine productivity and biomass yield on light energy.

In order to know the cells' light history it is necessary to analyse the flow patterns inside the PBR. These are closely related with the pattern of movements to which the cells are subjected within the PBR and thus allow establishing a correlation with light regime inside the PBR.

In this work this was achieved by a new approach, combining optical fiber technology and a very simple particle tracking methodology, applied to three column bioreactors: a bubble column and two different types of airlift.

The use of optical fiber technology, improved by our group [1], provides in-

formation about quantitative (photosynthetic photon flux density) and qualitative (spectral intensity distribution) aspects of light patterns.

For flow pattern visualization, a particle tracking system based on alginate spheres with incorporated riboflavin was used. The riboflavin-loaded alginate particle was placed in the liquid phase and illuminated at 90 degrees to the camera by two fluorescent black lights (Genesis F20T9/BLB) in order to make the riboflavin glow. Particle flow was followed by sets of images grabbed with a Canon EOS 600D photo camera.

The combination of these techniques allowed obtaining a full light characterization, a clear flow pattern image, as well as particle velocity and circulation time in three different PBRs at different values of superficial gas velocity.

References

1. Fernandes B., Dragone G., Teixeira J., Vicente A.: Light regime characterization in an airlift photobioreactor for production of microalgae with high starch content. *Applied Biochemistry Biotechnology*, **161** 218–26 (2010).