Solar Energy to Biomass –
Optimisation of light energy conversion in plants and microalgae Conference 2020

Solar Energy to Biomass Conference 2020

Porto, Portugal

11th - 14th February 2020

Program

Book of Abstracts

List of Participants

Sponsored by:

This project is funded by the European Union's Horizon 2020 research and innovation programme under grant agreement no. 675006

Red LED as trigger for cyanobacterial pigments production in a two-phase cultivation

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Cyanobacteria are photosynthetic organisms capable of chromatic acclimation in response to changes in light conditions. More specifically, red light is mainly involved in up-regulating pigments content, causing an increase of the production of phycobiliproteins and carotenoids. Cyanobacterial pigments have a high economical interest due to the several applications in industry. However, new strategies for the upstream processing are needed in order to increase the pigments productivity on these organisms, thus making the process economically viable. In this sense, two-phase light systems have been applied in microalgae and can be a feasible way to do the same in cyanobacteria.

This work explores the biotechnological potential of *Cyanobium sp*., by optimizing its response to white and red LED, aiming the establishment of the best conditions for pigments production – carotenoids and phycobiliproteins.

Cyanobium sp. was grown under seven different combinations of white (W) and red (R) illumination treatments, changing the time of each light phase (W + R: 21 + 0, 18 + 3, 14 + 7, 10 + 11, 7 + 14, 3 + 18 and 0 + 21 days). Biomass (dry weight), photosynthetic activity (in vivo chlorophyll fluorescence), and pigment composition in terms of carotenoids (HPLC) and phycobiliproteins (spectrophotometry) were measured along time.

Two distinct metabolic behaviors were found in *Cyanobium sp.,* one under white and another under red illumination. Red light induced to a higher photosynthetic activity and higher content of carotenoids (1.8-fold) and phycobiliprotein (1.6-fold) when compared to white light. The use of a two-phase system using both LEDs increased the maximum productivity of biomass and pigments. The optimal cultivation condition was 10 days of white plus 11 days of red light; although, the highest productivity was found after 4 days of the red phase. The optimized biomass contains 123.7 ± 3.9 mg.gDW-1 of phycobiliproteins and 32.8 ± 1.9 mg.gDW-1 of carotenoids.