Master thesis proposal in scope of the ALGAESOLUTIONS project

Universidade do Algarve

Academic Year: 2021-2022

Student	**Name:** **Number:** **Email:**
Title of Master Thesis	Optimal light for algae cultivation
Scientific Area	Microalgal Biotechnology
Supervisor(s)	João Varela, Universidade do Algarve, Campus de Gambelas, jvarela@ualg.pt Peter Schulze, Associação Oceano Verde, Universidade do Algarve; peterschulze@greencolab.com
Location	Associação Oceano Verde Universidade do Algarve, Campus de Gambelas Edf. 12 - Gab. H8 8005-139 Faro, Portugal www.greencolab.com
Goals	• Investigate optimal combinations of blue, red and green lights for photosynthetic performance at specific light intensities and culture concentrations in photobioreactors. • Develop models to predict optimal light regimes for algal cultures.
Abstract	**Background:** The major bottlenect in photoautotrophic microalgal cultivation is the delivery of light with the right properties to drive photosynthesis in all microalgal cells within a culture. One of the major problems of algal cultivation are the cells at the periphery, which prevent penetration of light into the phtobioreactor (PBR), limiting the photosynthetic efficiency and productivity of the whole culture. To improve the delivery of photons to cells in a culture, optimal wavelengths and light intensities need to be identified for a target species and culture concentration. **Objective:** This MSc thesis project will be part of the ALGAESOLUTIONS project and aims to develop models based on laboratory experiments that predict the required light intensity of algal cultures at a given growth stage that can be applied to the facilities of industrial partners. **Implementation:** The photosynthetic oxygen evolution will be measured in different microalgal cultures inside a photosynthetic chamber. Different LED combinations will be tested at different light intensities and biomass concentrations. The photosynthetic oxygen evolution rates obtained will be modelled and analysed. Secondly, to validate the model, cultures will be grown indoors in batch cultures under light regimes that were predicted from the model established. Samples will be collected to calculate the growth rates, biomass productivities, maximum biomass

	concentration, yield and to determine photosynthetic efficiency of algal cultures and biochemical composition of the biomass. **Outlook:** The developed knowledge will be used to design smart LED lighting systems that are tailored to the need of a specific culture. **Who:** You should be interested in microalgal biotechnology, photosynthesis, algae cultivation and designing/building of experimental setups. You should also have some lab experience. If you are interest to write your thesis on this topic, contact peterschulze@greencolab.com. **References:** I. Blanken, W., Cuaresma, M., Wijffels, R.H. and Janssen, M., 2013. Cultivation of microalgae on artificial light comes at a cost. Algal Research, 2, pp.333-340. II. Ooms, M.D., Dinh, C.T., Sargent, E.H. and Sinton, D., 2016. Photon management for augmented photosynthesis. Nature Communications, 7, pp.1-13. III. Schulze, P.S., Barreira, L.A., Pereira, H.G., Perales, J.A. and Varela, J.C., 2014. Light emitting diodes (LEDs) applied to microalgal production. Trends in biotechnology, 32, pp.422-430. IV. Schulze, P.S., Brindley, C., Fernández, J.M., Rautenberger, R., Pereira, H., Wijffels, R.H. and Kiron, V., 2020. Flashing light does not improve photosynthetic performance and growth of green microalgae. Bioresource Technology Reports, 9, p.100367.
Schedule	Experimental start: November 2021 Experimental end: June 2022