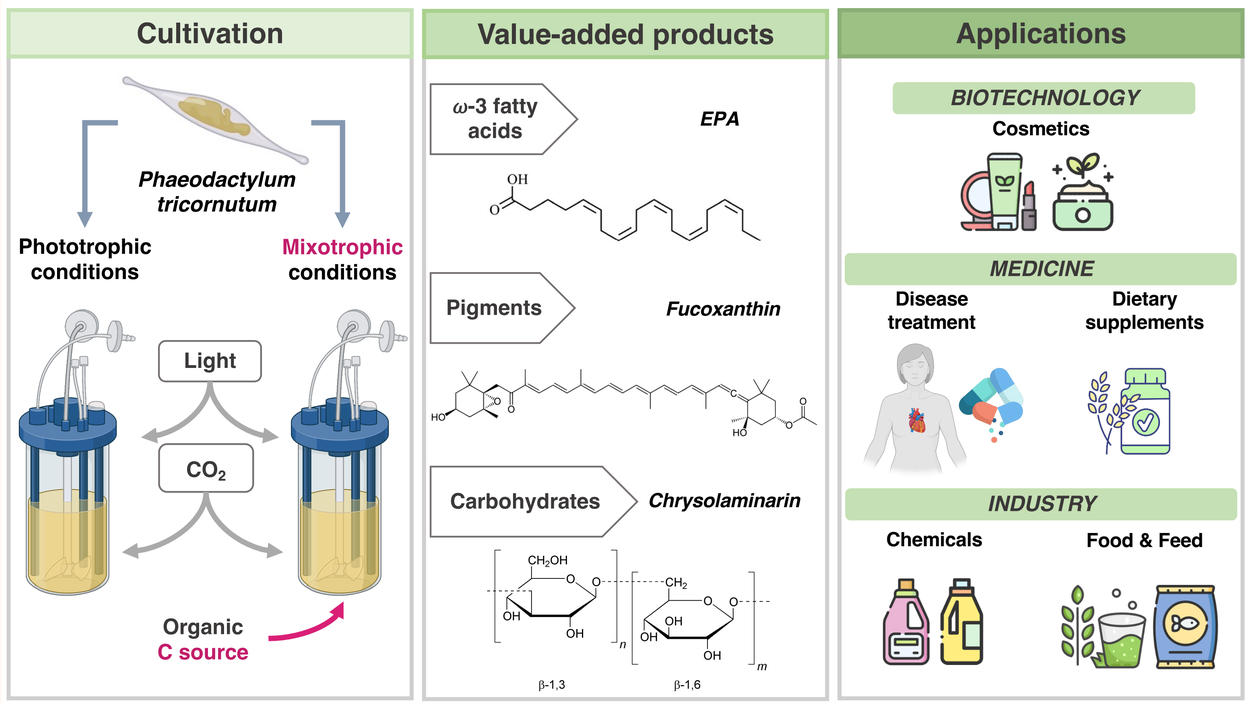
CULTIVATION OF *PHAEODACTYLUM TRICORNUTUM* IN A LABORATORY SCALE PHOTOBIOREACTORS SYSTEM

C. Celi *[a], F. Savorani [a] and D. Fino [a,b]

[a] Politecnico di Torino, Department of Applied Science and Technology, Torino, Piemonte, Italy

[b] Istituto Italiano di Tecnologia, Center for Sustainable Future Technologies, Torino, Piemonte, Italy

*corresponding author, *(e-mail: caterina.celi@polito.it)*



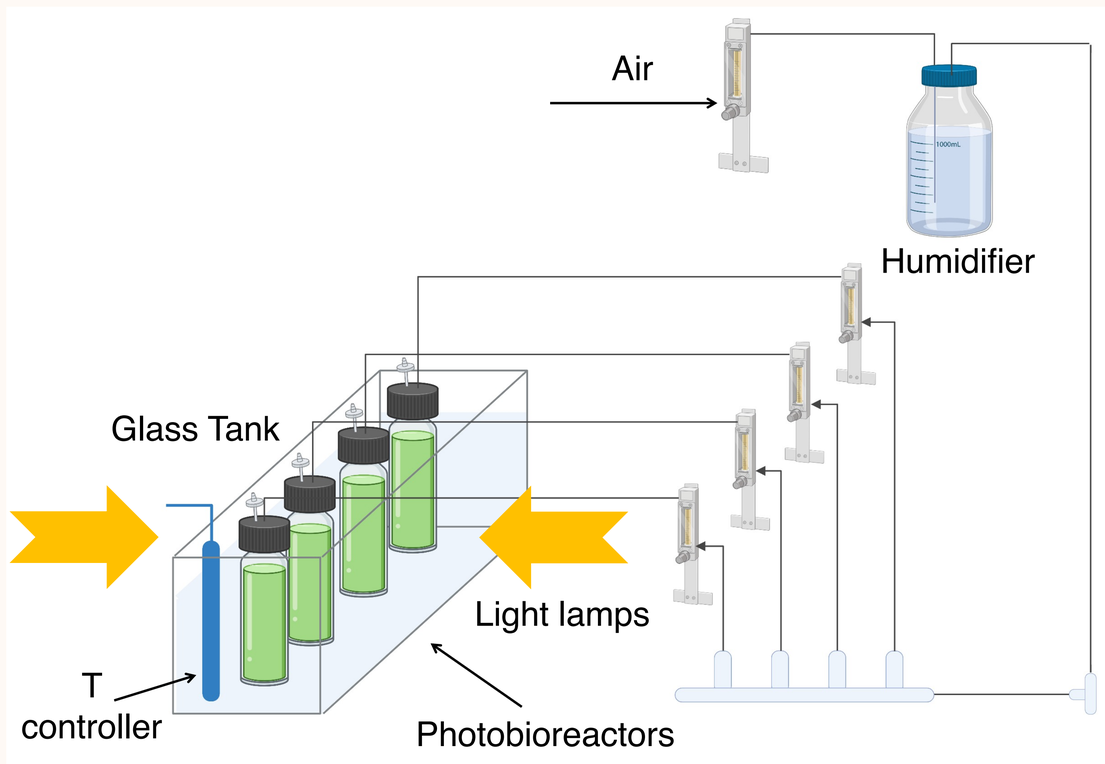
- ***Phaeodactylum tricornutum*** is a marine pennate diatom that accumulates a large spectrum of marketable products.
- It produces **Fucoxanthin**, **EPA** and **Chrysolaminarin.**
- It is a successful **photoautotroph**, but it is also capable of **mixotrophic** growth on glucose, acetate, glycerol, fructose and wastewaters.
- In this study *P. tricornutum* CCAP 1055/18 has been grown in a specially designed **laboratory-scale photobioreactors system**.

Introduction

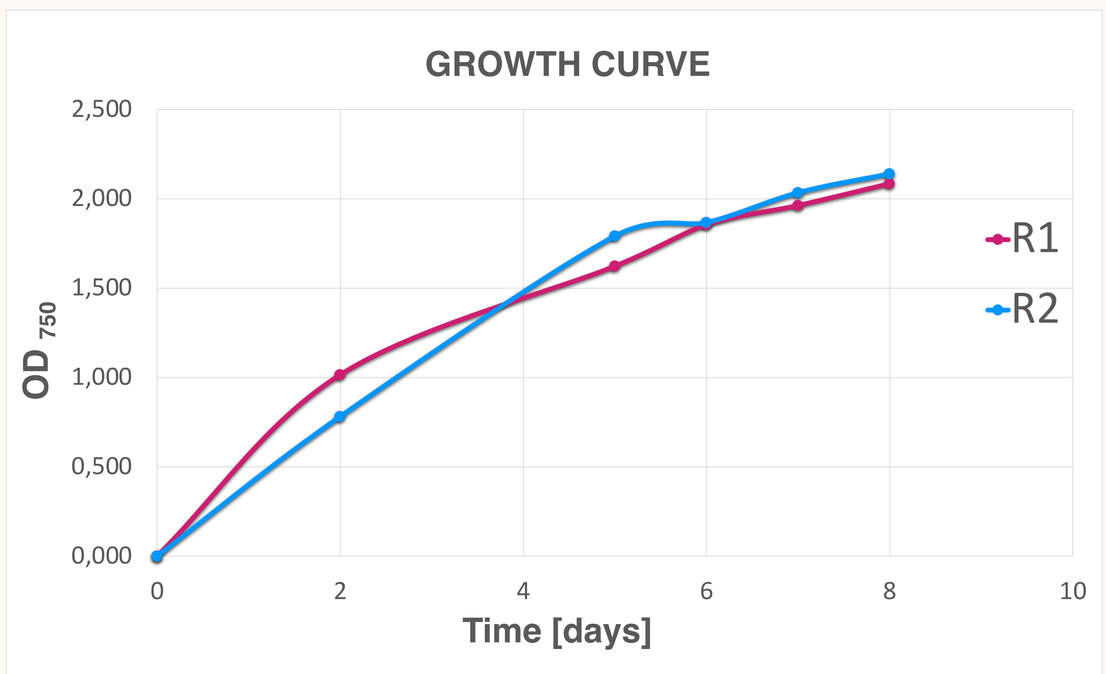
- The **laboratory-scale photobioreactor system** [1] is composed of a glass tank, enabling the passage of light.
- The **water bath** and the temperature controller assure the cultivation at specific temperatures.
- Light is provided by two **8000 lumen fluorescent white lamps** standing at the sides.
- **10 locations for photobioreactor** tubes of 200 mL each.

Methods

- **Number of reactors: 2 in phototropic conditions**
- **ESAW medium [2], Sodium Bicarbonate 0,174 g/L**
- **21± 0.5 °C**
- **pH= 8 ÷ 8.5**
- **Air flow: 1 vvm (200 mL/min)**



Results



- The plot shows the growth curve of *P. tricornutum* CCAP 1055/18 performed in two reactors of the designed system for 8 days of cultivation.
- Samples were measured through a spectrophotometer at 750 nm to acquire the Optical Density value.
- Data were analyzed through **linear regression**.
- The **exponential growth rate** for R1 and R2 resulted as **0.2532 d^{-1}** and **0.2727 d^{-1},** respectively.
- **Doubling time** was 2,738 for R1 and 2,542 for R2.
- The **final biomass concentrations** obtained after filtration were **0,851 g/L** and **1,164 g/L**, for R1 and R2 respectively.

Conclusions

- The **laboratory-scale photobioreactor system** tested in this study allowed to obtain higher growth rates for *P. tricornutum*, compared with flask cultivation, assuring also high reproducibility of experiments. Optimized ESAW medium also had a boosting effect on growth, thanks to high concentration of nutrients and the inorganic source, furnished as Sodium Bicarbonate.
- Further studies will be carried out in mixotrophic conditions, using Glycerol.
- Biochemical composition of *P. tricornutum* will be studied in relation to cultivation conditions.

[1] Qichen Wang, Haixin Peng, Brendan T. Higgins, Cultivation of Green Microalgae in Bubble Column Photobioreactors and an Assay for Neutral Lipids. J. Vis. Exp. (143), 2019, e59106

[2] Valeria Villanova, Dipali Singh, Julien Pagliardini, David Fell, Adeline Le Monnier, Giovanni Finazzi and Mark Poolman (2021) Boosting Biomass Quantity and Quality by Improved Mixotrophic Culture of the Diatom Phaeodactylum tricornutum. Front. Plant Sci. 12:642199