Abstract

Experimental Model for High-Throughput Screening of Microalgae Strains Useful for CO₂ Fixation †

Eliza-Gabriela Mihaila 1,2, Daria Gabriela Popa 1,3, Maria Daria Dima 4, Ioana Marcela Stoian 5, Cristian Florian Dinca 2, Diana Constantinescu-Aruxandei 1, and Florin Oancea 1,3,*

1 INCDCP-ICECHIM Bucharest, 202 Spl. Independentei, 6th District, 060021 Bucharest, Romania; eliza-gabriela.mihaila@icechim.ro (E.-G.M.); daria.popa@icechim.ro (D.G.P.); diana.constantinescu@icechim.ro (D.C.-A.)
2 Power Engineering Faculty, University Politehnica Bucharest, 060042 Bucharest, Romania; cristian.dinca@upb.ro
3 Faculty of Biotechnologies, University of Agronomic Sciences and Veterinary Medicine of Bucharest, 011464 Bucharest, Romania
4 International Computer High School of Bucharest, 032622 Bucharest, Romania; maria.daria0033@gmail.com
5 Faculty of Applied Chemistry and Materials Science, University Politehnica Bucharest, 060042 Bucharest, Romania; ioana_stoian18@yahoo.com
* Correspondence: florin.oancea@icechim.ro
† Presented at the 17th International Symposium “Priorities of Chemistry for a Sustainable Development” PRIOCHEM, Bucharest, Romania, 27–29 October 2021.

Keywords: CO₂; microalgae; experimental model; high throughput screening

In this study, we developed an experimental model for microalgae cultivation and CO₂ fixation. We used three different species of microalgae and several cultivation media. The industrial gas emissions contain a significant proportion of CO₂ (3–30%) [1]. Addition of extra CO₂ to microalgae culture initially boosts its development, but further acidification processes limit microalgae development [2]. In this study, three strains of microalgae were cultivated: Chlorella sorokiniana NIVA-CHL 176, Desmodesmus communis NIVA-CHL 7, and Raphidocelis subcapitata ATCC22662, using three different cultivation media, BG11 [3], BBM, and, Z8, respectively. The experimental model used for the cultivation of the microalgae was developed using a GLS80 glass reactor with an LED stripe for illumination. Nitrogen containing 7% CO₂ was discontinuously added (90 min/day), at 25 °C, 200 RPM and approximately 10 µE, in order to avoid acidification of the cultivation medium [4]. Microalgae growth was monitored via optical density, turbidity, chlorophyll content, biomass, pH, and cell number. The best cultivation protocol was selected after the initial experiments. C. sorokiniana NIVA-CHL 176 was raised in BG11 medium and D. communis NIVA CHL-7 in Z8 medium. R. subcapitata ATCC22662 had around half the growth rate of the other two microalgae, and experiments were discontinued. Subsequent to CO₂ bubbling, the pH dropped with one unit after the first 7 days (from pH 6 to 5), from day 7 to day 10 the values were constant (pH = 4), and, for 4 more days, the pH increased (to 6 and 6.5, depending on the microalgae). The control culture had a constant pH of 8. Based on optical density, the growth rates of the studied microorganisms were monitored. D. communis had the best results, and showed eight times greater growth rate than the control, and C. sorokiniana was two times greater compared to the control, not supplemented with CO₂. A higher rate of CO₂ significantly increases growth rates, but pH monitoring is needed. Our experimental model is efficient for high-throughput screening of microalgae strains useful for CO₂ fixation.
Author Contributions: Conceptualization, F.O. and D.C.-A.; methodology, E.-G.M. and D.G.P.; software, C.F.D.; validation, E.-G.M., D.C.-A. and F.O.; formal analysis, M.D.D.; investigation, I.M.S.; resources, F.O.; data curation, D.C.-A.; writing—original draft preparation, E.-G.M.; writing—review and editing, D.C.-A. and F.O.; visualization, D.G.P.; supervision, F.O.; project administration, C.F.D.; funding acquisition, C.F.D. and F.O. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the Government of Romania, Ministry of Research and Innovation, UEFISCDI Contract 296PED/2020 ASOCIAT.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

References