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Abstract

Experimental Model for High-Throughput Screening of Microalgae Strains Useful for CO_2 Fixation †

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In this study, we developed an experimental model for microalgae cultivation and CO_2 fixation. We used three different species of microalgae and several cultivation media. The industrial gas emissions contain a significant proportion of CO_2 (3–30%) [1]. Addition of extra CO_2 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% CO_2 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 CO_2 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 CO_2. A higher rate of CO_2 significantly increases growth rates, but pH monitoring is needed. Our experimental model is efficient for high-throughput screening of microalgae strains useful for CO_2 fixation.

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