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Lgem Lab-25 PBR, a versatile tool for research

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Introduction

The Lgem AlgaeHUB® provides customised research and development services for any kind of microalgal production process. As a first step in the design of a process for a large-scale facility, laboratory-scale understanding and optimisation of the production process are crucial. Data collected from small-scale experiments is used as a basis for designing large scale operation. The Lgem Lab-25 tubular photobioreactor (PBR) is the perfect tool for this first-stage process development. Here, we present data on process optimisation in a Lgem Lab-25 PBR during chemostat operation for commercially relevant microalgae species. For each species, different dilution rates were tested and the effect on biomass productivity and the biomass yield on light were investigated.

Results

Nannochloropsis and *Isochrysis* showed a similar trend, with increasing biomass productivity and biomass yield on light at higher dilution rates until an optimal value of around 1 $g_x \cdot L^{-1} \cdot d^{-1}$ was reached (**Figure 1**). In both cases, biomass productivity dropped when the dilution rate was increased above the optimal values. In the case of *Rhodomonas*, biomass productivity increased with higher dilution rates within the range tested (**Figure 1**).

In all three cases biomass yield on light at the optimal dilution rate value was > 0.55 $g_x \cdot mol_{ph}^{-1}$, indicating efficient conversion of the artificial light into biomass at high biomass productivities (**Table 1**). Moreover, continuous cultivation was maintained for > 85 days without signs of contamination or biofouling, showing the potential of Lgem systems for minimizing downtime during operation.

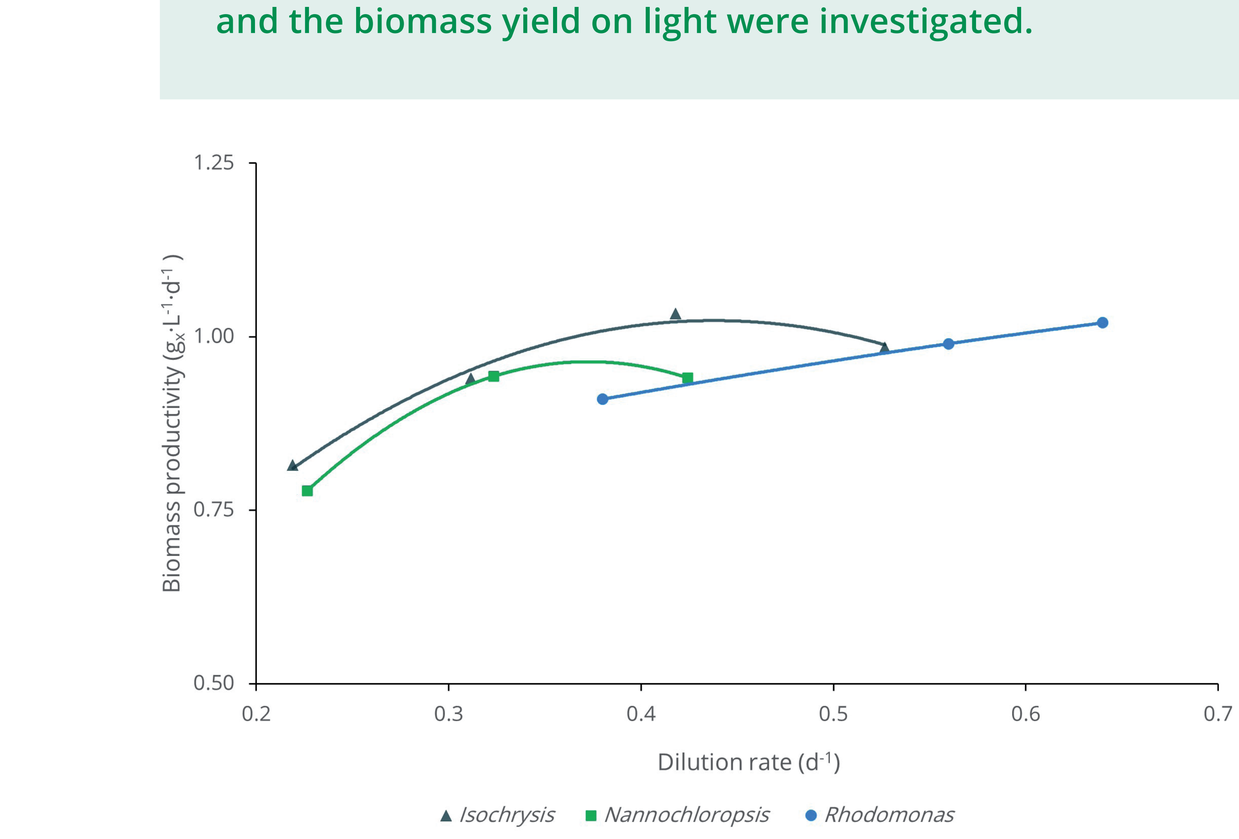
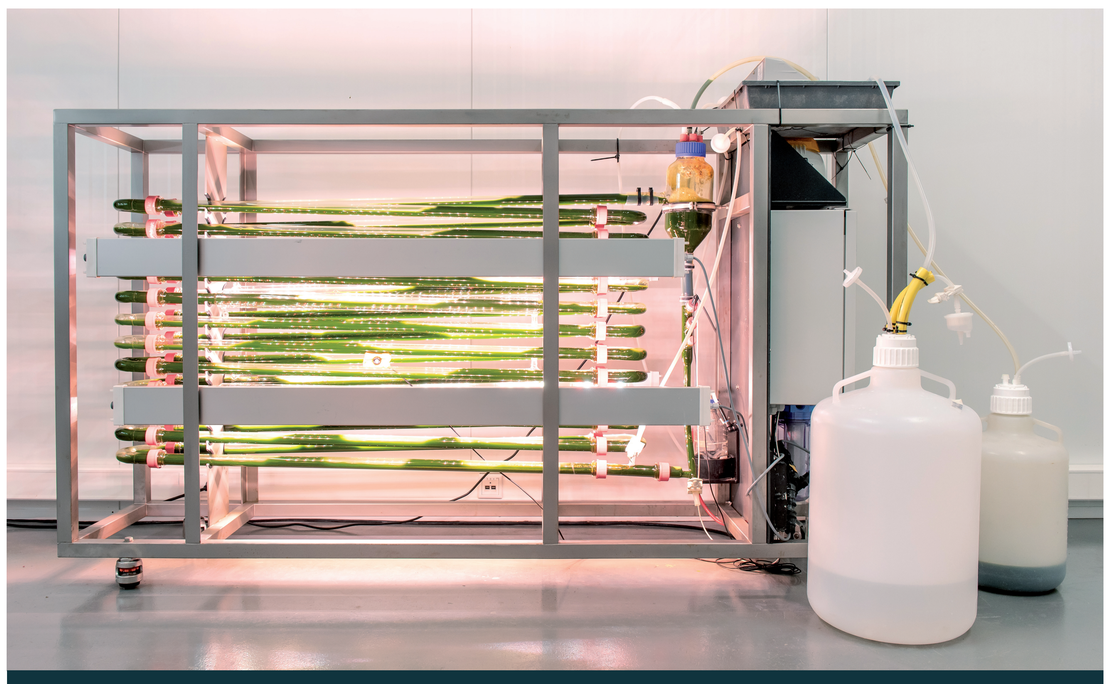


Figure 1. Biomass productivity at different dilution rates for the three microalgae species tested.

Species	Dilution rate (d^{-1})	Biomass productivity ($gx \cdot L^{-1} \cdot d^{-1}$)	Biomass yield on light ($g_x \cdot mol_{ph}^{-1}$)	Biomass density ($g_x \cdot L^{-1}$)
Rhodomonas salina	0,64	1,02	0,64	1,69
Isochrysis galbana	0,42	1,03	0,68	2,47
Nannochloropsis oculata	0,32	0,94	0,59	2,97

Table 1. Results under optimal dilution rate conditions of the chemostat experiments in a Lgem Lab-25 PBR.



Conclusion

These case studies demonstrate the relevance of process optimisation research aiming at defining the operational conditions that will deliver the desired productivities and biomass yield on light for specific species and production processes. Using the Lgem Lab-25 PBR, high biomass productivities and light to biomass conversion efficiencies were obtained for different species indicating that this system can serve as a useful tool for researchers. The possibility of translating the data obtained with this system to large-scale Lgem PBRs facilitates and reduces the risks of the scale-up process.

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