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ALGAE HUB by Lgem | Synalgae

Unstoppable Spirulina!

Two-year uninterrupted cultivation in an Lgem Helios H-17 photobioreactor

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Introduction

***Arthrospira platensis*, the cyanobacterium known as Spirulina, is interesting for its high phycocyanin and protein content. Spirulina is mainly produced in low-cost open pond systems; however, a closed cultivation system allows full control over the process resulting in reliable operation. Here we present more than two-year uninterrupted cultivation of Spirulina in a Lgem Helios H-17 horizontal PBR (working volume: 9 m³; 300 m²), carried out in Lgem's AlgaeHUB®.**

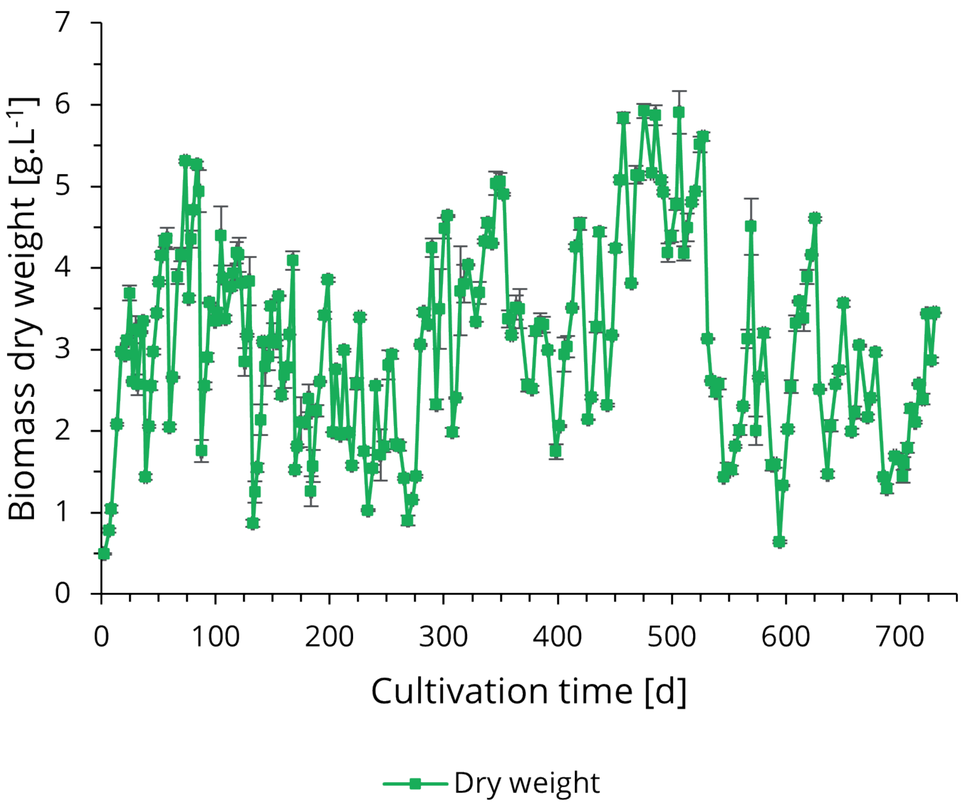

Figure 1. Biomass dry weight determined over the cultivation time of 730 days. Error bars represent standard deviation, n= 2.

Parameter	Unit	Demonstration scale	Industrial scale
Area	m^2	300	10.000
Reactor volume	L	9.000	300.000
Aerial productivity	$g_{-DW}.m2^{-1}.d^{-1}$	5,41	15
Volumetric productivity	$g_{-DW}.L^{-1}.d^{-1}$	0,18	0,5
Phycocyanin productivity	$mg_{-PC}.L^{-1}.d^{-1}$	15,98	45
Production biomass	$kg_{-DW}.d^{-1}$	1,62	150
Production phycocyanin	$kg_{-PC}.d^{-1}$	0,14	13,5
Energy	$kWh.kg_{-DW}^{-1}$	34	0,37

Table 1. Parameters for Spirulina cultivation on demonstration scale and for optimised industrial production.

Lgem Two-phase flow

Lgem's unique Wavywind® and Bubblebrush® principles in combination with Lgem's hygienic design were crucial for maintaining the two-year uninterrupted production. Benefits of this technology:

- culture medium and gas circulate through the glass tubes, mixing the culture without a liquid circulation pump
- Reduced optical path and minimal fouling
- Improved CO2 availability and enhanced removal of dissolved oxygen

Experiences from the AlgaeHUB®

Year-round Spirulina cultivation in the AlgaeHUB® allowed evaluation and optimisation of:

- Automation of operation
- Production process design, including culture medium optimisation
- Downstream processing, including filtration, centrifugation and vibrating screens
- Microbial contamination, food safety and nutritional value of produced Spirulina

Results

Over the two years of operation (**Figure 1**), an average biomass and phycocyanin productivity of 0.180 $g_{-DW}.L^{-1}.d^{-1}$ and 15.98 $mg_{-PC}.L^{-1}.d^{-1}$ were achieved, with an energy consumption of 34 $kWh.kg_{-DW}^{-1}$. However, productivities of up to 0.479 $g_{-DW}.L^{-1}.d^{-1}$ and 46.08 $mg_{-PC}.L^{-1}.d^{-1}$ were reached, when conditions were favourable for Spirulina, decreasing energy usage to 13 $kWh.kg_{-DW}^{-1}$. Extrapolating the findings from Lgem's AlgaeHUB® to industrial scale are shown in **Table 1**.

Conclusion

The two-year cultivation represents a business case for Spirulina production made possible by low downtime, low labour due to automation, and the reliability of the Lgem production system. Using Lgem's closed PBRs yielded in superior quality at low production costs. Lgem offers the possibility to validate controlled algae ingredient production in the AlgaeHUB® before investment and product launch, consequently reducing investment risks.

For an overview of Lgem's services offered in the AlgaeHUB® please visit lgem.com.

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