

APPLICATION NOTE A109-FP02 - CONTROLLED CO₂ SUPPLY FOR ALGAE GROWTH

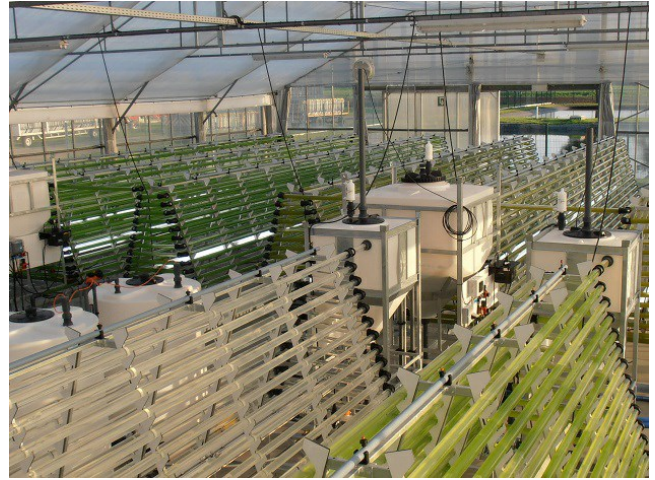
APPLICATION NOTE A109 - FP02

CONTROLLED CO₂ SUPPLY FOR ALGAE GROWTH

Radius, a strategic research group of the Belgian Thomas More University of Applied Sciences, investigates the conversion of CO₂ with sunlight into specialty chemicals. Microalgae play a key role here, and their CO₂ fixation rates and growth capacities are examined.

This research falls within European efforts to build a low-carbon economy to guarantee a sustainable, reliable and affordable supply of energy (e.g. biofuel) and materials (e.g. chemicals and cosmetics). In this respect, the greenhouse gas carbon dioxide (CO₂) is considered a valuable alternative source of carbon that is abundantly available, in applications for food, feed and biobased chemicals.

The researchers of Radius cultivate microalgae in photobioreactors. In order to investigate how much CO₂ gas is captured and converted by their algae, they need an accurate method to control and measure the CO₂ gas flow supplied to the algae during cultivation. To this end, the help of Bronkhorst's devices was requested.



(Source: Thomas More | Agro- and Biotechnology)

Application requirements

The amount of CO₂ that is dosed to stimulate the growth of the microalgae also influences the pH in the cultivation system that - in turn - has a large influence on the microalgae growth conditions. Therefore, the accuracy of the CO₂ supply according to the pH in the growth medium of the microalgae is important. Moreover, all parameters that are involved in the process need to be monitored.

Important topics

- Automated process for accurate supply of CO₂ based on current pH value
 - Monitoring of process parameters
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Process solution

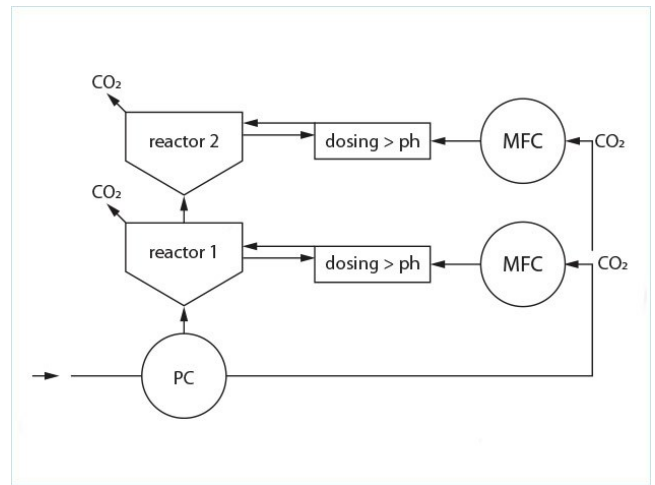
At Radius, experiments for microalgae cultivation on a pilot scale are conducted in closed, tubular photobioreactors with a total volume of 300 liters each, operating at atmospheric pressure in a climate-controlled greenhouse. Two IN-FLOW thermal mass flow controllers are used, each of them to supply CO₂ to these pilot scale reactors, with a maximum dosed flow rate of 886 milliliters CO₂ per minute for each reactor. There is a direct, automatic feedback between the current measured pH value and the supplied CO₂ flow to optimize growth conditions in this algae bioreactor application.

After a meeting with their supplier of CO₂ gas, Radius was introduced to Gefran, which is a distributor of Bronkhorst products in Belgium. Radius and Gefran together looked for a system that could accurately dose CO₂ based on the pH value in the growth medium of the microalgae. The combination of their requirements ultimately led to the purchase of the IN-FLOW mass flow controllers from Bronkhorst.

In the past, the supply of CO₂ gas as well as the control of the pH had to be done manually. With this new system, which utilises LabVIEW (instrument driver), they can perfectly monitor the CO₂ dosage in their pilot plant, and keep the pH at the desired level without too much effort. The best conditions for the algae to grow are in the pH range between 6.5 and 9.5, preferably around 8. This pH is similar to the natural alkaline habitat of the cultivated algae.

According to Radius, the accuracy of the mass flow controllers, the capabilities of the PID controller and the usability of LabVIEW makes Bronkhorst IN-FLOW mass flow controllers a solid and reliable gas dosing system. Currently they are looking for an extension of the system to monitor the outgoing CO₂ flow, in order to be able to even more accurately monitor the CO₂ uptake by their microalgae. This will provide enhanced insights in the algae growth conditions and an optimum between the CO₂ gas flow supply and pH control in photobioreactors.

Moreover, in the future, two larger photobioreactors with a total volume of 1800 liters each will also be equipped with Bronkhorst mass flow controllers for the control of CO₂ flow supply.



Flow scheme

Recommended Products



IN-FLOW F-201AI

Min. flow 0,4...20 l/min
Max. flow 0,6...100 l/min
Pressure rating 64 bar
Compact IP65 design
High accuracy and repeatability



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