

# APPLICATION NOTE A109-FP02 - CONTROLLED CO<sub>2</sub> SUPPLY FOR ALGAE GROWTH

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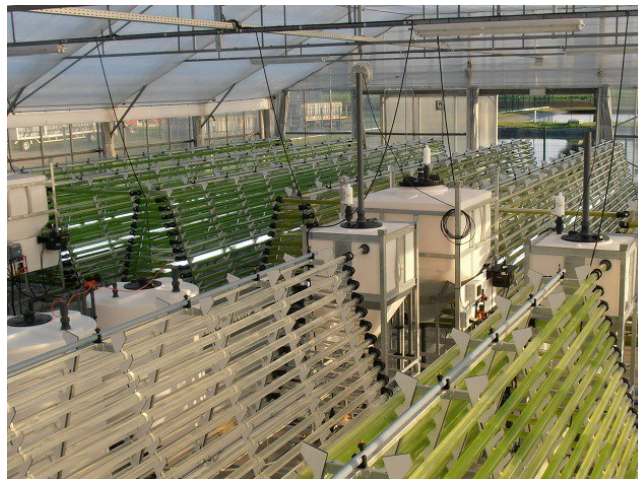
APPLICATION NOTE A109 - FP02

## CONTROLLED CO<sub>2</sub> SUPPLY FOR ALGAE GROWTH

**Radius, a strategic research group of the Belgian Thomas More University of Applied Sciences, investigates the conversion of CO<sub>2</sub> with sunlight into specialty chemicals. Microalgae play a key role here, and their CO<sub>2</sub> 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 (CO<sub>2</sub>) 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 CO<sub>2</sub> gas is captured and converted by their algae, they need an accurate method to control and measure the CO<sub>2</sub> gas flow that is supplied to the algae during cultivation. To this end, the help of Bronkhorst's devices was requested.



(Source: Thomas More | Agro- and Biotechnology)

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### Application requirements

The amount of CO<sub>2</sub> 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 CO<sub>2</sub> 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 CO<sub>2</sub> based on current pH value
  - Monitoring of process parameters
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## Process solution

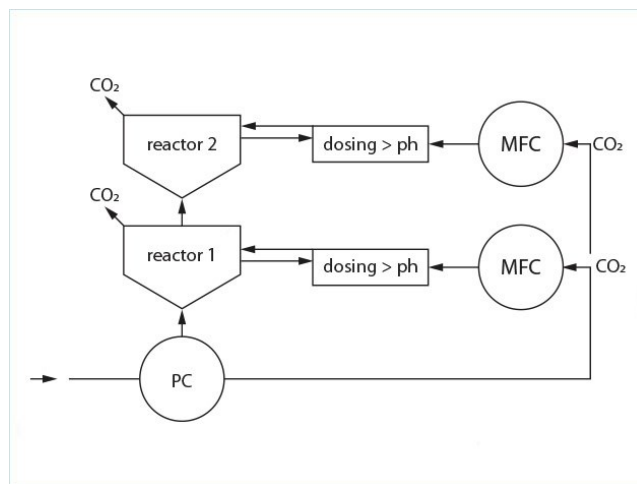
At Radius, experiments for microalgae cultivation on a pilot scale are conducted in closed, tubular photobioreactors with a total volume of 300 liters each, operating at atmospheric pressure in a climate-controlled greenhouse. Two IN-FLOW thermal mass flow controllers are used, each of them to supply CO<sub>2</sub> to these pilot scale reactors, with a maximum dosed flow rate of 886 milliliters CO<sub>2</sub> per minute for each reactor. There is a direct, automatic feedback between the current measured pH value and the supplied CO<sub>2</sub> flow to optimize growth conditions in this algae bioreactor application.

After a meeting with their supplier of CO<sub>2</sub> 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 CO<sub>2</sub> 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 CO<sub>2</sub> 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 CO<sub>2</sub> 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 system. Currently they are looking for an extension of the gas dosing system to monitor the outgoing CO<sub>2</sub> flow, in order to be able to even more accurately monitor the CO<sub>2</sub> uptake by their microalgae. This will provide enhanced insights in the algae growth conditions and an optimum between the CO<sub>2</sub> 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 by Bronkhorst mass flow controllers for the control of CO<sub>2</sub> flow.



Flow scheme

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## 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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### BRONKHORST (UK) LTD

1 Kings Court

Willie Snaith Road

Newmarket Suffolk CB8 7TG

Tel. +44 1223 833222

[sales@bronkhorst.co.uk](mailto:sales@bronkhorst.co.uk)

