Success Story

INGOLD
Leading Process Analytics

Modelling with CO_2 Measurement Allows Faster Scale-up of Fermentation Processes

The InPro 5000 sensor from METTLER TOLEDO enables precise and reliable inline measurement of dissolved CO_2 throughout an entire cultivation period at variable gas transfer from liquid to gas phase.

Kluyver Center, Delft, Netherlands
The Kluyver Center for Genomics of Industrial Fermentation in Delft, Holland, is a consortium of several different Universities and Research Centres. The center works closely together with Elscolab, a company which has represented METTLER TOLEDO Ingold in the Benelux countries in the field of process analytical measurement systems for more than 20 years.

Microbial genomics
The Kluyver Center applies microbial genomics to improve the performance of microorganisms in industrial fermentation processes. Fermentation is used in the production of renewable feedstocks for food products and ingredients, beverages, pharmaceutical compounds, nutraceuticals, through to fine and bulk chemicals.

Fig. 1: 4.0 liter laboratory fermenter with side-mounted CO_2 sensor.

METTLER TOLEDO

Scope of possible application

In connection with research programs covering yeast fermentation, fungal fermentation, lactic acid fermentation, bio catalysis and genomic tools including bioinformatics, the center is always on the lookout for the latest developments in inline measurement technology.

In this regard, Martin Hoogedoorn, Product Specialist at Elscolab Nederland B.V., introduced METTLER TOLEDO's new CO_2 measuring system to Sjaak Lispet, head of instrumentation at the center.

Importance of CO_2 measurement

Sjaak Lispet stated that *"dissolved CO_2 is, next to pH and dissolved oxygen, the most important measurement parameter for us".* Frederik Aboka, a PhD student in Bioprocess Engineering explained the reason why it is so important to be able to measure dissolved CO_2 directly inline: *"Many cell cultures are stimulated or inhibited by dissolved carbon dioxide. It is therefore very important to measure carbon dioxide content in the fermentation broth".*

Faster scale-up

An in-situ CO_2 sensor delivers information on the liquid phase of the bioreactor. It has to be considered that the liquid phase is generally never in a thermodynamic equilibrium with the gas phase during the process. A measurement in the liquid phase is dedicated to actual condition values of the volumetric coefficient of transfer.

This coefficient is an important design and scale-up parameter for bioreactors. In all processes where dissolved CO_2 plays a key role in the metabolism, in-situ CO_2 measurement allows a faster scale-up during process development and finally a faster time to market for new products.

Use of the CO_2 sensor InPro 5000

Asked about the use of the CO_2 measurement system, Frederik Aboka explained: *"In our lab, the sterilizable sensor InPro 5000 was employed in aerobic yeast fermentation in two ways. In the first instance, side-mounted in a fixed position in a 4.0 l laboratory fermenter during the whole period of the cultivation (see Fig. 1). In the second instance, the sensor was installed as shown in the diagram (Fig. 2). In this configuration, the sensor was placed in a small measurement cell of our own design. Culture broth is drawn off from the bioreactor and fed to the measurement cell by means of a pump."*

Reliable and stable measurement

In respect of results, Frederik Aboka stated: *"We are satisfied with the steady state measurement of dissolved CO_2 using the METTLER TOLEDO InPro 5000 sensor. Currently the data is being evaluated and will be made available to a wider public in a scientific journal".*

We would like to thank Frederick Aboka for providing us with this initial insight into his research project, and are pleased that we were able to supply him with the CO_2 sensor InPro 5000.

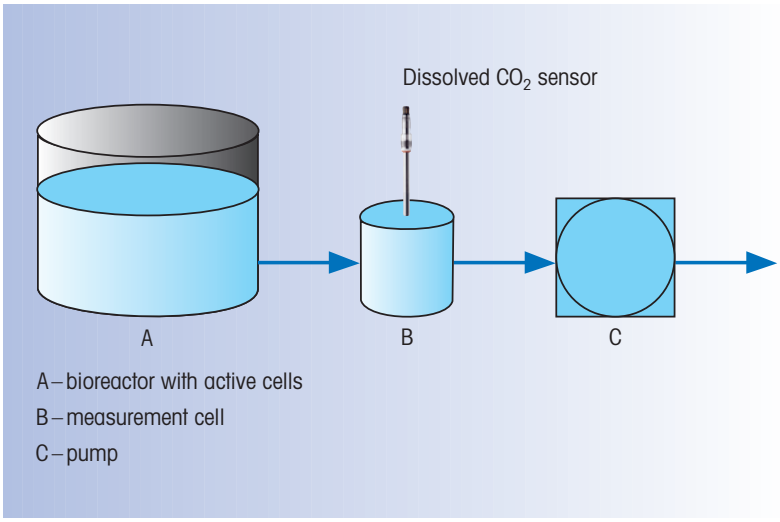

Fig. 2: Experimental setup for dissolved CO_2 measurement outside the bioreactor.

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