

## Versatile and sterilizable probe for the extraction and quantification of volatile compounds in liquids

### SUMMARY

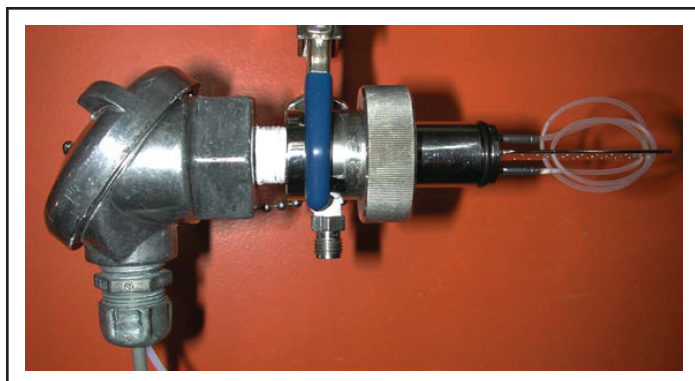
The growing use of fermentations by the biopharmaceutical, chemical and food industries has increased the demand for volatile compounds probes that are allowing efficient development and optimization of new fermentation processes. This technology provides a versatile tubing probe for the extraction and quantification of volatile compounds dissolved in a liquid. Delivering high performance at low cost, this sterilizable probe allows monitoring real-time fermentation processes.

### APPLICATIONS

- Quantifies quickly and accurately volatile organic compounds in sterile liquid environments.
- Ensures optimal control of the substrate feeding rate or inducer when using methylotrophic microorganisms (e.g. during induction/expression of recombinant proteins in *Pichia pastoris*).
- Monitors selected secondary metabolites during fermentations.
- Optimizes biomass growth rate while minimizing methane supply/concentration during methanotrophic fermentation.

### CONCEPT

There is an increasing need to measure the concentration of volatile compounds in fermentation broths or in any liquids with gas sensors that are fast and responsive, adapted to sterile conditions, and compatible with most fermenters. A tube probe that allows for real-time measurement of dissolved volatile compounds and gases (hydrogen, carbon dioxide, etc.) in liquids was developed in order to improve process control (see Figure). The probe is made of a single piece of metal joined with a perforated plate. A



thin-walled silicone tube is attached to one end of the probe body and threaded through the plate. The plate and tube are inserted in the fermenter. The permeability of the silicone to gases but not to liquids allows the extraction of volatile compounds in a continuous fashion without affecting the sterility of the liquid enclosed in the fermenter. Volatile compounds that pervaporate through the permeable tube wall are transported by a carrier gas to the outside of the fermenter for analysis.

### FEATURES AND BENEFITS

#### Easy to build and robust

The single body construction of the probe ensures that its manufacturing is easy and economical. Maintenance is simplified by using readily available silicone tubing. Robustness is also improved by threading the tubing in and out of a perforated plate which ensures tubing stability and protection against mechanical stresses due to agitation and aeration.

#### Versatile design

The flexibility of the design allows for optimization of the probe to suit the volatile(s) of interest and the operating conditions. The protective perforated plate can be adjusted to fit a variety of tubing diameters or lengths allowing, for instance, the use of much longer tubing than the single loop approach. Furthermore, the standard design of the probe, made to fit the standard 25 mm port used with most fermenter, can be easily adapted to match other port structures.

#### Sterilizable

The probe is designed in such a way that substantially only the gas permeable tube is located inside the fermenter. The improved tube probe is sterilizable-in-place due to its sealing mechanism and solid tubing attachment.

#### Suitable for real-time measurement

The probe allows for almost simultaneous extraction and quantification of volatile compounds from a fermenter without affecting the sterility of the liquid phase. Real-time monitoring can improve process control as well as to prevent and minimize hazards.

### PROTECTION STATUS

Sterilizable probe for extraction of volatile compounds in liquids and their quantitative determination (NRC no. 11320).

### CONTACTS

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