

O₂ pH



SFR Shake Flask Reader

Oxygen and pH monitoring in
Erlenmeyer flasks

- Higher quality in your seed train
- Optimization of growth conditions
- Compatible with standard shakers
- For microbial cultivations & cell culture



SFR Shake Flask Reader



The SFR Shake Flask Reader monitors oxygen and pH in up to 9 Erlenmeyer flasks simultaneously. It fits in nearly all standard shakers. The corresponding ready-to-use flasks contain pre-calibrated sensor spots. The system monitors non-invasively through the transparent bottom of the shake flask. Different types and sizes of Erlenmeyers are available. Plastic flasks contain pre-calibrated oxygen and pH sensors. They are ready-to-use for one cultivation. Glass flasks are equipped with autoclavable oxygen sensors only.

Features

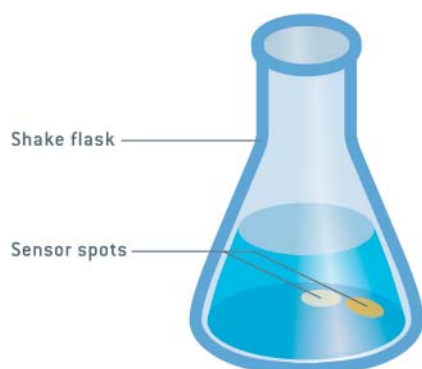
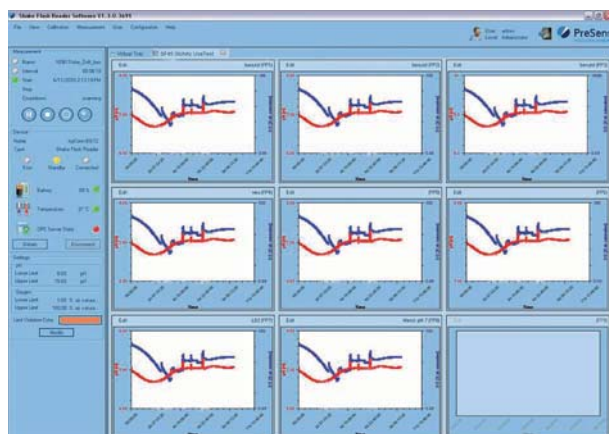
- Rapid, parallel online monitoring of up to 9 shake flasks
- For microbial cultivation and cell culture
- Pre-calibrated shake flasks are ready-to-use
- Compatible with standard shakers
- Glass & plastic flasks in different sizes available
- Non-invasive measurement
- Used in seed train & bioprocess development

Software

The SFR Software SFRS is the integrated control center for the SFR Shake Flask Reader. In addition, it offers an integrated database to show and evaluate measurements. The connection between PC and SFR is wireless. Oxygen and pH are visualized in real-time during the entire cultivation. Results are displayed in a variety of graphical representations. All measured data can be exported to Excel® or as .csv for further evaluation. In addition, the current measurement can be compared to stored cultivations online.

Benefits

- Enables process monitoring in shake flasks
- Systematic optimization of cultivation parameters
- Reliable comparison of screening results
- Enhanced culture quality and efficiency
- Real-time data acquisition
- Convenient electronic data documentation
- Compatible with established protocols
- Detects metabolic shifts



The Smart Measurement Method

The sensor spots are fixed at the bottom of the shake flasks. The luminescence of the dyes embedded in these sensor spots is excited by the Shake Flask Reader. The luminescence lifetime is detected non-invasively through the transparent flask. The luminescence lifetime of the sensor dye depends on the oxygen partial pressure and the pH of the sample, respectively. It is converted to oxygen and pH values by the software using the provided calibration data and internally stored conversion formula.

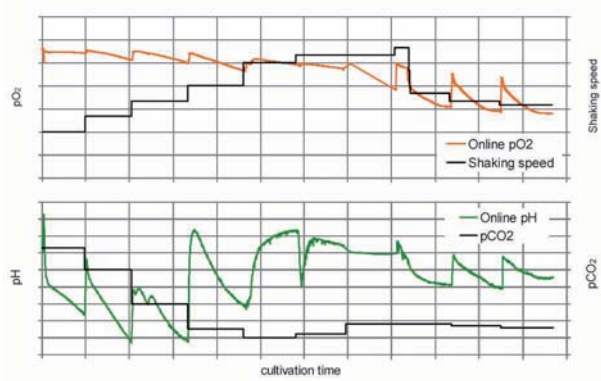
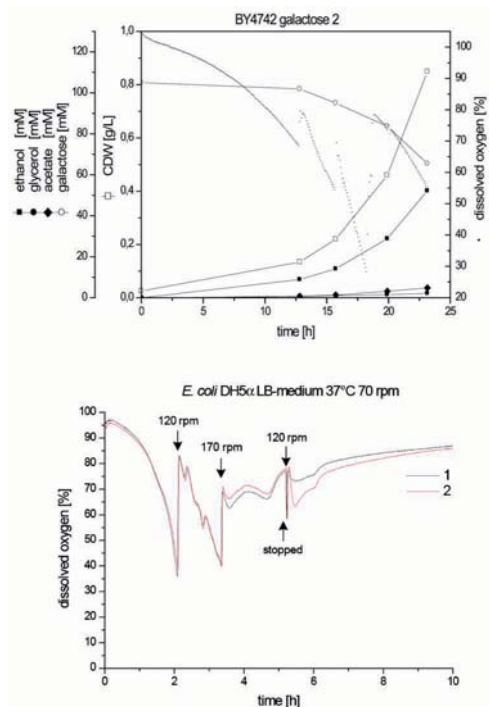
Examples for Applications

Yeast & E. coli: Ensure Enough Oxygen Supply

S. cerevisiae grows on different sugars as carbon source. While growth on glucose and fructose is mainly fermentative, growth on galactose is mainly respirative. This leads to low oxygen concentration in the shake flasks. The accurately measured oxygen indicates the need to increase rotation frequency to avoid oxygen limitation.

High oxygen demand is typical for *E. coli* in its exponential phase. In the cultivation shown on the left, rotation speed had to be changed twice in order to avoid oxygen limitation. In addition, changes in the metabolism can be detected by measuring DO.

*Schneider et al., University of Saarland, Saarbrücken, Germany
Bioprocess Biosyst Eng., 33(5), 541 - 547, 2009*



Process Monitoring in Suspension-Adapted CHO Cell Cultures

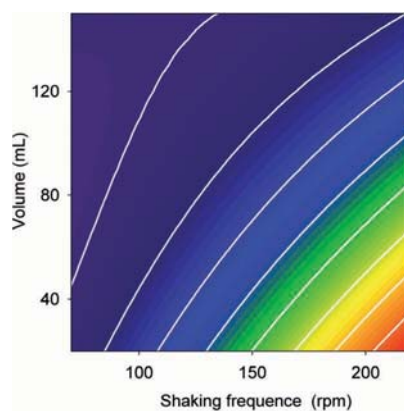
The online measurement of dissolved oxygen concentration and pH in shaken bioreactors paves the way for proper scale down activities from bench-top stirred-tanks to smaller scales. Adjustment of shaking speed as a function of pO₂ is now possible avoiding possible oxygen limitations at high cell densities. Even a simple pH readjustment by tuning the pCO₂ in the incubator is feasible to optimize the output from simple experiments with shaken bioreactors.

Dr. Robert Puskeiler, Roche Diagnostics, Penzberg, Germany

Systematic Determination of Oxygen Uptake in Shake Flasks

Oxygen supply is crucial for almost all cultivations. In shake flasks for a given geometry oxygen transfer is dependent on the shaking frequency and the filling volume. The contour plot on the left shows oxygen transfer rates in 250 ml plastic shake flasks. By using a software for statistical design of experiments discrete volume and rotation speed combinations were measured. As a result it is possible to determine the k_La values for the typical working range for microbial and cell cultivations.

*Ries et al., ZHAW, Wädenswil, Switzerland
Eng. Life Sci 10, No. 1, 75 - 79, 2010*



Specifications	Oxygen	pH*
Measuring range	0 - 100 % O ₂	5.5 - 8.0 pH
Response time (t ₉₀) at 25 °C	< 60 s	< 60 s
Resolution	± 0.01 % O ₂ at 0.21 % O ₂ ± 0.1 % O ₂ at 20.9 % O ₂	± 0.01 pH at pH = 7**
Accuracy	± 0.4 % O ₂ at 20.9 % O ₂ ± 0.05 % O ₂ at 0.2 % O ₂	± 0.1 pH at pH = 7 with one-point adjustment ± 0.2 pH at pH = 7 with pre-calibration
Drift	< 0.01 % O ₂ per day (sampling interval of 1 min.)	< 0.01 pH per day (sampling interval of 1 min.)
Properties		
Temperature range	from 5 °C to 50 °C	
Compatibility	aqueous solutions, ethanol (max. 10 % v/v), methanol (max. 10 % v/v), pH 2 - 10	
Cross-sensitivity	typically no cross-sensitivity in culture media	reduced to ionic strength (salinity); a high concentration of small fluorescent molecules in the visible range can interfere
Storage stability	12 months provided the sensor is stored in the dark Sensor flasks are delivered irradiated.	

*provided Sensor Flasks are used without further handling in physiological solutions

** at 100 rpm & cell culture media

Systems

SET-UP

Included in SFR System are:



USB to Bluetooth Adapter



Software



Shake Flask Reader SFR main unit



2 rechargeable batteries included



Battery charger

ACCESSORIES



Shake Flasks in different sizes



SFR Clamps in different sizes



Attachment Set (available for different shakers)

Technical data can change without prior notice.

Bring to light what's inside. Ask our experts:

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