

# Application report:

# Glucose / Lactate

Method:

Dialysis

Measurement range: Glucose 0.5 – 20 g/L, Lactate 0.25 – 10 g/L



## INTRODUCTION

### Glucose

Glucose is by far the most important substrate for microorganisms and animal cell lines in bioprocesses. In over 90 % of all microbial cultivations and in many animal cell cultivations it is used as carbon source. Monitoring and control of glucose concentrations is required for several processes. A typical example is the high cell density cultivation of *E.coli* for the production of recombinant proteins. The glucose concentration must remain below 1 g/L during the production phase of this fed-batch process to prevent the formation of unwanted byproducts. Total depletion of Glucose will immediately lead to a decrease in cell viability. The control of the substrate feed requires high frequent and reliable measurements of the present glucose concentration.

### Lactate

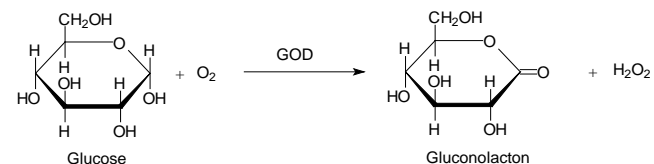
Lactate is a metabolic product of various microorganisms. Monitoring and control of this metabolite is in some biotechnological processes necessary to avoid unwanted effects which can occur by the accumulation of lactate. Lactate is also a very important byproduct in animal cell cultivations. The productivity of animal cell cultures is determined by the lactate concentration in the media. An increase of the lactate concentration over a specific value during the cultivation causes a decrease of cells. Therefore, an online monitoring of the metabolite lactate is necessary for an optimal fed-batch process control.

Analysis methods like HPLC or enzyme kits are capable of measuring Glucose and Lactate concentrations, but are relatively expensive or problematic for online analysis. The online analyser TRACE C2 Control allows a rapid and precise determination of Glucose and Lactate concentrations inside the bioreactor.

## MEASUREMENT PRINCIPLE

### Glucose

The enzyme glucose oxidase (GOD) is used for the detection of glucose.

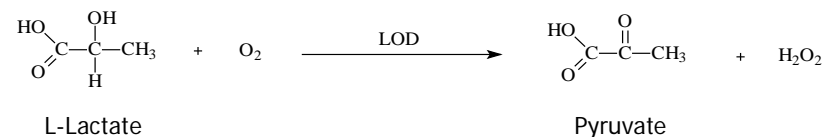


In presence of oxygen, glucose oxidase catalyses the transformation of β-D-Glucose to D-Glucono-δ-lactone and hydrogen peroxide. The Glucose content is measured indirectly via the formed peroxide, which is oxidized to water and oxygen during the amperometric measurement. The resulting electrical current at the electrode is directly proportional to the amount of oxidized Glucose.



### Lactate

The enzyme lactate oxidase (LOD) is used for the detection of lactate.



In presence of oxygen, lactate oxidase catalyses the transformation of L-Lactate to Pyruvate and hydrogen peroxide. The Lactate content is measured indirectly via the formed peroxide, which is oxidized to water and oxygen during the amperometric measurement. The resulting electrical current at the electrode is directly proportional to the amount of oxidized Lactate.



# Application report:

# Glucose / Lactate

Method: Dialysis  
Measurement range: Glucose 0.5 – 20 g/L, Lactate 0.25 – 10 g/L



## SYSTEM PERFORMANCE

These data were compiled in order to give an overview of the system- and sensor-performance in the normal concentration range using the dialysis sampling method.

### Linearity

By comparing the actual value with the set value a regression coefficient  $R^2$  of not less than 0.9995 will be obtained (Figure 1).

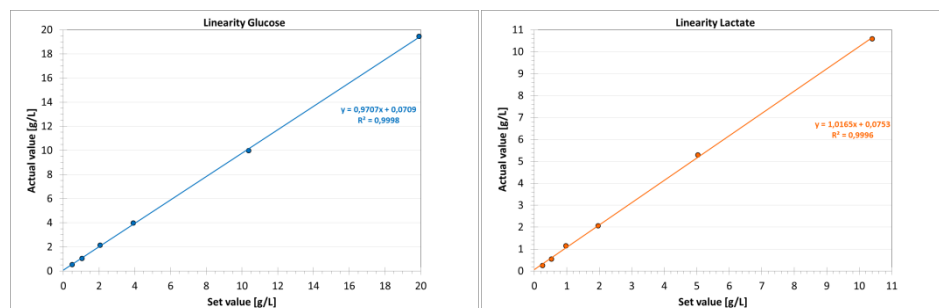


Figure 1: Linearity of Glucose ( $R^2=0.9998$ ) and Lactate ( $R^2=0.9996$ )

### Precision

The typical variation about the mean value is below 1.5% (Figure 2), except for the low concentrations (< 2.5%).

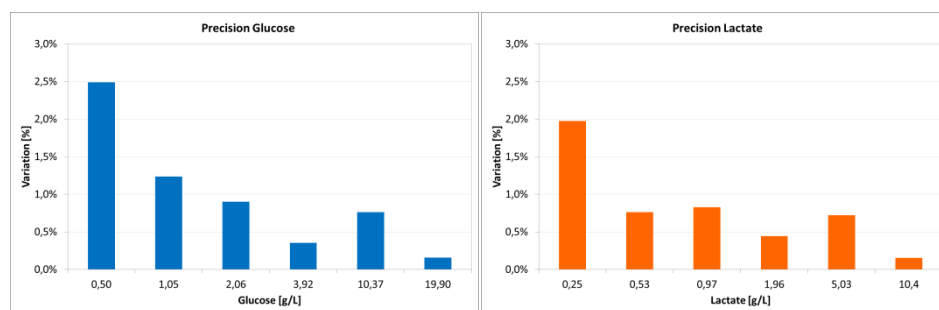


Figure 2: Precision of Glucose and Lactate

## Recovery

The recovery of the glucose and lactate values is shown in figure 3.

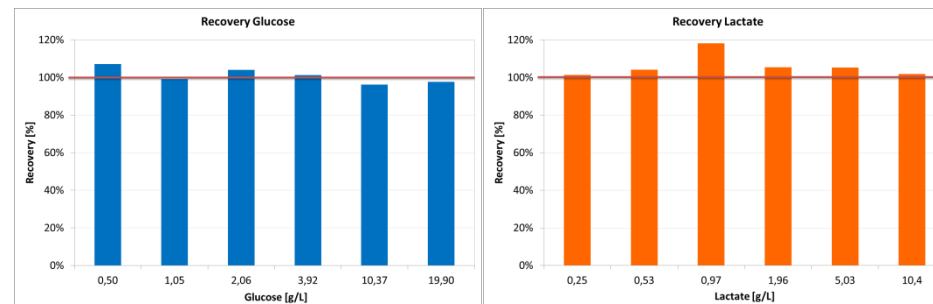


Figure 3: Recovery of Glucose and Lactate

## Operational stability

Long term stability for the application Glucose/Lactate is guaranteed for 5.000 measurements or 14 days.

## Shelf life

Glucose-/Lactate-Sensors have a shelf life of at least 12 months at room temperature.

## Consumables

Consumables for the application Glucose/Lactate are listed in the following table:

Part	Part number
Tubing set dialysis (Glucose/Lactate)	130.200.000
Transport buffer 20x, for cell cultivations (Glucose/Lactate)	850.300.135
Transport buffer 5x, for microbial cultivations (Glucose/Lactate)	850.300.102
Calibration Standard 0,5 g/L Glucose, 0,25 g/L Lactate	850.305.000
Calibration Standard 2 g/L Glucose, 1 g/L Lactate	850.305.002
Calibration Standard 10 g/L Glucose, 5 g/L Lactate	850.305.004
Cleaning solution	850.300.710