Application report: Ethanol

Method: Dialysis
Measurement range: Ethanol 1 – 40 g/L

TRACE Analytics

INTRODUCTION

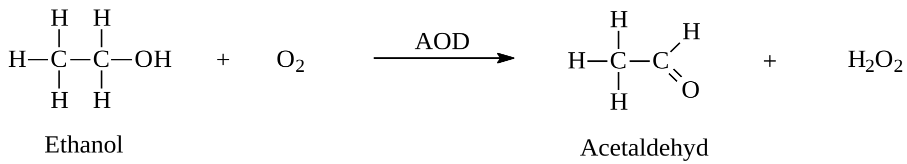
Ethanol is a metabolic product of various microorganisms. Under anaerobic growing conditions Ethanol will be formed especially by yeasts. Depending on the process Ethanol can be main product or by-product. In an alcoholic fermentation for instance TRACE C2 Control can determine the actual product concentration of Ethanol during the whole process. In other processes Ethanol is a toxic by-product that should be avoided. In those cases it is necessary to have an on-line control system which can regulate the process. Using the on-line-analyzer TRACE C2 Control a continuous control of ethanol concentration can be guaranteed and an optimal process can be achieved.

The online analyzer TRACE C2 Control (Figure 1) allows a rapid and precise determination of the Ethanol concentration in the fermenter.

Figure 1. Trace C2 Control

MESASUREMENT PRINCIPLE

Ethanol
The enzyme alcohol oxidase (AOD) is used for the determination of Ethanol.



In the presence of oxygen, the alcohol oxidase (Figure 2) catalyses the transformation of alcohols, mostly Methanol and Ethanol, to the corresponding aldehydes and hydrogen peroxide. The alcohol content is measured indirectly via the formed peroxide, which is oxidised to water and oxygen during an amperometric measurement. The resulting electrical current at the electrode is directly proportional to the amount of oxidized alcohols.

$$H_2O_2 \longrightarrow O_2 + 2\,H^+ + 2\,e^-$$

Figure 2. Enzyme reactor alcohol oxidase (AOD)

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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 0,999 will be obtained (Figure 3).

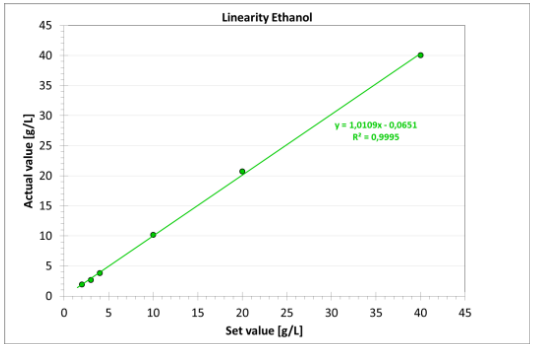

Figure 3. Linearity of Ethanol (R^2=0,9995)

Precision

The typical variation about the mean value is below 3,0 % (Figure 4).

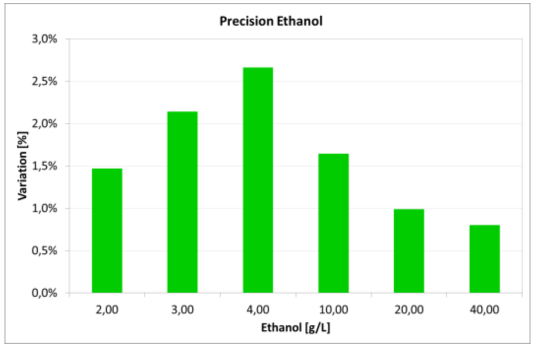

Figure 4. Precision of Ethanol

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Recovery

The recovery of the Ethanol values is shown in figure 5.

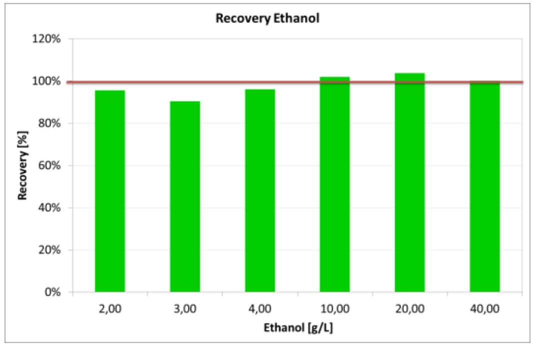

Figure 5. Recovery of Ethanol

Operational stability

Long term stability for the application Ethanol is guaranteed for 5.000 measurements or 14 days.

Shelf life

Alcohol oxidase enzyme reactors have a shelf life of at least 6 months at 4-10°C.

Consumables

Consumables for the application Ethanol are listed in the following table:

Part	Part number
Tubing set dialysis (Ethanol/Methanol)	130.200.020
Transport Buffer conc. 5x (Ethanol/Methanol)	850.300.613
Enzyme reactor for application Ethanol/Methanol	811.100.120
Calibration Standard 40 g/L Ethanol	850.302.005
Calibration Standard 4 g/L Ethanol	850.302.002
Calibration Standard 2 g/L Ethanol	850.302.001
Cleaning solution (Ethanol/Methanol)	850.300.711