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Measurement with Glucose oxidase biosensor – AC1.GOD

Introduction:

A bioactive membrane containing the enzyme **Glucose-oxidase (GOD)** from *Aspergillus Niger* is immobilised on the platinum working electrode of the SPE sensor type AC1.W2.RS. The diameter of the immobilized bioactive membrane is 2 mm and the mean applied activity is 1 unit/mm^2.
The sensor is intended for measuring the concentration **of β-D-Glucose** in aqueous solutions by chronoamperometry method.

Sensor function principle:

The enzyme Glucose-Oxidase (GOD) catalyzes the reaction between β-D-glucose (substrate) and oxygen (cosubstrate) to form gluconic acid and hydrogen peroxide (as products).

$$\beta - \mathrm{D} - Glucose + O_2 \rightarrow D - Gluconic\ acid + H_2O_2$$

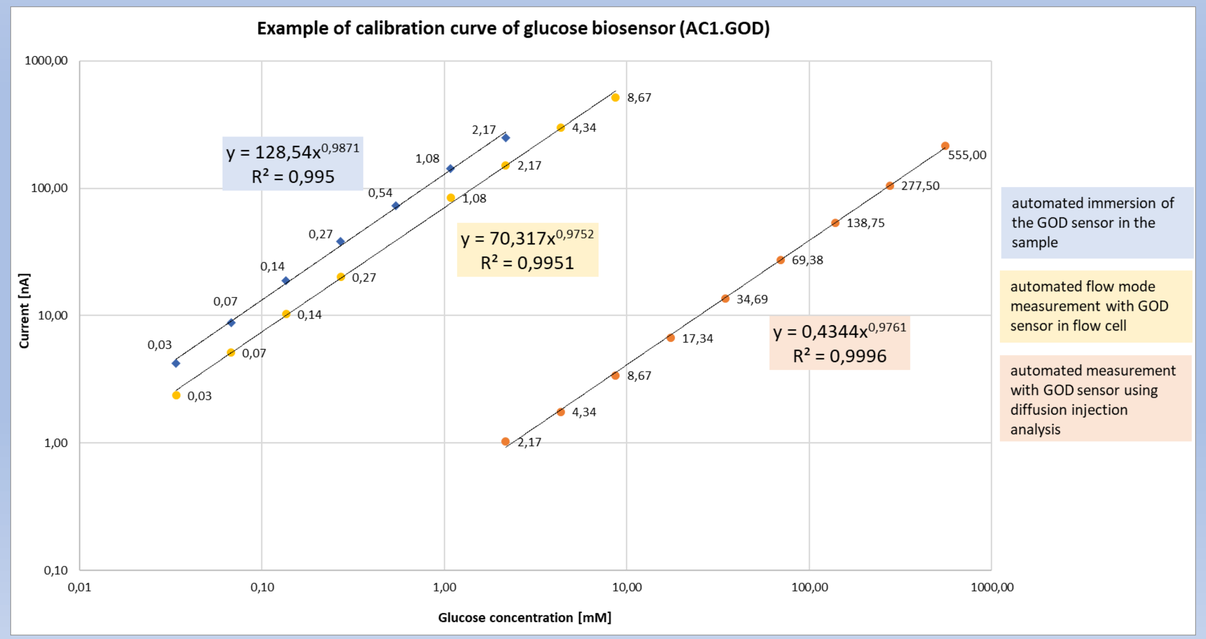
The resulting H_2O_2 (as a product of the aforementioned enzymatic reaction) decomposes (more precisely - electrochemically oxidizes) on the working Pt electrode of the AC1.W2.RS sensor at an applied potential of +650 mV. The electrons released during the electrochemical oxidation of H_2O_2 subsequently cause a current response of the sensor, where the increase in current [nA] corresponds to the detected concentration of glucose in the solution.

$$2H_2O_2 \xrightarrow{working\ Pt\ electrode} 2H_2O + O_2 + 4e^-$$

AC1.GOD sensors parameters:

- **Linear calibration range of β-D-Glucose**: The linear calibration range of the GOD sensor is affected by temperature and the measurement method used (see below for a discussion of measurement results using 3 different methods).
- **Temperature usability**: Glucose-oxidase enzyme activity increases with temperature. From the point of view of long-term use, it is advisable to measure at 25 °C. To achieve the highest possible activity of the GOD enzyme, a temperature of 35 °C can be used (however, the service life of the sensor decreases during thermal stress).
- **Sensor lifetime**: from days to 2 months (depends on the measurement conditions and how the sensor is stored)
- **Sensor storage:** Before use, store the sensors in a dry state in the fridge in the original box with silica gel. Once the sensors have been used in liquid solutions, they must not be allowed to dry out (the active membrane of the biosensor swells in the liquid and its subsequent drying can damage the sensor)! When reusing GOD sensors after measurement, it is possible to store them, for example, in a test tube with a 0.01 M PBS buffer of pH 7.2 or in a physiological solution - bacterial contamination can be prevented by adding sodium azide to the storage solution (content 0.05%).

Measurement methods affect the linear calibration range of the biosensor:

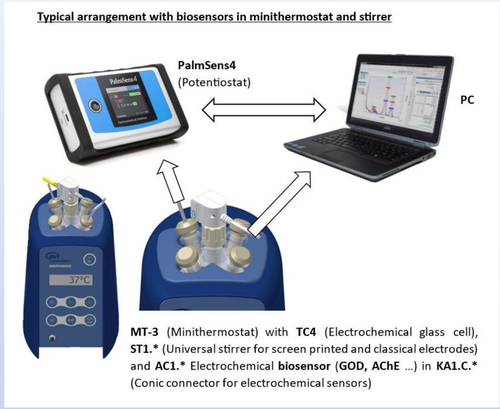


automated immersion of the GOD sensor in the sample

automated flow mode measurement with GOD sensor in flow cell

automated measurement with GOD sensor using diffusion injection analysis

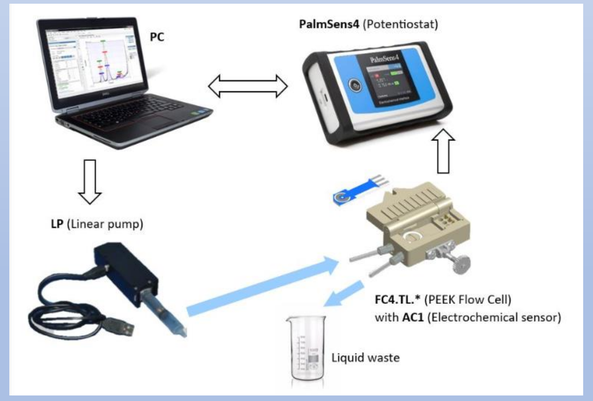
Automated immersion of the GOD sensor in the sample



The GOD sensor can be inserted into the **KA1.C** connector and then inserted into the glass electrochemical cell **TC6 or TC7**.
For measurement at a defined temperature, the **MT-3 minthermostat**.
The response of sensors depends dramatically on the hydrodynamics in the proximity of active sensors. Magnetic stirrer can be a source of non-reproducible results. We recommend to use **stirrer ST1. or ST3**. which was used for the applications where hydrodynamic noise generates problems. The sample is applied to the cell using a pipette with constant mixing.

Linear calibration range of GOD sensor approx.:
0,02-2,2 mM glucose

Automated flow mode measurement in flow cell

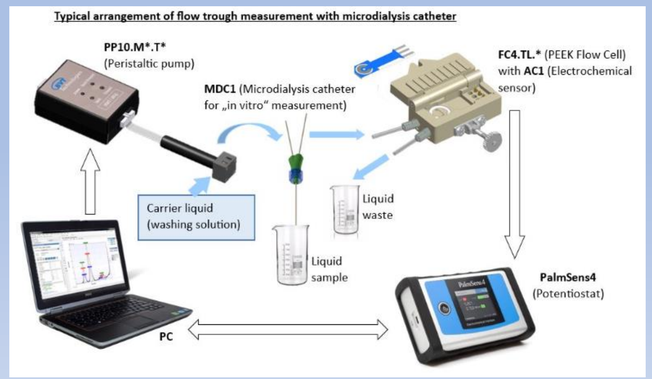


The GOD sensor works best in flow mode. For these purposes, we recommend the use of flow **cells FC2 or FC4** in conjunction with a suitable **pump**.

In this case, the sensor is enclosed in a defined environment where the flow of liquid and the time during which the sample is fed to the working electrode by the sensor can be regulated.

Linear calibration range of GOD sensor approx.:
0,02-8,7 mM glucose

Automated measurement using diffusion injection analysis



Combination of flow mode measurement using flow cell **FC*** in connection with mycrodialysis catheter **MDC1**.

The sample is pretreated ("diluted„) which increases the range of concentrations measured by the glucose biosensor.

Thanks to the use of microdialysis catheter, sterile conditions can be ensured during measurement and thus extend the life of the biosensor (the main reason for its degradation is mainly bacterial contamination).

Linear calibration range of GOD sensor approx.:
2-555 mM glucose