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Monitoring of glucose concentration is essential in medicine, food and pharmaceutical industries. MATINOES enzymatic biosensors with the optical oxygen transducer represent a cheap and robust device for monitoring of glucose in bioreactors.

To meet requirements of various applications the biosensor production have to ensure demanded analytical characteristics, such as sensitivity (SN), limit of detection (L_D), limit of quantification (L_Q), and linear dynamic range (LDR).

In a previous study we demonstrated a dependence of these characteristics on: weight (thickness) of an optically sensitive layer, amount of the enzyme, concentrations of substrates in the reaction medium, and morphology of the sensitive layer[1].

The first aim of my work was to determine boundaries of the above-mentioned parameters as maxima and minima of the weight (thickness) of the layer and the quantity of the immobilized enzyme. Glucose oxidase from *Aspergilus niger* (37.7 $\mathrm{KU \cdot g_{solid}^{-1}}$) immobilized on Sepabeads® (SPB) coated together with the ruthenium oxygen sensitive complex in the organic-inorganic polymer ORMOCER® were used in all experiments. From process parameters maxima and minima concentrations of oxygen and glucose were detected. The second aim was to prepare biosensors with substantially diverse analytical characteristics via combinations of these parameters. The obtained experimental data will be a base for a detailed mathematical model of MATINOES biosensors (outlined in our previous paper[1]), which we are going to develop in the collaboration with ICT Prague. This model should enable a preparation of MATINOES biosensors with tailor-made analytical features.

The results are summarized in table 1. While maintaining a constant morphology and oxygen concentration of 21 vol. %, SN was in the range from 0.029 to 0.303 $\mathrm{\mu s \cdot L \cdot mmol^{-1}}$, L_D in the range from 0.2 to 2.0 $\mathrm{mmol \cdot L^{-1}}$, L_Q in the range from 0.7 to 7.0 $\mathrm{mmol \cdot L^{-1}}$ and the maximum detectable value of glucose concentration in the range from 2.5

to 16.0 mmol·L^{-1}. Increasing the weight of the layer resulted in an increase of SN, contrary to L_D, L_Q, and LDR that drop. Higher amount of enzyme lead to increase SN in contrast to reduction of L_D, L_Q and LDR. During the measurement, increasing concentration of oxygen from 5 to 100 vol. % caused a decrease of SN and increase of L_D, L_Q, and LDR, respectively.

The analytical features of MATINOES glucose biosensor were varied within one order by changing of enzyme content and the thickness of the sensitive layer.

Table 1: Analytical characteristics of biosensors for glucose detection.

	Minimum value	Maximum value
Weight of optical active layer (mg)	4	16
Weight of immobilized enzyme ($mg_{enzyme} \cdot g_{SPB}^{-1}$)	12.5	350
Sensitivity (μs·L·mmol^{-1})*	0.029	0.303
Limit of detection (mmol·L^{-1})*	0.2	2.0
Limit of quantificaion (mmol·L^{-1})*	0.7	7.0
Maximum detectable value of glucose (mmol·L^{-1})*	2.5	16.0

*Detection under 21 vol. % (air), constant morphology of the layer

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References

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