Pengembangan sensor BOD berbasis rhodotorula mucilaginosa UICC Y-181 terimobilisasi pada matriks alginat = Development of a biochemical oxygen demand sensor based on rhodotorula mucilaginosa UICC Y-181 immobilized in alginate matrix

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Abstrak

[ABSTRAK
Elektroda AuNp-BDD dan Au-BDD dikembangkan sebagai elektroda kerja untuk pengukuran biochemical oxygen demand (BOD) menggunakan Rhodotorula mucilaginosa UICC Y-181 terimobilisasi pada Na-alginat. Pengukuran BOD dilakukan dengan mengamati perubahan konsentrasi oksigen akibat proses oksidasi senyawa organik dalam larutan oleh mikroorganisme. Glukosa dan galaktosa digunakan sebagai model senyawa organik. Teknik multi pulse amperometry pada potensial reduksi oksigen -670 mV vs Ag/AgCl digunakan untuk mendeteksi oksigen sisa yang tidak digunakan oleh mikroorganisme. Waktu tunggu optimum adalah 10 menit dan ketebalan lapisan imobilisasi adalah 2 mm. Karakterisasi elektroda dengan XPS menunjukkan rasio Au/C untuk Au-BDD dan AuNp-BDD adalah 0.0553 dan 0.2084. Pada pengukuran oksigen, elektroda AuNp-BDD ditemukan lebih sensitif dibandingkan elektroda Au-BDD maupun elektroda Au. Sedangkan sensor BOD dengan mikroorganisme terimobilisasi ditemukan memiliki waktu pengukuran lebih cepat, sensitifitas lebih tinggi, repeatbility lebih baik dan limit deteksi lebih rendah dibandingkan sensor dengan mikroorganisme bebas. Kelinieran yang baik (R2 = 0.994) ditunjukkan untuk glukosa pada retang konsentrasi 0.1 ? 0.9 mM (ekuivalen dengan 10 ? 90 mg/L BOD) dan limit deteksi 0.46 mg/L BOD. Kestabilan arus yang baik ditunjukkan oleh nilai RSD 3.35% (n=8 pengukuran). Laju konsumsi oksigen dengan sumber karbon glukosa lebih tinggi dari galaktosa menandakan bahwa khamir Rhodotorula mucilaginosa lebih mudah mendegradasi glukosa. Keberadaan ion Cu2+ memberikan pengaruh pada sel khamir Rhodotorula mucilaginosa dengan penurunan konsumsi oksigen.
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ABSTRACT
NanoGold-modified boron doped diamond (AuNp-BDD) and Golddeposited boron doped diamond (Au-BDD) electrodes were used as working electrodes for measuring biochemical oxygen demand (BOD) using Rhodotorula mucilaginosa UICC Y-181 immobilized in a Na-alginate matrix. BOD measurement is done by observing the changes in oxygen concentration due to oxidation of organic compounds in solution by microorganisms. Glucose and galactose were used as model organic compounds. Multy-pulse amperometry

technic at -0.67 V (vs Ag/AgCl) of oxygen reduction potensial was used to detect the remaining of oxygen which is not used by microorganisms. An optimum waiting time was observed to be 10 min and thickness of immobilization matrix is 2 mm. Ratio of Au/C 0.0553 and 0.2084 was obtained by XPS for Au-BDD and AuNp-BDD electrodes, respectively. Dissolved oxygen detection, AuNp-BDD electrode is more sensitive than Au-BDD or Au electrodes. The BOD sensor using immobilized microorganism was found to have a faster measurement time, higher sensitivity, better repeatbility and lower detection limit compared to the sensor using free microorganisms. Good linierity (R2 = 0.994) was shown in the range of glucose concentration of 0.1 ? 0.9 mM (equivalent to 10 ? 90 mg/L BOD) and detection limit of 0.46 mg/L BOD. Good stability of currents were shown by an RSD of 3.35%(n=8). The rate of oxygen consumption to glucose is higher than of galactose, indicating that glucose is a better substrate for Rhodotorula mucilaginosa than that of galactose. The presence of Cu ions influence the yeast cells with a decreasing in oxygen consumption.;NanoGold-modified boron doped diamond (AuNp-BDD) and Golddeposited
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