Development of Oxygen Sensing Microtiter Plate for Various Applications in Life-Science

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Abstract

Measurement of dissolved oxygen in microtiter plates is of potential interest for the screening of oxygen-consuming enzymes (e.g., oxidases), aerobic cell activities, and biological degradation of pollutants, and for toxicity tests.[1)]Optical sensors for the measurement of dissolved oxygen concentration have been studied for more than a decade and commercial systems have been introduced. Fluorescence methods are often superior to other optical and electrochemical methods because of their high sensitivity.[2)] The principle of measurement is based on the quenching effect: There are a number of fluorophors whose fluorescence emission can be hindered by molecular oxygen. This deactivation results from the interaction between the fluorophor and the oxygen molecule leading to a energy transfer from the excited fluorophor to triplett oxygen. This interaction is described by the Stern-Volmer-Equation. [3)]

In this work the oxygen sensing microtiter plate was developed using the highly fluorescent and photostable ruthenium diphenylphenanthroline complex as sensing fluorophor that is embedded in a sol-gel film. A various number of different sol-gel were tested as the suitable matrix. The film was prepared in situ and placed on the bottom of the microtiter wells. For the fluorescence detection the plate reader Victor 2 (Wallac/Perkin Elmer, USA, excitation filter swp 485nm, emission filter lwp 585nm) was employed. The matrix was found to have an effect on the fluorescence quality. Sol-gel with amine rest group showed less intense fluorescence whereas the fluorophor in a 3-glycidoxypropyl-siloxane matrix emits higher fluorescence yield. A fermentation in the micro-plate proved its good performance under real conditions.

Acknowlegdement

This project is supported by the Center for Biophotonics Gwangju [BPF-2004-S-1-6]

References

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