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Abstract

On-Line Monitoring of the Metabolic Activity of Bacteria and Eukaryotic Cells Utilizing Light-Addressable Potentiometric Sensors †

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On-line monitoring of the metabolic activity of eukaryotes and microorganisms can avoid complex process disturbances at an early stage in various biotechnological applications. For instance, downtimes in a biogas plant caused by metabolically inactive microorganisms can induce irreversible hindrances and cost-intensive interventions, which can be prevented by utilizing an efficient monitoring system. Short response times, small sizes, mass fabrication and solid-state nature of field-effect-based (bio-)sensors such as LAPS (light-addressable potentiometric sensors) are promising properties enabling a low-cost and precise monitoring system. LAPS provide a spatially resolved concentration detection of an analyte solution and can record 2D-chemical images of concentration changes of (bio-)chemical species on its flat surfaces. In this work, a LAPS-based multi-chamber measuring system was developed. By means of 3D-printed polymer-based structures combined with LAPS chips, differential and simultaneous measurements were realized. The differential measurement principle was carried out to eliminate the external influences, such as temperature fluctuations, pH value variations and sensor signal drifts. Simultaneous measurements were facilitated by applying four-chamber cells reducing the measurement time. As test samples, *Escherichia coli* K12 bacteria and Chinese Hamstery Ovary cells have served to study the metabolization rate of those assays after glucose uptake.

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