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Abstract

Portable Multi-Analyte Sensor System for On-Site Monitoring of Fermentation Processes †

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Process control of complex fermentation processes requires monitoring of various key parameters. In this regard, knowledge about specific process-related metabolites, in particular, is of great interest. Herein, an electrochemical multi-analyte sensor system is presented that enables simultaneous analysis of four different metabolites, namely ethanol, formate, D- and L-lactate. The platinum sensor chip (14 × 14 mm^2) comprises five working electrodes (each 2 mm in diameter) and an integrated counter electrode. Each working electrode is functionalized with an immobilized enzyme membrane, consisting of a specific nicotinamide adenine dinucleotide (NAD^+)-dependent dehydrogenase in combination with a diaphorase from *Clostridium kluyveri*. Amperometric detection is performed at an applied potential of +0.3 V vs. Ag/AgCl by anodic oxidation of enzymatically produced ferrocyanide. Thereby, the generated current is proportional to the analyte concentration in the sample solution. The compact and portable electrochemical sensing device comprises the biosensor chip in combination with a multiplexer potentiostat. In this way, rapid on-site monitoring of organic acids and alcohol is realized. Additionally, application of the sensor system in real samples from a biogas plant will be presented in this work.

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