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Co-immobilization of glucose oxidase and catalase on electrodes' surface: A multifunctional tool for biosensing applications

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Real world application of reductase-based electrochemical biosensing devices is limited by the need of anaerobic working conditions. Molecular oxygen is a main interferent because (a) it can react with many redox mediators in their reduced form, and (b) the reduction of oxygen at the working electrode surface generates an intense background noise that can mask important redox processes occurring between -200 and -800 mV (vs SHE). Standard laboratorial oxygen removal strategies, such as argon purging or vacuum degassing, are incompatible with on-site monitoring. Alternatively, a bi-enzymatic scavenging system that efficiently reduces the soluble oxygen content in small volume samples, and can maintain anaerobic conditions in an open-air environment for extended periods of time, was adapted for biosensing purposes. The scavenging system is composed by glucose oxidase (GOx) and catalase (Cat) in solution and uses the glucose as main substrate, removing oxygen in a two-step cycle. This strategy was successfully employed with a miniaturized reductase-based biosensing tool to monitor nitrite in real samples. We now aim at making the scavenging system an integral part of the biosensors, simplifying operating procedures and reducing costs. Therefore, we have immobilized GOx and Cat on pyrolytic graphite electrodes, using a silica sol-gel matrix, and tested the system's ability to provide local anaerobic conditions. Several combinations of GOx/Cat in solution and in the immobilized state were prepared and the electrochemical response, in non-deareated solutions containing glucose, was monitored by cyclic voltammetry. Our results showed that although the scavenging system was more effective when in solution, the co-immobilized GOx and Cat were still able to provide a satisfactory anaerobic environment. Additionally, the configurations containing either immobilized GOx or Cat were explored as biosensing tools to monitor glucose and hydrogen peroxide, respectively. The GOx-based bioelectrode responded linearly to glucose concentrations from 1.2 – 7 mM.

Biography

Tiago Monteiro is a second year PhD student at the Doctoral Program in Sustainable Chemistry at Faculdade de Ciências e Tecnlogia, Universidade Nova de Lisboa, Portugal. He has previously obtained a MSc degree in Biotechnology (2013) and a BSc degree in Molecular and Cellular Biology (2011) at the same institution.

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