

Improved Reuse and Storage Performances at Room Temperature of a New Environmental-Friendly Lactate Oxidase Biosensor Made by Ambient Electrospray Deposition

Authors : Antonella Cartoni, Mattea Carmen Castrovilli

Abstract : A biosensor for lactate detection has been developed using an environmentally friendly approach. The biosensor is based on lactate oxidase (LOX) and has remarkable capabilities for reuse and storage at room temperature. The manufacturing technique employed is ambient electrospray deposition (ESD), which enables efficient and sustainable immobilization of the LOX enzyme on a cost-effective commercial screen-printed Prussian blue/carbon electrode (PB/C-SPE). The study demonstrates that the ESD technology allows the biosensor to be stored at ambient pressure and temperature for extended periods without affecting the enzymatic activity. The biosensor can be stored for up to 90 days without requiring specific storage conditions, and it can be reused for up to 24 measurements on both freshly prepared electrodes and electrodes that are three months old. The LOX-based biosensor exhibits a linear range of lactate detection between 0.1 and 1 mM, with a limit of detection of 0.07 ± 0.02 mM. Additionally, it does not exhibit any memory effects. The immobilization process does not involve the use of entrapment matrices or hazardous chemicals, making it environmentally sustainable and non-toxic compared to current methods. Furthermore, the application of an electrospray deposition cycle on previously used biosensors rejuvenates their performance, making them comparable to freshly made biosensors. This highlights the excellent recycling potential of the technique, eliminating the waste associated with disposable devices.

Keywords : green friendly, reuse, storage performance, immobilization, matrix-free, electrospray deposition, biosensor, lactate oxidase, enzyme

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