Amperometric Phenol Biosensor Based on a New Immobilization Matrix: Polypyrrole Nanotubes Derived from Methyl Orange as Dopant

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A novel polypyrrole nanotubes (PPy-NTs) derived from methyl orange (MO) was used as matrix to construct a highly responsive phenol biosensor. The phenol sensor based on polyphenol oxidase could be easily obtained by casting the bio-composite via the cross-linking in the presence of glutaraldehyde on glassy carbon electrode surface. PPy-NTs matrix has features of special three-dimensional structure, biocompatible properties and high surface area, and the features above resulted in high enzyme immobilization and the enzyme buried in PPy-NTs retained its activity to a large extent. This biosensor exhibited a series of better performance such as high sensitivity ($2981 \text{ mA} \cdot \text{M}^{-1} \cdot \text{cm}^{-2}$), good affinity to its substrate (the apparent Michaelis-Menten constant was 0.12 mM) and remarkable long-term stability (it retained 88% of the original activity after 30 days) and acceptable repeatability. The detection limit of the biosensor was 1.22 nM. Furthermore, the optimization of biosensor preparation and effects of experimental variables, such as pH, temperature and potential of the sensor were discussed.

Keywords: Electrochemical biosensor; Polypyrrole nanotubes; Phenols

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