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Electrochemical Phenol Biosensor Configurations Based on Nanobiocomposites

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Different biosensor configurations were constructed based on nanobiocomposites for the detection of phenol. The immobilization of laccase (TvLac) was achieved on a glassy carbon (GC) with polypyrrole (PPy), polypyrrole-multiwall carbon nanotube (PPy-MWCNT), and polypyrrole-multiwall carbon nanotube-Prussian blue (PPy-MWCNT-PB) composites via electrochemical polymerization. A comparative study was made of the analytical properties of the biosensors corresponding to the three configurations, namely, GC/PPy-TvLac, GC/PPy-TvLac-MWCNT, and GC/PPy-TvLac-MWCNT-PB. All the configurations indicated that the (TvLac-MWCNT-PB) nanobiocomposites were entrapped within the porous PPy film and resulted in a hybrid film that showed a high electrocatalytic ability toward the oxidation of phenol at a potential of −200 mV vs Ag/AgCl. The GC/PPy-TvLac-MWCNT-PB working electrode gave performance characteristics with high sensitivity (309.1 nA/μM), low detection limit, and good stability. This electrode allowed the determination of phenol in the 0.2 –2.56 μM concentration range. The sensitivities (S/N = 3) for phenol obtained from the different working electrodes were found to be 4.56, 91.03, and 309.1 μM, respectively.

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