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Disposable electrochemical biosensor with multiwalled carbon nanotubes - Chitosan composite layer for the detection of deep DNA damage

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Abstract

A novel electrochemical DNA-based biosensor for the detection of deep DNA damage was designed employing the bionanocomposite layer of multiwalled carbon nanotubes (MWNT) in chitosan (CHIT) deposited on a screen printed carbon electrode (SPCE). The biocomponent represented by double-stranded (ds) herring sperm DNA was immobilized on this composite using layer-by-layer coverage to form a robust film. Individual and complex electrode modifiers are characterized by a differential pulse voltammetry (DPV) with the DNA redox marker [Co(phen)3]3+, cyclic voltammetry (CV) and electrochemical impedance spectroscopy (EIS) with [Fe(CN)6]3- as a redox probe in a phosphate buffer solution (PBS). A good correlation between the CV and EIS parameters has been found, thus confirming a strong effect of MWNT on the enhancement of the electroconductivity of the electrode surface and that of CHIT on the MWNT distribution at the electrode surface. Differences between the CV and EIS signals of the electrodes without and with DNA are used to detect deep damage to DNA, advantageously using simple working procedures in the same experiment.

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