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Complex electrochemical and impedimetric evaluation of DNA damage by using DNA biosensor based on a carbon screen-printed electrode

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Abstract

DNA biosensor (DNA/SWCNT-COOH-CHIT/SPCE) composed of dsDNA adsorptive layer on a carboxylated single-walled carbon nanotubes-chitosan composite deposited at a commercial carbon based screen-printed electrode has been prepared and applied to a complex investigation of damage to DNA by the Fenton type cleavage agent (hydroxyl radicals formed in the mixture of Cu2+, H 2O2 and ascorbic acid) and copper(ii)-quercetin system in 0.1 M PBS pH 7.0 under aerobic conditions. The dsDNA damage detection is performed by using square-wave voltammetry (SWV), cyclic voltammetry (CV) and electrochemical impedance spectroscopy (EIS) in 1 × 10-7 M thioridazine and 1 × 10-3 M K4[Fe(CN) 6]/K3Fe(CN)6 in the 0.1 M phosphate buffer solution, pH 7.0. Initial enhancement of the intrinsic guanine and adenine moieties SWV response over that of original dsDNA one indicates opening of the helix structure in the first stage of damage. At the same time, decrease in the intercalated thioridazine response confirms damage of the helix structure in parallel to deep degradation of the DNA chain and its removal from the electrode surface as indicated by the CV and EIS measurements in the presence of the [Fe(CN)6]3-/4- redox indicator in solution. © 2011 The Royal Society of Chemistry.

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