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Electrochemical DNA sensor based on carbon black—poly(Neutral red) composite for detection of oxidative DNA damage

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Abstract

 Voltammetric DNA sensor has been proposed on the platform of glassy carbon electrode covered with carbon black with adsorbed pillar[5]arene molecules. Electropolymerization of Neutral Red performed in the presence of native or oxidatively damaged DNA resulted in formation of hybrid material which activity depended on the DNA conditions. The assembling of the surface layer was confirmed by scanning electron microscopy and electrochemical impedance spectroscopy. The influence of DNA and pillar[5]arene on redox activity of polymeric dye was investigated and a significant increase of the peak currents was found for DNA damaged by reactive oxygen species generated by Cu2+/H2O2 mixture. Pillar[5]arene improves the electron exchange conditions and increases the response and its reproducibility. The applicability of the DNA sensor developed was shown on the example of ascorbic acid as antioxidant. It decreases the current in the concentration range from 1.0 μM to 1.0 mM. The possibility to detect antioxidant activity was qualitatively confirmed by testing tera infusion. The DNA sensor developed can find application in testing of carcinogenic species and searching for new antitumor drugs.

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Keywords

DNA sensor, Electrochemical impedance spectroscopy, Electropolymerization, Oxidative DNA damage, Poly(neutral red)

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