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Electrochemical DNA sensors with layered polyaniline—DNA coating for detection of specific DNA interactions

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Abstract

© 2019 by the authors. Licensee MDPI, Basel, Switzerland. A DNA sensor has been proposed on the platform of glassy carbon electrode modified with native DNA implemented between two electropolymerized layers of polyaniline. The surface layer was assembled by consecutive stages of potentiodynamic electrolysis, DNA drop casting, and second electrolysis, which was required for capsulation of the DNA molecules and prevented their leaching into the solution. Surface layer assembling was controlled by cyclic voltammetry, electrochemical impedance spectroscopy, atomic force, and scanning electron microscopy. For doxorubicin measurement, the DNA sensor was first incubated in the Methylene blue solution that amplified signal due to DNA intercalation and competition with the doxorubicin molecules for the DNA binding sites. The charge transfer resistance of the inner layer interface decreased with the doxorubicin concentration in the range from 1.0 pM to 0.1 µM (LOD 0.6 pM). The DNA sensor was tested for the analysis of spiked artificial urine samples and showed satisfactory recovery in concentration range of 0.05–10 µM. The DNA sensor developed can find application in testing of antitumor drugs and some other DNA damaging factors.

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Keywords

DNA intercalator, Doxorubicin, Electrochemical DNA sensor, Electrochemical impedance spectroscopy, Electropolymerization, Polyaniline

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