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Current Approach in Biodosimetry: Electrochemical Detection of DNA Damage

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Abstract : At present, electrochemical methods are used in various research fields, especially for analysis of biological molecules. The fact offers the possibility of using the detection of oxidative damage induced indirectly by γ rays in DNA in biodosimentry. The main goal of our study is to optimize the detection of 8-hydroxyguanine by differential pulse voltammetry. The level of this stable and specific indicator of DNA damage could be determined in DNA isolated from peripheral blood lymphocytes, plasma or urine of irradiated individuals. Screen-printed carbon electrodes modified with carboxy-functionalized multi-walled carbon nanotubes were utilized for highly sensitive electrochemical detection of 8-hydroxyguanine. Electrochemical oxidation of 8-hydroxoguanine monitored by differential pulse voltammetry was found pH-dependent and the most intensive signal was recorded at pH 7. After recalculating the current density, several times higher sensitivity was attained in comparison with already published results, which were obtained using screen-printed carbon electrodes with unmodified carbon ink. Subsequently, the modified electrochemical technique was used for the detection of 8-hydroxoguanine in calf thymus DNA samples irradiated by 60Co gamma source in the dose range from 0.5 to 20 Gy using by various types of sample pretreatment and measurement conditions. This method could serve for fast retrospective quantification of absorbed dose in cases of accidental exposure to ionizing radiation and may play an important role in biodosimetry.

Keywords : biodosimetry, electrochemical detection, voltametry, 8-hydroxyguanine
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