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Review Article

Carbon Nanotube-Based Electrochemical Sensors: Principles and Applications in Biomedical Systems

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Abstract

Carbon nanotubes (CNTs) have received considerable attention in the field of electrochemical sensing, due to their unique structural, electronic and chemical properties, for instance, unique tubular nanostructure, large specific surface, excellent conductivity, modifiable sidewall, high conductivity, good biocompatibility, and so on. Here, we tried to give a comprehensive review on some important aspects of the applications of CNT-based electrochemical sensors in biomedical systems, including the electrochemical nature of CNTs, the methods for dispersing CNTs in solution, the approaches to the immobilization of functional CNT sensing films on electrodes, and the extensive biomedical applications of the CNT-based electrochemical sensors. In the last section, we mainly focused on the applications of CNT-based electrochemical sensors in the analysis of various biological substances and drugs, the methods for constructing enzyme-based electrochemical biosensors and the direct electron transfer of redox proteins on CNTs. Because several crucial factors (e.g., the surface properties of carbon nanotubes, the methods for constructing carbon nanotube electrodes and the manners for electrochemical sensing applications) predominated the analytical performances of carbon nanotube electrodes, a systematical comprehension of the related knowledge was essential to the acquaintance, mastery and development of carbon nanotube-based electrochemical sensors.

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