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Electrochemical Modification of Boron Doped Carbon Nanowall Electrodes for Biosensing Purposes

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Abstract : Boron-doped-carbon nanowall (BCNW) electrodes are recently in much interest among scientists. BCNWs are good candidates for biosensor purposes as they possess interesting electrochemical characteristics like a wide potential range and the low difference between redox peaks. Moreover, from technical parameters, they are mechanically resistant and very tough. The production process of the microwave plasma-enhanced chemical vapor deposition (MPECVD) allows boron to build into the structure of the diamond being formed. The effect is the formation of flat, long structures with sharp ends. The potential of these electrodes was checked in the biosensing field. The procedure of simple carbon electrodes modification by antibodies was adopted to BCNW for specific antigen recognition. Surface protein D deriving from H. influenzae pathogenic bacteria was chosen as a target analyte. The electrode was first modified with the aminobenzoic acid diazonium salt by electrografting (electrochemical reduction), next anti-protein D antibodies were linked via 1-ethyl-3-(3-dimethylaminopropyl) carbodiimide hydrochloride/N-hydroxysuccinimide (EDC/NHS) chemistry, and free sites were blocked by BSA. Cyclic voltammetry measurements confirmed the proper electrode modification. Electrochemical impedance spectroscopy records indicated protein detection. The sensor was proven to detect protein D in femtograms. This work was supported by the National Centre for Research and Development (NCBR) TECHMATSTRATEG 1/347324/12/NCBR/ 2017.

Keywords : anti-protein D antibodies, boron-doped carbon nanowall, impedance spectroscopy, Haemophilus influenzae.
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