Preface

This book presents the fabrication of a glucose biosensor by modification of the surface of a glassy carbon electrode (GCE) using optimized carbon nanotubes (CNTs). The chemical vapor deposition (CVD) method was utilized to grow vertically aligned carbon nanotubes (VACNTs) with various aspect ratios. Field emission scanning electron microscopy (FESEM) images, coupled with Raman spectroscopy results, highlighted the high aspect ratio and uniformity of the high-crystalline carbon nanotubes. Transmission electron microscopy (TEM) images of the CNTs which had been grown confirmed the successful synthesis of a multiwall carbon nanotube (MWCNTs) due to the larger outer diameter of the CNTs. Furthermore, to increase the graphitic ratio of the synthesized CNTs, sequential experimental strategies, based on response surface methodology (RSM), were employed to investigate the crystallinity model of CNTs. Further to that, glucose oxidase (GOx) was immobilized on an optimized multiwall carbon nanotube/gelatin (MWCNTs/Gl) composite, using the entrapment technique to achieve the enzyme-catalyzed oxidation of glucose at anodic potentials, which was then drop-casted onto the GCE. Cyclic voltammetry (CV) results, coupled with the chronoamperometric response obtained from a modified GCE, indicated that a GOx/MWCNTs/Gl/GC electrode can be utilized as a glucose biosensor with a high direct electron transfer rate (8.42 s^{-1}) between GOx and MWCNTs/Gl within a wide linearity range (8.9 mM) of glucose. The recorded detection limit of the fabricated biosensor was 0.59 mM by keeping its initial stability of 75.4% after 25 days. The performance of the fabricated biosensor as a glucose-based electronic tongue was also investigated by designing an electric circuit which was attached to the electrochemical cell. The resistivity alteration of GOx/MWCNTs/Gl/GCE was recorded in the electrochemical cell, after each drop of glucose, by measuring the output

resistivity recorded by the electric circuit. The oscilloscope results clearly showed that, by adding glucose to the circuit design, the output oscillation frequency changed and the square-wave frequency reached a new stable value. These results indicated that the modified GCE, with GOx/MWCNTs/Gl, showed potential as an application in the determination of glucose in human serum samples, as well as a voltammetric-based electronic tongue for diagnose glucose.

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April 2017

http://www.springer.com/978-3-319-66847-5

Nanocomposite-Based Electronic Tongue
Carbon Nanotube Growth by Chemical Vapor Deposition and Its Application
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2018, XIII, 101 p. 45 illus., 35 illus. in color., Hardcover
ISBN: 978-3-319-66847-5