Synthesis, Characterization and Electrochemical Evaluation of Polyvinylalcohol/Graphene Oxide/Silver Nanocomposites for Glucose Biosensing Application

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Hybridization of nanoscale metals and carbon nanostructures into composite nanomaterials has produced some of the best-performing super capacitors and biosensors to date. The challenge remains to develop scalable nanofabrication methods that are amenable to the development of biosensors. A scalable nanostructured composite based on graphene oxide nanosheets (GO), Ag nanoparticles, and a biorecognition element (glucose oxidase) was presented. In addition to good conductivity and biocompatibility, this matrix had a low total cost. The surface of composite was rough due to the presence of GO in PVA matrix that could increase contact area between composite and enzyme layer and consequently enhanced biosensor electrochemical response. Surface morphology was analyzed by SEM and characterization of the composite elements was carried out using FTIR and XRD. Finally, impedance of different samples was determined by electrochemical impedance spectroscopy (EIS) and the effect of GO amount on impedance of the composite was investigated. This method to synthesis of the nanocomposite was devoted to glucose sensing succeeded a favorable device design that also exhibited remarkable glucose biosensing performance such as improved glucose sensitivity (25 nM limit of detection, 15.32 mA M⁻¹ cm⁻² of sensitivity, 150 nM to 10 mM of linear range), and excellent selectivity. To the best of our knowledge, this device is the first biosensor protocol that used the nanocomposite for glucose determination.

Keywords: nanocomposite, graphene oxide, polyvinylalcohol, biorecognition element, FTIR, XRD

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