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Fabrication of Ag@C@Fe3O4 nanoparticles encapsulated silica nanocomposite towards the enhanced performance of cholesterol nanobiosensor

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The increasing prevalence of cardiac arrest and cardiovascular diseases are a major reason of death of humans worldwide. The cholesterol level detection in human blood is of great significance in clinical diagnosis as high cholesterol in blood is associated with coronary heart disease, hypertension, myocardial infarction, brain thrombosis, atherosclerosis, lipid metabolism dysfunction, etc. A multienzymatic biosensor system has been fabricated in which, cholesterol oxidase and cholesterol esterase horseradish peroxidases are simultaneously immobilized in silica sol gel film, on the indium tin oxide electrode. Silica sol gels are prepared with tetraethyl orthosilicate as a precursor and fuctionalization with bovine serum albumin to minimize cracking and stabilize immobilized enzymes. Ag@C@Fe3O4 nanoparticles are prepared with facile method and utilized to enhance electron transfer between enzymes and electrode. Fe3O4 nanoparticles prepared by modified co-precipitation method and subsequently, depositing silver on Fe3O4 core by green approach. Herein, cholesterol oxidase and cholesterol esterase immobilized in the protective microenvironment of the silica sol gel matrix along with hydrogen peroxidase adsorbed on Ag@C@Fe3O4 for biosensor. Ag@C@Fe3O4 nanoparticles and silica/Ag@C@Fe3O4 nanocomposite have been characterized by Fourier Transform Infra Red (FTIR) spectroscopy, UV-visible spectroscopy and X-ray diffraction techniques. Electrochemical impedance spectroscopy (EIS) was used to confirm the configuration and rotational mobility of enzymes within sol gel microenvironment. The surface topographies of the nanocomposite thin films investigated by scanning electron microscopy (SEM), Transmission electron microscopy (TEM). Cyclic-voltammetry (CV) and Differential Plus voltammetry (DPV) utilized for the electrochemical behavior of proposed biosensor based on Silica/Ag@C@Fe3O4/ChOx/ChEt/HRP/ITO nanobioelectrode. The high sensitivity of the biosensor is attributed to the large surface area of Ag@C@Fe3O4 for effective loading of HRP besides its high electron communication capability with the aid of enhanced selectivity and anti interference ability due to the silica sol gel entrapped with ChOx and ChEt. This multienzymatic biosensor system makes cholesterol detection possible in human serum and whole blood.

Biography

Rajshri K Satvekar has completed his MSc from Shivaji University and doing PhD from Center for interdisciplinary Research, D. Y. Patil University. She has published more than 3 original papers and 1 review in reputed journals. She has expertise in synthesis of silica sol gels materials as well as silica nanocomposites and magnetic nanoparticles by using different preparation methods viz., sol gel technique, co-precipitation and green synthesis for application in biosensors. Moreover, she has handled Cyclic Voltammetry, X-ray Diffractometer, Zeta potential and particle size analyzer, and UV Visible spectrophotometerCharacterization instruments.

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