Abstract

Introduction: CA19-9 is measured regularly in patients with pancreatic cancer. Certainly, its potential as a biomarker is endangered by false-negative results in CA19-9 negative patients and false-positive results in benign pancreatic-biliary diseases. Serum levels of CA19-9 can provide significant information about the prognosis, overall survival and response to chemotherapy, as well as predicting postoperative recurrence. One of the powerful tools in detecting very low CA19-9 values is the use of biosensors. Among these, photoelectrochemical biosensors are of especial importance due to their high stability, ease of construction and ability to be implemented in clinical applications.

Methods: In this study, the project was first performed to design a suitable sensor (Figure 3-1, Panel A) in which the surface of the Screen-Printed Electrode (SPE) with gold nanoparticles (AuNP) and the initial antibody CA19-9 (Ab_1) was Corrected. In the continuation of this project, the necessary measures were taken to design SnSe nanoparticles with suitable photoelectrochemical properties, which are covered by gold, with shell@core structure (SnSe@Au). The SnSe@Au surface was then modified by the secondary antibody CA19-9 (Ab_2). The prepared electrode Ab_1-AuNP-SPE was first incubated with CA19-9 solution then with SnSe@Au- Ab_2 nanoparticles to obtain SnSe@Au- Ab_2-(CA19-9)-Ab_1-AuNP-SPE electrode. The photoelectrochemical signal of the fabricated electrode was recorded in the presence of $Fe(CN)_6^{-4/-3}$ redox pair.

Results and conclusions: The biosensor designed for CA19-9 has a detection limit of $9/7\times10^{-4}$ $U.mL^{-1}$ and a linear range of 0.001 to 100 $U.mL^{-1}$. Performance characteristics of the real-sample analysis show that this biosensor has significant performance and a high potential for future clinical diagnosis and provides a promising platform for the early detection of pancreatic cancer.

Keywords: biosensor; photoelectrochemical; biomarker; nanoparticle