Label-free Electrochemical Sensor for Ex-vivo Monitoring of Alzheimer's Disease Biomarker

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Abstract:

The beta-amyloid (Aβ) peptide was used as an important biomarker for Alzheimer's disease (AD) diagnosis. The development of an accurate, selective, rapid, and highly sensitive technique for detecting of Aβ level is an important issue in biology, and medicine to assess human health risks. Here, gold nanoparticles (Au NPs) with different size were electrochemically deposited onto the indium tin oxide (ITO) substrate in the presence of different molecular weights of surfactants. The modified substrates were used as a high sensitive electrochemical sensor of in-vitro as well as ex-vivo monitoring of Aβ based on cyclic voltammetry and square wave voltammetry techniques. Our findings revealed that the modification of ITO electrode with Au NPs could enhance its sensor performance with high sensitivity for low concentration levels of Aβ over a wide linear range with a detection limit of about 20.7 ng/g, which is less than the concentration of insoluble Aβ40 (105.4±40.2 μg/g) in brain of AD induced. In addition, Au NPs/ITO modified electrodes have demonstrated ability to monitor Aβ in the brain extracted samples without any potential interference with other components. Raman spectroscopy has been used to confirm the presence of Aβ in the AD-induced samples. Thus, it is applicable for analyzing ex-vivo samples.

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