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Label-free electrochemical immunosensor based on graphene nanocomposite for cancer diagnosis

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The report of the results of studies relating to fabrication of the sensing platform for development of label free electrochemical immunosensor based on Graphene (Gr) and Copper Sulfide (CuS) composite and further poly p-phenylenediamine and Graphene Nanocomposite (PPD-GR). Graphite Screen-Printed Electrodes (SPEs) modified with CuS-GR and PPD-GR nanocomposite and applied to advance label-free and non-enzymatic electrochemical immunosensor for quantitative determination of protein biomarker carbohydrate antigen 15-3 (CA15-3) and Neuron-Specific Enolase (NSE), respectively. CuS-GR nanocomposite shows excellent electrocatalytic activity towards catechol as probe, which improve the sensitivity of the immunosensor. Also, it was found that the PPD-GR nanocomposite exhibits excellent electrocatalytic activity towards Ascorbic Acid (AA) oxidation as analytical signal based on EC mechanism. The CuS-GR based immunosensor exhibited a wide linear range of 1.0-150 U mL^{-1}, with a low detection limit of 0.3 U mL^{-1} toward CA15-3. In the case of PPD-GR nanocomposite based immunosensor due to the excellent electrocatalytic activity of PPD-GR nanocomposite, determination of NSE antigen was based on its obstruction to the electrocatalytic oxidation of AA after binding to the surface of electrode through interaction with the anti-NSE. The proposed immunosensor exhibited a wide linear range of 1.0-1000 ng mL^{-1}, with a low detection limit of 0.3 ng mL^{-1} toward NSE. These developed immunosensor showed good specificity, accuracy, stability and it was successfully applied for the determination of CA15-3 and NSE in real samples. The CuS-GR and PPD-GR nanocomposite materials-based immunoassay provides a promising sensitive biosensor approach for clinical applications.

Biography

Mehdi Rahimi-Nasrabadi is currently working as a Professor in Molecular Biology Research Center, Baqiyatallah University of Medical Sciences, Iran. He has authored and co-authored multiple peer-reviewed scientific papers and presented works at many national and international conferences. His contributions have acclaimed recognition from honorable subject experts around the world. He is actively associated with different societies and academies. His research interests include medical science.

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