Abstract

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Point-of-care detection of SARS-CoV-2 : The impedimetric and voltammetric-based disposable immunosensors

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Abstract

COVID-19 has spread globally since its discovery in China in December 2019, causing a growing demand for rapid and accurate diagnostic assays to enable mass screening and testing of both high-risk groups and normal population [1]. According to WHO, the current gold standard for the detection of SARS-CoV-2 is reverse transcription polymerase-chain reaction (RT- PCR), but has limitations, such as low specificity, long response time, expensive instruments, well-trained personnel and no point-of-care (POC) use [1-3].Therefore, early, rapid and more sensitive detection methods of SARS-CoV-2 would represent a significant achievement to identify positive patients, allowing crucial decisions and public health strategies by healthcare providers and policy makers. In this work, two proof-of-concept label-free electrochemical immunosensors for rapid SARS-CoV-2 detection via the spike protein have been developed. The platforms consist of a MWCNTs-screen-printed electrode (SPE) functionalized with electro-adsorbed methylene blue (MB) and bio-active layers of chitosan/protein A to enhance the bio-activity of the immobilized SARS-CoV-2 antibodies.Electrochemical characterization by cyclic voltammetry (CV) and electrochemical impedance spectroscopy (EIS) techniques evaluated the fabrication steps of the immunosensors. A change in mass and thickness on the electrode surface will be expected, due to the formation of the antibody-antigen complex, which blocks the electron transfer of the redox probe [(Fe(CN)6)]3−/4−) to the electrode surface, causing a decrease of the current signal detected by differential pulse voltammetry (DPV), and an increase of the charge transfer resistance (Rct), detected by EIS. A comparison of the performances of the voltammetric and impedimetric-based immunosensors was reported.The proposed devices were successfully applied to the determination of the SARS-CoV-2 spike protein in saliva samples.

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Biography

Riccarda Antiochia is Associate Professor at Sapienza University of Rome (Italy). She received a MSc degree in Chemistry with honors in 1992 and a MSc degree in Pharmacy with honors in 2009 both at Sapienza University of Rome. In 1994 received the Diploma of Imperial College at Imperial College, London and in 1996 received a PhD in Chemical Sciences at Sapienza University of Rome. She was awarded of the national scientific qualifications as Full Professor for the scientific sectors CHIM/01, Analytical Chemistry in 2018, and MED/46, Applied Medical Technologies, in 2019. She is a Member of the Steering Committee of CNIS, Research Center for Biotechnology applied to Engineering of Sapienza University of Rome from 2011. She is author of 90 papers on international peer-reviewed scientific journals, 3 book chapters and 1 monography.

