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Abstract

Portable, Highly Sensitive and Selective Electrochemical Biosensors for SARS-CoV-2 Detection †

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Abstract: Infectious diseases, such as COVID-19, continue to cause an enormous burden of death and disability in developing countries, and there is an urgent need to better understand these infectious pathogens and develop ways to control their spread. We have developed a new type of testing strategy based on electrochemical biosensing aspects, created using a microfluidic detection platform for rapid, sensitive, and specific detection of infectious SARS-CoV-2 and its variants. The target compounds, i.e., SARS-CoV-2 variants, were selected due to the current worldwide outbreak; however, the fabricated biosensing aspect may be expanded to future emerging pathogens by undemanding modifications. The biosensor platform is based on screen-printed electrodes (SPEs), modified with nanostructured polystyrene (PS)/polyaniline (PANI)-Au NP composites. The surface of modified-SPEs is later immobilized using different representative receptor elements, i.e., specific viral antibodies. Tackling PS/PANI-Au NP composites on the nanoscale enables us to exploit its outstanding conductivity, biocompatibility, and high surface area which facilitate the loading of a huge amount of viral receptor elements (Ab), thus resulting in high sensitivity, specificity, and low detection limits (i.e., at attomolar concentration levels). Such a construction is able to translate this specific covalent interaction (Ab) with its corresponding binding viral target, i.e., receptor-binding domain ((RBD) of spike (S) glycoprotein) into a measurable, concentration-dependent electrochemical response. By creating an electrochemical readout, data enable qualitative and quantitative analysis. The fabricated system represents a low-cost and efficient alternative to conventional assays for testing as it offers a simple in-situ method of analysis in much shorter time frames. Its feasible design is easy to use and can be operated by patients themselves using simple samples such as saliva, thus allowing population-scale screening.

Keywords: eletrochemical biosensors; biosensors; SARS-CoV-2; virus

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