Electrochemical Biosensor for Fast Detection of Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2)

J. Disagini and M. Thanihaichelvan*

Department of Physics, Faculty of Science, University of Jaffna, Jaffna 40000, Sri Lanka
**thanihai@univ.jfn.ac.lk*

COVID-19 pandemic is the global challenge as of today and scientists are working on developing therapeutics and fast diagnosis techniques. Since the therapeutics are delayed, fast diagnosis techniques might be helpful to restore the normalcy. At present, the most reliable diagnosis method for COVID-19 caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is reverse transcription polymerase chain reaction (RT-PCR). Again, it is time consuming and needs experts and expensive machines. In recent past, many nanomaterial-based sensors have been reported for detection of biomolecules at very low concentrations. These molecular sensing techniques can be effectively used for fast detection of SARS-CoV-2. Moreover, the testing can be done within a minute with extremely high selectivity. In this work we developed and demonstrated a proof-of-concept diagnosis technique for COVID-19. The sensor was designed to target the RNA-dependent RNA polymerase gene (RdRp) sequence of the SARS-CoV-2. The control sequence was the same RdRp sequence of the severe acute respiratory syndrome (SARS) virus. The probe for the biosensor was then selected as the reverse sequence of the RdRp gene of SARS-CoV-2. The RdRp gene of the SARS virus has three mismatches in the reverse sequence when compared to that of SARS-CoV-2. Then we immobilized the selected probe sequence in a gold electrode and the response was measured using electrochemical impedance spectroscope from 1 MHz to 0.1 Hz. The results showed a clear concentration dependent response to the positive target sequence with a limit of detection of 100 fM. The response to the negative sequence was much lesser when compared to the positive sequence. The study was conducted with synthetic sequences and the results were promising. The results need to be validated along with the gold standard PCR data before going for a clinical trial.

Keywords: Biosensor, SARS-COV-2, Electrochemical impedance spectroscope, Impedimetric biosensor, Aptamer