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Laser-synthesized Selenium nanoparticles for SARS-CoV-2 detection using LSPR

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Abstract: Accurate and timely diagnostics are essential for identifying infected individuals, enabling prompt treatment and control strategies to prevent further spread. The COVID-19 pandemic highlighted the critical role of diagnostic testing for disease preparedness and response. Conventional diagnostic techniques such as polymerase chain reaction (PCR) are effective at detecting viral pathogens, but they have shortcomings, such as long turnaround times. In this work,a photonic-based diagnostic tool, localized surface plasmon resonance (LSPR) integrated with selenium nanoparticles (SeNPs), is proposed. The laser ablation approach was used to synthesize SeNPs. Furthermore, an optical biosensing substrate coated with APTES was functionalized with SeNPs and Severe acute respiratory syndrome coronavirus 2 monoclonal antibodies (SARS-CoV-2 mAb). After characterization of the biosensing substrate, it was used for the detection of SARS-CoV-2 pseudovirus (analyte) using an in-house-built LSPR system. The presence of SARS-CoV-2 pseudovirus was successfully detected using LSPR integrated with SeNPs. In the presence of pseudovirus, a wavelength shift brought on by the SeNPs was observed, whereas the negative sample, which was pathogen-free, showed no shift. The LSPR technique can be translated into a rapid and accurate diagnostic tool for detecting infectious viral pathogens such as SARS-CoV-2, especially in point-of-care settings. Such photonics-based methods have the potential to contribute to addressing challenges with effective disease control and hence significantly reduce mortality rate due to the spread of infectious diseases.
Keywords: Selenium nanoparticles, SARS-CoV-2, Localized surface plasmon resonance, laser ablation

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