Surface-enhanced Raman scattering-based immunoassay for severe acute respiratory syndrome coronavirus 2

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Abstract

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has affected humans worldwide for over a year now. Although various tests have been developed for the detection of SARS-CoV-2, advanced sensing methods are required for the diagnosis, screening, and surveillance of coronavirus disease 2019 (COVID-19). Here, we report a surface-enhanced Raman scattering (SERS)-based immunoassay involving an antibody pair, SERS-active hollow Au nanoparticles (NPs), and magnetic beads for the detection of SARS-CoV-2. The selected antibody pair against the SARS-CoV-2 antigen, along with the magnetic beads, facilitates the accurate direct detection of the virus. The hollow Au NPs exhibit strong, reproducible SERS signals, allowing sensitive quantitative detection of SARS-CoV-2. This assay had detection limits of 2.56 fg/mL for the SARS-CoV-2 antigen and 3.4 plaque-forming units/mL for the SARS-CoV-2 lysates. Furthermore, it facilitated the identification of SARS-CoV-2 in human nasopharyngeal aspirates and diagnosis of COVID-19 within 30 min using a portable Raman device. Thus, this assay can be potentially used for the diagnosis and prevention of COVID-19.
Keywords: Antibody, Coronavirus disease 2019, Immunoassay, Nanoparticle, Surface-enhanced Raman scattering, Severe acute respiratory syndrome coronavirus 2