Application of SERS-based assay platforms to improve the accuracy of currently commercialized SARS-CoV-2 immunodiagnostic kits

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The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic has caused significant social and economic problems worldwide. Currently, RT-PCR, which detects RNA inside a virus, is used as the standard diagnostic method for SARS-CoV-2, but the total diagnostic time, including sample preparation, gene amplification, and detection, requires approximately 3-4 h. Various rapid kits for immunodiagnosis using antigen-antibody reactions have also been developed and commercialized to shorten the diagnosis time. However, they have not been adopted as the standard diagnostic method owing to their low limit of detection and poor accuracy [1]. In particular, a false-negative result obtained by the commercialized immunodiagnostic kit is a severe problem that can aggravate the spread of SARS-CoV-2. To resolve this problem, we developed new SERS-based various assay platforms to quantify SARS-CoV-2 lysates with high sensitivity [2-4]. This presentation will introduce three different types of SERS-based assay platforms; a SERS-based lateral flow assay (LFA) immunodiagnostic strip with a portable Raman reader, a SERS aptasensor using nano-popcorn substrates and an Au-Nanoparticle-Internalized nano-dimple SERS-PCR sensor. Our SERS-based assay platforms show a strong potential to resolve the problems in terms of low sensitivity and limit in quantitative analysis inherent in conventional antigen tests to detect SARS-CoV-2. The results of this study demonstrate the possibility of a clinical application that can dramatically improve the detection limit and accuracy of the currently commercialized SARS-CoV-2 immunodiagnostic kit.

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