# Development of SERS-based assay platforms for *in vitro* diagnostics

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Lateral flow assay (LFA) strip biosensors are simple devices intended to detect the presence of a target biomarker in a clinical fluid. The benefits of LFA biosensors include short times to obtain test results, a user-friendly format, low cost, and long-term stability. However, they possess major limitations in terms of quantitative analysis and detection sensitivity. To resolve these problems, many different types of optical readers in combination with a LFA strip for the detection of fluorescence, chemi-luminescence and electrochemical signals have been employed but they still suffer from poor sensitivity and low precision. Our research group recently developed several different types of surface-enhanced Raman scattering (SERS)-based assay platforms for the highly sensitive biomarker detection. We believe that our proposed SERS-based assay platforms, which possess both high sensitivity and quantitative evaluation capability, show significant potential for the rapid and sensitive detection of target markers in a simplified manner. In this presentation, the current advances of SERS-based assay platforms and their application potential in biomedical *in vitro* diagnostics will be discussed. The development of surface-enhanced Raman scattering (SERS)-based microfluidic platforms has also attracted significant recent attention in the biomedical sciences. SERS is a highly sensitive detection modality, with microfluidic platforms providing many advantages over microscale methods, including high throughput, facile automation and reduced sample requirements. Accordingly, the integration of SERS with microfluidic platforms offers significant utility in chemical and biological experimentation. Herein, we report a fully integrated SERS-based microdroplet platform for the automatic immunoassay of specific target antigens. Specifically, highly efficient and rapid immunoreactions are achieved through sequential droplet generation, transport and merging, whilst wash-free immunodetection is realized through droplet-splitting. Such integration affords a novel multifunctional platform capable of performing complex multi-step immunoassays in nL-volume droplets. This assay system has additional advantages including reduced sample consumption (less than 100 μL), rapid assay times (less than 10 minutes) and fully automated fluid control. We anticipate that this integrated SERS-based microdroplet device provides new insights in the development of facile assay platforms for various hazardous materials.

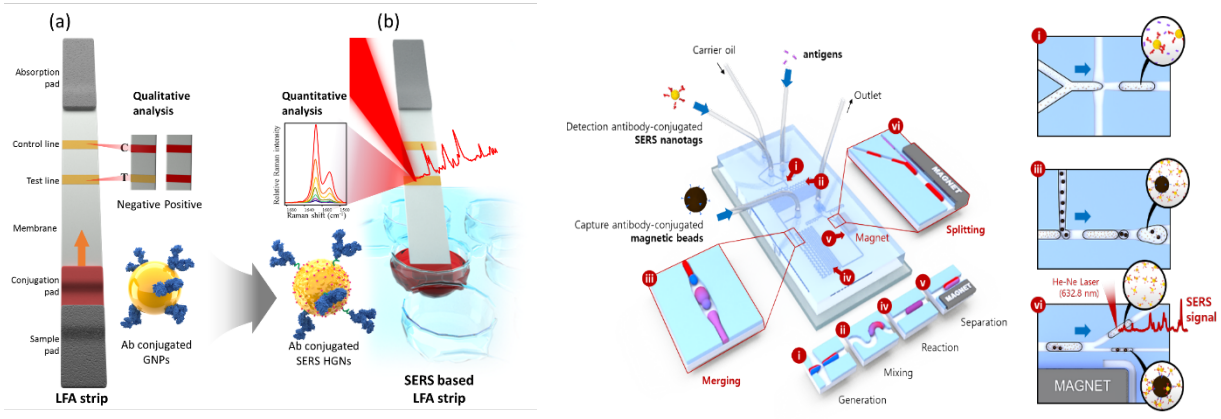


Figure 1. Schematic illustrations of SERS-based LFA strip and microfluidic device.