Au@Ag SERRS tags coupled to a lateral flow immunoassay for the sensitive detection of Pneumolysin

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Pneumonia is an inflammatory condition of the alveolar spaces of the lungs caused mainly by Streptococcus pneumoniae, a pathogenic bacterium which affects two thirds of both adults and children. [1] Establishing a definitive diagnosis of pneumonia is difficult using conventional diagnostic tests. Nowadays, the most advantageous option is the development of a point-of-care (POC) test, based on antigen detection. These assays are portable, with short analysis time, and they can be used by untrained personnel in any location. [2] Lateral Flow immunoassay (LFIA) is a very successful POC test in which an immunoassay takes place at a membrane. Typically, the sensitivity and quantification capabilities are constrained to the measurement of the optical density at the test zone (colorimetric test), which has some limitations in terms of detection and quantification.

In this work we have developed a lateral flow immunoassay for the ultrasensitive detection of pneumolysin, an important biomarker of pneumonia, employing plasmonic Surface-Enhanced Resonance Raman Scattering (SERRS) tag as labelled probe. The combination of Au@Ag core-shell nanoparticles as plasmonic platform and Rhodamine B Isothiocyanate as Raman reporter has allowed us to fabricate a SERRS tag with high efficiency and reliability. Moreover we carried out the bioconjugation of the plamonic nanoparticles with anti-pneumolysin antibody (PLY-7) with the aim of the detection of pneumolysin in a lateral flow immunoassay by SERRS. Finally, we demonstrated that Au@Ag NPs allowed the detection and quantification through both, SERRS-based LFIA and optical density readings. The comparison of the sensitivity of the SERRS-based LFIA with the value achieved based on the optical density reading showed a better performance of the SERRS assay. [3]

The coupling of a SERRS-based sensor within a lateral flow immunoassay strip will boost its sensitivity and quantitative capabilities, showing a great potential for the qualitative and quantitative detection of analytes in biomedical, food and environmental analysis.

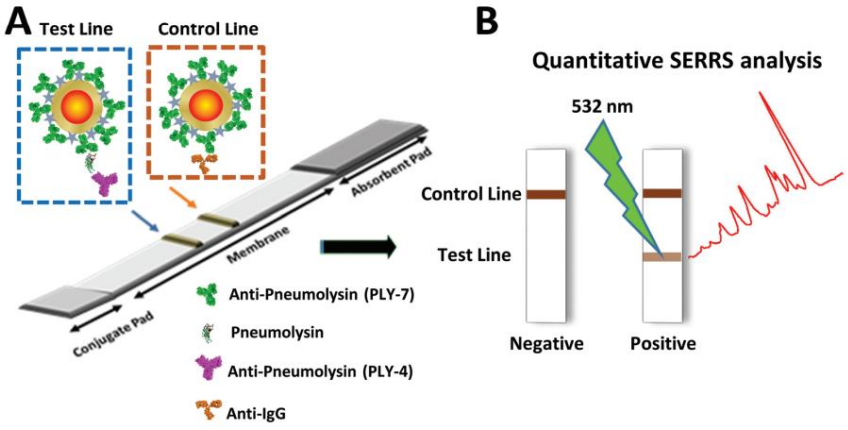

Fig. 1 (A) Schematic illustration of the SERRS-based LFIA strip. (B) Qualitative analysis in the strip, where only brown line is observed in the control zone in the absence of pneumolysin (Negative) and two lines appear in presence of the pneumolysin (positive). The SERRS characterization of the test line allows a quantitative analysis.

1) M. Díaz-González, et al., *Sensor Actuat. B-Chem*., **2006**, *113*, 1005
2) P.B. Luppa, et al., *Trac-Trend Anal. Chem*., **2011**, *30*, 887
3) L. Blanco-Covián, et al., *Nanoscale*, **2017**, in press