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Ultrasensitive detection of SERS nano-tagged α-thrombin

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Highly sensitive detection of disease-related proteins (*biomarkers*) in serum or plasma has become increasingly important for early stage biomedical diagnosis. Innovative approaches to obtain sensitivity enhancements with detection limits even down to the single molecule have been proposed in the nanotechnology framework. In the nanoplasmonics field, surface enhanced Raman scattering (SERS) spectroscopy has been performed as an ultrasensitive, fast and universal analytical technique. Since SERS retains the fingerprinting capabilities of Raman spectra, the internal modes of a reporter molecule brought at metallic NPs junctions where strong field enhancement occurs, can be used as diagnostic tools.

In this context, we have recently developed an ELISA-analog immunoassay for detecting the presence of α-thrombin at *femto* molar level. α-Thrombin, a specific serine protease involved in the coagulation cascade, is crucial in physiological and pathological coagulation, and regulates many processes in inflammation and tissue repair at the vessel wall. So, establishing a high sensitive and selective method to detect α–thrombin becomes very important. We report on the development of *antitags*, a sensitive and selective nanostructured tool based on Ag-nano dumbbells that employs antibodies as protein recognition probes and relies on SERS as the detection technique. Moreover, we show how the insertion of polyethylene glycol (PEG) chains as capping agents on the Ag NPs interaction improves SERS tags sensitivity (fM), thus rendering them less prone to ligand exchange and undesired aggregation. Overall, the method allows the selective detection of a specific target amongst a pool of different proteins in complex matrices, such as human plasma and serum opening the possibility of highly sensitive multiplexing diagnosis or medical investigations.

Biography

Nekane Guarrotxena is a Ph.D. from the University of Complutense, Madrid-Spain in 1994 and has been post-doctoral research at the Ecole Nationale Superieure d´Arts et Metiers, Paris-France (1994-1995) and the University of ScienceII , Montpellier-France (1995-1997). From 2008-2011, she was visiting professor in the Department of Chemistry, Biochemistry and Materials at University of California, Santa Barbara-USA and the CaSTL at University of California, Irvine-USA. She is currently Research Scientist at the Institute of Polymers Science and Technology, CSIC-Spain. Her research interest focuses on the synthesis and assembly of hybrid nanomaterials, nanoplasmonics, and their uses in nanobiotechnology applications (bioimaging, drug delivery, therapy and biosensing).

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