

NANOSTRUCTURED ANTITAGS-BASED BIOSENSORS FOR SENSITIVE PROTEIN DETECTION BY SERS ENHANCEMENT.

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The development of effective methods for the reliable and trace measurements of proteins are highly desired to facilitate the diagnosis disease states, improve drug discovery and defend against biological threats. Certainly, new methods that enable sensitive, selective, and rapid detection of proteins are essential. The potential benefits of protein biomarkers for disease detection and treatment have greatly motivated both academic and industry researchers to apply new proteomic technologies for biomarker discovery and to develop quantitative analytical methodologies for rapid and sensitive biomarker detection [1]. However, disease biomarkers and biological agents are often present at very low concentrations. Therefore, protein detection with high specificity and sensitivity is required.

Highly sensitive detection of proteins is commonly accomplished via antibody-based immunoassays, with the primary antibody is attached to a solid surface [2]. Based on this principle antibody-antigen interaction, the ELISA assay is one of the most important biochemical techniques used in immunology to detect the presence of an antibody or an antigen in a sample [3, 4].

However, the lack of amplification methods for protein detection, as compared to "PCR-like" amplification protocols for the case of nucleic acid detection limits the analysis and underscores, undoubtedly, the importance of new strategies for their detection and signal amplification that incorporate sensitive spectroscopic techniques and novel recognition systems.

Based on these considerations, while the majority of these bioassays, such as a sandwich ELISA (capture antibody and detector antibody involved), rely on the use of enzyme labels; our efforts have led to the development of a nanoparticle-based for immunoassays of proteins. The attractive amplification and multiplexing properties of metal nanoparticles make these suspensions of NP dimers and small aggregates ideal labels for immunoassays of proteins.

In this presentation, we disclose the design, preparation and function of *antitags*, which contain antibodies as the recognition element. These materials can be defined as nanostructured tools for developing ELISA analogues based on SERS concept [5]. SERS (Surface enhanced Raman spectroscopy) takes advantage of strongly increase Raman scattering signals generated by local field enhancements near metallic nanostructures. Since SERS retains the fingerprinting capabilities of Raman, the internal modes of a reporter molecules brought in close proximity to the metallic surface can be used as diagnostic signals for analyte detection.

In summary, the combination of opportunities given by nanotechnology and SERS enhancement together with the application of classic sandwich ELISA concept allow us to develop new sensitive protein detection. The main advantage of our method resides in the capability of the SERS-based techniques to allow multiplex detection not possible with the colorimetric and fluorometric ELISA analogue and in the creation of tags not dependent upon surface-specific enhancements. The use of antibodies should increase considerably the scope of targets, in comparison to recent reports of aptamer-based sensing [6].

References

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