Nanomaterials based electrochemical biosensors for diagnostics applications

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Biosensors represent an interesting alternative for an efficient, fast, low-cost and user-friendly clinical analysis in general and cancer diagnostic particularly. Between different biosensing alternatives the nanotechnology oriented biosensors or nanobiosensors represent a very attractive tool for clinical applications. The need for nucleic acid and protein based diagnostic tests has increased enormously in the last few years and the design of novel nanostructures with special optical and electrochemical properties is bringing significant advantages in several fields being diagnostic one of the most important.

Electrochemical biosensors based on the use of nanoparticles (NPs) as electroactive labels may offer several advantages in terms of cost-efficiency in comparison to traditional methods of bioanalysis such as ELISA or PCR. Gold nanoparticles (AuNPs) stand out from the variety of nanoparticles used as labels in biosensing due to their simple synthesis, narrow size distribution, optical and electrochemical properties and easy bioconjugation alternatives. The advantageous properties of AuNP-based immuno and DNA electrochemical assays have given rise to an increased number of publications and other reports in the last years.

The aim of this work is to present the different strategies developed in our group for the direct (redox properties) [1] and indirect (electrocatalytic properties) [2-4] electrochemical detection of AuNPs tags in immunosensing assays, avoiding their previous dissolution in a separate and highly acidic media. Furthermore different platforms (i.e. magneto - screen-printed electrodes, nanoporous surfaces [5-7] etc.) that improve the performance of the performed assays have been used so as to improve the biosensing performances. Of special interest is the use of nanoporous materials not only as sensing systems but also as filters, minimizing matrix effects in human blood analysis.

The optimized immunosensors have been applied for the detection of protein biomarkers in real samples. The obtained results show that the developed technologies can be valid alternatives to the traditional methods. These works and their final validation in real samples analysis are still in progress at our laboratories and will be object of future presentations.

Acknowledgments. We acknowledge MEC (Madrid) for the projects MAT2008–03079/ NAN and CSD2006–00012 ‘‘NANOBIOMED’’ (Consolider-Ingenio 2010), the E.U.’s support under FP7 contract number 246513 “NADINE” and the NATO Science for Peace and Security Programme’s support under the project SfP 983807 and the CIDEM (Generalitat de Catalunya) for VALTEC08-1-0007 Project.

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