Microchimica Acta topical collection IX NyNA 2019

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Published online: 2 May 2020

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In 2006, Spanish researchers in analytical chemistry launched a pioneering initiative: the first workshop on *Analytical Nanoscience and Nanotechnology*. Initially at the national level, the objective of the workshop was to bring together Spanish scientists interested in analytical nanoscience and nanotechnology, enabling them to know who was who and to establish collaborations and links in a research topic which at that time was considered a rising star in the field.

From the beginning, the main goal of this conference was to promote the development of novel approaches at the interface between analytical chemistry and nanoscience and nanotechnology within the framework of nanomaterials as analytes in single and complex matrices, mainly as tools for developing analytical detection principles and methods. Since then, nine events took place.

We are delighted to introduce the first *Microchimica Acta* Topical Collection with selected papers from the latest proceedings of this International Congress on Analytical Nanoscience and Nanotechnology (IX NyNA 2019, Zaragoza, Spain). The selected works demonstrate how nano- and micro-materials offer unique opportunities to overcome analytical challenges, from the analysis of contaminants

to monitoring of biomarkers, to cell studies. In this regard, noble metals, colloidal nanoparticles, and nanostructures and nanocomposite materials once again demonstrate their feasibility as unique tools for the scientific community, *ready to use* in solving complex challenges.

Silver has been employed under different dimensions and conformations, from colloidal dispersions to microstructures, confirming a renaissance of the ‘silver age’. Three-dimensional silver mirror-like micro-pyramids are employed as an active substrate for surface-enhanced Raman spectroscopy (SERS), enabling the ultrasensitive determination of organophosphorus pesticides [1]. Heterocyclic aromatic amines are determined in food samples using a screen-printed carbon nanofiber electrode modified with silver nanoparticles (AgNPs) embedded in the Nafion matrix. The proposed sensor coupled with liquid–liquid microextraction assisted by ionic liquid was applied for the determination of 2-amino-3,8-dimethylimidazo[4,5-f]quinoxaline [2]. A sensor based on L-cysteine oligomers electropolymerized on a glassy carbon electrode is proposed for the rapid quantification of AgNPs. Ligands with amino, sulfur and carboxy functional groups are used to retain AgNPs, followed by stripping voltammetry [3]. A method for quantifying water-stabilized silver sulfide quantum dots further illustrates the suitability of stripping voltammetry for the determination of such tiny nanotools. *Escherichia coli* determination, where silver sulphide quantum dots are used as tags, is employed as a proof of concept to demonstrate the outstanding applications of the method [4].

Gold nanoparticles (AuNP) still remain unique tools, having earned a place of honor in the ecosystem for the use of nanomaterials for analytical purposes. Our article selection illustrates the unprecedented capability of AuNPs as replacement for O₂ in the oxidase enzymatic reaction. This strategy is employed to determine tyramine in cheese samples using tyramine oxidase and exploiting the localized surface plasmon resonance (LSPR) of the formed AuNPs as analytical signals [5]. Taking further advantage of the AuNPs LSPR, a colorimetric assay is proposed for microRNA146a determination. AuNPs functionalized with selected RNA probes aggregate in the presence of miR146a, resulting in a color/plasmonic shift

This editorial corresponds to the IX NyNA 2019, International Congress on Analytical Nanoscience and Nanotechnology at Zaragoza (Spain) on 2–4 July 2019

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used as analytical signal, with excellent performance and applicability for the analysis of raw cow milk samples [6].

The topical collection also covers novel developments in not so widely used nanomaterials. For example, ZnO nanowires are employed for the determination of lactate and cholesterol through the detection of hydrogen peroxide generated during the enzymatic reactions (using lactate oxidase and cholesterol oxidase), taking advantage of the electrostatic interactions between the enzymes and the ZnO nanowires. By exploiting the ability of hydrogen peroxide to quench the fluorescence of the ZnO nanowires, lactate and cholesterol are determined [7].

Exploiting magnetic beads, and using a screen-printed carbon electrode, an immunosensor is proposed for the analysis of HER2-ECD, a biomarker in breast cancer and breast cancer cells in human serum. The affinity process is detected using electroactive labels composed of core/shell streptavidin-modified CdSe@ZnS quantum dots. Cd²⁺ ions released from the quantum dots are determined by differential pulse anodic stripping voltammetry. The immunoassay was successfully applied to breast cancer cell lines SK-BR-3 (a HER2-positive cell line), MDA-MB-231 (a HER2-negative cell line), and MCF-7 (a cell line with low HER2 expression) [8]. A method for the electrochemical detection of methylisothiazolinone is also proposed, taking advantage of membranes [polystyrene sulfonate or poly(diallyldimethylammonium)] incorporating AuNPs [9].

In sum, the selected manuscripts reflect the ‘horizontal use’ of nanomaterials, involving different analytical fields and exciting applications.

This topical collection demonstrates how the IX NyNA 2019 conference has again proved to be a fruitful occasion of high-level scientific debate and vibrant activities of Spanish analytical nanoscience.

We are looking forward for the next edition that will take place in 2021 in Spain.

We invite our entire readership to participate in this congress and to send their best works in the field of analytical sciences based on micro- and nanomaterials to the journal.

We hope our readership enjoys this collection and finds it useful.

Juan R. Castillo,
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Compliance with ethical standards

Conflict of interest The authors declare that they have no competing interests.

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