

## Issue dedicated to modern analytical chemistry in interdisciplinary research

Analytical chemistry is one of the most ancient branches of the chemistry science. According with definition, it focuses on the development of instrumental and methodological tools, suitable for qualitative and quantitative assessment of the composition of a given sample or given system under study. Typically, the determination of known chemical species is required for the quality control purposes, for refining industrial processes, as well as in the environmental, clinical, pharmaceutical, forensic and many other studies or applications. The permanent challenge is the improvement of analytical performance while using simplified, automatized, micro-scale and environmentally friendly protocols. Another focus of analytical chemistry covers explorative studies, where the identity of analytes is not always known. Within this context, the exponential growth in the demand for reliable analytical results has been certainly a driving force in the development of basic concepts and tools and has contributed to the present position of analytical chemistry in interdisciplinary research. Indeed, analytical chemistry has been at the forefront of many important discoveries in medicine, toxicology, biological and material sciences, providing valuable information on the identity and the amount of chemical species of interest, and helping in the elucidation of biological pathways and reaction mechanisms. The role of analytical chemistry in a domain of “omics” sciences should also be highlighted, since analytical techniques and methodologies elegantly complement results obtained in application of molecular biology procedures.

“Interdisciplinary research” is a popular term though somehow ambiguous, mainly because of its emerging character. It has been defined in the US National Academies’s report as “...a mode of research by teams or individuals that integrates information, data, techniques, tools, perspectives, concepts, and/or theories from two or more disciplines or bodies of specialized knowledge to advance fundamental understanding or to solve problems whose solutions are beyond the scope of a single discipline or area of research practice” [1]. In this regard, there are two spotlights integrating analytical chemistry into the interdisciplinary context: (i) application of new knowledge from other disciplines for the improvement of instrumentation, methodology and data analysis used in analytical chemistry; (ii) providing specific and quantitative information in support of

the hypotheses formulated in other disciplines thus enabling to extend current borders of knowledge. The collection of articles presented in this special issue covers both interdisciplinary aspects of analytical chemistry.

The first article is a comprehensive review in which Maria Armienta presents, from the Mexican perspective, the role of analytical chemistry in environmental geochemistry studies. The next six contributions show the expanding applications of analytical chemistry tools in different areas of biological, biomedical and nutritional sciences. Claudia Maier and Armando Alcazar report very refined metabolomic study based on liquid chromatography - high resolution mass spectrometry focusing the identification and quantification of cyanobacterial toxins from Pacific Northwest freshwaters. In the next work, Alma Escobosa with co-workers isolate indigenous bacteria from marine environment at Rosarito Port, B.C., Mexico, contaminated with polycyclic aromatic compounds (PAHs), and perform identification of microorganisms by matrix assisted laser desorption/ionization - mass spectrometry with Biolyzer software. Adolfo Lopez group propose novel procedure enabling for the assessment of global DNA methylation after microwave assisted acid digestion and gas chromatography - mass spectrometry determination of nucleobases in multiple reaction monitoring mode; the feasibility of this procedure was demonstrated by analyzing DNA methylation in white blood cell extracts and a series of microfungi. Further, Julio Landero explores the application of molecular mass spectrometry tools for structural characterization of DNA - protein crosslinks formed in simple, model solution. Given the importance of dietary supplements in human nutrition, with the aid of different analytical tools Eunice Barrientos and co-workers evaluate comparatively four different edible plants in terms of their capability for the uptake of inorganic selenium and its biotransformation to organic compounds, as well as the impact of Se on the plant growth and the status of other mineral elements. Finally, Armando Gomez with his group synthesized an advanced glycation end product pentosidine and incorporate its determination by liquid chromatography with fluorimetric detection into a clinical study focusing the efficiency of pharmacological treatment of diabetic patients with podocyturia.

The following five articles show advances in analytical methodology for the determination of classic and emerging contaminants along with the application of analytical chemistry tools in establishing of suitable remediation strategies. In the first place, Kazimierz Wrobel and his research group introduce gas chromatography - mass spectrometry procedure in multiple reaction monitoring mode for the determination of phthalates in Mexican maize tortilla; possible sources of these contaminants in the analyzed samples are also explored. The next two articles deal with herbicide atrazine; whereas Jorge Guzman proposes an on-line sample pretreatment coupled to sequential injection chromatography for the determination of atrazine and 2,4-dichlorophenoxyacetic acid in corn samples, Juan Peralta and co-workers address the electrochemical abatement of atrazine using an undivided stirred tank cell with platinum or boron doped diamond anode. Regarding mercury as a classic heavy metal contaminant, Erika Bustos studies the adsorption of Hg(II) from aqueous solution into Ca-bentonite using both, the MINSQ and GAUSSIAN 09 programs and performing batch experiments under controlled temperature and constant pressure conditions. Last, but not least, Andres Galan and co-workers propose an interesting square wave anodic stripping voltammetry assay for the detection of arsenic (III) which is based on co-deposition of silver at screen printed and glassy carbon electrodes.

In analytical chemistry research, considerable effort is dedicated to ensuring reliability of analytical results. Two articles in this issue are focused on the refinement of calibration protocols; Barbara Wagner with co-workers demonstrate the utility of mineral apatite for matrix-matched calibration in multi-elemental analysis of tooth enamel samples by laser ablation - inductively coupled plasma - mass spectrometry; this

work is a nice example of the role of analytical chemistry in archeological research. Marcia da Rocha in collaboration with the research group headed by Alfredo Sanz-Medel, prove the feasibility of single point calibration for quantitative speciation of selenomethionine in selenized yeast by liquid chromatography - inductively coupled plasma - mass spectrometry. In interdisciplinary study by David Rodriguez and co-workers, polydimethylsiloxane-phenylsiloxane coatings were obtained by sol-gel method and were applied for stir bar sorptive extraction, yielding efficient extraction/preconcentration of several organic pollutants potentially present in well water or seawater water. Maria Vargas applies highly sulfated cyclodextrins to study chiral separation of benzodiazepines by capillary electrophoresis, and conveniently integrates molecular modelling in her study. In the last article in this issue, Miguel de la Guardia and co-workers propose a rapid and efficient extraction of polyphenolic compounds from pulses with the aid hard cap espresso machine; according with the expertise of this research group, the procedure complies with the principles of green chemistry.

As a guest editor, I express my gratitude to all authors contributing to this special issue with novel and interesting articles. I sincerely thank professor Ignacio Gonzalez, editor-in-chief of Journal of the Mexican Society, for his invaluable help in the realization of the project. Finally, I would like to dedicate this special issue to new generations of scientists, encouraging them to participate in interdisciplinary research, where analytical chemists work hand in hand with researcher from other disciplines to create new knowledge.

Sincerely,  
Katarzyna Dorota Wrobel