Moving forward to greener extraction techniques

Extraction is usually considered as a key step affecting the whole analytical methodology; moreover, when talking about Green Analytical Chemistry (GAC, defined as “the use of analytical chemistry techniques and methodologies that reduce or eliminate solvents, reagents, preservatives and other chemicals that are hazardous to human health or the environment and that may also enable faster and more energy-efficient analysis without compromising performance criteria”), the extraction step has an important contribution to the final greenness of the entire analytical process. In the last four years, there have been important contributions in this field, mainly focused on the use or design of new solvents, sorbents, strategies, methodologies and ideas to greener the extraction step, on how to measure the greenness of an analytical methodology, as well as a large number of applications of the extraction from a greener perspective. The interest and novelty of all these new developments and their everyday wider application, have taken us to prepare this special issue on “Green Extraction Techniques”, that is a continuation of our previous special issue on TrAC (released on September 2015 (Volume 71)).

Our main objective in preparing this Special Issue of TrAC was to present top review papers from experts in the field, showing technologically and methodologically innovative strategies, together with current trends, methods and applications of advanced Green Extraction Techniques.

The result is this Special Issue that contains 24 review papers that cover some of the most hot topics nowadays in the field, together with some interesting and new applications on Green Extraction Techniques, namely: i) their role in Green Analytical Chemistry (M. de la Guardia); ii) the green extraction of natural products, discussing its origins, current status, and future challenges (F. Chemat); iii) the use of Hansen solubility parameters for selection of green extraction solvents (A.P. Sanchez-Camargo); iv) the employment of hydrophobic deep eutectic solvents (DES) for the extraction of organic and inorganic analytes from aqueous environments (J. Lee); v) the use of IL-based advanced techniques for the extraction of value-added compounds from natural sources and food by-products (M.C. Garrigos); vi) and up date on the use of sub- and supercritical fluid extraction of bioactive compounds from plants, food-by-products, seaweeds and microalgae (M. Herrero); vii) pressurized hot water extraction of bioactives (M. Plaza); viii) pressurized liquid extraction of organic contaminants in environmental and food samples (Y. Pico); ix) supercritical fluid extraction of essential oils (M. Rahimi-Nasrabadi); x) the recent advances in the coupling of carbon dioxide-based extraction and separation techniques (L. Mondello); xi) the use of ultra-sound technology for the extraction of biologically active molecules from plant, animal and marine sources (B. Tiwari); xii) ultrasound-assisted extraction of organic contaminants (J.L. Tadeo); xiii) microwave-assisted extraction of pharmaceuticals, personal care products and industrial contaminants in the environment (M. Llompart); xiv) the use of combined assisted extraction techniques as green sample pretreatments in food analysis (A. Moreda-Piñero); xv) approaches for multi-objective optimization of microextraction procedures (M. Tobiszewski); xvi) selecting an extraction solvent for a greener liquid phase microextraction (LPME) mode-based analytical method (J.M. Kokosa); xvii) current trends and future perspectives on the application of ionic liquids in microextraction techniques (L. Marcinkowski; in this particular review article we want to include a special memory to Prof. Jacek Namiesnik who passed away recently and who largely contributed to the development of GAC); xviii) recent advances and future trends on new materials in sample preparation (F. M. Lanças); xix) the use of new tailored and engineered materials for matrix solid-phase dispersion (MSPD) (L. Ramos); xx) the application of green solvents as sorbent modifiers in sorptive-based extraction techniques for extraction of environmental pollutants (B. Hashemi); xxi) the current trends in

QuEChERS method as a versatile procedure for food, environmental and biological analysis (M.A. Rodríguez-Delgado); xxii) a critical review on regulatory sample preparation methods related to validating solid-phase microextraction techniques (J. Pawliszyn); xxiii) an overview on green techniques for extraction of bioactive carbohydrates (M.L. Sanz); and xxiv) and an over-view on green analytical methods for metals determination in biosorption studies (K. Chojnacka).

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