Editorial.

Highlights in sample preparation

For years, sample preparation has been considered the limiting step of many analytical procedures. The reason is that, for too long, analytical chemists focus on the development of more and more sophisticated instruments, allowing the sensitive and selective determination of gradually smaller amounts of the targeted analytes. Today, powerful separation techniques are available to isolate trace components in extracts of increasing complexity. These techniques combined with appropriate spectroscopic detection (e.g., the sophisticated mass spectrometric systems now available) provide unambiguous determination of amounts of substances that are smaller than ever, thanks to the possibility of simultaneous structural confirmation. However, all this is value less if the extract to be analyzed is not representative of the original sample, is too diluted or contains so much interfering material that masks the compound of interest or the instrument is contaminated – that is, if the necessary sample treatment has not been properly performed. Sample preparation is a critical step in the analytical process, with a profound influence on both the total time required to complete the analysis and the quality of the results obtained. Understanding this started to spur research in this field a couple of decades ago. Since then, new concepts and ideas have been introduced. Some new technologies have been developed in an attempt to provide faster, more efficient and more selective sample-preparation procedures that allow enhanced concentrations while minimizing (or virtually eliminating) use of solvents and sorbents, waste generation, and exposure of the analyst to hazardous reagents. Miniaturization and integration of the several treatments involved in sample preparation are nowadays clear trends. Both extremely selective and multiresidue analytical protocols have been proposed. Finally, progress in new materials is also opening up new possibilities with the synthesis of novel sorbents and tunable greener solvents with improved features. This Special Issue of Trends in Analytical Chemistry (TrAC) reviews and highlights many advances and developments in sample-preparation methods in recent years. Although special attention has been paid to the analysis of food and environmental samples, the general knowledge and background associated with most of the topics covered in this Special Issue are also applicable to many other types of matrix and research applications. The articles discuss modern solvent-less techniques and the latest achievements and novel materials used for solid-phase extraction, solid-phase microextraction or stir-bar sorptive extraction. They evaluate the advantages and the limitations of new green alternative solvents for these applications, and those approaches requiring minimum sample manipulation, and highlight the latest trends and emerging applications in the use of enhanced extraction techniques. Finally, a coverage of emerging issues in sample preparation, mainly associated with the need to develop and to validate novel analytical procedures for accurate determination of new (frequently toxic) compounds, has been included. At this point, we would first like to thank all the participants for their very significant contributions, which made this Special Issue possible. In this sense, we would also like to make a particular mention of TrAC Contributing Editor Professor Dr. Udo A.Th. Brinkman who suggested this idea of this Special Issue to us: “Thank you very much for our trust in us.” We hope that the interested readers are persuaded that sample preparation remains a challenging step within analytical determination and that they will at least get a glimpse of possible limitations but, above all, will realize the prospects of these state-of-the-art methodologies.

Yolanda Pico / L. Ramos