Analytica Chimica Acta 885 (2015) 57–91

Contents lists available at ScienceDirect

Analytica Chimica Acta

journal homepage: www.elsevier.com/locate/aca

Tutorial

Introduction of organic/hydro-organic matrices in inductively coupled plasma optical emission spectrometry and mass spectrometry: A tutorial review. Part II. Practical considerations

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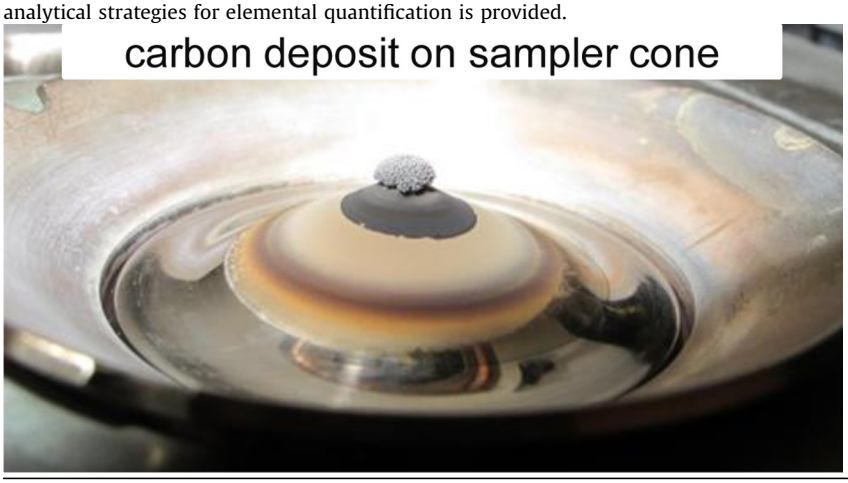
HIGHLIGHTS

- Practical considerations to perform analyses in organic/hydro-organic matrices.
- Description, benefits and drawbacks of recent introduction devices.
- Optimization to improve plasma tolerance towards organic/hydro-organic matrices.
- Analytical strategies for elemental quantification in organic/hydro-organic matrices.

GRAPHICAL ABSTRACT

This tutorial review is dedicated to the analysis of organic/hydro-organic matrices by ICP techniques. A state-of-the-art focusing on sample introduction, relevant operating parameters optimization and analytical strategies for elemental quantification is provided.



ARTICLE INFO

Article history:
Received 25 November 2014
Received in revised form 31 March 2015
Accepted 2 April 2015
Available online 22 June 2015

Keywords:
Inductively coupled plasma
Mass spectrometry
Optical emission spectrometry

ABSTRACT

Inductively coupled plasma optical emission spectrometry (ICP-OES) and mass spectrometry (ICP-MS) are increasingly used to carry out analyses in organic/hydro-organic matrices. The introduction of such matrices into ICP sources is particularly challenging and can be the cause of numerous drawbacks. This tutorial review, divided in two parts, explores the rich literature related to the introduction of organic/hydro-organic matrices in ICP sources. Part I provided theoretical considerations associated with the physico-chemical properties of such matrices, in an attempt to understand the induced phenomena. Part II of this tutorial review is dedicated to more practical considerations on instrumentation, instrumental and operating parameters, as well as analytical strategies for elemental quantification in such matrices.

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http://dx.doi.org/10.1016/j.aca.2015.04.039
0003-2670/

Organic matrices
Instrumental and operating parameters
Quantification strategies

Two important issues are addressed in this part: the first concerns the instrumentation and optimization of instrumental and operating parameters, pointing out (i) the description, benefits and drawbacks of different kinds of nebulization and desolvation devices and the impact of more specific instrumental parameters such as the injector characteristics and the material used for the cone; and, (ii) the optimization of operating parameters, for both ICP-OES and ICP-MS. Even if it is at the margin of this tutorial review, Electrothermal Vaporization and Laser Ablation will also be shortly described. The second issue is devoted to the analytical strategies for elemental quantification in such matrices, with particular insight into the isotope dilution technique, particularly used in speciation analysis by ICP-coupled separation techniques.

Contents

Amélie Leclercq received her Engineering and Master's degrees in Chemistry from the University of Rouen (France) in 2009, and her Ph.D. in Chemistry from the University of Nice-Sophia Antipolis (France) in 2013. She was working on the behavior and transfers of anthropogenic radionuclides in environmental compartments. In 2013, she joined the Laboratory of Nuclear, Isotopic and Elemental Analytical development (LANIE) of the French Alternative Energies and Atomic Energy Commission (CEA, France) as a postdoctoral researcher, where she is focusing on the introduction of high-content organic matrices in ICP-MS.

José-Luis Todolí has been teaching Analytical Chemistry since 1994 at the University of Alicante. In April 2012 he gained a full professor position. His fundamental research has been focused on characterization and overcoming of matrix effects and development of instrumentation for Inductively Coupled Plasma techniques. Furthermore, he has been involved in projects related with the development of new chromatographic separation methods and their coupling to ICP. His research has been applied to the analysis of environmental samples, foodstuff, fuels and clinical samples. He has coauthored about 100 papers, book chapters and research books and he has about 200 contributions to international meetings among them over 20 invited lectures.

Anthony Nonell obtained his Ph.D. in Isotope Geochemistry from the Paul Sabatier University (Toulouse III, France) in 2005. Since 2006, he has been a researcher in the Nuclear Energy Division of the French Alternative Energies and Atomic Energy Commission (CEA). Within the Laboratory of Nuclear, Isotopic and Elemental Analytical development (LANIE), he is conducting research on state of the art analytical developments for isotopic and elemental measurements on radioactive samples by mass spectrometric techniques such as MC-ICP-MS and TIMS.

Carole Bresson received her Ph.D. in Coordination Chemistry from the Paul Sabatier University (Toulouse, France), in 1999. She worked afterwards two years as a post-doctoral researcher at the Free University of Belgium, on the stereospecific synthesis of optically active Ru(II) complexes. Since 2002, she has been a researcher in the Nuclear Energy Division of the French Alternative Energies and Atomic Energy Commission (CEA). In 2011, she joined the Laboratory of Nuclear, Isotopic and Elemental Analytical development (LANIE), to carry out developments for speciation analysis in the field of nuclear toxicology and spent fuel reprocessing, especially by hyphenated chromatographic techniques.