Meeting report

Recent trends and progress in trace-element speciation

A report on the international conference "Progress in Analytical Methodologies for Trace Metal Speciation (TraceSpec 2007)", held in Münster, Germany, 4–7 September 2007

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1. Introduction

Close to 200 participants from more than 30 countries met in Münster, Germany, on 4–7 September 2007 to discuss recent trends and progress in the field of trace-element speciation. The conference was co-organized by the University of Münster, the European Virtual Institute for Speciation Analysis (EVISA) [1], and the International Association of Environmental Analytical Chemistry (IAEAC). It was the eleventh event in a series of conferences devoted to trace-metal speciation that was initiated by the IAEAC in 1983 with a workshop on "Carcinogenic and/or Mutagenic Metal Compounds: Environmental Chemistry, Analytics, Biological Effects" held in Geneva, Switzerland, with further meetings organized every two to three years in co-operation with different local organizers. Starting from 2000, with the eighth meeting in this series (held in Lisbon, Portugal, in conjunction with the Euroanalysis XI conference), the focus shifted to analytical aspects and that was reflected in the new name of this conference series, "Progress in Analytical Methodologies for Trace Metal Speciation". The most recent event in this series, TraceSpec 2007, was fully in line with this concept and presented the newest research results, as well as novel strategies capable of facing the future challenges in speciation analysis.

The conference was held at the Old Castle of Münster, now part of the University, which offered the perfect setting. Lectures were held in the historical "Aula" of the castle, which impressed participants both with its distinguished setting and modern technical facilities. Posters were displayed in the spacious halls of the Old Castle. The very well attended exhibition for companies was located in the foyer of the castle, where coffee and lunch were provided during breaks and which presented

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Abbreviations: AED, Atomic emission detector; AFS, Atomic fluorescence spectroscopy; AGNES, Absence of Gradients and Nernstian Equilibrium Stripping; CE, Capillary electrophoresis; EDTA, Ethylediamine tetraacetate; EI, Electron impact; ESI, Electrospray ionization; FIA, Flow-injection analysis; FT-ICR, Fourier-transform ion cyclotron resonance; GC, Gas chromatography; GF-AAS, Graphite furnace-atomic absorption spectrometry; HG, Hydride generation; (HP)LC, (High-performance) liquid chromatography; ICP, Inductively coupled plasma; ID, Isotope dilution; LA, Laser ablation; MALDI, Matrix-assisted laser desorption-ionization; MeCAT, Metal Coded Affinity Tagging; MS, Mass spectrometry; PAGE, Polyacrylamide gel electrophoresis; PBDE, Polybrominated diphenyl ether; PED, Plasma emission detection; RP, Reversed phase; SPME, Solid-phase microextraction; TOF, Time-of-flight; WFD, Water Framework Directive; XANES, X-ray absorption near edge spectroscopy; XRD, X-ray diffraction.

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a very pleasant forum for communication between the conference participants.

The conference was preceded by a short (half-day) course provided by O.F.X. (Olivier) Donard from the University of Pau, France. He discussed with about 35 participants – coming in large part from industry – how to perform ''speciation analysis in a practical way''. After a general introduction on the motivation for doing speciation analysis and an outline of the historical development of this topic, Olivier Donard presented practical approaches to doing speciation measurements in routine analytical laboratories. He pointed out that, for many routine applications, such as organotin or organomercury speciation, instrumentation commonly available in analytical laboratories (e.g., gas chromatography with mass spectrometry (GC-MS) or flame photometric detection (GC-FPD)) can be used, and that it is not necessary to use highly specific or very costly instrumentation (e.g., GC with atomic emission detection (GC-AED) or GC or HPLC coupled to inductively coupled plasma MS (ICP-MS)). Sample preparation remains a key issue for a successful speciation method, particularly in speciation analysis because the risk of analyte loss, degradation or transformation is much higher than in inorganic analysis. From this perspective, modern sample-preparation (extraction) techniques (e.g., microwave-assisted or ultrasound-assisted extraction, or pressurized liquid extraction) are receiving increasing attention.

The main conference program featured five plenary and 38 contributed lectures and more than 80 poster presentations in two-and-a-half days. The conference was formally opened on Wednesday morning by the conference chairman, Professor Uwe Karst of the University of Münster (Germany), who cordially welcomed all participants to the city of Münster and to the conference. Welcoming addresses were also presented by the President of IAEAC, Professor Dieter Klockow, and the Director of EVISA, Michael Sperling.

Each scientific session started with a plenary lecture, which set the theme and was followed by contributed presentations.

2. Environmental speciation analysis

The first plenary lecture brought Olivier Donard to the stage again, and his very lively presentation entitled ''Environmental chemistry of elements – elemental speciation at last!'' put speciation analysis in the context of European legislation, where (although very slowly) it is being realized that the determination of total-element concentration cannot always provide the right answer, but speciation analysis is required instead. Many European Directives (e.g., RoHS (Restriction of Hazardous Substances, Directive 2002/95/EC), WEEE (Waste Electrical and Electronic Equipment, Directive 2002/96/EC) or REACH (Registration, Evaluation, Authorization and restriction of Chemicals, Directive 2006/1907/EC)) demand speciated measurements. This will have an enormous impact on both analytical laboratories and instrument manufacturers, which now have to respond to this challenge.

The following presentations discussed environmental speciation analysis from different viewpoints.

Petra Krystek presented work performed with RIVM (Bilthoven, The Netherlands), in which chromium (VI) species and other selected metals were monitored to study the exposure of the population close to a foundry. It was pointed out that the design of the study was of the utmost importance to cover the different stages of production in the foundry, and to take account of the meteorological conditions that also affected emissions.

Markus Lenz (Wageningen University, The Netherlands) presented a study on the prospects of bioremediation for selenium by activated sludges, which was followed by various analytical approaches, involving SPME-GC-MS to monitor volatile Se species, ion chromatography for the dissolved Se species, and XRD and XANES for solid-state speciation.

María Jiménez Moreno (University of La Castilla-La Mancha, Spain) presented a new method for the analysis of methylmercury by GC-pyrolysis-atomic fluorescence detection, which appeared to be able to cope with samples of very different methylmercury-concentration levels without species interconversion.

The session continued with Patrick Thomas (Institut Pasteur, Lille, France), who presented the viewpoint of a contract laboratory on speciation analysis, particularly on method validation.

Hans van der Sloot (Energy Research Centre of the Netherlands, Petten) compared the model predictions and practical measurements of leaching behavior of various elemental species and discussed current achievements and limitations.

Ruth E. Wolf (US Geological Survey, Denver, CO, USA) explained the interest of the USGS in speciation analysis and also gave an example of a very straightforward approach for simultaneous multi-elemental speciation by RP-LC (using ion pairing chromatography of EDTA complexes), followed by ICP-MS detection.

The concluding presentation of the morning session was given by Shona McSheehy (ThermoFisher Scientific, Bremen, Germany), who extended the scope of speciation analysis to include the determination of polybrominated diphenyl ethers (PBDEs). These compounds have been included in the European Union's WFD due to their great environmental relevance, and they can very selectively and sensitively be detected by GC-ICP-MS.

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