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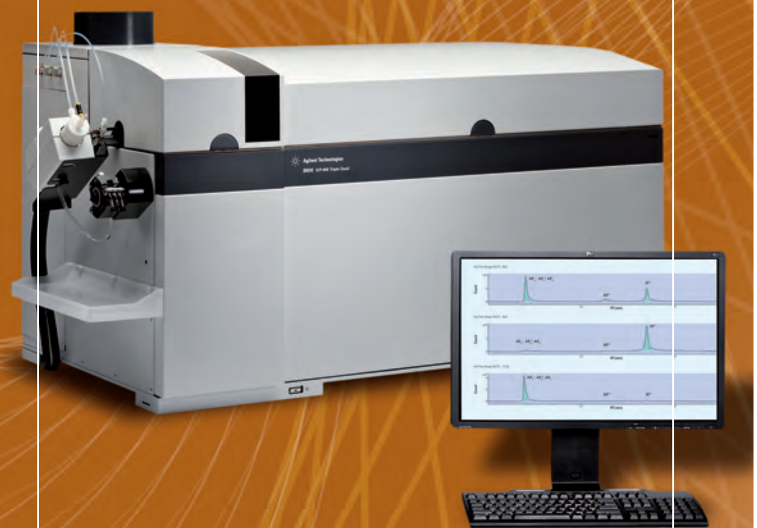


Inside this Issue

New Revision of ICP-MS MassHunter, Agilent Compliance Software Options, and USP<232>

Ed McCurdy
Agilent Technologies

An updated version of ICP-MS MassHunter software for the 7700 Series ICP-MS and 8800 ICP-QQQ has been released. The new revision (G7201B, rev. B.01.03), supports integration with Agilent's OpenLAB Data Store compliance software, includes a new Preset Method for USP<232>, and adds other new and enhanced functions.

Agilent's ICP-MS MassHunter software revision G7201B (64bit platform) has been shipping with new 7700 Series ICP-MS and 8800 ICP-QQQ systems since June 2012.

An updated revision (B.01.02, released in December 2012) added support for SDA (Agilent's PC-based, standalone compliance software solution), fast TRA acquisition, User Tune and Global Tune functionality, enhanced chromatography data analysis, and support for Excel 2013.

Now a further update (B.01.03) has been released, which will ship with all new Agilent ICP-MS and ICP-QQQ systems from **August 2013**.

MassHunter B.01.03 Key Features

The major developments in the new B.01.03 revision are:

- Adds support for OpenLAB Data Store compliance software
- Enhanced functionality with SDA and OpenLAB ECM compliance software
- New Preset Method for USP<232>/<233> Elemental Impurities in pharma products
- New data output and report storage options
- Support for GC 7890B
- Support for Injector Program for LC autosamplers

Compliance Software Options

The addition of support for Agilent's Data Store compliance software means that Agilent ICP-MS users now have a complete range of compliance solutions to choose from, depending on their lab type, number of ICP-MS instruments, data volume, and security requirements.

- **SDA:** For labs that require a simple to use compliance package, and have only a single ICP-MS instrument, Agilent's SDA offers a cost-effective solution. The secure database is located on the ICP-MS instrument control PC, rather than a separate server, which reduces equipment and setup costs, but means that each SDA installation can only support one ICP-MS instrument. SDA allows labs to comply with 21 CFR Part 11.
- **OpenLAB Data Store:** NEW option for ICP-MS data compliance with ICP-MS MassHunter B.01.03. Data Store is a server-based compliance software product, suitable for all medium sized and expanding laboratories. ICP-MS Data Store supports two Agilent ICP-MS systems as standard, and is scalable to allow connection of up to 15 instruments. As well as exceeding the requirements of 21 CFR Part 11, Data Store also supports local language (English, Japanese and Chinese), and includes integrated search and retrieve of records, using predefined data filters.
- **OpenLAB ECM:** Agilent's OpenLAB ECM is also a server-based compliance solution. ECM provides the most powerful and flexible option for global organizations requiring a compliance solution to support multiple sites, and/or a large number of instruments from a variety of vendors.

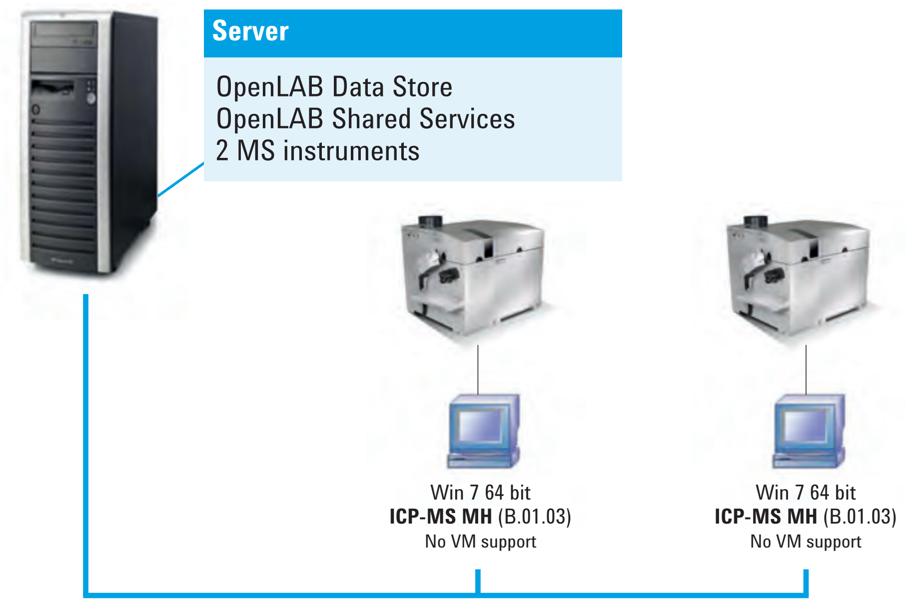


Figure 1. ICP-MS Data Store setup

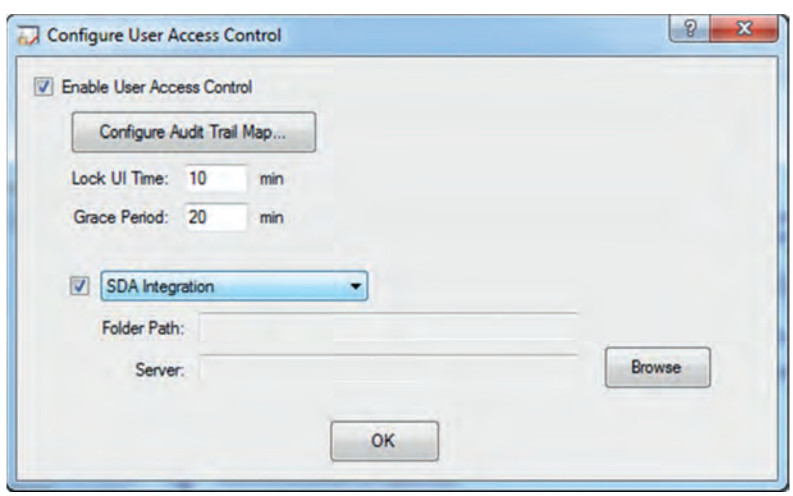


Figure 2. ICP-MS MassHunter User Access Control

Preset Method for USP<232>

The United States Pharmacopeia (USP) and equivalent bodies in other countries have been developing updated methodology for monitoring and controlling the levels of elemental impurities in pharmaceutical products. The proposed new USP General Chapters <232> (Limits) and <233> (Methods) define the elements, limits and methods to be used for Elemental Impurities in drug products.

The compendial methods defined in USP<233> are ICP-OES and ICP-MS, and the new revision of ICP-MS MassHunter includes a Preset Method for USP<232>. The Preset Method defines the analyte and Internal Standard masses, the tune mode and integration times, and the autotune parameters, to help new users to configure and run their Agilent ICP-MS for this application (see Figure 3). Versions of the Preset Method are included for the 7700 (must have "Full" version of ICP-MS MassHunter), and 8800 ICP-QQQ.

The original implementation deadline for USP<232>/<233> (May 2014) is currently deferred, to allow further consultation and alignment with the parallel developments being undertaken by the International Conference on Harmonization (ICH). However, many pharmaceutical manufacturers are already installing ICP-MS equipment to ensure they are ready to perform USP<232> when the methods do become mandatory.

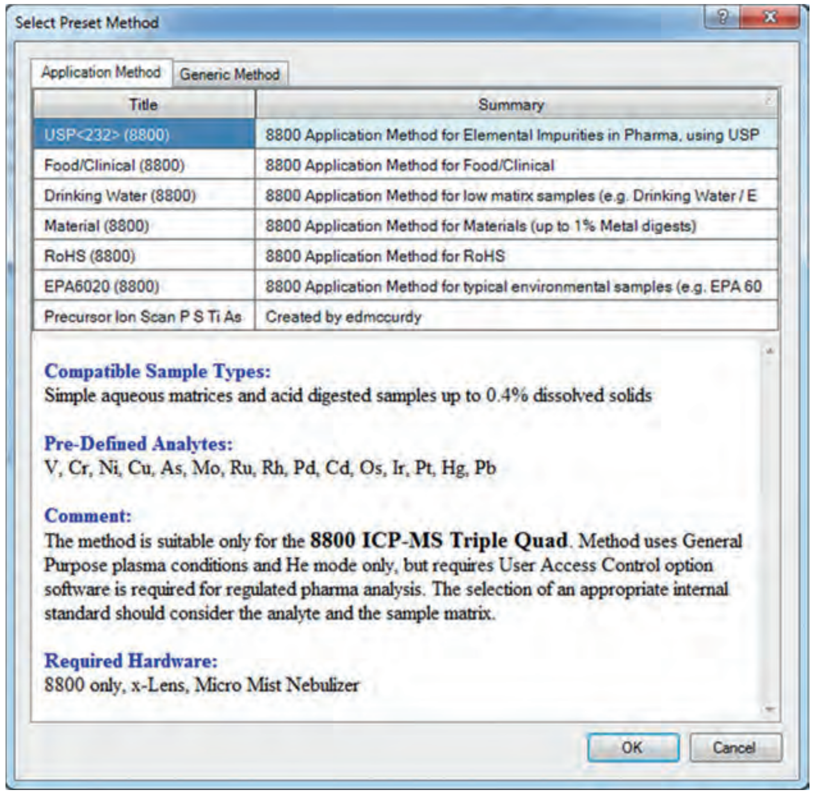


Figure 3. USP<232> Preset Method

Enhanced reporting functions

Many laboratories, including those in regulated industries, routinely save a copy of the Acquisition Method, Data Analysis Method and QC Method with their data batches. In ICP-MS MassHunter B.01.03, this function is made simpler and more flexible through the inclusion of options to save these reports in the batch or each datafile, in "Configure MassHunter" dialog (see Figure 4).

Previous revisions of ICP-MS MassHunter have supported the export of text files (csv or tab-separated) containing the counts measured in TRA acquisitions. Revision B.01.03 adds support for similar functionality for spectrum data. The options available for both data types are shown in Figure 4.

Agilent GC and LC support

ICP-MS MassHunter revision B.01.03 includes a new version of the GC driver package that supports the latest Agilent 7890B GC. This allows fully integrated setup and control of GC-ICP-MS applications, with the GC hardware, method and sequence being controlled from the ICP-MS MassHunter batch.

Enhanced functionality for LC autosamplers is also included, allowing LC-ICP-MS users to utilize the LC autosampler's Injector Program functions.

Availability

The new B.01.03 revision of ICP-MS MassHunter ships as standard with all new 7700 Series ICP-MS and 8800 ICP-QQQ instruments from August 2013.

The latest revision is also available for all existing 7700 Series and 8800 ICP-QQQ users:

- Current users of G7201B rev B.01.01 and B.01.02 are entitled to a free update to B.01.03, which can be downloaded from the support website, or the media can be ordered through your support representative.
- 7700 Series users with earlier revisions of MassHunter (G7200B and G7201A) can purchase an upgrade to G7201B rev.B.01.03. This upgrade may require a new PC or on-site upgrade from 32bit to 64bit operating system.

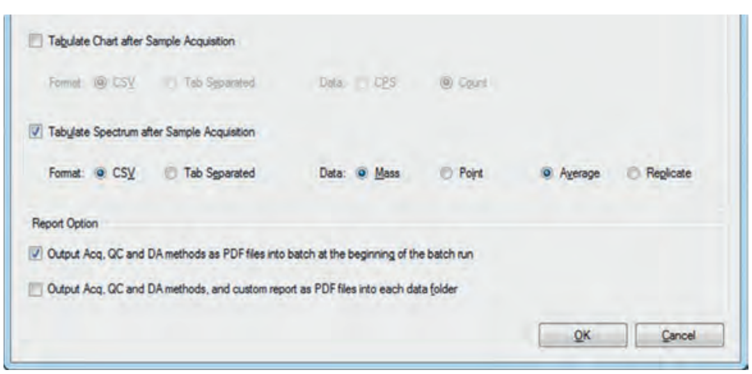


Figure 4. New reporting options

Speciation of Aluminum Fluoride Complexes and Al^{3+} in Environmental Samples using HPLC-ICP-MS

[1]**Marcin Frankowski**, [2]**Jan Kuta**
[1]Adam Mickiewicz University in Poznań, Poland, [2]Masaryk University, Brno, Czech Republic

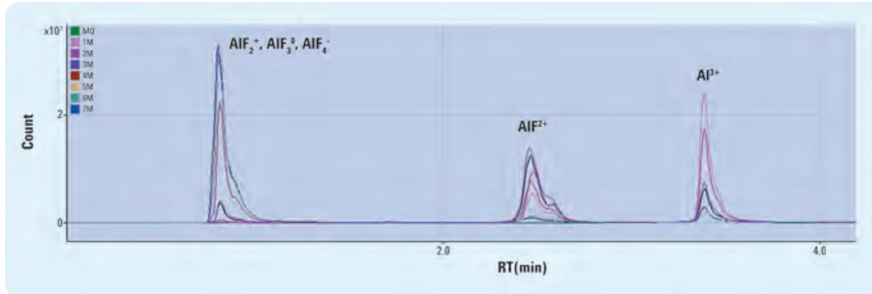


Figure 1. Overlapping chromatograms for seven model solutions of Al and F

Introduction

The occurrence of $AlF_x^{(3-x)}$ complexes in natural acid solutions is limited by the concentration of fluoride ions. Aluminum toxicity is mainly due to the occurrence of the free Al^{3+} ions, hydroxy-complexes, which include $Al(OH)^{+2}$, $Al(OH)_2^+$ $Al(OH)_3$, $Al(OH)_4^-$, and various inorganic complexes. Aluminium and fluoride ions form soluble complexes, mainly AlF_2^+, AlF^{2+}, AlF_3, AlF_4^-, both in water and soil. Although they are less toxic than the hydroxy forms and Al^{3+}, there is growing concern that they contribute to changes in the metabolism, growing processes and homeostasis of living organisms [1].

The aim of this work was to develop a method for the separation/speciation and determination of Al^{3+} and aluminum fluoride complexes by HPLC-ICP-MS in a single, simple analysis to be applied to the analysis of soil-water extracts and groundwater samples.

Materials and Methods

Analytical system

A 7500ce ICP-MS coupled to an 1100 Series HPLC system was used in this study. The ICP was generated at 1500 W with 15 L/min plasma gas flow. A concentric (MicroMist) nebulizer with 1.1 L/min (carrier + make-up) argon gas flow was used to nebulize the HPLC eluent. ^{27}Al (monoisotopic) was used for data acquisition with 0.5 sec. integration time. The HPLC was equipped with a quaternary pump, a vacuum degasser, an autosampler and a heated column compartment. Ion-exchange columns - Dionex IonPac CS5A (analytical column, 250 mm, 4.0 mm i.d., particle size 9.0 µm, containing mixed anion and cation beds with sulfonic acid and alkanol quaternary ammonium functional groups) and IonPac CG5A (guard column, 50 mm, 4 mm i.d. particle size 9.0 µm) (Dionex, USA) were also used. Table 1 summarizes the basic HPLC parameters.

Eluent A	1.5 M NH_4Cl pH≈3.0
Eluent B	Water acidified to pH≈3.0
Column	Dionex IonPac CS5A with IonPac CG5A
Eluent flow	2.0 mL/min
Injection volume	100 µL
Column temp	25°C

Table 1. Basic HPLC parameters used for HPLC-ICP-MS

Model solutions

A series of $AlF_x^{(3-x)}$ model solutions were prepared using variable fluoride concentrations in relation to the concentration of Al, so that the formation of aluminum and aluminum fluoride complexes could be studied: Mix A: 2.5/0.5; Mix B: 2.5/1.0; Mix C: 2.5/2.0; Mix D: 2.5/4.0; Mix E: 2.5/6.0; Mix F: 2.5/8.0 and Mix G: 2.5/10.0 [mg/L Al/F].

Results and Discussion

Based on the analysis of the seven model solutions, the separation of aluminum fluoride complexes (AlF_2^+, AlF_3, AlF_4^-, AlF^{2+}) and Al^{3+} was obtained in a single analytical cycle. During the process of chromatographic separation, eluent salt precipitation and torch clogging was observed. This was overcome by using 5% HNO_3 as a post-column eluent. Figure 1 presents the overlapping chromatograms for the model solutions.

We used the new method to analyze a series of soil samples (soil-water extracts) and groundwater samples (results not shown). The samples were collected in the area located near a chemical plant, which for many years served as a post-crystallization leachate disposal site storing chemical waste. Details of the site can be found in Reference [2]. The concentration of Al, the concentration of fluorides and the pH of the analyzed samples was taken into consideration. An example of HPLC-ICP-MS speciation analysis results for the soil-water extracts (Table 2) are presented as chromatograms alongside the determined concentrations of Al (obtained using FAAS) and fluorides (obtaining by a fluoride ion selective electrode), the sample pH and the corresponding concentrations of particular Al forms depending on the F/Al proportion and pH.

The results of the studies of total Al concentration are similar to the results obtained as the sum of forms of aluminum fluoride complexes and Al^{3+}.

Conclusions

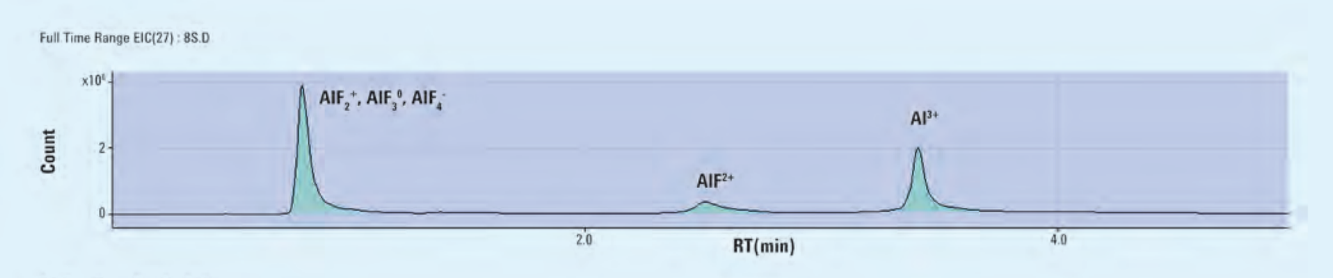
The new HPLC-ICP-MS method with post-column addition of 5% HNO_3 is a useful tool for the speciation analysis of Al^{3+} and aluminum fluoride complexes, including AlF_2^+, AlF_3, AlF_4^-, AlF^{2+} and it allows for the quick determination (4 minutes) of important Al forms in aluminum fluoride complexes. The HPLC-ICP-MS method could also be applicable to the speciation of different sample types.

Acknowledgements

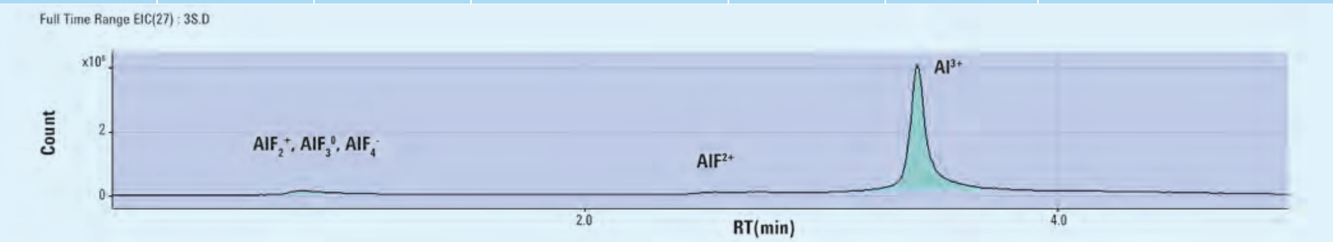
The research was supported by the Polish Ministry of Science and Higher Education through research project N 304 374 338 (2010-2012).

References

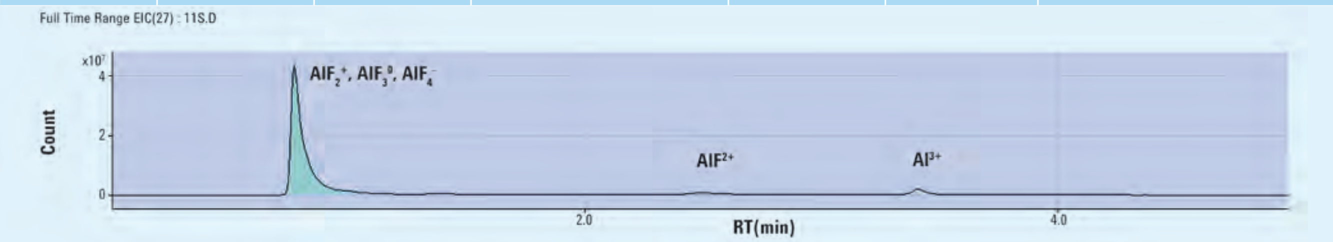
1. Frankowski, M., Zioła-Frankowska, A., Siepak, J. (2010), Talanta 80, 2120–2126
2. Frankowski, M., Zioła-Frankowska, A., Siepak, J. (2010), Microchem J. 95, 366-372.



*Al	**F$^-$	pH	AlF_2^+, AlF_3^0, AlF_4^-	AlF^{2+}	Al^{3+}	Σ of Al forms
4.96	38.2	4.73	2.72	0.601	1.24	4.56



*Al	**F$^-$	pH	AlF_2^+, AlF_3^0, AlF_4^-	AlF^{2+}	Al^{3+}	Σ of Al forms
1.48	1.69	4.89	0.082	0.018	1.27	1.37



*Al	**F$^-$	pH	AlF_2^+, AlF_3^0, AlF_4^-	AlF^{2+}	Al^{3+}	Σ of Al forms
32.79	227.7	5.37	30.07	1.30	1.02	32.39

*Concentration of total Al was determined by FAAS. **Concentration of fluorides was determined with a fluoride ion selective electrode (FISE).

Table 2. Results obtained for the samples of soil water extracts (1:10 v/v) by HPLC-ICP-MS [mg/kg d.m.]

Tips and Tricks

Easy Steps to Clean Your Torch

Dr Michael Fricke from Ben Venue Laboratores has shared a tried and tested recipe for cleaning your ICP torch – without any mechanical scrubbing.

Cleaning torches is always a tricky problem because quartz is fragile and the typical deposits that form on a torch are notoriously impervious to laboratory detergents. To remove the evidence of heavy use, many chemists have sat down with a cotton swab and meticulously gone over every surface with mixed results.

To solve this problem, Dr Fricke proposes this formula of 90% isopropanol, 7% deionized water and 3% sodium hydroxide (50%) that he has been using to return his torches to almost new. This solution, which can be re-used several times before discarding, is similar to a concoction Fricke used in graduate school and is common in synthetic organic laboratories for cleaning reaction glassware.

The torch is soaked in the mixture for a few hours and then rinsed with deionized water without any mechanical scrubbing.

The results are evident in the before and after pictures taken by Dr Kevin Kubachka from US FDA. Kubachka and Fricke were collaborators while they were post doctoral fellows at US EPA in Cincinnati and both report incorporating the above recipe into their regular torch cleaning regimens with continuing success for several years.

Figure 1. Torch in need of cleaning

Figure 2. After soaking for 4 hours – not yet rinsed with DI water

Figure 3. After soaking for 4 hours – just rinsed with DI water

Nanoparticles: Three Recorded ICP-MS Webinars and Upcoming Workshop

Engineered nanoparticles (NPs) are used in a wide variety of manufactured goods, industrial processes, food additives and consumer products, and new applications are being developed at a rapid rate. Furthermore, NPs that arise from human activities (e.g. combustion) or natural processes (e.g. volcanic ash) are also likely to be present unintentionally in the environment and in consumer products. Irrespective of their source, little is known about the potential impact of NPs on consumers' health and the environment. Consequently there is a clear requirement for reliable methods to characterize nanomaterials. The principle analytical aims for NP characterization include:

- **Detection:** is there any NP present in the matrix?
- **Identification:** what type of materials of analytical interest is present, what is their form and size?
- **Quantification:** how many particles are at the nanoscale (1-100 nm) and at which percentage (size distribution)?

In the series of webinars organized by **Postnova Analytics** and **Agilent**, the latest information on NPs was shared. In the first presentation Dr. Hubert Rauscher (European Commission), Dr. Sebastien Sannac (Agilent), and Dr. Soheyl Tadjiki (Postnova) co-presented a two-hour seminar titled: **Nanoparticles: Definition, regulations and analytical challenges**.

Dr Rauscher shared the definition of nanomaterials the EU uses for regulatory purposes and gave an overview of current EU regulations that are relevant to nanomaterials in the fields of cosmetics, food contact materials and biocidal products. He also explained that there is a high level of cooperation between different country-regulatory bodies that may lead to harmonization of regulations and testing methods affecting nanomaterials in the future.

The main emphasis of Dr Sannac's talk was to explain how Agilent ICP-MS can be used in Single Particle mode (SP-ICP-MS). The two critical parameters that must be optimized for a successful analysis include:

- The **speed of acquisition** of the ICP-MS – this is vital to avoid the double counting of two NPs (as would happen if the integration time is too long) or the partial counting of one NP (as would happen if the integration time is too short).
- **Sample dilution** is also critical in order to introduce only one NP to the ICP-MS during the time of acquisition.

The 7700 ICP-MS was used to detect and measure a mix of 30 and 60 nm of gold NPs. See the following article on page 7 for more details.

Dr Sannac also explained that ICP-MS can be easily coupled to various separation techniques that can be used for the analysis of NPs. The theme of coupling Field-Flow Fractionation (FFF) to ICP-MS was explored in detail by Dr Tadjiki in his section of the presentation. FFF is a powerful method of separation and fractionation ideal for the separation of various nano- and macro-sized sample types. Dr Tadjiki provided an overview of the different FFF methodologies that are currently available.

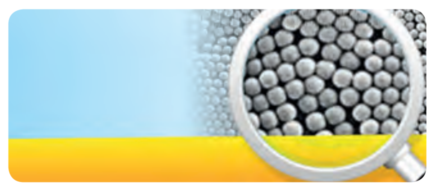
The second webinar, **Food and cosmetics application examples for nanoparticle characterization and speciation**, was divided in two parts. Dr. Volker Nischwitz (FZ Jülich) presented work carried out at LGC UK where he had worked until recently with Heidi Geonaga-Infante on developing asymmetric FFF-ICP-MS applications. He gave details on the characterization of TiO_2 NPs in sunscreens and for the characterization of SiO_2 NPs added to food, including coffee creamer. In the second part of the webinar, Prof. Frank von der Kammer (University of Vienna) discussed the quantitative analysis of NPs in food using FFF-ICP-MS and light scattering (LS) for complementary size information. He gave a detailed overview of an internally validated method for the analysis of SiO_2 NPs in tomato soup.

In the final webinar, Prof. Dr. James F Ranville (Colorado School of Mines) presented an overview of methods relating to **Environmental application examples for nanoparticle characterization and speciation** using SP-ICP-MS (for counting and size distribution information) and FFF-ICP-MS (characterization of NPs). He believes that these techniques are complementary.

Did you miss one of the Webinars or wish to listen to them on-demand?

Recordings of the three webinars are freely available on-line. Look for the link from: **agilent.com/chem/nanoparticles**

Nanoparticles Workshop – Your Invite



If you would like to learn more about the instrumentation and latest methodology available in the field of nanoparticle characterization, and discuss the topic in more detail with experts and fellow analysts, why not attend an upcoming Workshop hosted by Agilent and Postnova?

Title: **Nanoparticles Workshop**
Dates: **24 September 2013**
Place: **Waldbronn, Germany**

The workshop is free to attend. Places are limited and will be awarded on a first-come, first-served basis. Take a look at the agenda and book your place at: **agilent.com/chem/nanoparticles**

Characterization of Nanoparticles using Single Particle-ICP-MS

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The unique properties of nanoparticles (NPs) mean they are being investigated for use in products and processes in industries ranging from cosmetics, pharmaceuticals and medicine, to food packaging, fuel cell technology and electronics. However, concerns have been raised about their potential impact on both the environment and human health, so there is an urgent need to develop analytical methods that are suitable for the particular evaluation of NPs. These methods need to be appropriate to the specific properties of nanoparticles, including mass concentration, evaluation of their size, and size distribution.

In 2004, Degueldre et al. [1] characterized NPs based on elemental determination using an Agilent 4500 ICP-MS. If samples containing NPs are introduced at a low flow rate and the number of particles in the solution is sufficiently low, analysis using ICP-MS in time-resolved mode makes it possible to collect the intensity for a single particle as it is vaporized in the plasma. Then, each measured data point can be correlated to a size and a mass fraction for a unique NP. This method of NP characterization is called Single Particle ICP-MS analysis (SP-ICP-MS). The key feature of this analysis lies in the capacity of the ICP-MS to collect the data for a single NP. For this reason, care must be applied to the sample dilution factor and in the selection of the integration time.

Determination of size distribution of gold and silver NPs

Measurements of NPs in a mixture of two gold NP standard reference materials: NIST 8012 and NIST 8013 (Gaithersburg, MD, USA), certified at 30 and 60 nm respectively, were performed using the Agilent 7700x ICP-MS in time-resolved analysis (TRA) mode. The samples were introduced directly into the ICP-MS system using a standard peristaltic pump with Tygon pump tubing (internal diameter of 1.02 mm), and ASX-520 auto-sampler. A rinse solution containing 1% nitric acid was used to ensure sample washout between each analysis. The general settings of the 7700x system are detailed in Table 1.

Parameter	Value
RF power	1550 W
Carrier gas	1.05 L/min
Spray chamber temperature	2 °C
Nebulizer pump	0.1 rps
Sample depth	8.0 mm
Integration time	3 ms
Acquisition time	60 s
Mass monitored	^{107}Ag or ^{197}Au

Table 1. ICP-MS settings

Figure 1 shows the typical pattern of intensities measured by the 7700x ICP-MS in TRA mode for one of the gold NP standards (NIST 8012). The raw data, is filtered to remove the background values, and the remaining intensities are converted into particle size to give a size distribution pattern.

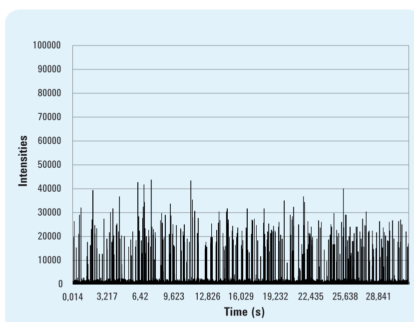

Figure 1 Typical measurement of NPs using SP-ICP-MS. Example of the measurement of 30 nm gold NP standard (NIST 8012)

The particle size distribution pattern for the mixed gold NP reference standards at 30 nm (NIST 8012) and 60 nm (NIST 8013) is displayed in Figure 2. The method was clearly able to identify the presence of the two different NP populations, and the peaks for the two different sizes of particles were resolved to baseline. The method has therefore been shown to have sufficient resolution to detect and discriminate different NP sizes that are mixed together in one sample. The absence of a significant number of particle events at a size greater than 60 nm indicates that the sample preparation approach successfully avoided the problem of particle agglomeration. The size distribution pattern in Figure 2 also confirms that the chosen acquisition parameters did not lead to the measurement of more than one NP in each TRA integration period. Multiple NPs would have appeared as a larger particle size on the particle size distribution plot. Therefore, the integration time selected in the method was suitable for the discrete analysis of each individual NP introduced in the system.

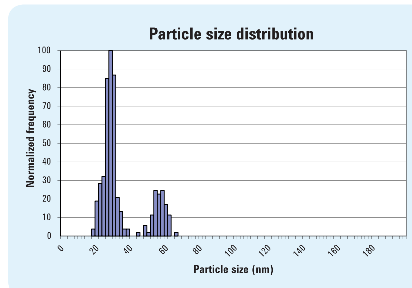

Figure 2 Particle size distribution for a mixture of 30 nm and 60 nm gold NP standards (NIST 8012 and 8013). A dedicated spread sheet developed by RIKILT (the National Institute of Food Safety in the Netherlands) was used for data conversion.

Conclusions

The method has been successfully applied to the analysis of gold and silver NPs with sizes from 15 to 60 nm. SP-ICP-MS was able to deliver the size distribution, median size, number of particles and the elemental concentration of a given NP sample.

Additional work may be required to fully validate the SP-ICP-MS measurement and data analysis approach, and in particular to validate the assumptions currently being used when converting the measured intensities into NP sizes. Additional approaches should also be developed to confirm the results obtained by the SP-ICP-MS analysis, such as the use of Scanning Electron Microscopy (SEM) or the coupling of Field Flow Fractionation (FFF) devices with ICP-MS.

References

1. Degueldre S., Favarger P.-Y., Bitea C., (2004) Analytica Chimica Acta, 518: 137-142

More Information

Agilent Application Note: “Single particle analysis using the 7700x ICP-MS”, 5991-2894EN or visit **agilent.com/chem/nanoparticles**

End of Guaranteed Support Notice for First Generation 7500 Series ICP-MS

Tomo Yamada
ICP-MS Product Marketing,
Agilent Technologies

Retiring soon: 1st generation Agilent 7500 ICP-MS

Agilent will continue to fully support all first generation 7500 Series instruments: 7500a (G3151A/B), 7500i (G3152A), 7500s (G3153A/B), 7500c (G3155A/B), 7500cs (G3162A/B) until the End of Guaranteed Support (EGS) date of **Jan 31, 2014**.

Post EGS date, Agilent will offer service on a "best-efforts" basis to keep older systems operating reliably and performing well. Consumables will continue to be available.

Laboratories that rely on their first generation Agilent 7500 for all ICP-MS analysis, where the instrument is the only ICP-MS in the lab, are advised to plan now to replace it.

Agilent will announce a special trade-up program for 7500 EGS users from September 1, 2013 featuring a free water chiller or heat exchanger, a free ASX-520 Series or I-AS autosampler, plus free MassHunter software. Contact your Agilent support sales representative for more information.

Agilent Consumables Supplier Wins U.S. President's Award

Many of the inert sample introduction components used in Agilent's ICP-MS systems are supplied by a company recognized for making a global impact on U.S. exports. Savillex was awarded the prestigious President's "E" Award for Exporting Excellence in May 2013 at a Washington D.C. ceremony – one of only 50 companies in the US to be honored. Savillex and its partners regularly export to over 50 countries.

New! Agilent 8800 Applications Handbook – Request Your Copy

The Agilent 8800 is the world's first and, to-date, only triple quadrupole ICP-MS. In the year since its launch, the unique capabilities of the ICP-QQQ have been used to address many applications that have long been considered difficult or impossible for quadrupole ICP-MS. According to Frank Vanhaecke of Ghent University, Belgium, who kindly wrote the foreword to the 92-page Handbook: "It seems clear that with the introduction of the 8800 ICP-QQQ, the analytical community has entered a new era of ICP-MS. This handbook provides an overview of the analytical approaches developed using ICP-QQQ thus far."

The Handbook includes 27 application briefs from across industries including semiconductor, environmental, materials, geological, nuclear, clinical, life science and pharma. Each brief focuses on particular analytes or sample types that have proved difficult to analyze accurately by conventional ICP-MS, and clearly demonstrates how the 8800 can be used to overcome the challenges. There is also a comprehensive glossary that includes a definition of many of the terms used throughout the Handbook.

Request your copy of the 8800 Handbook at: **agilent.com/chem/icpms**

Conferences. Meetings. Seminars.

- **Goldschmidt 2013**, Aug 25-30, Florence, Italy, **goldschmidt.info/2013/index**
- **JASIS**, Sept 4-6, Makuhari Messe, Japan, **jasis.jp/2013/en/**
- **Analitica Tradeshow**, Sept 14-16, SP, Brazil, **analiticanet.com.br/en/**
- **EXTEMIN**, Sept 16-20, Arequipa, Perú, **convencionminera.com/perumin31/en/**
- **Workshop on Nanoparticles Characterization**, Sept 24, Agilent Technologies, Waldbronn, Germany, **agilent.com/chem/nanoparticles**
- **SCIX 2013** (formerly FACSS), Sept 29-Oct 4, Milwaukee, Wisconsin, US, **scixconference.org**
- **Gulf Coast Conference**, Oct 15-16, Galveston, Texas, US, **gulfcoastconference.com**
- **30th International Mining Congress**, Oct 16-19, Acapulco, Mexico, **expominmexico.com.mx/eng/inicio**
- **Materials Science & Tech/Conference of Metallurgists**, Oct 27-31, Montreal, Quebec, Canada, **matscitech.org**
- **SLACA, Latin American Food Symposium**, Nov 3-6, SP, Brazil, **slaca.com.br/pt-br/home**
- **BRMass Tradeshow**, Dec 7-11, SP, Brazil, **brmass.com.br/congresso/**
- **Winter Conference on Plasma Spectrochemistry**, Jan 6-11, 2014, Amelia Island, Florida, US, **icpinformation.org**

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