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Agilent Technologies

Using Qualifier Ions in ICP-MS to Validate Data

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The Agilent 7700x ICP-MS incorporates a 3rd generation Collision/Reaction Cell (CRC) which operates effectively in helium (He) mode. In contrast to reactive cell gases, which work only for specific reactive interferences, He mode is universal, as it effectively filters out all polyatomic ions regardless of their reactivity. The benefits of He mode for multi element analysis of complex, variable and unknown sample matrices have been well documented, but He mode has a further important benefit. He mode simultaneously removes all polyatomic interferences from all isotopes of each analyte, thereby making secondary ions (isotopes) available for many analytes.

The use of qualifier ions to confirm the identity of a target analyte is common practice in organic mass spectrometry, where the mass of the target ion does not provide unequivocal analyte identification. ICP-MS spectra are comparatively simple, which means that primary or preferred isotopes give much more certain identification of the target analyte; however, quantification of many elements can be affected by the presence of matrix-based polyatomic interferences. By quantifying an element independently using both the primary and secondary isotopes, the results can be compared; good agreement validates the data, indicating that the reported concentration was not affected by any interference.

Comparison of Results for Isotope Pairs

In the data presented here, ten complex synthetic sample matrices were analyzed on the 7700x, using He, reaction (H_2) and no gas modes. In each matrix, the relative % difference (RPD) was calculated, to compare the results from the primary and qualifier isotopes of several analytes; good agreement (i.e. a RPD close to zero) indicates effective removal of interferences from both isotopes.

Figure 1 shows excellent agreement between the $^{65}Cu/^{63}Cu$ results in He mode (green bars) in all matrices (all He mode results were <2% RPD). This is in contrast to both no gas mode (blue bars) and reaction mode (H_2 cell gas, red bars), where the incomplete removal of interferences from one or other isotope led to large differences between the results (up to 182% RPD between ^{65}Cu and ^{63}Cu results in no gas mode, and up to 915% RPD in reaction mode). Negative RPD values (e.g. $^{65}Cu/^{63}Cu$ in H_3PO_4 measured in H_2 and no gas mode) indicate an interference (PO_2 in this case) on the primary isotope.

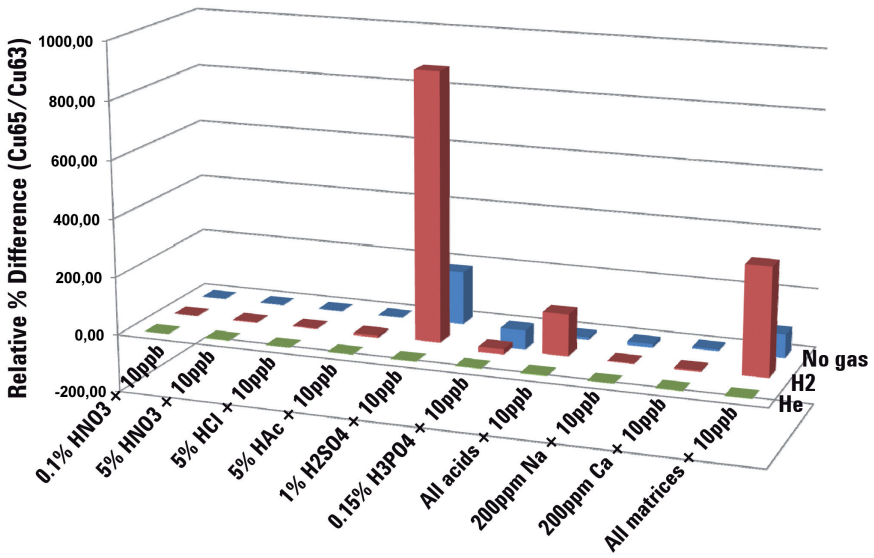

Figure 1. Comparison of $^{65}Cu/^{63}Cu$ results in 3 modes and 10 matrices

Figure 2 shows the same comparison for $^{53}Cr/^{52}Cr$, again demonstrating the excellent agreement between the results from the 2 isotopes measured in He mode (<3% difference in all matrices). As with Cu, the residual (or newly-created) interferences in no gas and reaction mode gave poor agreement between the Cr isotopes (up to 453% RPD in H_2 mode and 744% RPD in no gas mode).

Conclusions

Operating the 7700x ORS^3 in He mode is a simple and effective method of removing matrix-based polyatomic interferences, allowing the user to measure additional isotopes for many analytes.

Measurement of secondary (qualifier) isotopes can be used to improve ICP-MS data quality in complex sample matrices, by validating the measured results from the primary isotope.

For more information on the 7700x visit the Agilent Technologies web site at: **www.agilent.com/chem/icpms**

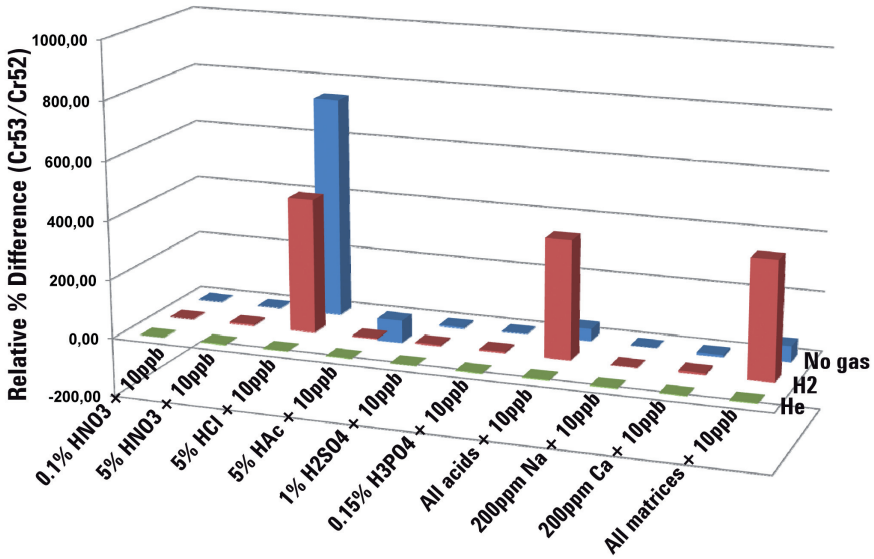

Figure 2. Comparison of $^{53}Cr/^{52}Cr$ results in 3 modes and 10 matrices

Pharma Labs Embrace ICP-MS Ahead of New US Pharmacopeia Standards

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Pharmaceutical companies will soon be using instrument-based methodology to control elemental impurities in their products, rather than the outdated wet-chemistry based colorimetric test (USP<231>) that is the current standard method recommended by the US Pharmacopeia (USP).

USP is a non-profit, non-governmental agency that sets standards for pharmaceutical manufacturers and buyers to follow; these standards are then enforced by the US Food & Drug Administration (FDA). USP is fully committed to advancing the current standards that govern metals in pharma products so that widely agreed upon safe limits for key metal impurities are properly measured, thereby protecting public health. To achieve this goal, USP has drafted a new performance-based method, USP <232> (target analytes and limits) and USP <233> (procedures) for determining elemental impurities in pharmaceutical materials.

The revisions focus on two areas:
- Introducing new "performance-based" methodology to test for elemental impurities in drug substances and drug products including analysis using modern analytical technology.
- Setting limits for acceptable levels of metal impurities.

Current revisions are out for consultation, with comments due by April 15, 2010. Final versions are scheduled for release by June 2010 with implementation expected by September 2013.

Key Points of the New Standards

- Drug manufacturers will be able to select any analytical method or instrument, as long as they can demonstrate accuracy, sensitivity and specificity.
- Instrumental analytical techniques (e.g. ICP-MS/OES) are recommended.
- A list of 16 elements has been compiled, with limits based on toxicology rather than the (limited) capability of the existing USP<231> method.
- Compliance with the limits specified for Class 1 elemental impurities (As, Cd, Hg, Pb) is required for all drug products.
- A risk-based approach can be used to define which other elements (Class 2 elemental impurities) should be analyzed in different sample types.
- A full description of proposed methodology is provided, including sample preparation steps, with guidance on how to evaluate analytical merit.
- Speciation of As & Hg is required if total content determined in dietary supplements* exceeds a defined limit.

***USP is also introducing a new General Chapter relating to dietary supplements and their ingredients: Elemental Contaminants in Dietary Supplements (USP<2232>).**

The Role of ICP-MS in Pharma

The control of inorganic impurities has always been a critical issue to the pharmaceutical industry, as even trace levels can adversely affect drug stability and shorten the shelf life of some pharmaceutical products. As a result, ICP-MS is already widely used by the pharmaceutical industry ahead of proposed changes to USP protocols. Typical applications include quantification of metallic impurities and catalyst residues in in-process controls, raw materials, and isolated intermediates leading up to active pharmaceutical ingredient (API). There is also a diverse range of applications for trace metal analysis in pharmaceutical discovery, development and commercialization projects utilizing HPLC and GC to separate species prior to ICP-MS analysis.

Advantages of ICP-MS Compared to ICP-OES for New USP Methods

Of the two recommended techniques (ICP-OES and ICP-MS) described in the USP methods, ICP-MS is a much better fit for the application than ICP-OES. All the Class 1 elements (As, Cd, Pb and Hg) and Class 2 elements (transition metals and platinum group elements used as catalysts) defined in the proposed method USP <232> are easily measured at low concentrations by ICP-MS in a single run, with superior sensitivity to ICP-OES. In addition,

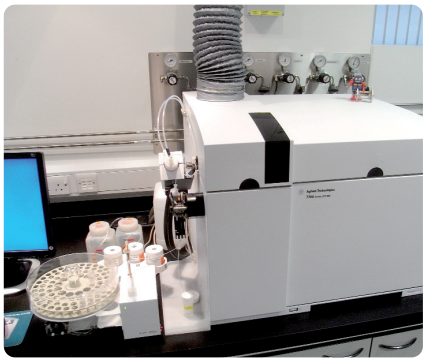

Figure 1. Agilent 7700x ICP-MS – capable of routine pharma applications, as well as more advanced studies for R&D facilities.

the proposed method USP <2232> (for dietary supplements) requires speciation measurement for As and Hg if these elements are present above the threshold limit. ICP-MS is much better suited to speciation measurement than ICP-OES due to better sensitivity and interference removal. Labs that want to buy a single instrument and have to choose between ICP-MS and ICP-OES will find that ICP-MS offers much greater flexibility and performance for not much more investment.

Benefits of Agilent ICP-MS for Pharma Applications

- High sensitivity and 9-orders dynamic range
- Excellent matrix tolerance with HMI (High Matrix Introduction)
- Potential to analyze a large number of samples daily
- Semiquantitative screening using helium mode to effectively remove polyatomic interferences
- Full 21 CFR Part 11 compliance with Agilent OpenLab ECM
- Tolerance to organic solvents, and ease of coupling to LC and GC for speciation studies.

Further Reading

- www.usp.org

High Throughput Analysis of Lead in Whole Blood using ICP-MS with ISIS-DS

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Ryszard Gajek, Flavia Wong
State of California Department of Public Health, USA

Introduction

Lead poisoning has been plaguing the world for millennia. Although much stricter regulations have been implemented on the use of lead, it still finds its way into many consumer products [1]. Excessive exposure to lead can cause plumbism, or lead poisoning, which can affect nearly all bodily functions but is especially harmful to children, where it may result in impaired cognitive functions and development. As a result of its toxicity, emphasis has been placed on its analysis in biological fluids.

For the analysis of Pb in whole blood, minimal sample handling is critical in order to minimize contamination. A highly robust and stable instrument is essential to minimize signal suppression and drift due to the complex sample matrix. Furthermore, clinical laboratories typically require the highest possible sample throughput in order to cope with large numbers of samples generated during routine blood-lead screening.

The analytical merits of ICP-MS with discrete sampling were investigated for this application. In addition to increasing sample throughput, Agilent's Integrated Sample Introduction System with Discrete Sampling (ISIS-DS) also reduces the total amount of sample matrix the ICP-MS interface is exposed to, improving long term stability with this type of complex sample matrix. As a result, instrument maintenance is reduced, further increasing overall sample throughput.

Instrumentation

The ISIS-DS is fully integrated with the Agilent 7500 (and 7700) Series ICP-MS instruments and is controlled by the instrument operating software. Configuring the ISIS-DS is simple, since it consists essentially of a switching valve and sample loop. The ICP-MS is tuned for typical robust plasma conditions providing a highly reproducible and accurate analysis.

Experimental

Instrument parameters were optimized to normal robust plasma conditions with oxide levels ~1% (CeO^+/Ce^+) – Table 1.

Instrument Parameters	No Gas Mode
Forward power (W)	1550
Sample depth (mm)	8
Carrier gas (L/min)	0.85
Makeup gas (L/min)	0.15
Extract 1 (V)	0
ISIS loop length (cm)	50
ISIS loop ID (mm)	0.8
ISIS loop volume (µL)	250
ISIS stabilization time (sec)	20

Table 1. 7500cx and ISIS-DS operating parameters

Samples were supplied by the California Department of Public Health (CADPH) and were analyzed according to the CADPH method which specifies a 50x dilution of the whole blood. The high matrix tolerance of the 7500cx allows whole blood to be analyzed routinely at a 10x dilution and many labs take that approach. However, in compliance with the CADPH method, a 50x dilution was applied for this work. The samples consisted of the following: base blood, 1 ppb spike base blood, 1 ppb CCV, CCB (diluent only), and the following CADPH Standard Reference Materials (SRM); low blood QC (4.98±0.17 µg/dL* Pb), medium blood QC (9.66±0.12 µg/dL Pb), and high blood QC (19.03±0.29 µg/dL Pb) samples. These samples were analyzed repeatedly for a total of approximately 300 analyses. Calibration standards were not matrix matched and consisted of a blank, 0.01, 0.05, 0.1, and 1 µg/dL Pb, yielding an instrument detection limit of 3.09 x 10^{-4} µg/dL (3.1 ppt) (Figure 1).

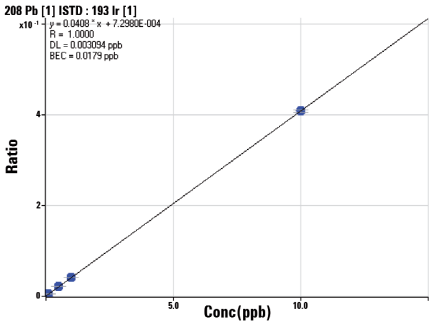

Figure 1. Calibration curve for Pb
***Note: 1 µg/dL = 10 ppb**

Calibration standards were prepared in an NH_4OH, EDTA, 1-butanol, Triton X-100 diluent from an Agilent stock standard solution (2% NH_4OH, 4% 1-butanol, 0.1% EDTA, 0.1% Triton X-100).

Results and Discussion

Sensitivity and Precision

To determine the method sensitivity and precision for Pb, seven replicates of the 0.01 µg/dL were acquired and the standard deviation was multiplied by 3.14 (99% confidence limits for student t-test.) to give the measured detection limit (DL) in the diluent. Table 2 shows the concentration and standard deviation used to calculate

Samples	Measured Pb Conc (ppb)	Measured Pb Conc (µg/dL)
1	0.0997	0.00997
2	0.0985	0.00985
3	0.0968	0.00968
4	0.1001	0.01001
5	0.0985	0.00985
6	0.0952	0.00952
7	0.0972	0.00972
Standard Deviation	0.001734	0.0001734
DL	5.445×10^{-3}	5.445×10^{-4}

Table 2. Precision and measured detection limits for lead

Sample Name	Sample No. (n)	Ave Pb conc (µg/dL)	Std Dev	% RSD	% Recovery
Base Blood	52	0.004	0.0003	6.09	NA
Base Blood Spike (1 ppb)	45	0.097	0.0011	1.20	97%
CCB	26	0.0002	0.00010	46.5	NA
CCV	26	0.099	0.0014	1.36	99%
Low Blood SRM	45	4.911	0.0687	1.40	99%
Med Blood SRM	44	9.696	0.1136	1.18	100%
High Blood SRM	44	18.947	0.2231	1.18	100%

Table 3. Whole blood samples. (All samples were diluted 50x except CCV/CCB, NA-not applicable)

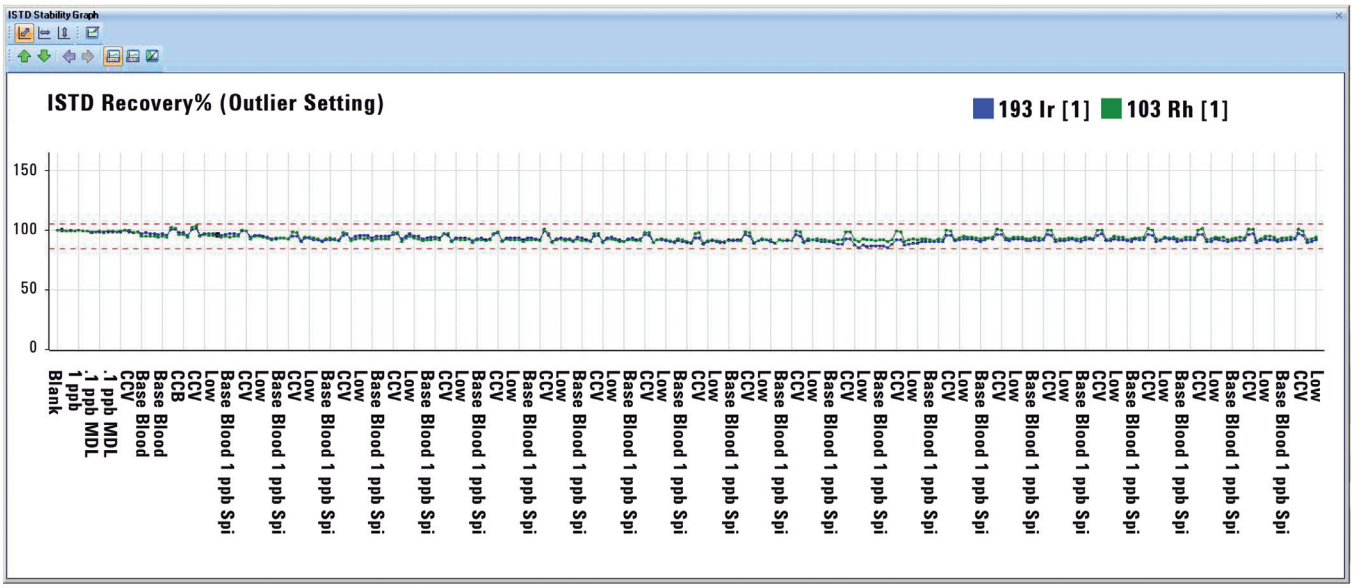

Figure 2. ISTD recoveries (due to space limitation, not every sample name is displayed on the x-axis)

the resulting on-instrument DL of 5.4 x 10^{-4} µg/dL (5.4 ppt). In-sample method detection limits would require correction for the sample prep dilution factor, which in this case was 50x. However, Agilent standard procedure specifies 10x, which would result in a MDL of 54 ppt.

Whole Blood Results

Three CADPH SRMs, spike base blood, and CCV/CCB (Continuing Calibration Verification/Blank) were repeatedly analyzed, totaling 301 individual analyses. There were over 40 analyses per sample, with the exception of the CCV/CCB pair, which was analyzed after every ten analytical runs. The entire analysis took 259 minutes, resulting in a sample-to-sample run time of 52 seconds. Table 3 details the sample results.

SRM	Value (Undiluted) µg/dL	Value (50x Dilution) µg/dL
Low Blood SRM	4.98 ± 0.17	0.0996
Med Blood SRM	9.66 ± 0.12	0.1932
High Blood SRM	19.03 ± 0.29	0.3806

Table 4. Reference values for the CADPH Standard Reference Materials

Reference values for the SRM samples are listed in Table 4. Note that the sample concentration as presented to the ICP-MS ranged from approximately 0.099 to 0.381 µg/dL (~1-4 ppb), illustrating the ability of the 7500cx to accurately measure low analyte concentrations in a complex matrix.

Internal Standard (ISTD) Recoveries

The long term instrument stability can be demonstrated by monitoring ISTD recovery vs time. Figure 2 details the ISTD recoveries for the entire analytical run. Both ^{103}Rh and ^{193}Ir are plotted here, though only ^{193}Ir was used for all calculations. Control limits (red dotted lines) were set at 85-105%. ISTD stability was excellent through the entire run with no significant drift observed. In addition, ISTD suppression due to the 50x whole blood matrix was minimal, demonstrating the robustness of the 7500cx. The slightly elevated points visible in the plot are due to the small increase in nebulization efficiency when the non-matrix QC samples (CCB and CCV) samples were measured.

Conclusions

High throughput whole blood analysis presents several challenges for ICP-MS. Rapid sample handling, high sensitivity, excellent long term stability and high tolerance to complex matrices are all critical to a successful analysis. The 7500cx with ISIS-DS allows for rapid (52 sec), sample-to-sample analysis with minimal to no carryover and superb long term stability throughout a sequence of more than 300 samples. The highly robust plasma of the 7500cx ICP-MS eliminates the need for matrix matched standards and blanks, further simplifying the analysis.

References

1. Centers for Disease Control and Prevention, National Center for Environmental Health online resource, US, **www.cdc.gov/nceh/lead**

Further Information

To find out more about the Agilent ISIS-DS, look under the ICP-MS Sample Introduction section on the Agilent 7700 Series web page at: **www.agilent.com/chem/icpms**

Simultaneous Speciation Analysis of Fe, Zn, S and P using the 7500ce with O_2 Cell Gas

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Introduction

Analysis of bio-available minerals in cereal grains has recently gained major attention in plant science. This is because many human populations that consume cereals as their primary food source are suffering increasingly from mineral deficiencies, especially of Fe and Zn[1]. As these two elements are poorly bio-available to humans from grain tissues, the chemical form of each element rather than the total concentration is of most interest. A chromatographic separation step such as Size Exclusion Chromatography (SEC) hyphenated to ICP-MS is one way to identify and quantify these organo-metal complexes and hence evaluate their bioavailability. The macro elements P and S serve as important indicators of the type of ligands that contain Fe and Zn. We have therefore developed an analytical method for the simultaneous analysis of Fe, Zn, P and S using SEC-ICP-MS. By introducing a mixture of O_2 and He into the ORS cell of an Agilent 7500ce, our results have shown good sensitivity, accuracy and reproducibility for these traditionally difficult elements[2].

A P-rich storage molecule known as phytic acid, which is present in all cereals, is thought to be of major importance in limiting the bio-availability of Fe and Zn in the cereal grain. At physiological pH, the negatively charged phytic acid molecule binds positively charged cations in strong coordination complexes which are bio-unavailable in the human digestion system[3]. Other ligands, e.g. proteins may also be of importance. As most cereal proteins contain S (present in the amino acids cysteine and methionine), this element is a suitable indicator of proteins.

When operated in standard mode without an active ORS, the elements of interest, Fe, S and P, suffer from polyatomic interferences on their main isotopes. Operating the ORS in H_2 mode can efficiently remove the $^{40}Ar^{16}O^+$ interference on $^{56}Fe^+$. However H_2 reaction mode is not useful for reducing the significant polyatomic interferences on S and P. The major isotope of S suffers from a massive interference from $^{16}O_2^+$ at m/z 32, and the alternative isotope $^{34}S^+$ is only 4.3% abundant. These facts combined with a high ionization potential (10.36 eV) result in very poor S sensitivity, hampering speciation analysis of S in plant tissues.

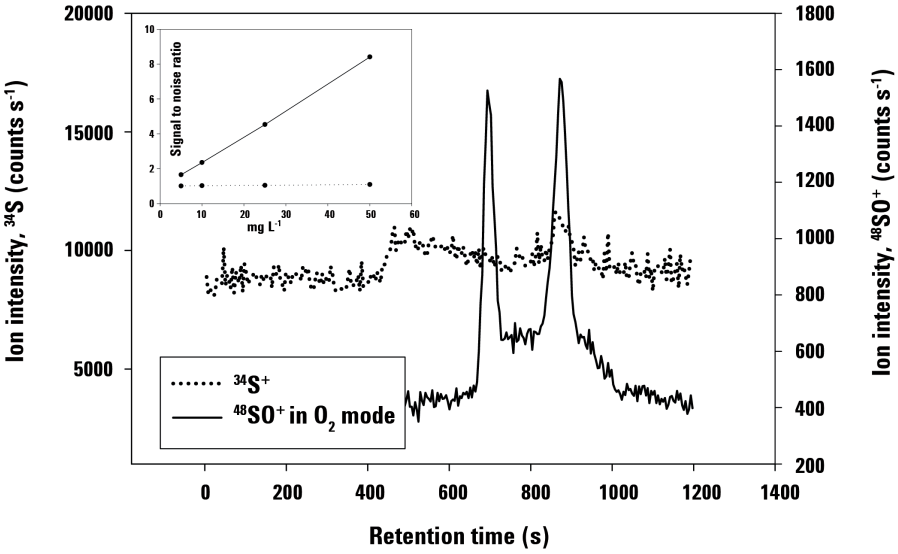


Figure 1. Upper left: S/N vs concentration for S with O_2 addition to the ORS. The method enabled identification of chromatographic peaks ($^{48}SO^+$ signal) not seen in standard mode (^{34}S signal).

Experimental

In order to overcome these problems, we investigated adding He/O_2 gas to the ORS. A substantial part of the $^{32}S^+$ isotope content can be monitored as $^{48}SO^+$, since the formation of this oxide is a thermodynamically favorable reaction under the conditions given. Bandura et al. (2002)[4] used a similar approach for single-element analysis of S, but this is the first time this method has been used on an ORS and in a multi-elemental speciation method.

The flow rate of O_2 (10% in He) was set to 0.5 mL/min and optimized by monitoring the ion intensity at m/z 48 ($^{32}S^{16}O^+$) with octopole and quadrupole bias voltages fixed at -16V. The bias voltage settings were then optimized in order to obtain the ideal setting, providing the highest oxide formation while at the same time ensuring the highest ion transmission for Zn at m/z 66.

Results & Discussion

The signal-to-noise ratio (S/N) for S detection at $^{48}SO^+$ was greatly improved relative to measurements of ^{34}S in standard mode. The S LOD was lowered from 25 to 3 µg/L, which made it possible to monitor chromatographic S-peaks (Figure 1). In addition to the oxide formation of S, we also looked for oxide formation of the other elements. Indeed, Fe and P could be monitored as oxides at m/z 72 ($^{56}Fe^{16}O^+$) and m/z 47 ($^{31}P^{16}O^+$), respectively. The S/N of Fe increased markedly compared to that in standard mode, and the LOD was lowered almost 20-fold to 0.5 µg/L. The S/N for $^{47}PO^+$ was similar to that of ^{31}P in standard mode and, consequently, the LOD was only marginally improved. Zn detection at m/z 82 ($^{66}Zn^{16}O^+$) was much poorer than the $^{66}Zn^+$ signal.

The major matrix-based polyatomic interferences or isobaric overlaps that could potentially occur on m/z 48 include $^{34}S^{14}N^+$, $^{14}N^{16}O^{18}O^+$ $^{31}P^{16}O^1H^+$, $^{48}Ca^+$ and $^{48}Ti^+$. Similarly, the major interferences that could occur at m/z 72 include $^{40}Ar^{32}S^+$, $^{40}Ar^{16}O_2$+, $^{35}Cl^{37}Cl^+$ and $^{72}Ge^+$. Hence, we were obliged to test the accuracy and robustness of the method on a number of reference metallo-proteins with known Zn/S and Fe/S ratios. Fortunately, very good agreement with the theoretical sulfur/metal ratios was obtained.

Conclusions

Using the new methodology, we have been able to document contrasting Fe and Zn speciation in rice and barley grains, with Fe being mainly bound to phytic acid oligomers and Zn to peptides. The method has proved to

be a valuable tool for the investigation of the chemistry of micronutrients in cereal grains. In addition, basic studies into plant biotechnology and plant breeding, aimed at improving the content of bio-available Fe and Zn in cereal grains[5], are greatly facilitated with this new methodology.

References:

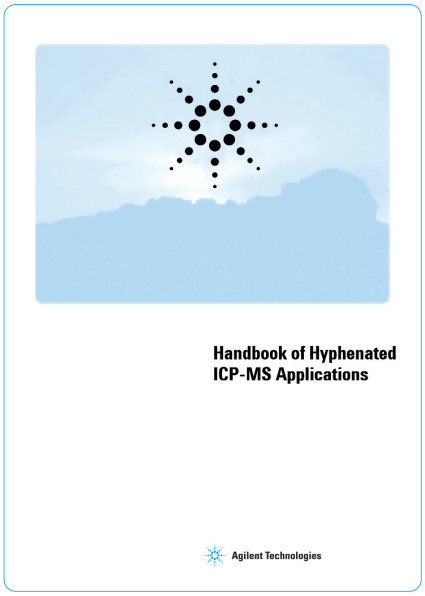
1. Welch and Graham (1999), Field Crops Research, vol. 60, 1-10.
2. Persson et al. (2009), Metallomics, vol 1, 418-426.
3. Raboy (2003), Phytochemistry, vol 64, 1033-1043.
4. Bandura et al. (2002), Anal. Chem., vol.74, 1497-1502.
5. Lee et al. (2009), PNAS, vol.106, no. 51, 22014-22019.

Call For Papers for 2nd Edition of Agilent's Speciation Handbook

Steven Wilbur

Applications Specialist, ICP-MS Environmental Marketing, Agilent Technologies

Agilent is accepting abstracts for the Second Edition of the Handbook of Hyphenated ICP-MS Applications.



First Edition of the Agilent Handbook of Hyphenated ICP-MS Applications, 5989-6160EN – pdf available from www.agilent.com/chem/icpms

First published in August 2007, the Agilent Handbook of Hyphenated ICP-MS Applications was intended to introduce researchers in elemental and molecular speciation to the diversity of emerging applications based on hyphenated ICP-MS techniques. The Handbook is a compendium of abbreviated application notes and papers submitted by acknowledged leaders in the field of speciation analysis. The Handbook covers multiple applications using GC-ICP-MS, LC-ICP-MS, CE-ICP-MS and techniques using multiple mass spectrometers. The printed version quickly ran out, and the online version, available free of charge from Agilent's web site, has been downloaded more than 2000 times.

Hyphenated ICP-MS has come a long way since 2007 and remains the fastest growing area of atomic mass spectroscopy. Newly applied separation techniques such as asymmetric flow field flow fractionation (A4F) coupled to ICP-MS have become important in the emerging field of nano particle analysis for example. It is time to update the Handbook accordingly.

Half page abstracts of documented hyphenated ICP-MS applications will be accepted until 30 Sept, 2010. Selection for inclusion will be based on applicability of the technique to solve novel, but important problems, availability of references for details since the included application briefs are short, the need to cover as many hyphenated techniques as possible, and in general, how fascinating they are. Final two page manuscripts of accepted abstracts will be due 31 Dec, 2010. Publication is anticipated mid 2011.

Significant prizes will be awarded to selected submissions at the Winter Plasma Conference in Spain in 2011. Submitters need not be present to win.

Please contact Steve Wilbur with your abstracts or any questions at **steven.wilbur@agilent.com**

20% Price Decrease for 7500 ICP-MS Supplies*

Marc Fuehrer

Product Manager, Column and Supplies Division, Agilent Technologies

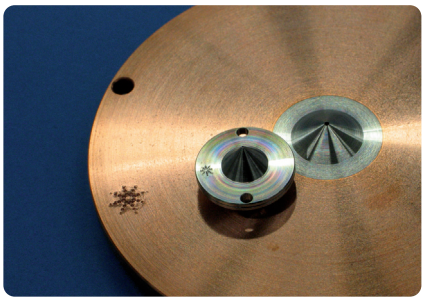


Figure 1. Look out for the Agilent "spark" logo on authentic consumables such as cones, torches and spray chambers

Starting January 2010, Agilent has reduced the list price for a number of 7500 ICP-MS parts and supplies. This 20% price decrease* is the direct result of reductions of raw material costs and strategic alliances.

Remember, using Agilent genuine parts (Figure 1) helps to insure your Agilent ICP-MS is operating at peak performance and with the highest possible uptime. Don't compromise your data quality by using inferior 3rd party consumables.

List of parts included in the 20% price reduction:

- G1820-65050 Nickel Skimmer Cone
- G1820-65237 Platinum Skimmer Cone
- G1820-65360 Platinum 18mm Sampling Cone
- G1820-65239 Platinum Sampler Cone
- G1820-65238 Nickel Sampler Cone
- G1820-65030 Concentric Nebulizer (Pyrex)
- G1820-65138 Concentric Nebulizer (Quartz)
- G1833-65463 Spray Chamber (Polypropylene with sapphire tube)
- G1820-65337 Spray Chamber for Babington Nebulizer

***Not available in some countries**

For information on new products, updates and promotions relating to ICP-MS Supplies, please visit Agilent's online store at **www.agilent.com/chem/store**

Reflections on the Winter Plasma Conference 2010

David Judd
Americas ICP-MS Business Team Manager, Agilent Technologies

The Winter Plasma Conference (WPC) which has been held on alternate years in Europe and the US since 1980, is the biggest conference event on the ICP-MS calendar.

This year's WPC was held January 4-9th in Fort Myers Florida at the beautiful Sanibel Harbour Marriott Resort. The event was well attended by an international community of plasma spectroscopists.

Agilent again hosted the ever popular ICP-MS user meeting at the resort hotel on Tuesday evening. The event was well attended by over 100 users. The master of ceremonies, Agilent's Chris Scanlon (pictured left), provided another new highlight at the meeting with the "What Do You Know about the Agilent 7700 ICP-MS" game show. Many great prizes were awarded to delighted game participants selected from the audience.

We now look forward to the next Winter Conference on Plasma Spectroscopy in Zaragoza, Spain January 30th to February 3rd 2011.

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5990-5335EN

Agilent ICP-MS Remains Research Instrument of Choice

2010's WPC contained a wide array of strong technical sessions. Once again, a thorough review of the posters presented at the WPC in Fort Myers showed that, where ICP-MS was used, Agilent instruments were featured more than any other. This corresponds to a similar analysis carried out at the 2009 WPC held in Graz, Austria, and underlines the performance and flexibility of the Agilent systems for research as well as routine applications.

The charts in Figure 1, which were compiled from a study of over 160 posters presented at the WPC, show that Agilent ICP-MS was the quadrupole system (left-hand chart) most used by poster presenters and the most widely used system compared to all other ICP-MS including High Resolution (HR) and Multicollector (MC) ICP-MS (right-hand chart).

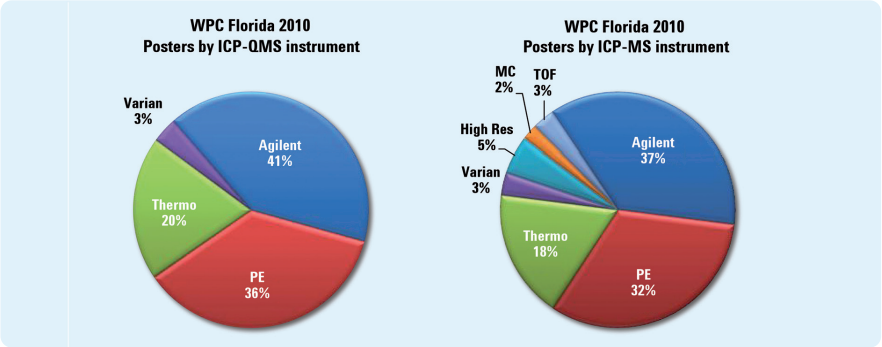

Figure 1. ICP-MS instruments featuring in 2010 WPC posters

Catch Up with Two New 7700 ICP-MS Recorded Webinars

If you missed the recent 7700 Webinars, hosted by Spectroscopy Now, you can view the recording at a time to suit you.

Part 1: He Mode Interference Removal for Spectral Clarity and Multi-Isotope Confirmation

Part 2: Using Qualifier Isotopes to Validate Multi-Element ICP-MS Data in Complex Sample Matrices

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