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Agilent Technologies

Measurement of Heavy Metals using ICP-MS for the RoHS/ELV Directives

Nihon Environmental Services Co., Ltd.

Taichi Yamamoto, Yuki Arai, Tomohiro Seki

<http://www.n-kankyo.com/english/english.html>

Introduction

In the EU, RoHS (the Restriction of the use of certain Hazardous Substances Directive 2002/95/EC) will come into effect in July 2006. This directive aims at restricting the use of hazardous chemical materials used in electric/electronic products while protecting the health of users of these products, as well as preventing environmental pollution that may be caused by their disposal. ELV (The End of Life Vehicles Directive 2000/53/EC) covering automotive parts has already come into force. In China and Japan, the respective equivalents of the RoHS directive will be enforced at the same time as in the EU. The Japanese version is currently being prepared by the Ministry of Economy, Trade and Industry.

Restricted substance	RoHS directive / mg/kg	ELV directive / mg/kg
Cd	100	100
Pb	1000	1000
Hg	1000	1000
Cr6+	1000	1000
PBBs	1000	-
PBDEs*	1000	-

*Only penta and octa forms of PBDEs are restricted.

Table 1: Substances restricted by the RoHS/ELV directives and their thresholds

Table 1 shows the heavy metals and compounds that are covered by the RoHS/ELV directives. In terms of product manufacturing, careful control is required to prevent the above substances entering the processes, especially resin materials. Nevertheless, there has been no official method for analyzing metal impurities in resin materials other than the BSEN1122:2001 "Plastics - determination of cadmium - Wet decomposition method" ("EN1122")¹.

Heavy Metals

Nihon Environmental Services Co., Ltd uses a 7500c ICP-MS method to



Analysts at Nihon Environmental Services Co., Ltd., Japan, in front of their Agilent 7500c ICP-MS

analyze cadmium, lead and chromium. Quantitative determination of mercury is also possible provided that the memory effect, the element's adsorption to the container, and the volatility of the material are taken into account.

Validation of Methods

To test the validity of their ICP-MS methodology the lab took part in the proficiency test in 2004 (IIS04P02): "Cadmium and Lead in Plastics" that was administered by the Institute for Interlaboratory Studies (IIS), in the Netherlands. At present, this is the only international proficiency test that is based on the ISO/IEC Guide 43. According to the report², this test attracted the participation of 56 analytical institutions from 20 countries all over the world, with a large number of participants from Japan, Hong Kong, China and other areas in Asia.

Three samples were used in the test. Cadmium was the target metal for #0454 and #0455, while lead was the target for #0456. All samples were polyvinyl chloride (PVC) moldings. Samples #0454 and #0456 contained over 10 times the regulated value of Cd and Pb respectively, while Sample #455 had only a moderate concentration of Cd. The results that Nihon Environmental Services obtained were close to the average for both the EN1122 and EPA Method 3052 (Microwave assisted acid digestion of siliceous and organically based matrices), as shown in the example histograms for Cd and Pb in Figure 1 and 2. The calculated z-scores were within a range of ± 1 .

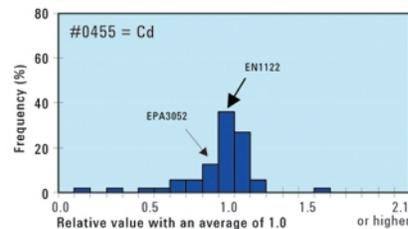
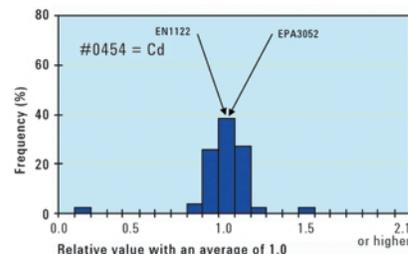


Figure 1: Histograms of results for Cd in sample #0454 and #0455

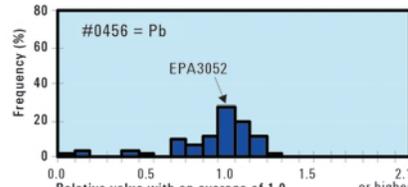


Figure 2: Histogram of results for Pb in sample #0456

Conclusion

The 7500c is capable of efficiently measuring the 4 substances covered by the RoHS/ELV directives as well as the 10 heavy metals specified in the guidelines currently prepared jointly by the industries concerned in Japan, the U.S. and the EU.³

References

1. BSEN1122:2001 "Plastics - determination of cadmium - Wet decomposition method"
2. Results Proficiency Test Cadmium and Lead in Plastics October 2004
3. Guideline for Standardization of Material Declaration by Japan Electronics and Information Technology Association (JEITA JGPSSI), <http://home.jeita.or.jp/eps/green2.htm>

Reducing Matrix Oxides with ORS

Bert Woods, Ed McCurdy, Don Potter,
Agilent Technologies

Matrix oxides, formed when a component of the sample matrix combines with an oxygen atom to produce a metal oxide ion (MO^+), remain some of the most troublesome interferences in ICP-MS. Examples include CaO^+ overlaps on ^{56}Fe , ^{59}Co and ^{60}Ni , from the Ca isotopes at mass 40, 43 and 44 respectively, and the MoO^+ interferences on all the main isotopes of Cd. Also, the oxides of the light rare earth elements (REE's) overlap the heavy REE's. While good plasma design can reduce MO^+ levels, oxide overlaps have remained a problem, until now. Using the ORS in He collision mode with Kinetic Energy Discrimination (KED) can virtually eliminate oxides from the ICP-MS mass spectrum, enabling advances in REE measurement and opening new possibilities in materials science applications.

Importance of Plasma Design

Good plasma and sample introduction system design will significantly reduce MO^+ levels by decomposition of the matrix. The parameter usually monitored to check plasma efficiency is the $^{140}\text{Ce}^{16}\text{O}/^{140}\text{Ce}$ ratio since the Ce-O bond is one of the strongest M-O bonds. Decomposition of MO^+ ions in the plasma is promoted by:

- i) Limiting the sample aerosol loading by using a low-flow sample introduction system
- ii) Removing the water vapor by cooling the spray chamber
- iii) Ensuring a diffuse aerosol in the plasma, by using a plasma torch with a wide internal diameter injector (2.5 mm)
- iv) Maintaining a high plasma temperature by using a high efficiency solid-state, digital drive RF generator operating at 27.12MHz

All of these strategies are employed in the 7500 Series, resulting in a typical CeO/Ce ratio of 0.3% to 0.5%, which is 5-10 times lower than other ICP-MS. Even at this level, oxides can still compromise analytical data if the parent ion is present at very high levels compared to the interfered ion, and especially if the

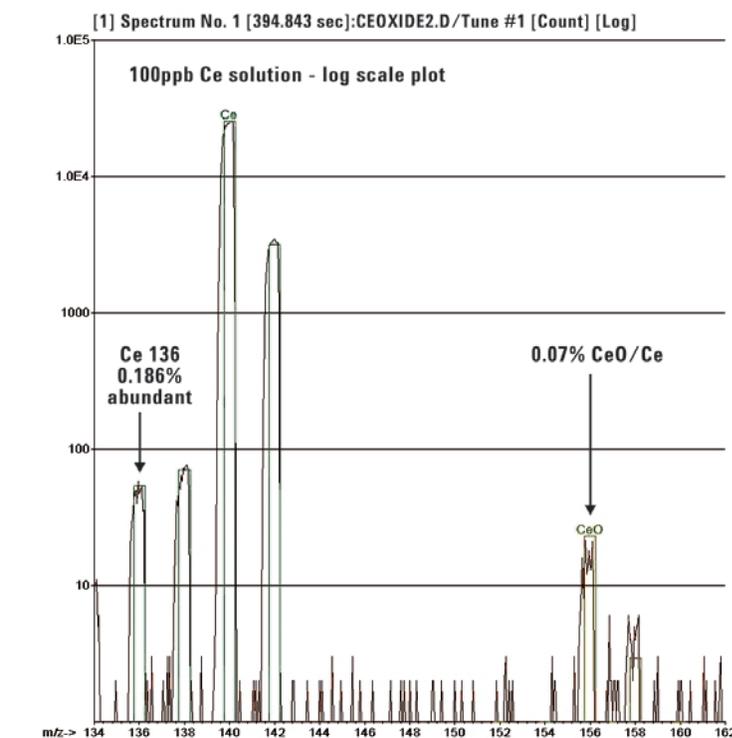


Figure 1: 100ppb Ce log scale spectrum showing Ce and CeO peaks. Agilent 7500ce operated in He mode, with normal concentric nebulizer.

oxide bond is strong (as is the case with REE's).

ORS/He Mode Approach

In He mode, all polyatomic ions can be removed simultaneously using KED, which removes the polyatomic (molecular) ions by virtue of their larger size (ionic cross section), relative to the analyte ions. The large molecular ions undergo more collisions in the cell, lose more energy and are filtered out at the cell exit. Efficient KED is only possible if the ions arrive at the cell with the same energy, and this is achieved with the ShieldTorch System. He mode has now been applied to further reduce the level of oxide interferences on the 7500ce. MO^+ species are the most difficult to remove from the spectrum - however, by applying a higher KED voltage than normal (10V compared to 4V typically used), and 4mL/min He to the cell, even CeO can be reduced from around 0.4% to less than 0.1%. Some sensitivity is lost, but CeO is attenuated at a greater rate than Ce. Figure 1 shows a log scale spectrum of a solution containing 100ppb Ce. Note the $^{140}\text{Ce}^{16}\text{O}$ peak at mass

156 is far smaller than the 0.186% abundant ^{136}Ce peak. The actual CeO/Ce ratio is 0.07% - the lowest ever reported for an ICP-MS operating with a conventional concentric nebulizer and without the use of aerosol desolvation. Note that only pure He cell gas was used.

Summary

- He mode can virtually eliminate CeO - x50 lower than other ICP-MS
- Inert cell gas so NO new oxides, hydrides, hydroxides or other interferences formed
- No need for desolvation devices
- No interference equations used
- All other analytes measured simultaneously, in ANY matrix
- Now high mass REE's can be measured
- Applies to ALL oxides and ALL polyatomics - simultaneously

Reducing matrix oxides in this way enables the accurate measurement of high mass REE's in natural samples without correction equations as well as unlocking previously interfered elements in other high matrix sample types.

Analysis of Methyl Mercury in Water and Soil by HPLC-ICP-MS

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Mercury can exist either in elemental or alkylated form. Biological activity will typically methylate mercury to either methyl mercury or less commonly, di-methyl mercury. The different chemical forms of mercury have different toxicities with methylmercury species being 10-100 times more toxic than inorganic mercury compounds. As a result, the Joint FAO/WHO Expert Committee on Food Additives (JECFA) recently recommended the Provisional Tolerable Weekly Intakes (PTWI) of methylmercury (MeHg) be reduced to 1.6 µg per kg body weight per week down from 3.3 µg per kg body weight per week.

The simultaneous determination of inorganic and organic mercury is difficult because the typical concentration of MeHg is much lower than inorganic mercury. The most common methods of mercury speciation are gas chromatography (GC) or high-performance liquid chromatography (HPLC) coupled with a mercury-specific detector (fluorescence, photometry or other elemental detector). The low concentration of mercury in natural waters leads to the need for very large sample volumes to be processed. A pre-concentration step is necessary because the reporting limit required is often below the sensitivity of the detector used.

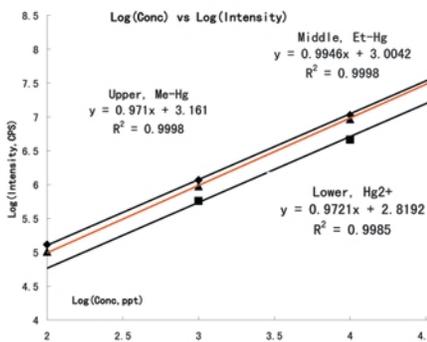


Figure 1. Calibration curves for MeHg, Hg²⁺ and EtHg

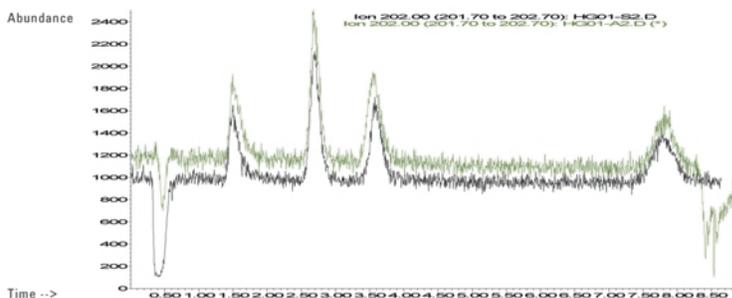


Figure 2. Overlaid HPLC-ICP-MS ion chromatograms of 100ng/L Hg species standards in pure water (upper) and in 3%NaCl (w/v, lower) (20uL loop).

Instrumentation

The aim of this work was to evaluate HPLC-ICP-MS in terms of its sensitivity and specificity for the determination of MeHg.

An Agilent 1100 LC was coupled to an Agilent 7500a ICP-MS using the LC-ICP-MS Connection Kit (G1833-65200).

HPLC Column

For best results, the HPLC column (ZORBAX Eclipse XDB-C18, 2.1mm IDx50mm, 5µm) should be pre-conditioned by pumping HPLC grade methanol at 0.4mL/min for more than 2 hours, and then conditioned with eluent (same flow rate) for more than half an hour.

Results and Discussion

A series of calibration standards was prepared from 10ng/L to 100ug/L by diluting a mixed Hg species stock solution (1.0 ug/mL Hg for Hg²⁺, MeHg and Ethyl-Hg, in pure water). A 20uL injection loop was used throughout except for the 10ng/L data which was obtained using a 100uL loop. The peak areas were integrated for different concentration levels of 3 mixed Hg species.

The linear range of the calibration curves (Figure 1) for Hg speciation by the HPLC-ICP-MS method was at least 4 orders. This range covers expected real sample levels, and so the method is appropriate for direct determination of water samples without the application of complicated preconcentration procedures.

Chromatographic Separation of Hg Species in 3% NaCl

In order to prove the ability of the method for high matrix sample analysis, the stock Hg

species solution was also diluted into 3% NaCl (w/v in water) to obtain 100ng/L MeHg, Ethyl-Hg and Hg²⁺. The solution was filtered through a 0.45µm membrane before analysis. A 20uL injection loop was used for the measurement. The chromatogram was overlaid with the chromatogram of the pure water diluted solution at the same concentration, as shown in Figure 2.

The peak areas of the Hg species in 3% NaCl were also integrated and the recoveries were between 90% and 110% relative to standards in pure water. This demonstrates that the method is suitable for even high matrix samples such as seawater.

Application to Soil Samples

When the HPLC-ICP-MS method is applied to solid samples such as tissues, soils or sediments, sample preparation is necessary. The extraction of Hg species from the solid samples is a crucial step due to the presence of mercury in environmental samples at low levels, and the Hg species, especially methylmercury are easy to lose or transform to other species. A simple extraction method based on dilute hydrochloric acid was used.

The spike recoveries of the soil samples were between 80% and 120%. Further testing of the method and the MeHg containing reference soil sample are planned for future work.

Conclusion

HPLC-ICP-MS is appropriate for water samples analysis, even when the matrix in the water sample is high. The method detection limits for MeHg, Ethyl-Hg and Hg²⁺ are better than 10ng/L and meet current regulatory requirements. When the method is applied to soil samples, Hg species extraction by 7.6% HCl is appropriate, with recoveries between 80% and 120%.

News: ICP-MS Only Approved Multi-element Method for Drinking Waters

Steven Wilbur,
Agilent Technologies Inc., USA



EPA withdraws approval of method EPA 200.7 and SM 3120b (ICP-OES) for analysis of arsenic in drinking waters according to 40 CFR 141.23, effective January 23, 2006.

"These methods are inadequate for determining compliance, determining eligibility for monitoring waivers and for the grandfathering of data for the revised arsenic MCL of 10 ppb (0.010 mg/L)"¹. This leaves graphite furnace and hydride AA as approved single element methods, and ICP-MS as the only approved multi-element method.

Introduction

Increasing awareness of the dangers of chronic exposure to arsenic, primarily from drinking water, but also from ingestion of contaminated food and inhalation of polluted air, has prompted stricter worldwide exposure regulations and monitoring requirements. The previous maximum levels for As in drinking water date from the 1950s. The World Health Organization (WHO) has had a public position on As in drinking water since 1958 when it stated a maximum allowable concentration of 0.2 mg/L. This was updated to 0.05 mg/L in 1963. In 1993, the level was set to 0.01 mg/L as a provisional guideline value, even though calculated risk of skin cancer due to

lifetime exposure to arsenic was much lower. Practical quantification limits based on instrumentation at the time precluded lower limits.² The estimated lifetime excess risk of skin cancer at the 0.01 mg/L exposure level is 6×10^{-4} or about 1 in 1700. Currently, the logistics and economics of treating water worldwide to meet lower levels as well as availability of appropriately sensitive testing methods are limiting regulation and enforcement of even lower levels. For a time in 2000, the US EPA proposed that the new standard be lowered to 0.005mg/L, but this was later relaxed to 0.01mg/L. In fact, while the EU and US have adopted the WHO recommendation of 0.01 mg/L, a number of countries have retained the 0.05 standard or some value between 0.01 and 0.05 mg/L.³ However, it is clear that the trend in permissible levels is downward following practical limits of quantification and that other worldwide regulatory agencies will follow suit, excluding the use of less sensitive methods. Australia has, for example, a maximum permissible level of 0.007 mg/L.

ICP-MS and Arsenic Measurement

As the need to measure arsenic at lower levels, in more complex samples and with other elements increases, only ICP-MS will remain as a suitable technique. However, not all ICP-MS instruments are equal when it comes to arsenic measurement. Traditionally, arsenic has been one of the "problem elements" by ICP-MS due to:

- Relatively high first ionization potential (9.81eV)
- Severe interferences from ArCl in samples containing chloride
- Mono-isotopic nature.

For relatively clean drinking water samples, the use of mathematical interference correction can compensate for interferences as long as:

1. The Cl concentration doesn't vary too much.
2. There isn't appreciable selenium or bromine in the sample
3. A suitable internal standard is used to compensate for the matrix suppression due to its high ionization potential.

As a result of these limitations, the USEPA reported MDLs for As by ICP-MS are 1.4 ug/L⁴. However,

improvements in ICP-MS technology including the development of extremely robust plasma conditions to minimize suppression, and helium collision mode with kinetic energy discrimination to eliminate the interferences, permit the Agilent 7500ce ICP-MS to achieve MDLs in the range of 20 ppt (0.02 ug/L) for arsenic in typical environmental samples (500x lower than required by current regulations). Similar detection limits can be achieved in clean drinking waters using the 7500a without the requirement of a collision cell. Other collision cell instruments use complex, reactive gases or measure arsenic as a polyatomic at mass 91, both of which are subject to matrix effects.

Conclusions

After January 2006, ICP-OES will no longer be approved for the measurement of arsenic in drinking water in the US. Only GFAA, hydride AA and ICP-MS will comply. Other countries are likely to follow suit. Of the ICP-MS solutions available, only the Agilent 7500ce ICP-MS can effectively ionize arsenic in complex matrices and eliminate interferences using simple, universal helium collision mode⁵. Helium collision mode does not compromise the performance of other analytes and does not require matrix specific optimizations or the use of complex or reactive gases or gas mixes.

References

1. http://www.epa.gov/safewater/ars/pdfs/regguide/ars_final_mainguide_9-13.pdf
2. http://www.who.int/water_sanitation_health/dwq/en/arsenicun5.pdf
3. Arsenic in Drinking Water, Committee on Toxicology, Board on Environmental Studies and Toxicology, Commission on Life Sciences, National Academy Press WHO, 1993
4. EPA method 200.8, www.nemi.gov
5. Trace Metals in Drinking Water using the Agilent 7500ce ICP-MS, 5989-0870EN

Chromium Speciation in Natural Waters by IC-ICP-MS

Tetsushi Sakai and Ed McCurdy
Agilent Technologies

Measurement of total chromium doesn't always tell you the whole story. The hexavalent form of the element is toxic, while the trivalent form is an essential element for human nutrition. Methods to establish the potential toxicity of Cr must therefore determine the concentration of Cr(VI), rather than simply total Cr.

Separating and detecting Cr is challenging because the common forms of Cr in natural samples such as water are chromate (CrO_4^{2-}) for Cr(VI) and chromic ion (Cr^{3+}) for Cr(III). Chromate is an anion and the chromic ion is cationic, so a single ion exchange method will not work for both forms under the same conditions. A further problem is that Cr(III) is the most stable oxidation state in samples such as water, whereas Cr(VI) ions are strong oxidizing agents and are readily reduced to Cr(III) in the presence of acid or organic matter. Consequently great care must be taken during sample collection, storage and preparation, to ensure that the Cr species distribution present in the original sample is maintained up to the point of analysis.

Agilent's newly developed method

Inject/ μL	Retention Time /min		Peak area/counts		DL (S/N=3) ng/L	
	Cr(III)	Cr(VI)	Cr(III)	Cr(VI)	Cr(III)	Cr(VI)
50	0.79	2.09	1082295	914804	69.5	139.4
100	0.79	2.09	1704312	1525147	43.4	82.8
250	0.85	2.21	4939876	4546219	17.5	28.5
500	0.97	2.39	10268086	9398651	13.2	15.8

Table 2. Detection Limits for Cr Species by IC-ICP-MS

used an optimized sample stabilization method, in which the samples were incubated at 40°C with EDTA, which forms an anionic complex with the Cr(III), allowing a single chromatographic method to be used to separate the Cr(III)EDTA complex and the Cr(VI).

The 7500ce ORS ICP-MS allows Cr to be measured with high accuracy and good sensitivity, using the main isotope at mass 52, by removing interferences from ArC and ClOH. The sample preparation method, column type and chromatographic conditions used for Cr speciation are shown in Table 1.

The nonmetal IC pump (Metrohm 818 IC Pump) was used to deliver the mobile phase, but the sample loop was filled and switched using the optional Integrated Sample Introduction System (ISIS) of the Agilent 7500ce ICP-MS. While this configuration maintains the high precision and relatively high pressure of the IC pump, it provides a much simpler and lower cost alternative to a complete IC or HPLC system, since only the IC pump module is required in addition to the ICP-MS system.

Cr column	Agilent part # G3268A, 30 mm x 4.6 mm i.d
Mobile phase	5 mM EDTA (2Na), pH 7 adjust by NaOH
Flow rate	1.2 mL/min
Column temperature	Ambient
Injection volume	50 ~ 500 μL
Sample prep	
Reaction temp	40°C
Incubation time	3 h
EDTA concentration	5 ~ 15 mM pH 7 adjust by NaOH

Table 1. Chromatographic conditions for Cr speciation

Results and Discussion

Under the conditions described above, with ICP-MS detection using the Agilent 7500ce in H_2 cell gas mode to remove the ArC and ClOH interferences on Cr at mass 52, detection limits (DLs) of <20 ng/L were obtained for the individual Cr species, as shown in Table 2.

Many international regulations for hexavalent Cr specify a maximum allowable concentration of 1 $\mu\text{g/L}$, with a required DL of one-tenth of this level (100 ng/L), and even the small sample volume injection of 100 μL easily meets these requirements. However, increasing the injection volume to 500 μL allowed the DLs to be reduced to 13.2 ng/L for Cr(III) and 15.8 ng/L for Cr(VI).

In order to test the suitability of the method for real-world sample types, the method was applied to the determination of both Cr species in spiked and unspiked mineral water samples.

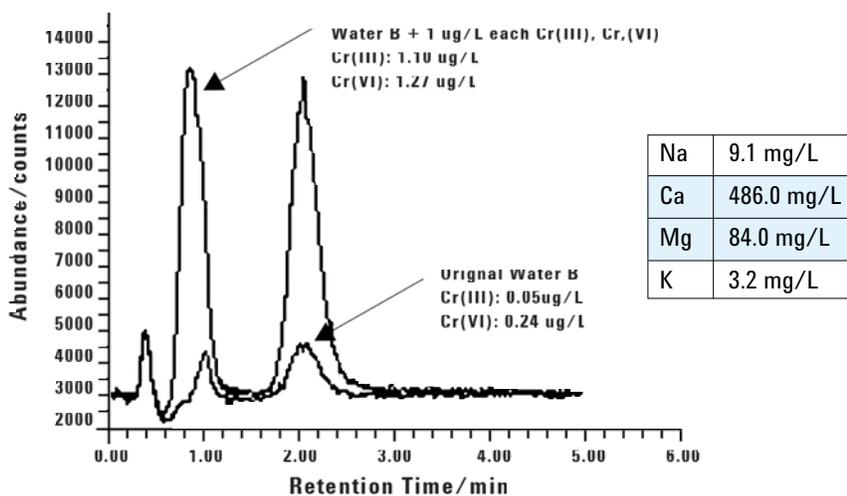


Figure 1. Major element composition (mg/L) and chromatogram for spiked mineral water B.

Element	Found (ug/L)			
	Original	Spike added	Spike found	Recovery (%)
Cr(III)	0.05	1.0	1.10	105.0
Cr(VI)	0.24	1.0	1.27	103.0

Table 2. Spike recovery data for 1.0ug/L spikes of Cr(III) and Cr(VI) in mineral water B

One mineral water sample analyzed was a French mineral water, referred to as mineral water B, which has among the highest levels of calcium and sulfates of any commonly available mineral water (over 450 mg/L Ca and more than 1000 mg/L sulfates). Mineral water B was analyzed with and without a spike of the two Cr species and the spike recovery was assessed. The results for the measured chromatograms are shown in Figure 1, while the spike recovery data are shown in Table 2. The major element composition of the mineral water is shown as an inset in the chromatogram, illustrating the very high mineral levels. Despite these high major element levels, the optimized sample prep. and chromatographic method gave good chromatographic separation and identification for both Cr species.

The ability to recover low concentration spikes for both Cr species in such a high matrix sample indicates the effectiveness of the optimized method for sample stabilization, which ensures that a high enough concentration of EDTA is available for complete complexation of the Cr(III) species, even in the presence of a high level of competing ions.

Furthermore the accurate recovery of low concentration spikes of both species indicates that potential problems of species interconversion (reduction of Cr(VI) to Cr(III)) was avoided through the selection of an appropriate pH for the samples and the mobile phase, together with the use of EDTA in the mobile phase as well as for sample stabilization. See Table 2.

Further Information

For a full account of this application see Agilent publication: Ion Chromatography (IC) ICP-MS for Chromium Speciation in Natural Samples, 5989-2481EN

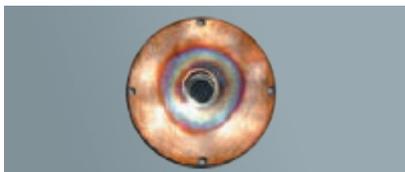
Tips and Tricks:

Here is a simple solution if your sampling cone surface becomes black - see photo below. This could happen if the sampling cone isn't tightened well enough. In this case there will be insufficient contact with the water-cooled interface for the heat to dissipate.



To ensure your cones are tight enough.

- Remove the sampling cone and o-ring.
- Clean the sampling cone threads.
- Reattach the sampling cone (no o-ring) to the interface.
- Tighten using the sampling cone tool. Stop tightening when the sampling cone and the cooling part of the interface are in contact. Mark the cone and the interface with a line.
- Remove the sampling cone.
- Reinstall it with the o-ring in place.
- Tighten the cone until the reference lines on the cone and interface meet.



Correctly installed sampling cone after 2 hours run with 1600 watts

Note: Do not over-tighten beyond the marked position; otherwise it may be difficult to remove the sampling cone.

User Tip

from Darrel Luck, Amdel, Cardiff, Australia. A contract environmental laboratory using a 7500c and ISIS with GE Micromist nebulizers, typically running >150 samples per day.

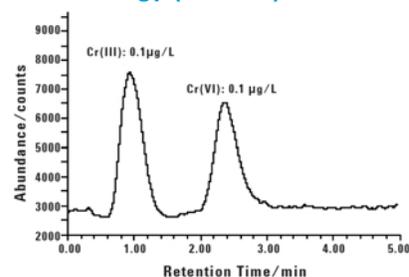
Amdel found that soaking the Micromist nebulizers in acids wasn't cleaning the nebs well enough. Now they use a protocol of soaking the nebs over night in a mixture of 50% methanol and 50% Decon 90, a laboratory surface cleaning agent. They found the method works great and removes the organic based contamination from inside the neb

which otherwise was left behind by acid soaking.

New Products for 7500 ICP-MS

Agilent have introduced two new products to enhance the capabilities of the 7500 Series ICP-MS.

Chromium Speciation Kit and Methodology (G3268A)



Separation and detection of Cr(III) and Cr(VI) at a concentration of 0.1ug/L each species

A new, simple and reliable method has been developed to separate and measure Cr (III) and Cr (VI) using an Ion Chromatography pump (Metrohm Ltd.) coupled to an Agilent 7500ce ORS ICP-MS. For the first time, using the new Cr Speciation Kit, speciation of Cr (III) and Cr (VI) is possible in less than 4 minutes run time with ppt detection limits.

Strengths of the method include:

- Simple sample prep
- Simple hardware
- Sensitivity - ppt detection limits
- Matrix tolerance - applicable to natural waters - see previous page
- Rapidity and simplicity of methodology

New Revision of ICP-MS ChemStation

The new revision of ICP-MS ChemStation Software (rev.B.03.02) allows Agilent GC/LC ChemStation (32bit) and ICP-MS ChemStation to co-reside on the same PC. LC/GC methods can now be run from the ICP-MS sequence table - making speciation studies easier and more powerful.

Another important software development includes "Pre-emptive rinsing". The result is shortened rinsing time and improved sample throughput. The upgrade software (G3149B) will be available from July. See next issue of the ICP-MS Journal for more details.

Share Your Successes Contribute to the Agilent ICP-MS Journal

Beginning with the next issue, the Agilent ICP-MS Journal will include a regular column dedicated to Customer Success Stories. These short articles will be selected from contributions by customers who have interesting stories to share about their success with their Agilent ICP-MS system. Beyond that there are no limitations. The success could be financial, technical, whatever. Just submit your story to our Editor, Karen Morton at editor@agilent.com. Please limit your draft to about a typed page, including any graphics you wish to include. We will take care of proofing and final formatting, and return to you for final approval. This is a great opportunity to share your successes with the many regular readers of the Agilent ICP-MS Journal.

Apple iPod Give-away

Each year, we will select what we think is the most fascinating success story and reprint a summary in the Winter Conference Issue of The Journal and award the submitter an Apple iPod mp-3 player. The winner will also receive recognition at the Agilent ICP-MS users meeting at the Winter Conference.

So get your stories in and get on the list for the iPod. If you have any questions, contact Karen Morton at editor@agilent.com or Steve Wilbur at steven.wilbur@agilent.com.

Trade Shows and Conferences

2005 N. American Seminar Series - Agilent and Milestone

June dates: 14 - Sacramento, 15 - Phoenix, 16 - St Louis, 21 - Montreal, 22 - Ottawa

September dates: 13 - Somerset, 14 - RTP, 15 - Tampa, 20 - Vancouver, 21 - Calgary

Please visit the Agilent ICP-MS website to register.

Agilent Environmental 2005 Seminars

31 May, Osaka, 3 June, Tokyo

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New Agilent ICP-MS Users

A very warm welcome to the following companies and institutions that have recently added an Agilent ICP-MS to their analytical facilities.

- National Measurement Institute, Australia
- Dept of Natl Defense, Canada
- Health Canada, Canada
- Taiga Environmental, Canada
- Inst. Kuhlmann 2, Germany
- Med. Lab. Bremen 2, Germany
- Chelab 2, Italy
- CTO Torino, Italy
- Ingenieros Asesores, Spain
- National TsingHwa University (NTHU), Taiwan
- Chiangmai University, Thailand
- BBSRC Rothamstead, UK
- STL Coventry 2, UK
- Capco, USA
- E-Labs 3, USA
- Intel Arizona 3, USA
- Molycorp, USA
- San Diego State U, USA
- U of Washington, USA
- Underwriter Labs, USA

New-look Agilent ICP-MS User Forum

ICP-MS Forum

Folder: [Bookmark](#) | [Edit](#) | [Delete](#) | [Move](#)

	Title
	Forum News Move
	Collision/Reaction Cell Move
	Miscellaneous Move
	Applications Move
	Software Move
	Speciation Studies Move
	Agilent 4500 Series ICP-MS Move
	Agilent 7500 Series ICP-MS Move

Check out the improved ICP-MS User Forum - the place where you can exchange information relating to your 4500 or 7500.

To join, you will simply need to log-in to the Agilent web site, or register if you haven't already, and enter your instrument's serial number on your first visit only.

Look for the link to the ICP-MS User Forum from:

www.agilent.com/chem/icpms

Many of the familiar features remain including:

- e-mail notification of any activity on the Forum
- powerful search facility

Additions include:

- Agilent ICP-MS User Resource Library - a database specifically for user-relevant information
- "Events Calendar" - information on trade shows, conferences, seminars and user meetings.

Because the ICP-MS User Forum is YOUR Forum we welcome your comments. Please post to the Forum, or if you prefer, e-mail Karen Morton at editor@agilent.com (ICP-MS User Forum Administrator).

Agilent ICP-MS Publications

To view and download these latest publications, go to www.agilent.com/chem/icpms and look under "Library Information"

- Ion Chromatography (IC) ICP-MS for Chromium Speciation in Natural Samples, **5989-2481EN**
- Evaluation of Conventional ICP-MS and ORS-ICP-MS for Analysis of Traditional Chinese Medicines, **5989-2570EN**
- Rapid and Reliable Routine Analysis of Urine by Octopole Reaction Cell ICP-MS, **5989-2482EN**

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