# NEWS

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*Application Spotlight*

# IsoMist XR: Improved Performance with Precise Temperature Control for any ICP Application

The temperature of a sample introduction system has a profound effect on ICP-OES and ICP-MS performance and controlling that temperature has many benefits. Most ICP-MS instruments use a cooled spray chamber to reduce oxide and polyatomic interferences. A cooled spray chamber is also often used to reduce the volatility of solvents so that a stable plasma is sustained. Heating the spray chamber results in higher sample transport, enhancing sensitivity (with certain limitations). Maintaining a constant and stable spray chamber temperature improves analytical stability and accuracy and enhances throughput by reducing QC failures and sample re-runs.

Glass Expansion developed the original IsoMist™ to meet the demand for a reliable and convenient temperature controlled spray chamber. On the 10th anniversary of the IsoMist release, we are pleased to introduce the IsoMist XR™ (Figure 1). With an extended temperature range of -25°C to +80°C the IsoMist XR guarantees optimum conditions for any application. In this article, we detail the new design features of the IsoMist XR and highlight several applications that benefit from the use of a temperature controlled cyclonic spray chamber.

Figure 1. IsoMist XR Temperature Controlled Spray Chamber


## Dates and Events


### PITTCON 2017

A wide selection of Glass Expansion products will be on display at Pittcon. Chicago, Illinois, USA, March 5 - 9, 2017. Glass Expansion specialists will be on hand to answer your questions and assist you to choose the optimum components for your ICP.
Please visit us at Booth 3424.
http://pittcon.org/pittcon-2017/

## In this issue:

Application Spotlight.....1 – 5
GE News.....1
New Products.....6 - 7
- *IsoMist XR*
- *PerkinElmer® Avio D-Torch*

Instrument News.....8 - 9
- *From PerkinElmer®*
- *From SPECTRO®*
- *From Agilent Technologies®*

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## Introduction

The IsoMist, first introduced by Glass Expansion in 2007,[1] provided ICP laboratories with a convenient self-contained alternative to a jacketed spray chamber by eliminating the need for a bulky chiller, liquid coolant, complex coolant tubing and the icing-up of the spray chamber. In contrast to the limited temperature range of a jacketed spray chamber, the IsoMist provided a programmable range of -10°C to +60°C in increments of 1°C. This temperature flexibility addressed the challenges associated with several ICP applications.[1-12]

The IsoMist XR incorporates an improved thermodynamic design, providing an extended temperature range and faster equilibration so that your target temperature is attained more quickly. The spray chamber temperature of the IsoMist XR is accurately controlled using a multi-stage Peltier device, with a range of -25°C to +80°C in increments of 1°C. The proprietary software of the IsoMist XR is connected via a USB port or wireless Bluetooth® technology.

A cyclonic spray chamber encapsulated with a temperature conductive resin provides the IsoMist XR with a uniform spray chamber temperature from top to bottom and an air tight fit within the module.[5,6] These features allow for a stable temperature to be maintained with an unmatched accuracy of +/- 0.1°C and prevent condensation build-up and freezing. The combination of the encapsulated spray chamber and dual-stage Peltier allows the IsoMist XR to reach -25°C in less than 15 minutes (from ambient temperature).

The IsoMist XR is compatible with interchangeable glass, quartz and PFA cyclonic spray chambers, offering the analyst the utmost flexibility and optimum setup for any matrix. Glass Expansion's proprietary Helix™ o-ring free nebulizer interface eliminates sample contamination and ensures easy nebulizer removal. This zero dead volume nebulizer interface reduces carry-over, improves washout between samples[5] and a built-in positive stop ensures optimum and reproducible nebulizer insertion depth for consistent nebulizer performance.

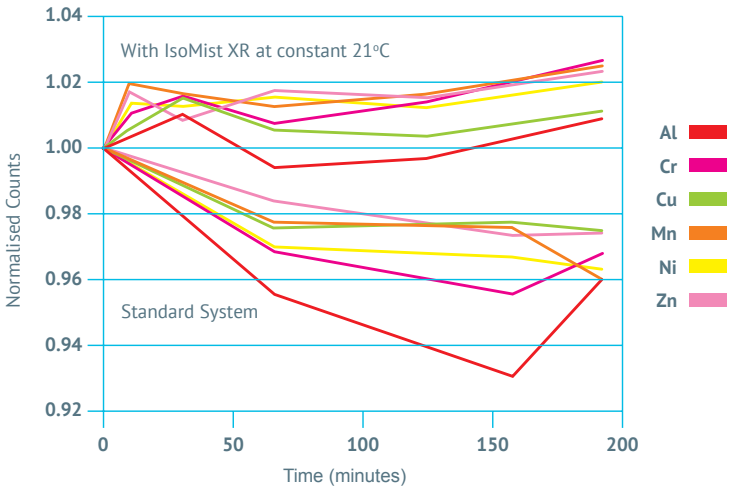
## Results

In order to achieve optimum ICP performance in each of the applications described, it is important to note that in addition to using the IsoMist XR, a proper nebulizer and optimum ICP operating conditions were selected to best handle the particular sample matrix studied. This is essential when dealing with a challenging sample matrix.

## Improved Stability

Fluctuations in laboratory temperature affect sample viscosity and nebulization efficiency. Previous investigations showed a change of 1°C in spray chamber temperature can result in a sensitivity change of 3%[6] Figure 2 compares the long term signal intensity achieved with the IsoMist XR held at a constant temperature compared to a conventional cyclonic spray chamber. The results show that maintaining a constant temperature with the IsoMist XR significantly enhances long term stability of the ICP signal intensity, resulting in improved analytical reproducibility and accuracy. Maintaining a stable ICP signal with the IsoMist XR also enhances throughput and lowers operating costs by reducing the need to re-run samples should a QC check drift outside the acceptable range.

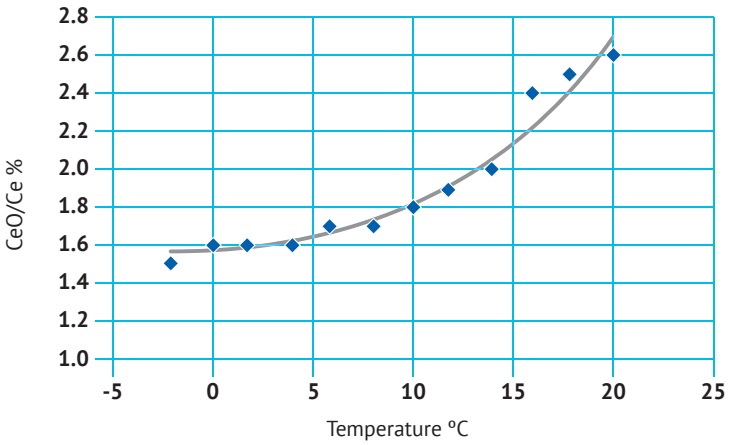
Figure 2. Effect of IsoMist XR on signal stability at ambient temperature




## Reduced Oxide Interferences

Using the IsoMist XR spray chamber at sub-ambient temperatures on an ICP-MS reduces the water vapor transferred to the plasma resulting in lower oxide formation and reduced polyatomic (ArO, ArOH) interferences. Figure 3 shows the effect of IsoMist XR temperature on the ICP-MS oxide ratio obtained on a PerkinElmer® Elan ICP-MS. A reduced temperature between 1 and 4°C provides the optimum oxide ratio. Lowering oxide formation in the plasma translates to fewer interferences, improving accuracy and detection limits.[1]

Figure 3. Effect of IsoMist XR Temperature on ICP-MS Oxide Ratio

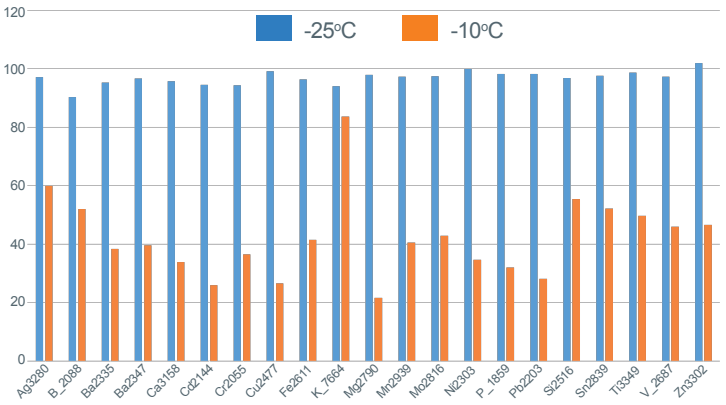



## Volatile Solvents

Volatile organic solvents are a challenge due to high transport efficiency to the plasma, creating an excessive load resulting in plasma instability or, in the worst case, cessation. One of the most difficult and commonly analyzed solvents is light naphtha. Due to its high volatility, naphtha is usually diluted with a less volatile solvent, like kerosene. However, a dilution restricts lower detection limits from being achieved. The IsoMist XR was used in combination with a Thermo® iCAP 6500 Duo ICP-OES for the direct analysis of naphtha, without dilution[12] Setting an IsoMist XR temperature of -25°C,

compared to previous work[1,2,7,8] at -10°C resulted in better precision and accuracy and higher intensities (Figure 4). The extended temperature range of -25°C makes the IsoMist XR the perfect tool for analyzing volatile solvents like naphtha and gasoline without dilution.

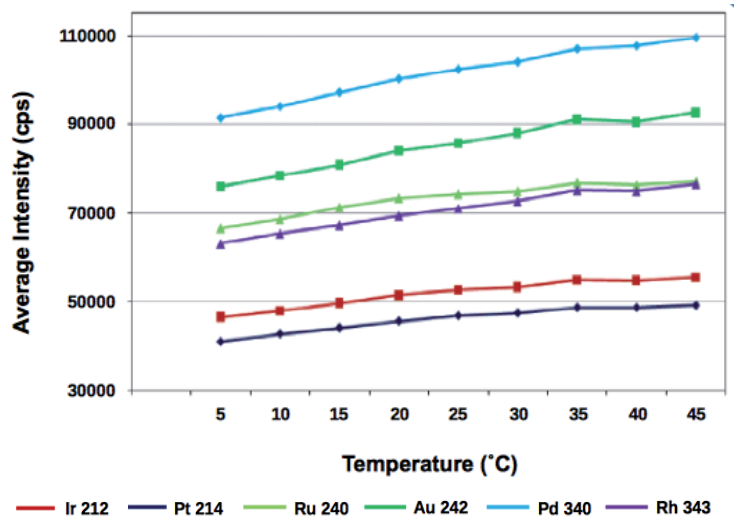
Figure 4. Effect of IsoMist XR Temperature on Signal Intensity in Naphtha




## Enhanced Sensitivity and Accuracy

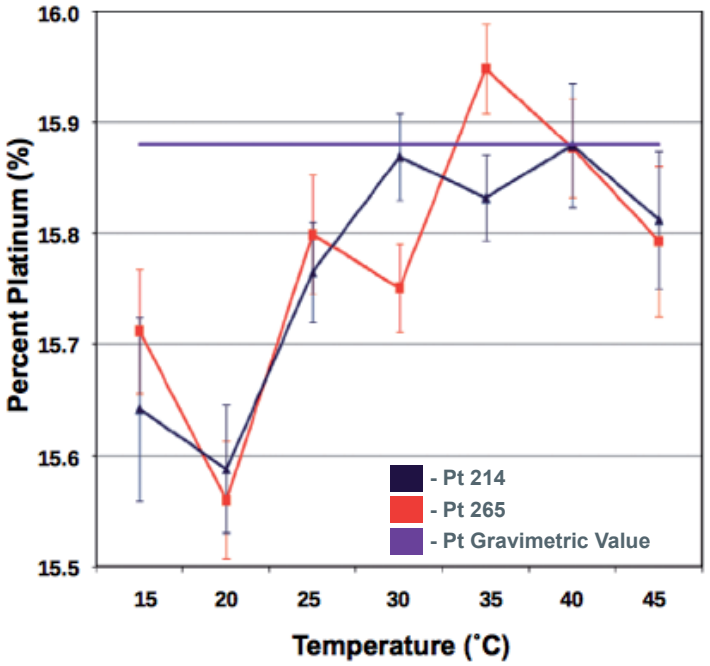
The sensitivity for many analyses can be enhanced by operating the spray chamber at elevated temperatures. In a previous study[4], the IsoMist XR was used in combination with an Agilent® (Varian) Vista Radial ICP-OES instrument to investigate the effect of spray chamber temperature on precious metal signal intensity and analytical accuracy. The elements analyzed included: gold (Au); iridium (Ir); palladium (Pd); platinum (Pt); rhodium (Rh); and ruthenium (Ru). Figure 5 shows the average signal intensity of these precious metals increasing relative to an increase in IsoMist XR temperature.

Figure 5. Effect of IsoMist XR Temperature on Signal Intensity for Precious Metals




To evaluate the effect of IsoMist XR temperature on the accuracy of precious metal measurements, a solution of Pt was analyzed at a range of temperatures and compared to the Pt concentration determined gravimetrically.[4] The results show the Pt concentration is closer to the gravimetric or true value at a temperature of 40 °C (Figure 6). The results from both experiments clearly highlight the advantage of utilizing the IsoMist XR at a higher spray chamber temperature to achieve improved sensitivity and accuracy, especially for the analysis of precious metals.

Figure 6. Effect of IsoMist XR Temperature on Measurement Accuracy




Another advantage of utilizing the IsoMist XR at an elevated temperature is when samples are very limited in volume. We have shown in two separate studies[2,5] that samples can be analyzed at very low uptake rates with a heated spray chamber without the ensuing loss in detection limits as would be realized on a conventional spray chamber without temperature control. (Heating the spray chamber for higher uptake rates may result in overloading the plasma.) Heating the spray chamber can also improve the analysis of viscous samples such as lubricants and edible oils, which would otherwise solidify at room temperature.

## Improved Detection Limits

An investigation was recently carried out using the IsoMist XR connected to a Spectro™ Arcos II MV ICP-OES at a NY water treatment facility. After optimizing the nebulizer and ICP operating conditions, the IsoMist XR was used to finely tune the conditions for optimal signal intensity and reduced background. Replacing the standard cyclonic spray chamber with the IsoMist and optimizing the sample introduction environment at 5°C provided a significant improvement in instrument detection limits (Table 1). In contrast to the precious metal study, a lower temperature with the water samples improved detection limits by reducing background and yielding a more robust and higher temperature plasma.

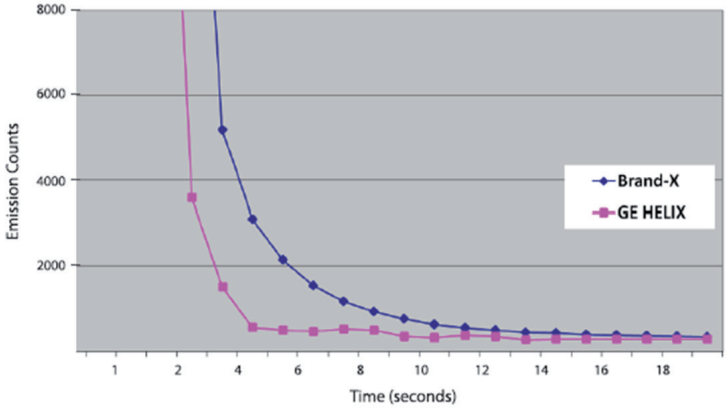
## Improved Washout

Previous work[6] highlighted the advantage of the Helix zero dead volume nebulizer interface by comparing the time required to washout a 10ppm Molybdenum standard with the Helix interface and a “Brand-X” spray chamber with an o-ring interface. The results showed the 10ppm standard washed out in 4 seconds with the Helix interface, compared to 16 seconds with “Brand-X” (Figure 7).

**Table 1. Comparison of Instrument Detection Limits with and without the IsoMist XR**

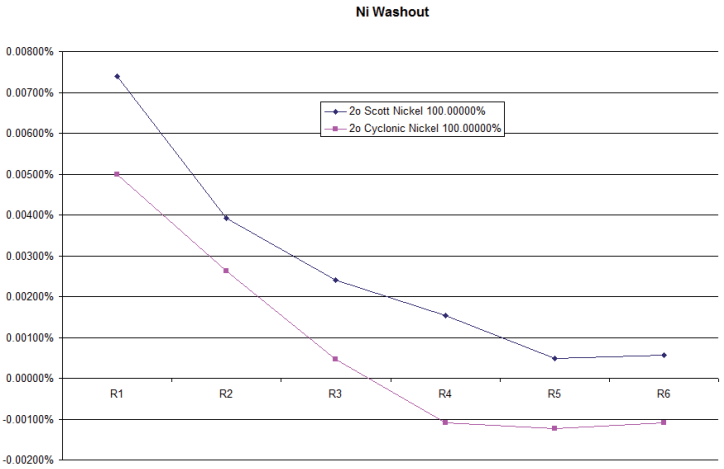
| Element | IDL without IsoMist (ppb) | IDL with IsoMist at 5 °C (ppb) |
|---|---|---|
| Ag | 1.00 | 0.50 |
| Al | 1.00 | 0.50 |
| As | 3.00 | 1.00 |
| Ba | 0.90 | 0.40 |
| Be | 0.10 | 0.09 |
| Cd | 1.00 | 0.50 |
| Co | 1.00 | 0.70 |
| Cr | 1.00 | 0.40 |
| Cu | 2.00 | 0.70 |
| Fe | 2.00 | 0.90 |
| Mg | 1.00 | 0.50 |
| Mn | 0.90 | 0.30 |
| Mo | 1.00 | 0.50 |
| Ni | 2.00 | 0.90 |
| Pb | 3.00 | 1.00 |
| Sb | 3.00 | 1.00 |
| Se | 5.00 | 2.00 |
| Tl | 2.00 | 1.00 |
| Zn | 1.00 | 0.50 |

Figure 7. Washout Comparison: Helix Vs. non-GE




In addition to the washout advantage of the Helix, the IsoMist XR incorporates a proven cyclonic spray chamber design. Compared to a Scott type spray chamber, cyclonic spray chambers are more sensitive and have better washout. Figure 8 compares the washout performance of the IsoMist XR to the Scott style spray chamber of the Agilent® 7700 ICP-MS. Both spray chambers were run on the same Agilent® 7700 instrument and set to 2°C. The IsoMist XR shows five orders of washout by the third rinse cycle whereas the Agilent® Scott style requires five rinse cycles to reach the same level of washout.

Figure 8. Washout Comparison: IsoMist XR Vs. Agilent Scott style spray chamber




## Summary

The IsoMist XR is an elegant, compact, stand-alone system resistant to attack from acids and solvents commonly used in ICP analysis. With varying sample types and laboratory conditions the ability to set a stable controlled spray chamber temperature is essential for optimum ICP results. Whether you are dealing with environmental samples, precious metals, low sample volume or volatile organics the IsoMist XR enhances the sample introduction environment to provide the conditions necessary for accurate and reproducible measurements for any ICP application. The compact design and customized interface kit allow the IsoMist XR to be compatible with virtually any ICP-OES or ICP-MS.

## References


1. Glass Expansion February 2007 Newsletter, “Enhanced Performance for ICP-MS and ICP-OES.”
2. Glass Expansion June 2007 Newsletter, “Applications of a Temperature Controlled Spray Chamber.”
3. Glass Expansion February 2008 Newsletter, “Spray Chamber Temperature: A Critical Parameter in ICP Experiments.”
4. Glass Expansion October 2010 Newsletter, “Improved Accuracy in the Analysis of Precious Metals.”
5. Glass Expansion June 2014 Newsletter, “Performance of a Souped Up ICP-OES System.”
6. Glass Expansion October 2014 Newsletter, “ICP Spray Chamber Update.”
7. M. Cassap, Thermo Fisher® Applications Note #40899, The Analysis of Trace Elements in Naphtha using the Thermo Scientific® iCAP 6000 Series ICP.
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10. M. Cassap, Thermo Fisher® Applications Note # 40971, Petrochemical Series – Accurate determination of copper, phosphorus and sulfur in ethanol using the Thermo Scientific® iCAP 6000 Series ICP.
11. A. Cosnier, S. Lebouil, S. Velasquez, HORIBA® Jobin Yvon, Bio-ethanol Application Flash.
12. Glass Expansion June 2015 Newsletter, “Optimizing the Analysis of Naphtha by ICP-OES.”

# IsoMist XR Programmable Temperature Spray Chamber for ICP-MS and ICP-OES

## Features and Information

Glass Expansion is pleased to announce the release of the new IsoMist XR Programmable Temperature Spray Chamber for all commonly available commercial ICP-OES and ICP-MS.

The IsoMist XR features an improved thermodynamic design allowing operation of the spray chamber across a wider temperature range (from –25°C to +80°C) with a faster cool-down. The temperature of the sample introduction system has a profound effect on the analytical performance of an ICP and controlling that temperature has many benefits. On the IsoMist XR, the temperature is controlled using a powerful, inbuilt, multi-stage thermo-electric peltier device, packaged in a compact, easy to use design.

Any temperature between –25°C and +80°C can be selected, allowing the optimum conditions for any application to be used. The IsoMist XR can be controlled from a PC through a Bluetooth® wireless interface or USB cable. It uses the proven Twister cyclonic spray chamber, combining excellent sensitivity and precision with exceptionally fast washout.


## The IsoMist XR provides the ICP user with significant analytical benefits:

- Introduction of the sample at sub-ambient temperature reduces oxide formation in the plasma, resulting in fewer interferences and improved detection limits for most ICP-MS applications
- The –25°C minimum operating temperature reduces the solvent load on the plasma, allowing direct ICP-MS or ICP-OES analysis of even the most volatile organic solvents such as naphtha and gasoline
- Maintaining the spray chamber at a constant temperature significantly improves long-term analytical stability
- For many ICP-OES analyses, sensitivity is enhanced by running the spray chamber at an elevated temperature, which is particularly important for limited volume samples

The IsoMist XR is compatible with almost all ICP-MS and ICP-OES models. Contact enquiries@geicp.com for details on connecting the IsoMist to a particular ICP.

For more information about the IsoMist XR get a copy of the IsoMist XR application note here: http://www.geicp.com/IsoMistXR-APP/.

# *TWO* Good Reasons to Examine your ICP RF Coil

- It is easy & inexpensive to replace
- It can be very expensive not to

Ready for replacement

**Learn all you need to know about RF coils by downloading our white paper at:**

**www.geicp.com/RFcoil**

## PerkinElmer's® NexION 2000 ICP Mass Spectrometer

PerkinElmer's NexION® 2000 is the most versatile ICP-MS on the market, featuring an array of unique technologies that combine to deliver the highest performance no matter what your analytical challenge.

NexION 2000's novel hardware features include:

- Integrated All Matrix Solution and Extended Dynamic Range capabilities provide the ability to handle high dissolved solids as well as high- and low-level elements in a single sample;
- Three gas channels combined with three modes of operation offer better interference removal, delivering better detection limits/improved data accuracy;
- Industry's fastest data acquisition speed on the market (100,000 points/sec) to handle any particle size;
- New solid-state RF generator with revolutionary LumiCoil™ technology – first ICP-MS RF coil that requires no maintenance or cooling;
- Triple Cone Interface with Quadrupole Ion Deflector deliver no maintenance beyond the cones;
- Unique SMARTintro™ dedicated sample-introduction modules simplify operator setup, streamlining analytical workflows;
- Syngistix™ software provides an intuitive interface that mirrors your workflow, with left-to-right, icon-based navigation that guides you through your analysis. Plus, it's a cross-platform solution, easing the transition from technique to technique.

Discover the effortless versatility of an instrument that makes it easy to handle any sample matrix, any interference, and any particle size. For more information, visit www.perkinelmer.com/NexION2000.

## SPECTRO™ Introduces New SPECTROBLUE ICP-OES Analyzer with Powerful New Generator for Ultra-Precise Analysis, Higher Productivity

SPECTRO™ Analytical Instruments introduced its latest version of the SPECTROBLUE inductively coupled plasma optical emission spectrometer (ICP-OES) — updated with a powerful new generator — that brings a new level of performance to routine laboratory analysis in industrial and environmental applications.

The latest version of the SPECTROBLUE analyzer capitalizes on more than 30 years of benchmark service by SPECTRO™ ICP-OES analyzers. That heritage can be found in its Paschen-Runge optical system, which provides unmatched optical resolution and sensitivity. The new instrument also utilizes revolutionary UV-PLUS gas purification technology, as well as a breakthrough OPI-AIR interface that avoids costly, complicated external water cooling.

The new SPECTROBLUE model brings next-generation plasma power to midrange spectrometers. Its new laterally diffused metal oxide semiconductor (LDMOS) generator delivers up to 1700 W of proven power. The benefits of the latest version include faster warmup time for high productivity, excellent matrix compatibility and longer lifetime.

The SPECTROBLUE spectrometer is available with three versions of plasma interface, depending on its intended use: Axial interface, radial interface and twin interface.

# Agilent Technologies® - New Standards for ICH/USP Applications

Agilent® has introduced a suite of Certified Reference Materials (CRMs) to simplify testing of inorganic contaminants in pharmaceutical products to ICH Q3D and USP<232> requirements.

Control of impurities, including elemental contaminants, is critical in pharmaceutical development and production. The current US Pharmacopeia method (USP<231>) does not give adequate information regarding contaminant levels. The new performance-based International Conference on Harmonization (ICH Q3D) and USP methods (USP<232> (limits) and USP<233> (procedures)) address the limitations of the USP<231> method with additional analytes, reduced maximum permitted exposure limits and consideration of the route of exposure. The reference analytical methods are ICP-MS and ICP-OES.

Agilent's® ICH/USP<232> impurities kit (pn 5190-9771) includes 5 CRMs with elements sorted by class, chemical compatibility and the relative concentration. These CRMs are manufactured in an ISO Guide 34 facility and certified in an ISO/IEC 17025 testing laboratory. They include a Certificate of Analysis confirming actual concentrations, measurement uncertainty, and NIST traceability.

Agilent's® ICP-OES and ICP-MS instrumentation also provides ideal capabilities for determining inorganic contaminants to ICH Q3D and USP<232> requirements. Together with the ICH/USP<232> impurities kit, Agilent® offers a complete solution supporting transition to the new methods for elemental impurities in pharmaceuticals. To learn more about Agilent's® ICP-OES and ICP-MS, visit http://www.agilent.com/chem/atomic.

| P/N | Product Name | Product Description | Matrix | Volume |
|---|---|---|---|---|
| 5190-9766 | ICH/USP Target Elements Standard A | Hg @ 30; As @ 15; Cd, Pb @ 5 µg/ml | 2% HNO3 | 100ml |
| 5190-9767 | ICH/USP Target Elements Standard B | Ni @ 200; Ag, Se @ 150; V @ 100; TI @ 8; Co @ 50 µg/ml | 2% HNO3 | 100ml |
| 5190-9768 | ICH/USP Target Elements Standard C | Au, Ir, Os, Pd, Pt, Rh, Ru @ 100 µg/ml | 15% HCI | 100ml |
| 5190-9769 | ICH/USP Target Elements Standard D | Cr @ 11,000; Sn @ 6000; Cu, Mo @ 3000; Ba @ 1400; Sb @ 1200; Li @ 550l µg/m | 5% HNO3/tr. HF | 100ml |
| 5190-9770 | Pharma Internal Standard 1 | Te @ 25; Sc @ 10; Ge, In, Lu, Bi @ 5 µg/ml | 2% HNO3/tr. HF | 100ml |