

NEWS

Glass Expansion Newsletter | June 2011 | Issue 25

APPLICATION SPOTLIGHT

ENHANCED PRODUCTIVITY FOR THE ANALYSIS OF ORE SAMPLES

Introduction

The Niagara Plus sample introduction accessory has greatly enhanced the performance of ICP-OES and ICP-MS instruments. The accessory uses Flow Injection technology to reduce analysis time by 50%, typically, resulting in reduced environmental impact and lower operating cost. In addition to the cost and environmental benefits, the Niagara Plus delivers an improvement in analytical performance. Currently, instruments use a read/uptake delay, stabilization delay (incorporated in the read delay), read/analysis time, and rinse delay. With the Niagara Plus only a read/uptake delay and read/analysis time are required. The rinse cycle of the nebulizer occurs during the read/uptake delay (Figure 1) and the rinse cycle of the autosampler probe and uptake tubing is performed during the read/analysis time (Figure 2), thus eliminating the rinse delay. The constant flow of solution to the plasma and uniform internal diameter throughout the entire system allow the stabilization time to be reduced significantly and it is incorporated into the read/uptake delay to simplify the setup process. The purpose-built 3 stacked 4 way diagonal valve with internal mixing T-piece gives a sample swept volume of only 0.4 μ L before mixing occurs with the diluent or internal standard. This allows for automatic addition of the internal standard or diluent (Figure 2) simplifying the sample preparation for ICP-OES and ICP-MS.

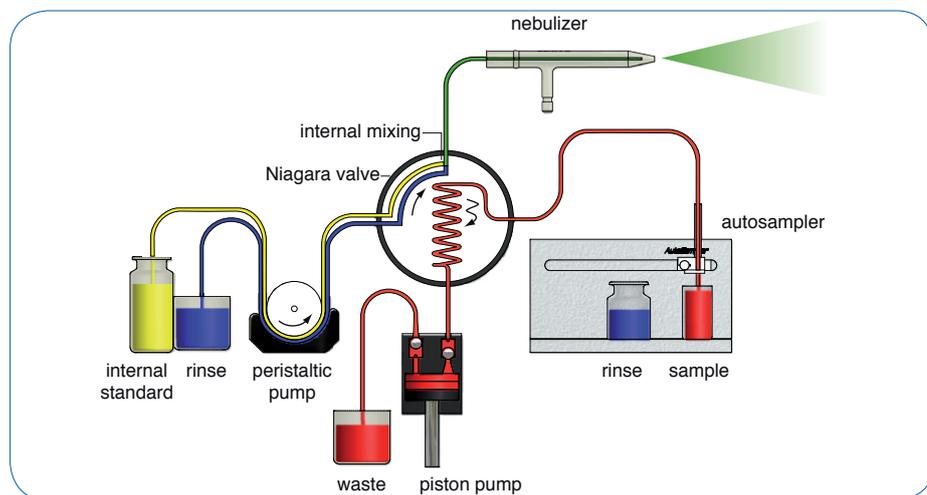


Figure 1: Niagara Plus flow diagram showing the positive displacement pump rapidly filling the sample loop.

This report highlights the performance of the Niagara Plus at the Marine and Freshwater Research Laboratory (MAFRL) at Murdoch University. We will also introduce a new improved 7-port valve for the Niagara Plus. The MAFRL is an accredited testing laboratory of the Australian National Association of Testing Authorities (NATA). Their facility is staffed with experts studying marine systems, estuaries, wetlands, and rivers. Seawater is their typical sample matrix, but as a commercial and university laboratory they also receive various samples and student research projects. The results will focus on the benefits that the Niagara Plus has provided MAFRL since its installation in December 2009. The data discussed in detail below is from a project examining ore samples for mineral processing.

GE NEWS



New 2011 Catalogue

The new 2011 Glass Expansion catalogue is now available and finding the most suitable sample introduction system has never been easier. A new section lists the most frequently used applications and shows the recommended components for each application. A full list of the available products for each of the most prevalent ICP-OES and ICP-MS models is also included. Please send your mailing address to enquiries@geicp.com and we will send you a catalogue immediately.

JAIMA EXPO 2011 / SIS 2011

A full range of Glass Expansion products will be on display at the JAIMA/SIS Show, Tokyo, Japan, September 7 to 9, 2011 and Glass Expansion specialists will be on hand to assist you.

JAIMA EXPO-2011
SIS 2011

IN THIS ISSUE:

- Application Spotlight 1 – 3
- GE News 1
- New Products 4
- Instrument News 5
 - From PerkinElmer
 - From Spectro
 - From Thermo Fisher



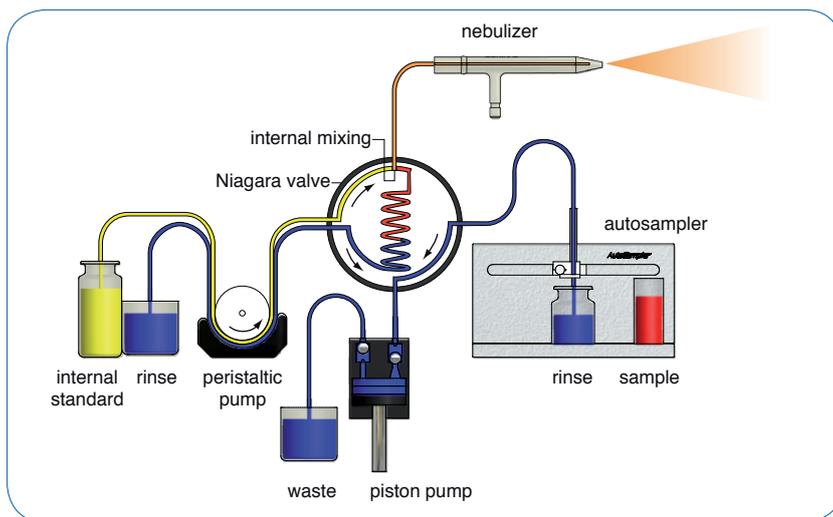


Figure 2: Niagara Plus flow diagram showing the rinse pushing the sample into the nebulizer and aspirating the sample while the internal standard is mixed with the sample within the valve.

Results

The installation of the Niagara Plus valve at MAFRL has resulted in a marked improvement in carryover, productivity, and argon and internal standard consumption without a loss in sensitivity. A comparison of the ICP operating conditions with and without the Niagara Plus is listed in Table 1. The result with the Niagara Plus is a reduction in sample time from 93 seconds to only 48 seconds per sample, which translates to a 40 to 50 % reduction in argon usage.

Another advantage that the Niagara Plus provides is the ability to run at lower sample uptake rates without sacrificing valuable analysis time. The Niagara Plus method parameters are listed in Table 2. Many laboratories use high uptake rates to reduce the time for filling and emptying the sample line, but the higher rate results in wasted sample and reduced lifetime of the peristaltic pump tubing. A plot of tertiary flow rate (the amount of sample reaching the torch) versus sample uptake rate in Figure 3 shows that tertiary flow rate plateaus at 0.6mL/min and a higher uptake rate or pump RPM provides no analytical benefit. The Niagara Plus fills the sample line quickly with its built-in positive displacement pump, allowing MAFRL to reduce their peristaltic pump speed by half and eliminate the need for the fast pump option available on the Varian ICP. This translates to a saving in sample and internal standard consumption, in addition to an improvement in the lifetime of the peristaltic pump tubing and other consumables.

	Without Niagara Plus	With Niagara Plus
RF power (kW)	1.20	1.20
Plasma gas flow (L/min)	15.00	15.00
Auxiliary gas flow (L/min)	1.50	1.50
Nebulizer gas flow (L/min)	0.80	0.80
Replicate read time (sec)	10.00	10.00
Stabilization delay (sec)	15.00	18.00
Sample uptake delay (sec)	18.00	0.00
Rinse time (sec)	30.00	0.00
Pump rate (rpm)	20	10
Fast pump	On	Off
Replicates	3	3
Total analysis time (sec)	93	48

Table 1: Varian Vista Pro ICP-OES operating conditions

Niagara Plus method parameters	
Loop uptake delay	6.3 sec
Uptake pump speed (refill)	450 RPM
Uptake pump speed (inject)	40 RPM
Bubble inject time	6.0 sec
Time in sample	4.9 sec
Loop size	1.0 mL

Table 2: Niagara Plus method parameters

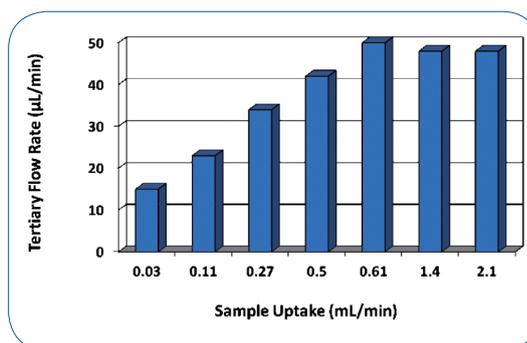


Figure 3: Tertiary flow rate versus sample uptake rate.

The inert sample loop, Time in Sample (TIS) feature, and bubble injector of the Niagara Plus provide enhanced washout and reduced carryover, which not only speeds up the analysis, but also conserves sample and reduces memory, a benefit that is particularly valuable for those “sticky” elements. The TIS feature allows the operator to program the time the autosampler probe sits in the sample tube instead of waiting until the loop is filled. The bubble injector introduces a series of air bubbles at the end of the sample segment to reduce boundary diffusion. These features permit a smaller volume of sample to fill the loop and prevent any sample dilution/mixing with the carrier solution. One of the most noted performance improvements for MAFRL is the reduction in carryover for Mo and Fe. Without the Niagara Plus the carryover for Mo from a 500µg/L sample was >20µg/L. With the Niagara Plus installed, the carryover is now undetectable at <4µg/L. An Fe sample with a concentration of 10,000µg/L previously had carryover >5µg/L that is now undetectable at <2µg/L. The Niagara Plus has also improved MAFRL’s calibration data: Sb calibrations have shown improvement with an average correlation of 0.999974 compared to 0.997692 without the Niagara Plus.

A complete list of the calibration data MAFRL collected for the mineral processing analysis is shown in Table 3. Their results show excellent correlation coefficients for all observed wavelengths and % recoveries are in the range of 98% to 105%. An in-house (MAFRL) standard reference material, which was validated using certified reference materials from Environment Canada, was used to calculate the % recoveries.

In addition to offering the user improved analytical performance, the Niagara Plus is also a rugged accessory. With a rotor made from PEEK and a Teflon stator sleeve, the valve can handle almost any matrix and maintenance is easy. The Niagara Plus unit at MAFRL was installed in 2009 and their valve components have shown no sign of wear or degraded performance. However, when valve components do wear they can be individually and easily replaced. The replacement parts and procedure are listed in the Help file shipped with the Niagara Plus.

Element (λ)	# Data Points	Correlation Coefficient	% Recovery
Ag 328	3	0.999999	105
Al 237	5	1.000000	98
As 188	3	0.999967	101
B 249	3	0.999851	98
Ba 233	3	1.000000	100
Ca 422	4	1.000000	101
Cd 214	3	0.999997	99
Co 228	3	1.000000	100
Cr 267	3	0.999999	101
Cu 327	3	0.999990	98
Fe 238	4	1.000000	100
K 766	5	1.000000	99
Mg 279	4	1.000000	101
Mn 257	3	1.000000	101
Mo 202	3	0.999999	100
Na 589	5	1.000000	103
Ni 227	3	1.000000	100
P 213	5	1.000000	101
Pb 220	3	0.999985	101
S 181	3	1.000000	102
Sb 206	3	0.999336	101
Se 196	3	0.999999	99
Sn 189	3	0.999995	100
Sr 407	3	0.999998	99
Ti 334	3	1.000000	98
Tl 190	3	0.999999	101
V 292	3	0.999996	101
Zn 213	3	0.999999	100

Calibration standards were made up in 1.0% HNO₃ within a concentration range of 0.5mg/L to 50.0mg/L.

Table 3: Calibration data with Niagara Plus using in-house standard reference material.

Improved Design

The new 7-port valve has been designed to switch easily between internal standard (or dilution) mode and straight sample mode. One major advantage of the new valve is the incorporation of the removable T-piece. This not only cuts down on the components required, but along with a newly designed mixing piece, reduces the swept volume of the sample from the valve to the nebulizer. The valve is composed of one 6-port valve that is switched between two positions, with a removable T-piece creating the 7th port. If an internal standard or dilution is not required, the T-piece can be removed quickly and the valve becomes a 6-port valve with no added dead volume. The 7-port valve has a slightly faster uptake compared to the 12-port that further reduces the uptake delay. Simpler valve connections and less tubing reduce the number of fittings required. All ports on the 7-port valve have been color-coded to allow easy connection to the color-coded tubing. The one port that is not color-coded is to be connected to the nebulizer. A close-up of the valve and T-piece is shown in Figure 4, along with the valve completely assembled with all the tubing and bubble injector.

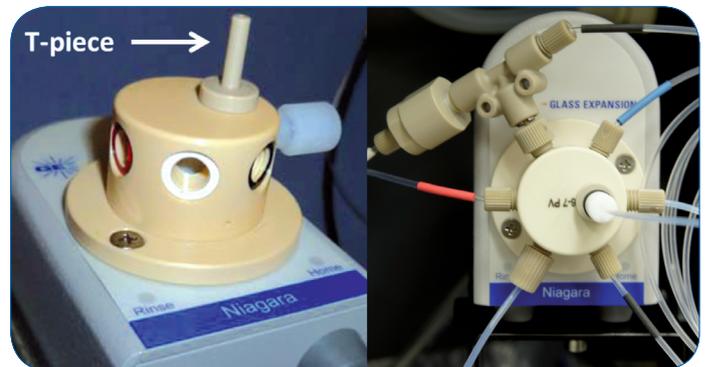


Figure 4: Niagara Plus 7-port valve with new removable mixing T-piece.

Conclusions

In this report, MAFRL has demonstrated a number of the advantages to using the Niagara Plus for examining ore samples, the most obvious being the increase in productivity resulting from the reduction in sample cycle time. The washout and memory effects are also greatly reduced due to the fact the sample does not come in contact with the peristaltic pump tubing and is in contact with the sample introduction components for less time. The lifetimes of ICP consumables are extended due to reduced sample wear as a result of the switching valve. A final benefit is the improvement in analytical performance. MAFRL showed an improvement in calibration data that helps to provide greater accuracy. This is extremely important to MAFRL and other laboratories required to meet stringent QC protocols. After several years of testing, Glass Expansion has concluded that the Niagara Plus is a robust flow injection switching valve system with the least carryover and fastest washout of any valve we have tested. The new 7-port valve simplifies connections and further reduces the already minimal uptake delay.

Acknowledgements

We would like to thank Jamie Woodward and Hanna Swan of MAFRL for the high quality of data presented in this report and their assistance in the generation of this paper.

NEW PRODUCTS

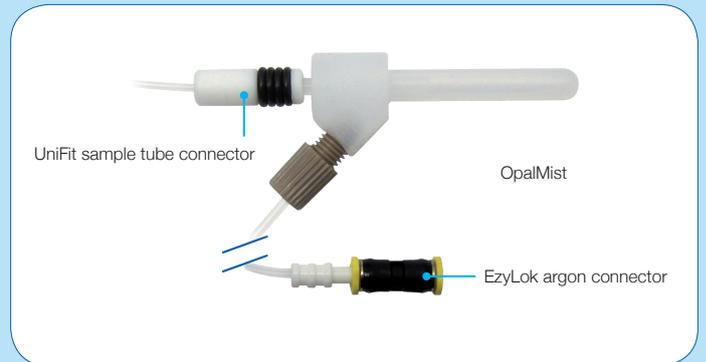
Consumables for PerkinElmer NexION 300 ICP-MS

The PerkinElmer NexION 300 was released in 2010. We can now supply a full range of consumables for this model, including nebulizers, spray chambers, torches, cones and RF coils. You can see these products in our new 2011 catalog or on our website. [Click here](#) to find products to suit your application or [here](#) to see the full range.



New Design for OpalMist and PolyCon Nebulizers

The OpalMist and PolyCon nebulizers have been redesigned to make them more user-friendly. With the old design, the sample tubing was connected using a screw-on cap and o-ring seal while the EzyLok argon connector was permanently connected to the side-arm. The new design uses the same convenient UniFit sample tube connector as our U-Series glass nebulizers. And the EzyLok argon connector is attached by a screw-in fitting that is easily removable. These connectors are the same as those used with our new DuraMist nebulizer. The updated OpalMist and PolyCon nebulizers deliver the same outstanding performance as the old design since the internal construction is unchanged.



New Eluo Version

If a particle lodges in the nebulizer capillary or tip, the sample flow is constricted, thereby reducing nebulizer efficiency and performance. The simplest way to remove blockages and restore nebulizer performance is to use the Eluo Nebulizer Cleaning Tool. We have released a new version of the Eluo to suit the new design of the OpalMist, PolyCon and DuraMist nebulizers. So now there are three versions of the Eluo, one for the glass concentric nebulizers, one for the new OpalMist, PolyCon or DuraMist and one for the old OpalMist or PolyCon.

Part No.	Description
70-ELUO	Eluo Nebulizer Cleaning Tool for glass concentric nebulizers
70-ELUO-OPD	Eluo Nebulizer Cleaning Tool for new OpalMist, PolyCon or DuraMist
70-ELUO-OP	Eluo Nebulizer Cleaning Tool for old OpalMist or PolyCon



INSTRUMENT NEWS

From PerkinElmer – The New Optima 8x00 ICP-OES Spectrometer

PerkinElmer Inc has announced the launch of its Optima™8x00 series of ICP-OES. The Optima 8x00 ICP-OES platform offers improved performance and reduced operating costs for analysis of environmental, food, pharmaceutical, product safety and geochemical samples.

“Whether the challenge is identifying and quantifying environmental contaminants, or determining the quality of pharmaceuticals and nutraceutical supplements, the new Optima 8x00 series is an ideal solution for today’s laboratories,” said Dusty Tenney, President, Analytical Sciences and Laboratory Services, PerkinElmer. “We are excited to launch the next generation of ICP-OES instruments, which will further improve productivity, sensitivity and cost of ownership to meet the diverse needs of today’s labs, worldwide.”

Key features of the Optima 8x00 platform include:

- **eNeb™ Sample Introduction:**
By generating a constant flow of small uniform droplets, eNeb enables the Optima to deliver superior instrument stability and detection limits – ideal for environmental and pharmaceutical labs.
- **Flat Plate™ Plasma Technology:**
A patented RF generator featuring maintenance-free plasma induction plates in place of the traditional helical load coil. With no cooling required and reduced argon consumption, operating costs are dramatically reduced.
- **PlasmaCam™ Viewing Camera:**
By offering continuous viewing of the plasma, this integrated camera simplifies method development and enables remote diagnostic capabilities for maximum uptime. Ideal for high-throughput contract labs in food/product safety/geochemical.

For more information, visit us at www.perkinelmer.com/optima8x00.

From Spectro – New White Paper for SPECTRO MS: Isotope Ratios in Geochemistry

A new white paper dealing with isotope ratios in geochemistry for the simultaneously measuring SPECTRO MS ICP mass spectrometer is available from SPECTRO Analytical Instruments. The white paper, titled “Fully Simultaneous ICP-MS: A New Approach to Isotope Geochemistry,” details ways geological laboratories can profit from isotope and element ratio analysis and designates the SPECTRO MS as a powerful, user-friendly and less-expensive alternative to multi-collector mass spectrometers.

The isotope ratios offer insight into the age and origin of rock samples and can be used to determine the “fingerprint” of rock, mineral and ceramic samples.

Rare earth metals are especially important geochemical indicators, whose relative presence helps establish conclusions as to tectonic environment and history.

“Until now simultaneous determination of isotope and element contents was only possible to a certain degree; making analyses both time consuming and expensive,” explains Willi Barger, Product Manager for ICP-MS at SPECTRO. “The SPECTRO MS simultaneously records 210 isotope concentrations and ratios to four decimal places during every measurement and at a much lower cost than sequential mass spectrometers. “Detection limits for the SPECTRO MS are in the low parts-per-trillion (ppt) range. In addition, the SPECTRO MS is easy to operate. Users obtain categorized, reproducible results with the press of a button.

Users who want to find out more about using the SPECTRO MS for isotope and element ratio analysis in geochemistry will find a comprehensive description in the new white paper “Fully Simultaneous ICP-MS: A New Approach to Isotope Geochemistry” that is available for free at www.spectro.com. The white paper is oriented not just towards geochemical laboratories but to other users as well: The SPECTRO MS is ideal for origin determination in the food industry, forensic science and other areas.

From Thermo Fisher – Thermo Fisher Scientific Implements and Extends LIMS Solution for Eastman Chemical Company

Thermo Fisher Scientific Inc., has announced that Eastman Chemical Company, a large global manufacturer of chemicals, fibers and plastics, has expanded its deployment of Thermo Scientific SampleManager LIMS (laboratory information management system), which it has used since 2000 in its manufacturing quality control laboratories, to its Corporate Technology Analytical Laboratories. For the implementation, Eastman Chemical Company chose an enterprise level solution set, which enables the LIMS to be fully integrated with the laboratory’s instruments and with other proprietary databases and ERP (enterprise resource planning) systems across the organization.

Eastman Chemical Company selected Thermo Scientific SampleManager LIMS for its ability to operate a certified interface with SAP, and the system has integrated seamlessly with it since implementation. Based on the successful deployment of SampleManager LIMS at its quality control laboratories across 13 sites in eight countries, Eastman Chemical extended the LIMS implementation to its Corporate Technology Analytical Laboratories, located at its Tennessee headquarters.

“The Technology division selected Thermo Scientific SampleManager because it was easy to use and could be easily configured and managed in-house at Eastman Chemical,” said James Watson, systems analyst at Eastman Chemical Company. “We have reduced costs by eliminating paper reports, working electronically and involving sample submitters in the process by giving them access to results in real-time. LIMS standardization is the solution required in today’s high throughput analytical laboratories.”

To achieve optimal quality control, Eastman Chemical needed a coherent strategy that would integrate data between the LIMS, ERP multiple instruments and ELNs (electronic laboratory notebooks) across the enterprise. “The overall integration of our connected informatics solutions provides a seamless and secure quality control environment at Eastman Chemical Company,” added James Watson.

For more information about Thermo Scientific informatics solutions, please e-mail marketing.informatics@thermofisher.com or visit www.thermoscientific.com/informatics.