



GLASS EXPANSION NEWSLETTER

Quality By Design

June 2003

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APPLICATION SPOTLIGHT

Determination of trace metals in Seawater by ICP-AES

SAMPLES

A variety of seawater samples are to be analyzed, ranging from open ocean to brackish waters. All samples are filtered through 0.45 micron filter paper and acidified to 1% nitric acid. Open ocean seawater is around 3% in total dissolved solids (TDS). Samples will therefore be at a maximum of 3% TDS and range down to 1% TDS or less with the brackish waters.

ICP-AES SYSTEM

A high-sensitivity model of ICP is called for here, typically an axial version, although some manufacturers claim the resolution and light throughput necessary to achieve optimal detection limits with a radial view model. A dual-view model may offer the advantage of measuring the alkali earth and alkali metal elements radially with fewer interferences.

RECOMMENDED SAMPLE INTRODUCTION SYSTEM

Nebulizer: SeaSpray concentric glass nebulizer; The SeaSpray nebulizer is designed to handle up to 20% TDS.

Spray Chamber: The Twister cyclonic spray chamber will provide the best performance in terms of producing a steady state signal with excellent filtering of larger droplets.

Torch: An ABC Fully Demountable Torch provides specific advantages for this application. The presence of high TDS creates an extremely corrosive environment for the quartz torch, particularly the outer tube. De-vitrification can occur in short order rendering a non-demountable torch useless. A fully demountable torch has replaceable inner and

outer tubes as well as the injector and therefore dramatically extends the lifetime of the torch.

Torch Injector: A wide bore injector is recommended to avoid "salting out" of the orifice as long as possible, typically 2.0mm to 2.5mm. It is also believed that a capillary bore, as opposed to a tapered bore, provides greater freedom from clogging.

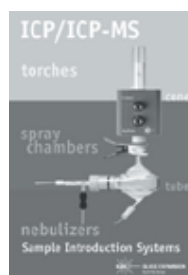
Argon Humidification: Dry argon is more likely to cause salting out at either the nebulizer or injector orifices than moist argon. Hence, it is advantageous to use an argon humidifier such as the Capricorn. Use of a humidifier not only provides higher quality results over a longer term, it also saves significantly on down-time and maintenance.

Internal Standard: Particularly for an axial determination, the use of internal standards can provide higher accuracy. The presence of high TDS typically causes a suppression on many analytes, the degree of which is significantly greater for ion lines as opposed to atom lines. It is, therefore, necessary to link the ion lines to an ion internal standard line (there are many good ion lines for either yttrium or scandium). Atom lines may either be linked to an atom line reference or not used with internal standard, depending on the degree of the interference.

OTHER CONSIDERATIONS

Auxiliary Argon Flow: The use of a higher auxiliary argon flow rate is recommended to lift the plasma off the injector and thereby further reduce the likelihood of clogging.

RF Power: Because the high TDS concentration saps some of the power from the plasma, best recoveries for some analytes (typically the so called hard lines) are usually obtained with somewhat high powers than normally used for aqueous matrices.

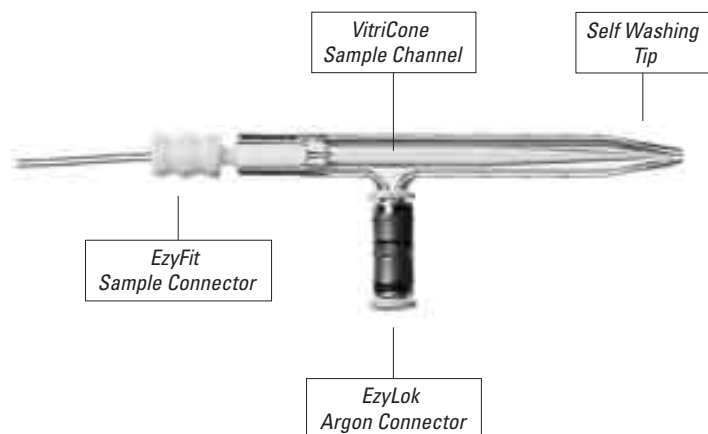


GLASS EXPANSION CATALOG

The Glass Expansion 128 page catalog lists nebulizers, spray chambers, torches and other parts for over 70 ICP-AES and ICP-MS models. If you would like your personal copy, please send your mailing address to enquiries@geicp.com.

PRODUCT DESIGN FOCUS

The SeaSpray Nebulizer



The SeaSpray glass concentric nebulizer is the culmination of 18 years of Glass Expansion nebulizer development. It combines excellent stability and precision with high tolerance to dissolved solids. A recent publication (J. Anal. At. Spectrom., 2002, 17, 57-63) reported that the SeaSpray nebulizer is *"capable of continuous operation with concentrated sodium chloride solutions without any of the clogging problems typically observed with the conventional pneumatic concentric nebulizers."*

With some glass concentric nebulizers, the sample channel is constructed from drawn out capillary tubing. The problems with this type of construction are:

- * The tube is tapered, encouraging salt deposition as the tube narrows
- * The tubing is very fragile and easily broken
- * The tubing can vibrate under the influence of the high speed argon flow, leading to poor precision
- * It is very difficult to reproduce the same performance with different nebulizers

The SeaSpray nebulizers (and all other Glass Expansion concentric glass nebulizers) use the unique Glass Expansion **VitriCone** construction for the sample channel. With the VitriCone design, the sample channel is constructed from heavy glass capillary which is machined to very tight tolerances. The benefits of the VitriCone construction are:

- * The sample channel is uniform, so salt deposition is inhibited
- * The cone is stable and not easily broken
- * The rigid construction helps achieve good short term precision and long term stability
- * Every SeaSpray nebulizer meets the same demanding performance criteria

In addition the **nebulizer tip** has been carefully designed with smooth surfaces to minimize adhesion of salt crystals. The design also uses the washing action of the dispersing droplets to further prevent crystal growth, allowing the SeaSpray to handle up to 20% salt solutions.

The **EzyFit** sample tubing connector eliminates the usual hassle of connecting the sample uptake tubing. EzyFit connectors are simple to use, reduce washout times and eliminate dead volume.

The **EzyLok** argon connector is a simple clip-on gas connection which eliminates bonding of the argon supply tubing to the nebulizer side arm and enhances safety. With conventional connection where the tubing slides over a bulb on the nebulizer side arm, the tubing stiffens over time, leading to a loss of seal and argon leaks. There is also a tendency for some types of tubing to bond to the glass, making it extremely difficult to remove. Users often remove the bonded tubing by cutting it away with a blade – a very hazardous operation. The EzyLok connector eliminates these problems and provides a one-touch disconnection.

NEW PRODUCTS

CAPRICORN ARGON HUMIDIFIER

An argon humidifier is commonly used in ICP analyses involving samples with high dissolved solids concentration. Prior to being introduced to the nebulizer, the argon is bubbled through a water vessel so that it becomes saturated with moisture. This helps to prevent salt buildup inside the sample introduction system allowing uninterrupted and maintenance-free operation.

HELIX NEBULIZER FITTING

The Helix connects the nebulizer to the spray chamber without using o-rings. Even the most chemically resistant o-rings are prone to wear and need regular replacement. The Helix eliminates tedious o-ring replacement and allows the smooth insertion and removal of the nebulizer.

ELUO NEBULIZER CLEANER

A build-up of particles in a nebulizer capillary and tip can reduce the performance of the nebulizer. The Eluo is designed to deliver a cleanser through the nebulizer capillary to dislodge any particles and thoroughly clean the nebulizer.

For more information on these, or any other Glass Expansion product visit our website at www.geicp.com or email enquiries@geicp.com

INSTRUMENT NEWS

FROM PERKIN ELMER

Perkin Elmer has released the Optima™ 4300V, a new version of the best-selling ICP spectrometer that provides high throughput and accurate results on difficult matrices such as oils/organics, precious metals and geochemical samples. The innovative design of the Optima 4300V also significantly reduces maintenance and operating costs. Please visit www.perkinelmer.com for more information.

FROM THERMO ELEMENTAL

The new-generation Intrepid II spectrometers extend and enhance the application-proven performance of the popular Thermo Elemental IRIS series. They combine the speed, accuracy and throughput of a simultaneous ICP with the flexibility of a sequential system, providing a powerful, easy-to-use elemental analysis solution that delivers high productivity and optimum analytical results - no compromises required. The Intrepid series offers options for extended wavelength coverage. And to best match the needs of your particular analysis, systems can be configured for radial, axial or duo (radial and axial) plasma viewing. Please visit www.thermo.com for more information.

FROM VARIAN

The new Varian ICP-MS offers:

- * World's first ICP-MS with tunable gigahertz sensitivity, providing one thousand million counts per second for every part per million
- * Unique ion-mirror that reflects analyte ions through 90 degrees while neutrals and photons pass through the hollow structure
- * Highest signal-to-background ratio available and the lowest detection limits
- * All-digital, extended range detector providing nine orders of linear dynamic range without digital to analog cross calibration
- * Reliable, easy-to-use detector offering linear performance from parts per trillion to hundreds of parts per million

Please visit www.varianinc.com for more information.

HINTS FOR THE OPERATOR

Nebulizer Uptake Rates

Most ICP operators use a peristaltic pump to control the sample flow to the nebulizer, enabling the flow to be changed if required. However, each Glass Expansion nebulizer is designed for a specified sample uptake by natural aspiration and the best precision will always be

obtained at an uptake close to that 'design aspiration level'. Glass Expansion nebulizer part numbers always end with the uptake rate. Thus, for example, an AR30-1-PFA04 OpalMist nebulizer or an AR30-1-FM04 MicroMist nebulizer, which are both designed for an uptake of 0.4mL/min, will give the best stability at an uptake between ~0.3mL/min and ~0.5mL/min.

It is possible to operate a nebulizer at an uptake lower than the design level but you should never try to force the nebulizer to an uptake much above the design level by increasing the pumping rate. Thus while an AR30-1-FC3 Conikal nebulizer can be pumped at 3mL/min, it is impractical to try the same pumped uptake rate with an AR30-1-FM02 MicroMist nebulizer which is designed for an uptake of 0.2mL/min. Forcing a nebulizer to an uptake well above the design level will cause the pump pressure to rise rapidly and may burst the pump tube connections.

The uptake rate of a nebulizer can often be lowered without losing much sensitivity, particularly if a low-volume spray chamber, such as the Cinnabar, is used. Such an uptake reduction can be made by reducing the internal diameter (ID) of the peristaltic pump tube. Reducing the ID by a factor of 2 will reduce the uptake by a factor of 4 if the pump roller speed is unchanged.

Many analysts prefer to use natural aspiration with low-uptake nebulizers such as the MicroMist since this eliminates noise due to pump pulsations. The MicroMist is available with a wide range of natural aspiration rates. If however, there is a need to further reduce the uptake while retaining natural aspiration, this can be achieved by using nebulizer uptake tubing with a smaller ID or a longer length. Glass Expansion can provide EzyFit tubing with various IDs and lengths.

GLASS EXPANSION NEWS

GLASS EXPANSION USA

The USA Headquarters of Glass Expansion Inc. has recently moved to: 4 Barlows Landing Road, Unit #2, Pocasset, MA 02559, USA. President, Jerry Dulude, is well known in the industry after many years with TJA.

GLASS EXPANSION AUSTRALIA

Peter Liddell has joined the Australian office as Sales and Marketing Manager. Peter has previously worked with Varian and GBC.

Yoshi Yamano has taken on the role of Marketing Manager – Asia, after an extensive period with Shimadzu.

WEBSITE

For information on Glass Expansion products please visit www.geicp.com or email us at enquiries@geicp.com