



Performance Evaluation of the MCN-100 Microconcentric Nebulizer with ICP-MS

Problem: •Conventional pneumatic nebulization systems used with ICP-MS have a number of disadvantages. They are inefficient and produce more waste aerosol than analytically useful aerosol. As a result, sample consumption is greater than necessary with high solvent loading to the ICP interface.

Solution: The CETAC MCN-100 microconcentric nebulizer is a high efficiency, pneumatic nebulizer that operates at much lower sample flow rates than conventional nebulizers. The volume of analytically useful aerosol produced by the nebulizer is extremely high and sample usage is maximized.

Advantages:

- Low sample consumption, 10-100 $\mu\text{l}/\text{min}$.
- Excellent tolerance to dissolved solids.
- Inert construction.
- Excellent performance with a wide range of reagents.
- Completely HF and NH_4OH resistant.
- Adapts to any sample introduction system.

Analytes: All analytes analyzed by ICP-MS.

Matrix: Compatible with all matrices.

Performance: The MCN-100 produces a highly efficient aerosol for ICP-MS. It operates at extremely low flow rates, often below 30 $\mu\text{l}/\text{min}$., with no degradation in performance compared with conventional pneumatic nebulization. Aggressive reagents are handled easily, as are higher salt content samples (<0.01% TDS), making it an ideal sampling device for many applications. The MCN-100 consumes sample at the rate of 10-100 $\mu\text{l}/\text{min}$. Figure 1 illustrates the flow/signal relationship for four elements. The MCN-100 will operate at lower flows when required and, in this case, the signal was optimized at 5 $\mu\text{l}/\text{min}$. Nebulization is so efficient that virtually 100% of the sample aerosol is transported to the ICP. Other benefits of the MCN-100 are reduction in doubly charged species ([Table I](#)).

Table I: Oxide and doubly charged performance using the MCN-100

Species	MCN-100	Pneumatic Nebulizer
CeO ⁺ /Ce ⁺	0.28 %	<3.0 %
Ce ²⁺ /Ce ⁺	2.2 %	<3.0 %

MCN-ICP-MS Effect of Sample Flow Rate

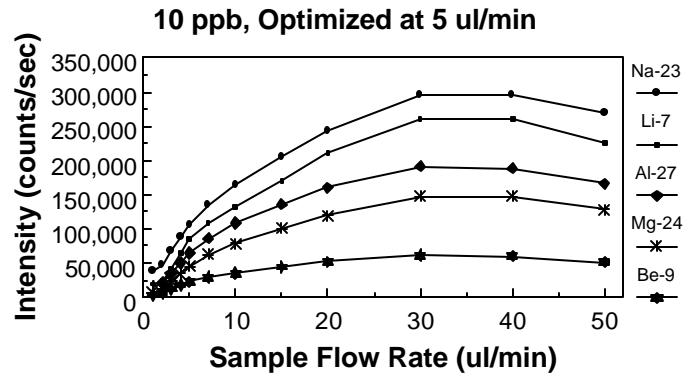


Figure 1: Flow rate/signal response functions for the MCN-100.

The MCN-100 is manufactured with inert materials and is compatible with aggressive matrices such as HF and H₂SO₄. Signal response in such matrices is excellent. Figure II shows acid levels as high as 20% HF. The lack of signal suppression at these high HF concentrations is due in part to the uniformity of the aerosol production.

MCN-ICP-MS

Hydrofluoric Acid Matrix Effects

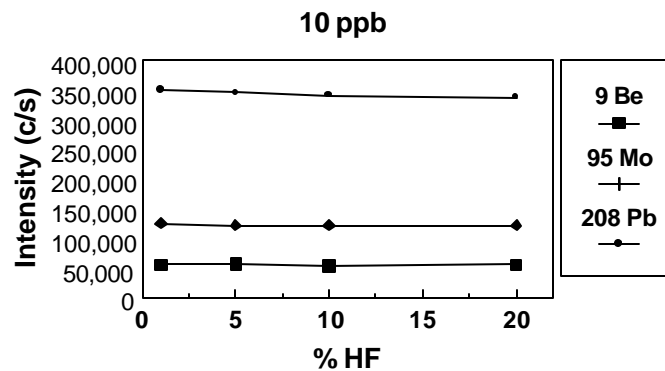


Figure 2: MCN-100, effects of HF on signal response.

When more viscous reagents such as H_2SO_4 are aspirated, the loss in precision is negligible. Internal standardization can easily be employed to correct for transport effects, as illustrated in Figure 3.

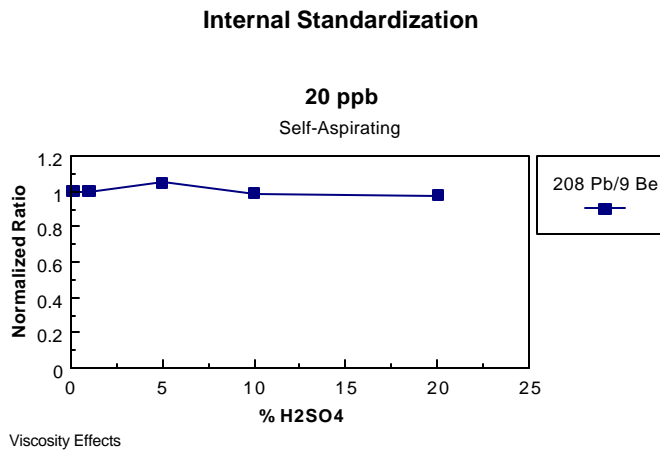


Figure 3: Correction of H_2SO_4 viscosity effects with internal standardization.

The effect of acid concentration on precision is illustrated as Figure 4. The %RSD of Be, Mo and Pb with increasing H_2SO_4 strength is shown.

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Sulfuric Acid Matrix Effects

1 s Integration Time, 10 Replicates

Self-Aspirating 20 ppb

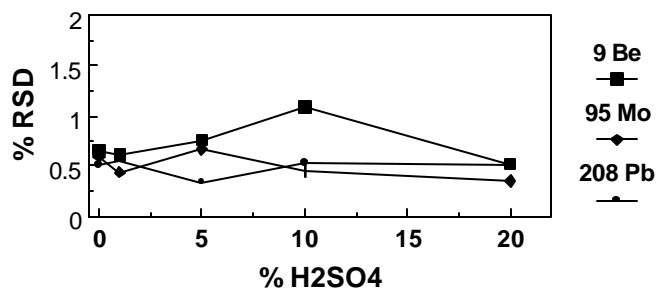


Figure 4: H₂SO₄ %RSD without internal standardization.

One of the most important performance parameters in ICP-MS is signal stability. Achieving good signal stability in a matrix with a high concentration of dissolved solids is particularly difficult. As can be seen in Table II, the stability over a 10-hour period using the MCN-100 is excellent.

Table II: MCN-100 long term (10 hour) stability data and recoveries for sea water matrix.

<u>Element</u>	<u>%RSD Over 10 hrs.</u>	<u>% Recovery @ 50mg/L</u>
Al	4.1	96.5
V	2.9	96.9
Cr	7.6	100.7
Mn	8	82
Co	6.2	77.5
Cu	11	80.2
As	.2	93
Mo	3.1	102.3
Ag	2.1	96.7
Cd	3.9	90.3
Sb	4.1	104.4
Ba	1.9	106.8
Pb	6.7	112.3
Th	6.8	107.2
U	6.5	107.6

When used in the self-aspirating mode, the CETAC MCN-100 has many inherent advantages: no pulsation's, minimal contamination, no chemical compatibility issues with peristaltic pump tubing and decreased memory effects (tubing).

Instrumentation: CETAC MCN-100 Microconcentric Nebulizer and ICP-MS.

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