Ultra High Matrix Introduction (UHMI)

Agilent ICP-MS technology brief

Benefits of Agilent Ultra High Matrix Introduction for aerosol dilution

Integrated

The UHMI system is fully integrated into the standard ICP-MS hardware and software. All Agilent ICP-MS systems include separate control of nebulizer and make-up/dilution gas flows.

Optimized

UHMI uses a proprietary algorithm to control plasma settings and aerosol dilution. A specific gas port connector adds the diluent argon gas flow to the aerosol stream.

Automated

The ratio of the nebulizer and dilution gas can be varied automatically to define the level of aerosol dilution. Dilution factors up to 100x are available.

Plasma preset conditions automate selection of plasma parameters (nebulizer and makeup/dilution gas flow rates, sampling depth, RF power) to give an easily selectable set of calibrated plasma conditions.

Dependable

UHMI settings are stable and reproducible, taking the guesswork out of setting up the ICP-MS to measure high matrix and variable samples.

Simplify high-matrix analysis with UHMI

Conventional ICP-MS can handle samples containing up to about 2000 ppm (0.2%) total dissolved solids (TDS). Above this level, the plasma can't fully decompose the matrix, allowing undissociated matrix to deposit on the interface cones and ion lens. These deposits lead to signal drift and more frequent maintenance. Incomplete matrix decomposition also increases interferences.

Agilent ICP-MS systems have the most robust plasma of any ICP-MS, as shown by the lowest CeO/Ce ratio. But dilution is required for samples that contain percent levels of TDS. Liquid dilution—manual or using an autodilutor—has limitations and adds hardware or labor costs. UHMI offers a better, simpler, more reliable approach, using automated aerosol dilution.

The UHMI* is part of the standard sample introduction hardware on all Agilent ICP-MS instruments. Using the same hardware for both low- and high-matrix samples, UHMI adds a precisely controlled flow of argon gas to dilute the aerosol stream. This dilution gas reduces the aerosol density and fragments the droplets, leading to higher plasma temperature, better matrix decomposition, lower oxides and other interferences, and reduced maintenance.

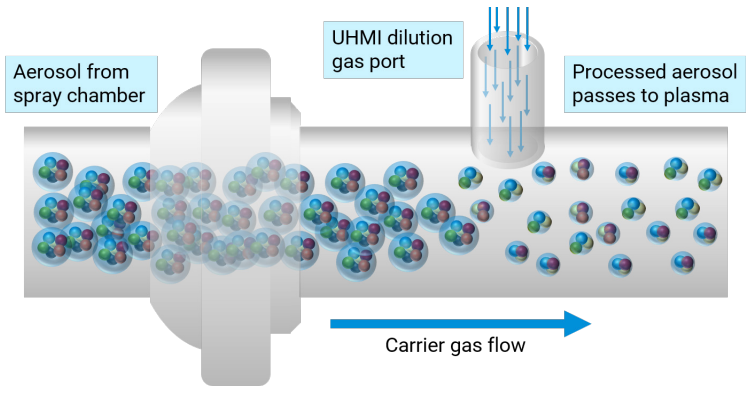

Figure 1. Agilent UHMI connector with aerosol dilution gas port. UHMI dilutes and fragments the droplets, improving drying and decomposition of the aerosol.

*UHMI is an enhanced version of the High Matrix Introduction (HMI) system released in 2007

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UHMI reduces suppression and interferences, improving accuracy

The robust plasma conditions provided by UHMI mean that high sample matrix levels do not overload the plasma. This minimizes signal suppression, giving more consistent recovery in high and variable samples, as shown in Figure 2 for undiluted seawater.

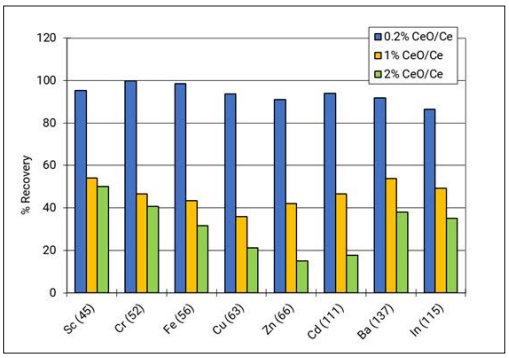

Figure 2. Analyte recovery in undiluted seawater vs aqueous calibration. Agilent UHMI increases plasma robustness (CeO/Ce ratio of ~ 0.2%), virtually eliminating matrix suppression. Reducing suppression simplifies calibration and improves recovery and accuracy in high matrix samples.

The CeO/Ce ratio is used to assess the plasma robustness of an ICP-MS. Lower CeO/Ce with UHMI also indicates more effective decomposition of matrix-based polyatomic interferences. Decreasing the level of polyatomic interferences gives more consistent results in variable samples, as illustrated in Figure 3 for ClO and SOH overlaps on V at *m/z* 51.

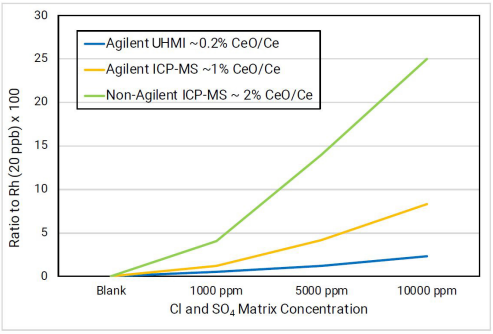

Figure 3. Agilent UHMI dissociates polyatomics more effectively. Common matrix-based interferences are 10x lower with UHMI at 0.2% CeO/Ce compared to typical non-Agilent ICP-MS operating at 2% CeO/Ce.

UHMI benefits compared to conventional liquid dilution

Diluting the aerosol in the gas phase rather than diluting the sample before analysis leads to:

- Higher plasma temperature
- Lower levels of oxides and other interferences
- Less signal suppression
- Less risk of errors or contamination

UHMI is faster than manual sample dilution and much lower cost than an autodilutor.

UHMI simplifies lab operations by reducing the requirement for samples to be individually diluted to control the TDS levels within a narrow range.

UHMI is easy to automate using the Agilent ICP-MS MassHunter preset plasma setting, with its calibrated and automated plasma correction function.

Conclusion

The increased robustness of the plasma with UHMI leads to better matrix decomposition, which allows higher matrix levels to be run without requiring a sample-specific dilution step. Improved matrix decomposition also reduces signal drift and extends the number of samples that can be run before maintenance is required.

UHMI reduces suppression, delivering consistent results in variable samples.

Better decomposition of the matrix also reduces matrix-based polyatomic ions, leading to lower levels of interferences and more accurate results.

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