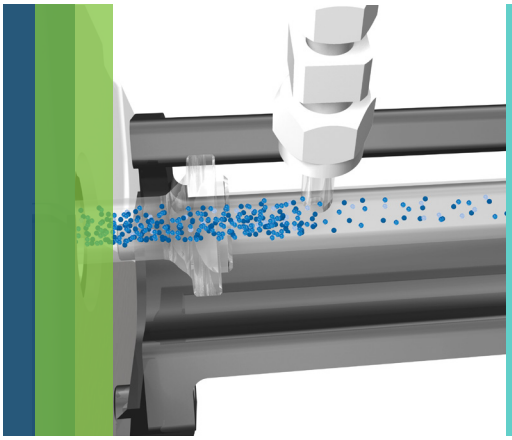

# High Matrix Introduction

## Agilent ICP-MS technology brief

### Benefits of Agilent High Matrix Introduction (HMI) for aerosol dilution

**Integrated**

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

**Optimized**

HMI 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 (up to 100x for Ultra HMI—UHMI).

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**

HMI setting 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 HMI

Traditionally, ICP-MS can handle samples containing up to about 2000 ppm (0.2%) total dissolved solids (TDS). Above this, 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 % levels of TDS. Liquid dilution—manual or using an autodilutor —has limitations and adds hardware or labor costs. The Agilent HMI system offers a better, simpler, and more reliable approach, using automated aerosol dilution.

Using the same hardware for both low- and high-matrix samples, HMI adds a precisely controlled and calibrated flow of argon gas to dilute the aerosol stream. This dilution gas reduces the density of the aerosol and fragments the droplets, leading to higher plasma temperature, better matrix decomposition, lower oxides and other interferences, and less frequent maintenance.

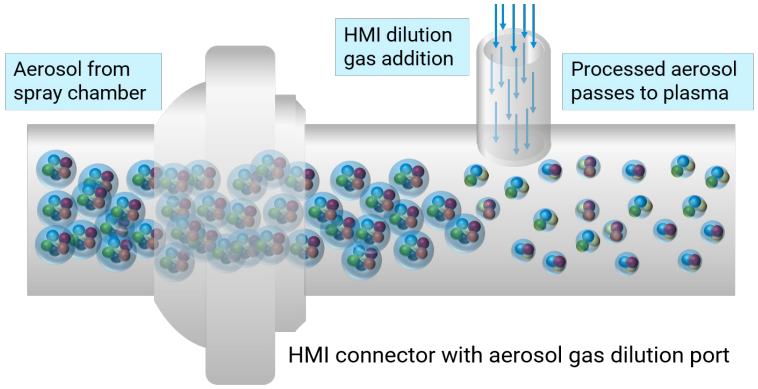


**Figure 1. Agilent HMI connector with aerosol gas dilution port. HMI dilutes and fragments the aerosol droplets, making it easier for the plasma to dry and decompose the aerosol.**

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## HMI reduces suppression and interferences, improving accuracy

The robust plasma conditions provided by HMI 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.

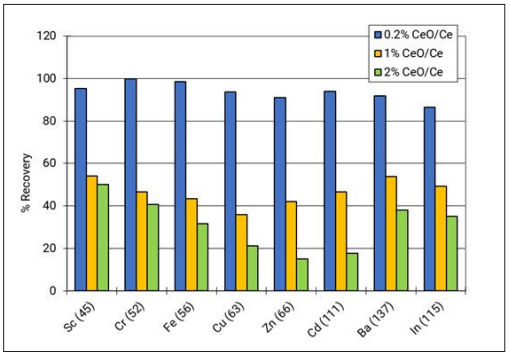


**Figure 2. Analyte recovery in undiluted seawater vs aqueous calibration. Agilent HMI increases plasma robustness (CeO/Ce ratio of ~ 0.2%). This virtually eliminates matrix suppression, improving recovery and accuracy in high matrix samples.**

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

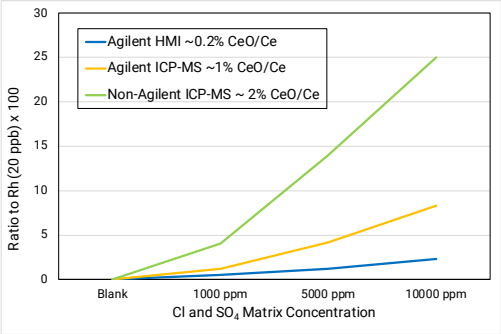


**Figure 3. Agilent HMI dissociates polyatomics more effectively. Common matrix-based interferences are 90% lower with HMI at 0.2% CeO/Ce compared to typical non-Agilent ICP-MS operating at 2% CeO/Ce.**

### HMI benefits compared to conventional liquid dilution

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

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

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

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

HMI is also 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 HMI leads to better matrix decomposition, which allows higher matrix levels to be run without requiring a sample-specific dilution step.

HMI reduces suppression, delivering consistent results in variable samples.

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

## Learn more:

www.agilent.com/chem/icpms

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