Application Brief

Environmental

Agilent

Trusted Answers

Routine Analysis of Soil Samples using ICP-MS

Benefit from sample and operational insights with the Agilent 7850 ICP-MS

The right tools for challenging samples

Laboratories have been using ICP-MS for the trace metal analysis of environmental samples for decades—including for the routine analysis of soils, sediments, and wastes. However, when analyzing samples with a high and variable solids content, the sample preparation and method development can be more time-consuming than with simpler sample matrices. Routine analysis of high matrix samples can also lead to concerns about signal stability and increased instrument maintenance after long analytical runs.

An Agilent 7850 ICP-MS fitted with the Agilent ISIS 3 discrete sampling system and SPS 4 autosampler was used for the analysis of varied soil and sediment digests. Agilent ICP-MS MassHunter (version 5.1 or later) software has a range of features that assist users to optimize sample preparation, avoid unnecessary instrument maintenance, and achieve high-quality data in challenging samples.

Know more about your sample matrix

The ICP-MS MassHunter software IntelliQuant function provides Total Matrix Solids (TMS) data, enabling analysts to quickly assess the matrix level in every sample. The TMS data provides valuable information for method development, or if there are in-run or post-run data queries. It can also be used to inform decisions on routine maintenance. IntelliQuant data can be viewed as a periodic table heat map, which gives a clear visual indication of the concentration ranges of all elements in each sample (*1*). The data can be used to confirm the presence of unexpected elements, helping to reduce the need for sample remeasurement.

Less sample dilution; more time saving

Ultra High Matrix Introduction (UHMI) technology was used to minimize the need for sample dilution before analysis, avoiding a time-consuming manual process that can introduce error. UHMI uses argon to dilute the sample aerosol, reducing the sample matrix reaching the plasma and avoiding the need for liquid dilution. A preset method with a suitable UHMI aerosol dilution level is selected as appropriate for the sample type and expected matrix level.

Robust methods for challenging samples

The 7850 ICP-MS includes the ORS^4 collision/reaction cell for control of polyatomic interferences. Samples with high and variable solids content can be difficult to analyze by ICP-MS due to the formation of variable and unpredictable matrix-based polyatomic interferences. The ORS^4 cell is the optimum configuration for helium (He) collision mode, effectively reducing all common matrix-based polyatomic interferences under one set of standard cell conditions.

In addition to He mode, the M^{2+} correction feature in ICP-MS MassHunter automatically corrects for doubly charged rare earth element interferences that can occur unexpectedly in certain types of soil samples.

Long-term stability

A Continuing Calibration Verification (CCV) sample was measured every after 10 soil and sediment samples. All the CCV recoveries were within 10% (Figure 2), confirming the excellent matrix tolerance of the 7850's robust, low CeO/Ce plasma that minimizes matrix deposition.

The CCV results demonstrate the long-term robustness and high matrix tolerance of the 7850 ICP-MS with UHMI.

Optimize your maintenance schedule

Analyzing complex samples such as soil and sediment digests can be tough on the sample introduction system of an ICP-MS. To maximize analytical performance and minimize unplanned instrument downtime, it can be beneficial to schedule routine maintenance tasks by the number of solutions measured rather than time. The user can configure the early maintenance feedback (EMF) counters, or default counters for specific sample types can be generated automatically (Figure 3). The ISIS 3 discrete sampling system reduces the sample matrix reaching the cones, allowing those counters to be set to longer intervals or a higher number of samples.

As well as the normal pre-run performance check, a post-run check can be scheduled to run after the sample sequence has completed. This performance check gives users a clear indication if they need to perform routine maintenance tasks such as cleaning the cones before the next run, making scheduling maintenance easier.

Sample Name	TMS (ppm)
River Sediment-A	1071.914
River Sediment-B	2600.848
Estuarian Sediment	2283.137
Soil-A	2141.833
Soil-B	2180.814

Figure 1. Screenshot showing total matrix solids data for five soil samples calculated by the TMS function of ICP-MS MassHunter.

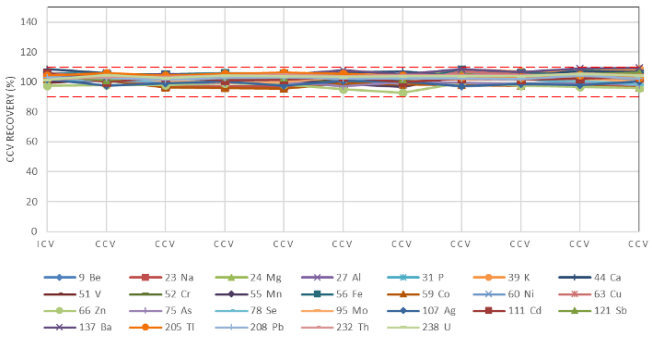

Figure 2. CCV stability over the eight hour sequence. All CCV recoveries were within 10%.

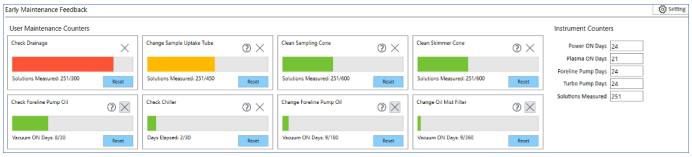

Figure 3. To maintain peak ICP-MS performance, EMF prompts maintenance such as cleaning the interface cones, adjusting or replacing the pump tubing, etc. after a specified number of samples have been analyzed.

Reference

1. Agilent IntelliQuant for ICP-MS, Agilent publication, 5994-2796EN

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