Soil/Sediment

Determination of Mercury in Soil Samples Using Direct Mercury Analysis

Mercury analysis of soil and sediment samples is becoming increasingly important due to mercury's toxicity and the adverse effects it can have on human health. Dumping of contaminated wastes, effluents from manufacturing processes, and combustion of fossil fuels are a few common sources of soil contamination. Remediation of mercury contaminated sites require specific procedures which vary based on the levels of mercury found in the soil and sediment samples from the site.

Summary

Conventionally, to analyze mercury in soils and sediments, the samples need to be digested in acid and are then analyzed using either cold vapor atomic absorption spectroscopy (CVAA) or an ICP system. While these are tried and tested methodologies, the need to digest samples prior to analysis proves to be a very costly and a time and labor-intensive step. Additionally, the user is required to ensure that the digestion unit is properly maintained, safe working protocols are followed, and waste acids are properly disposed. This ultimately hinders the productivity of the lab. Direct mercury analysis eliminates these challenges completely, while providing accurate and reproducible data.

Instrumentation

Direct mercury analysis, as described in U.S. EPA Method 7473, is a cost effective, proven alternative to these labor-intensive, wet chemistry techniques. Direct Mercury Analysis involves an integrated sequence of combustion, catalytic conversion, amalgamation and detection using Atomic Absorption. Direct analysis affords the laboratory many benefits including:

- Reduced Sample Turnaround (6 Minutes)
- No Sample Preparation
- Reduced Hazardous Waste Generation
- Reduction of Analytical Errors
- General Cost Savings (70% vs. CVAA)

The Milestone DMA-80 direct mercury analyzer provides a highly flexible platform with an extremely wide dynamic detection range to analyze soil samples with varying mercury levels. Additional features such as internal temperature monitoring, auto-blanking and preheated cuvettes ensure a complete and safe decomposition of the highly organic and oily samples without any contamination or memory effects. The DMA-80 features a circular, stainless steel, interchangeable 40-position autosampler for virtually limitless throughput and can accommodate both nickel (500 mg) and quartz boats (1500 uL) depending on the requirements of the application. It operates from a single-phase 110/220V, 50/60 Hz power supply and requires regular grade oxygen as a carrier gas.

Calibration

The DMA-80 can be calibrated using aqueous standards or Standard Reference Materials (SRM's). The DMA-80 used for this experiment had a tri-cell spectrophotometer and covered a dynamic range of 0.0015-1200 ng Hg. Calibration was performed using different volumes of 1ppm and 0.1 ppm stock solutions, prepared from an NIST traceable 1000 ppm stock solution (VHG Labs).

Experiment and Results

In this experiment, 5 different soil samples were analyzed 4 times to study the concentration range of mercury in soil.

Direct Mercury Analysis

A standard solution of 0.500 ppm was analyzed before and after the sample analysis. The results and profile are shown in Tables 1 and 2.

Table 1. Analysis of Unknown Soil Samples

Sample	Concentration (ppm)
Standard Pre-check (0.500 ppm)	0.491
A	0.0940+/-0.02
B	0.1228+/-0.02
C	0.1423+/-0.02
D	0.0900+/-0.02
E	0.9620+/-0.02
Standard Post-check (0.500 ppm)	0.495

Conclusion

A lab analyzing mercury in soil samples is required to maintain high throughput while keeping its costs under control. The DMA-80 is an excellent tool as it yields results in ~6 min/sample and proves to be proficient, matrix-independent and cost effective while completely eliminating the sample preparation challenges posed by conventional mercury analysis techniques.

Table 2. Profile

Step	Time (hh:mm:ss)	Temperature (°C)
1	00:00:10	250
2	00:00:30	250
3	00:01:30	650
4	00:01:30	650

Max Start Temperature: 250°C
Catalyst Temperature: 600°C
Purge Time: 60 seconds
Amalgamation Time: 12 seconds at 900°C
Oxygen Flow: 120 mL/m

Learn more or request an onsite demonstration:
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