Hydra-C

Application Note #1051

The Determination of Mercury in Foods using the Hydra-C Mercury Analyzer

Introduction

Did you know that some foods consumed on a daily basis contain mercury? Fish, such as tuna, may contain mercury at levels that are unhealthy for higher-risk groups such as expectant mothers and young children. Other food products less notorious for their mercury content contain mercury at concentrations which may be worthy of evaluation.

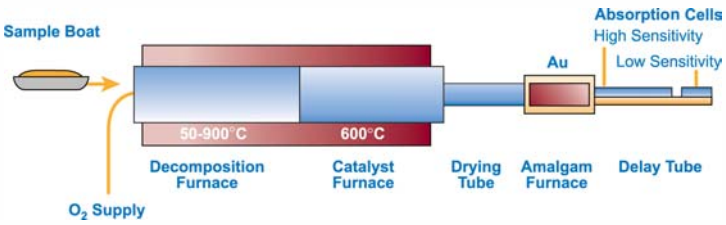
Teledyne Leeman Labs Hydra-C (Direct Mercury Analyzer) provides a fast, simple and convenient approach for the analysis of mercury without any sample pretreatment and without any hazardous chemical wastes. Typical analysis times are about 5 minutes per sample. Hydra-C employs EPA Method 7473 which is approved for both laboratory and field analysis for mercury in solids and solutions using Thermal Decomposition, Amalgamation and Atomic Absorption Spectrophotometry

Instrumentation

The Hydra-C (shown to the right) is fully automated for unattended operation. It comes complete with a 70-position autosampler that has on-the-fly loading capability for virtually unlimited sampler capacity. Hydra-C operates from a single 110/220V supply and oxygen supplied at 15-20 psig. All instrument operating parameters (e.g. furnace temperatures, gas flows, autosampler control) and process stages are computer controlled for ease-of-use. The figure below depicts the analytical process with gas flowing from left to right.

Hydra-C Mercury Analyzer

Principle of Operation



A small amount of sample (typically 0.05 to 1 gram) is weighed and deposited into a sample boat. The weighed sample is then introduced into the Hydra C where oxygen begins to flow over the sample. The decomposition furnace temperature is then increased in two stages; first to dry the sample, then to decompose it. The evolved gases are carried through a heated catalyst to produce free mercury while removing halogens, nitrogen oxides, and sulfur oxides. The remaining combustion products including elemental mercury (Hg^0) are swept through a gold amalgamation trap where elemental Hg is trapped and concentrated. After the amalgamation step, the trap is heated to release the mercury into a carrier gas which transports it into an atomic absorption spectrometer.

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Experimental

Table I shows the instrument parameters employed for the analysis of various food products. For this analysis nickel boats were used for all samples and standards.

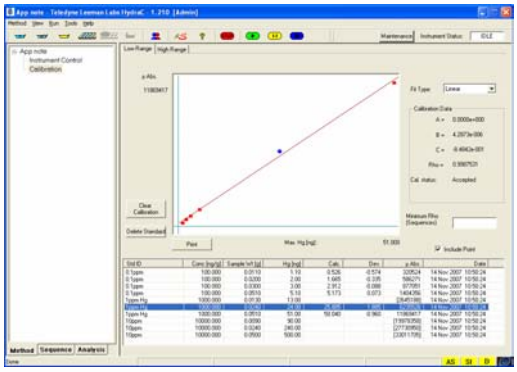
Table I: System Parameters

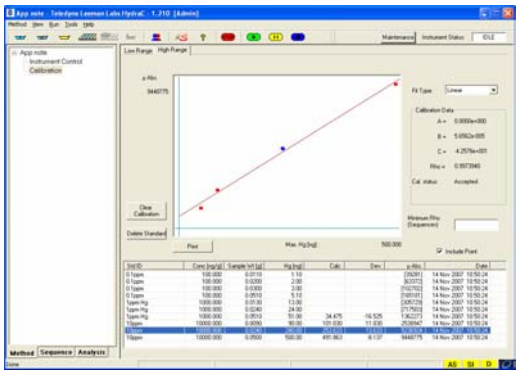
Parameter	Setting
Dry	300°C for 45 sec.
Decomposition	800°C for 150 sec.
Catalyst	600°C
Catalyst Wait Period	60 sec.
Gold Trap	600°C for 30 sec.
Measurement	90 sec.
Oxygen Flow	300 ml/min

Calibration

Calibration was completed using aqueous standards prepared in 10% HNO_3 from Plasma-Pure 100 ppm stock Hg solution. Working standards were blank, 0.1, 1.0 and 10.0 ppm at several different weights (volumes).

Low Concentration Range (0-50ng) **High Concentration Range (50-500ng)**





Results

Several certified reference materials were analyzed for mercury and the results appear below in Table II.

Sample Matrix	CRM Name	Certified Concentration (PPM)	Concentration (PPM)	Recovery (%)
Tuna	BCR463	2.85	3.04	105
Dogfish Muscle	NRCC Dorm2	4.64	4.73	102
Dogfish Liver	NRCC Dolt3	3.37	3.51	104
Spinach Leaves	NIST 1570A	0.030	0.033	109
Apple Leaves	NIST 1515	0.044	0.046	104
Wheat Flour	NIST 8437	0.004	0.0042	105

Conclusion

Results obtained from a variety of food products showed excellent correlation with certified values and were obtained without any sample treatment in about 5 minutes per sample.