HUMAN HEALTH

ENVIRONMENTAL HEALTH

SMS 100 MERCURY ANALYZER

SMS 100

Mercury analysis directly on solid samples from the undisputed leader in Atomic Spectroscopy

PerkinElmer®
For the Better

SMS 100

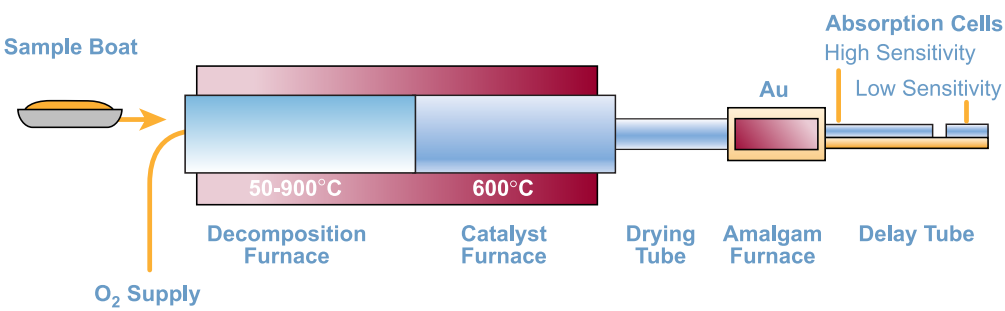
Overview

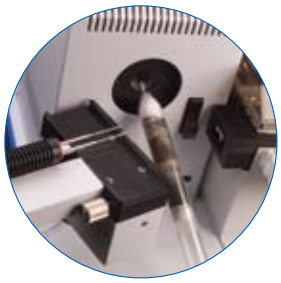
The SMS 100 is a dedicated mercury analyzer for the determination of total mercury in solid and liquid samples using the principle of thermal decomposition, amalgamation and atomic absorption described in U.S. EPA Method 7473.

The SMS 100 uses a decomposition furnace to release mercury vapor instead of the chemical reduction step used in traditional liquid-based analyzers. Both solid and liquid matrices can be loaded onto the instrument's autosampler and analyzed without acid digestion or sample preparation prior to analysis. Because this approach does not require the conversion of mercury to mercuric ions, lengthy sample pretreatment steps are unnecessary. As a result, there is no need for reagents such as highly corrosive acids, strong oxidizing agents or reducing chemicals...which means, NO hazardous waste disposal. The immediate benefit to the user is a reduction in analysis time, resulting in a significantly lower cost of analysis compared to conventional mercury analyzers. Some of the many sample matrices applicable to SMS 100 technology include sludges, sediments, soils, wastewaters, effluents, coal, fly ash, minerals, ores, fertilizers, various foodstuffs, blood, urine and hair.

Principles of Operation

The sample is heated in an oxygen rich furnace, to release all the decomposition products, including mercury. These products are then carried in a stream of oxygen to a catalytic section of the furnace. Any halogens or oxides of nitrogen and sulfur in the sample are trapped on the catalyst. The remaining vapor is then carried to an amalgamation cell that selectively traps mercury. After the system is flushed with oxygen to remove any remaining gases or decomposition products, the amalgamation cell is rapidly heated, releasing mercury vapor. Flowing oxygen carries the mercury vapor through an absorbance cell positioned in the light path of a single wavelength atomic absorption spectrophotometer. Absorbance is measured at the 253.7 nm wavelength as a function of the mercury concentration in the sample. A schematic of the SMS 100 is shown below.





Benefits

No Sample Preparation

The SMS 100 eliminates the need for dissolution techniques, complicated chemistry and hazardous wastes involved with traditional mercury analysis. A solid sample can be analyzed in approximately 5 minutes.

Extremely Low Detection Limits

By using a 25 cm optical path length cell, the SMS 100 is capable of extremely high sensitivity and low background levels, achieving a detection limit of 0.005 nanograms of mercury.

Full Automation for Maximum Productivity

The SMS 100 automatically transfers sample weights from your lab balance. Additionally, its 70-position autosampler allows you to load samples "on-the-fly", so one rack of samples can be analyzed while the next is being loaded.

Easy to Maintain

The modular design of the SMS 100 makes it extremely convenient for cleaning and reassembly. This also means that no additional tools are required to access the catalytic furnace and gold trap for maintenance purposes.

Table 1. Analysis Operating Parameters.

Parameter	Setting
Drying Temp/Time	300 °C for 45 sec
Decomposition Temp/Time	800 °C for 150 sec
Catalyst Temp	600 °C
Catalyst Wait Period	60 sec
Gold Trap Temp	600-700 °C for 30 sec
Measurement Time	90 sec
Oxygen Flow	300 mL/min
Applicable Sample Types	sludges, sediments, soils, wastewaters, effluents, coal, fly ash, minerals, ores, fertilizers, various foodstuffs, blood, urine and hair

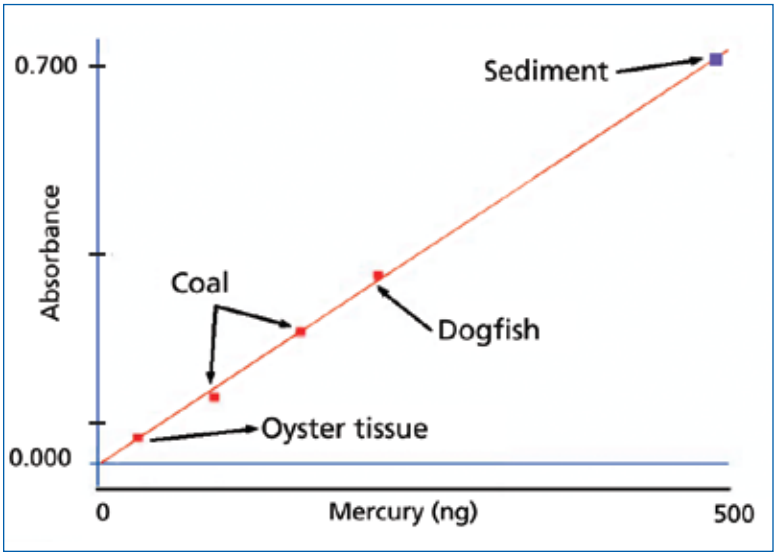


Table 2. Mercury Concentrations and % Recoveries.

Sample Matrix	SRM No.	Certificate (ppm)	Measured (ppm)	Recovery (%)
Bovine Liver	NIST 1577	0.016	0.0178	111.7
Blood	Lypho-1	0.0096	0.0091	94.8
Dogfish	Dorm-2	4.64	4.34	93.5
Oyster	NIST 1566	0.057	0.061	107.0
Soil	NIST 8406	0.06	0.061	101.7
Coal	HC-35150	0.176	0.177	100.6

Typical Applications

This technology has been mainly used to determine mercury in environmental-type samples, such as sediments, sludges and soils using EPA Method 7473, and for the analysis of coals, coal fly ashes and combustion residues using ASTM Method 6722-1. However, as it gets into more and more laboratories, it is finding uses in other diverse application areas, such as foodstuffs, fertilizers, geological minerals and human blood/urine samples. The major reason why it has gained such widespread acceptance, is that irrespective of the sample matrices, one set of operating conditions can be used for the analysis. This is exemplified in Table 1, which shows typical SMS 100 instrument parameters used for the analysis of many different sample types.

This means that under similar operating conditions, different sample matrices generate similar absorbance values as shown by the straight line calibration graph obtained from different concentrations of mercury in widely different samples. In many cases, simple aqueous standards can be used to calibrate the instrument and SRMs used for quality control purposes. Mercury concentration data and % recoveries in some common SRMs, using aqueous standards prepared in 10% nitric acid are shown in Table 2.

The Undisputed Leader in Atomic Spectroscopy…

PerkinElmer is the undisputed leader in Atomic Spectroscopy, with over 40 years experience and a product line that includes flow injection mercury systems (FIMS), flame Atomic Absorption (FAA) instruments, high performance graphite furnace AA (GFAA), high throughput inductively coupled plasma optical emission spectrometers (ICP-OES), and the most powerful ICP mass spectrometer (ICP-MS) on the market. We have placed over 50,000 systems worldwide, including over 5000 mercury analyzers. With the largest technical service and support staff in the industry and a solid reputation for quality products and service, you can be assured your SMS 100 will be in extremely good hands.

Specification Description	Specification Performance
Principle	Atomic Absorption with Thermal Decomposition
Source of Light	Low pressure mercury lamp
Instrument Control	External PC computer system
Mercury Wavelength	253.65 nm
Detectors	UV enhanced photodiodes (2)
Detection Limit	0.005 ng
Working Ranges	Automatic scale change; Dynamic range 0.05 ng – 1000 ng Hg
Precision	<1.5% @ 10 ng Hg
Typical Analysis Time	5 minutes
Sample Treatment	Adjustable from
Drying Time	1-999 s
Decomposition Time	1-999 s
Waiting Time	1-999 s
Calibration	Standard solution or CRM
Number of Standards	Minimum 2 (blank & high), max 100
Sample Type	Liquid or solid
Maximum Injection Volume	1400 µL
Maximum Sample Weight	1500 mg
Preconcentration Capability	10 x maximum
Carrier Gas	Oxygen
Input Pressure	15 Psi (100 kpa)
Peak Flow	~250 mL/min
Energy Consumption	
Peak (W)	600 W
Standby (W)	<100 W
Dimensions (with Autosampler)	
Inches (w x d x h)	19.5″ x 19″ x 18.5″
Centimeters (w x d x h)	(49.5 cm x 48.2 cm x 47.0 cm)
Weight (with Autosampler)	44 lbs (20 kg)
Autosampler	
No. of Samples	70, with unlimited “on-the-fly” loading
Sample type	Solid or Liquid
Power	110/220 VAC, 50/60 Hz
Temperature	16-35 °C
Relative Humidity	Maximum 80% non-condensing

And Other Analytical Disciplines…

PerkinElmer is a world leader in chemical analysis. Our analytical instrument technologies serve fast evolving pharmaceutical, biomedical, chemical, environmental, forensics and semiconductor industries, providing integrated solutions – from sample handling and analysis to management of the information. As one of the best-known brands in analytical research, routine analysis and quality testing, there is a good chance that ours was probably the first analytical instrument you ever used. In addition to our flagship AS systems, we offer a broad range of solutions in Luminescence, UV/Vis, NIR, GC, GC/MS, HPLC, Thermal Analysis, Elemental Analysis, FT-IR and LIMS. There are over 60 years of experience built into every product we make. So, for leading edge R&D and demanding QA/QC, you get the speed, accuracy and reliability you demand – with the productivity you need.

With Unmatched Support…

Our service and support people are located in 125 countries throughout the world and are factory trained. Compliance doesn't get any easier than with our software, including 21 CFR Part 11 technical compliance on the majority of our products. Our application and product specialists are some of the most well-respected scientists in their fields and our service engineers are known for their technical expertise and dedication. When this is combined with our legendary fast and efficient ordering system for spare parts and accessories, you not only get a support network that is second to none in the industry, but you can also be assured that consumables are always available to keep your SMS 100 in peak working condition whenever you need it.

SMS 100 Consumables and Replacement Parts

Atomic Absorption optical assembly

Amalgamator Tube

Sample Boat Rack

Catalyst Tube

PerkinElmer SMS 100 Spares and Accessories

Part No.	Description
N9309017	Nickel Boats pkg. 42
N9309032	Quartz Combustion Boats Pkg. 10
N9309036	Catalyst Tube (packed)
N9309007	Amalgamator Tube
N9309010	Mercury Lamp
N9309011	Hg Vapor Trap Kit with Carbon Material
N9309035	Replacement Carbon 500 g
N9309024	UV Windows
N9309091	On-line balance

SMS 100 Basic Spares Kit – Part No. N9309037
Kit includes one amalgamator tube (N9309007), two catalyst tubes (N9309036), one Mercury source lamp (N9309010), one Nafion Dryer (N9309021) and one O-ring kit (N9309029).

SMS 100 Extended Spare Parts Kit – Part No. N9309038
Includes two amalgamator tubes (N9309007), one sample gas tubing assembly (N9309008), one Mercury source lamp (N9309010), one injector fork assembly (N9309012), one CVAAS tubing kit (N9309013), amalgamator heater coil (N9309066), one tube 6g Krytox grease (306-00090), one Nafion dryer tubing (N9309021), six quartz windows (N9309024), two O-ring kits (N9309029), eight window end caps (N9309031), two 5-in-1 optical cells (N9309033), one in optical cell (N9309034), and four catalyst tubes (N9309036).

PerkinElmer, Inc.
940 Winter Street
Waltham, MA 02451 USA
P: (800) 762-4000 or
(+1) 203-925-4602
www.perkinelmer.com

PerkinElmer®

For a complete listing of our global offices, visit www.perkinelmer.com/ContactUs

008560B_01