



DMA-80 Direct Mercury Analyzer

5-Minute Mercury Analysis Without Sample Preparation



MILESTONE
HELPING
CHEMISTS

THE MILESTONE DMA-80





BENEFITS

NO SAMPLE PREPARATION

The DMA-80 enables the operator to do direct determination of total mercury without the need for acid digestion or other wet chemistry sample treatment prior to the analysis; this means no hazardous chemicals to purchase, handle and dispose.

HIGH PRODUCTIVITY

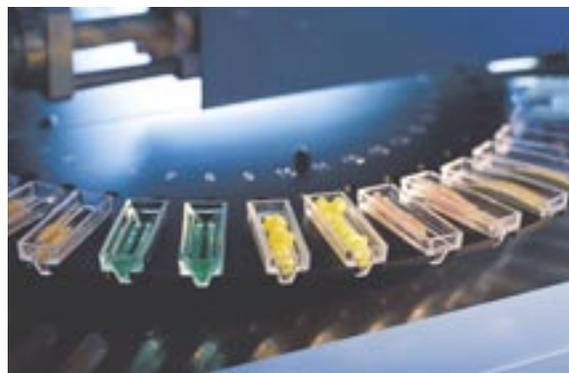
Typical analysis time is 5 minutes. A dual-tray autosampler allows for unattended analysis of multiple samples.

EXTREMELY LOW DETECTION LIMIT

Milestone's Tri-Cell DMA-80 combines an innovative mercury measuring system with a unique optical path spectrophotometer, achieving a detection limit of 0,0015 ng of mercury.

MATRIX-INDEPENDENT RESULTS

The DMA-80 is matrix-independent and can analyze both solid and aqueous samples with equal efficiency. A single method can be used to process organic and inorganic samples.



EASE OF USE

All you need to do is weigh your sample, load it onto the built-in auto-sampler and press 'start'. The DMA-80 is so simple to use that it can also be operated in the field, not only in the analytical laboratory.

LOW RUNNING COST

The DMA-80 has been shown to save laboratories more than 70% in costs when compared to traditional mercury analysis techniques like CV-AAS.

US EPA AND ASTM METHODS ALREADY AVAILABLE

The DMA-80 is fully compliant with US EPA method 7473 (Mercury in solids and solutions by thermal decomposition, amalgamation, and atomic absorption spectrophotometry) and with ASTM method D-6722-01 (Standard test method for total mercury in coal and coal combustion residues by direct combustion analysis).

EASY MAINTENANCE

All the DMA-80's components, such as the catalytic furnace, amalgamator and spectrophotometer, are easily accessible for routine maintenance and cleaning.

LARGE INSTALLED BASE

With hundreds of DMA-80's installed globally, Milestone is the acknowledged market leader in direct mercury analysis. Our extensive experience enables us to provide the highest level of applications and support.

PRINCIPLES OF OPERATION

Milestone's DMA-80 is a direct mercury analyzer which uses the principle of thermal decomposition, amalgamation and atomic absorption.

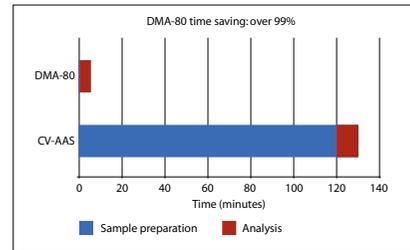
The DMA-80 can analyze both solid and liquid matrices with equal precision. Analysis takes only 5 minutes per sample and does not require any sample preparation.

All mercury is released from the sample through thermal decomposition. This eliminates the need for any sample preparation and, subsequently, purchasing, handling and disposing of hazardous chemicals. Because no sample preparation is required, the typical bottleneck in the analytical laboratory is eliminated.

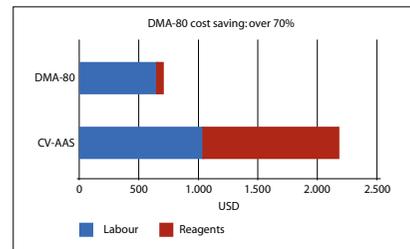
Therefore, analysis is reduced to only 5 minutes per sample, and at a fraction of the cost typically associated with traditional mercury techniques, such as CV-AAS, ICP-AES or ICP-MS.

Typical applications that the DMA-80 is used for include environmental, geochemical, petrochemical, food and feed, clinical and polymer samples.

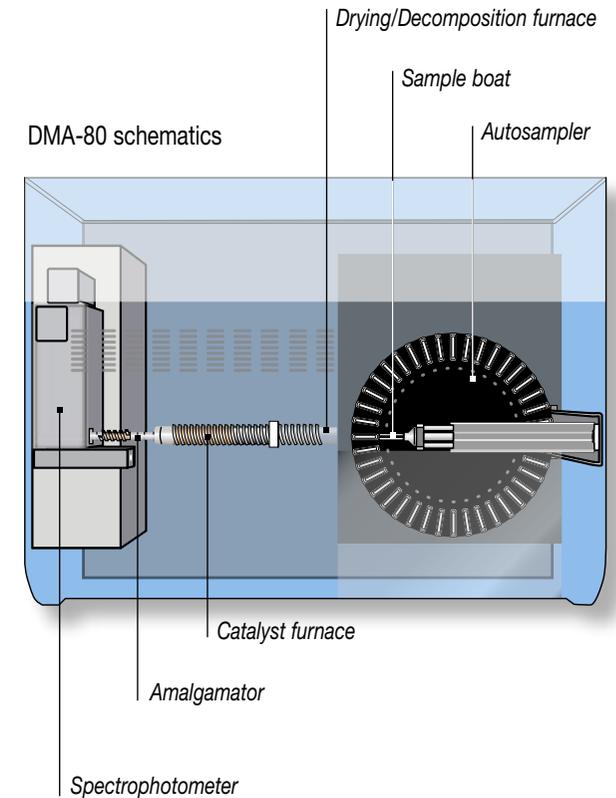
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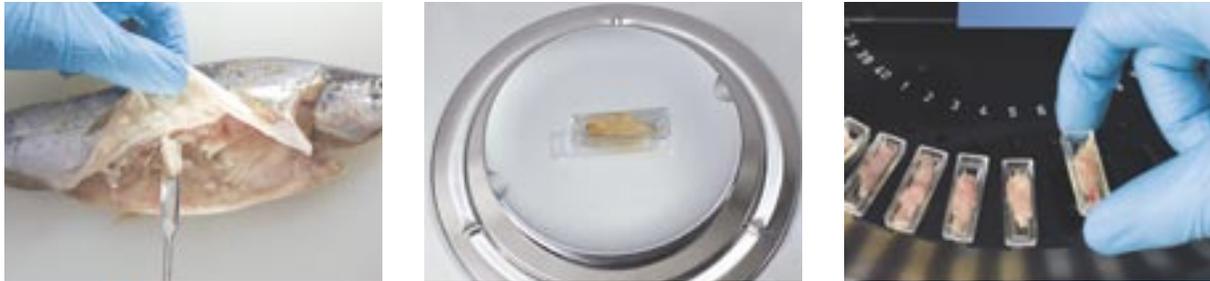
Typical analysis time. DMA-80 vs. CV-AAS



Typical analysis cost, based on US EPA 7473 (DMA-80) and US EPA 7471b (CV-AAS).
Calculation made for a batch of 250 unknown samples



HOW IT WORKS



Analyzing samples with the DMA-80 can't be easier.

A solid or liquid sample is weighed into a quartz or metal boat, and the sample weight is transferred from the analytical balance to the DMA-80.

Sample boats are loaded onto the instrument auto-sampler.

Samples are first dried and then thermally decomposed in an oxygen-rich furnace.

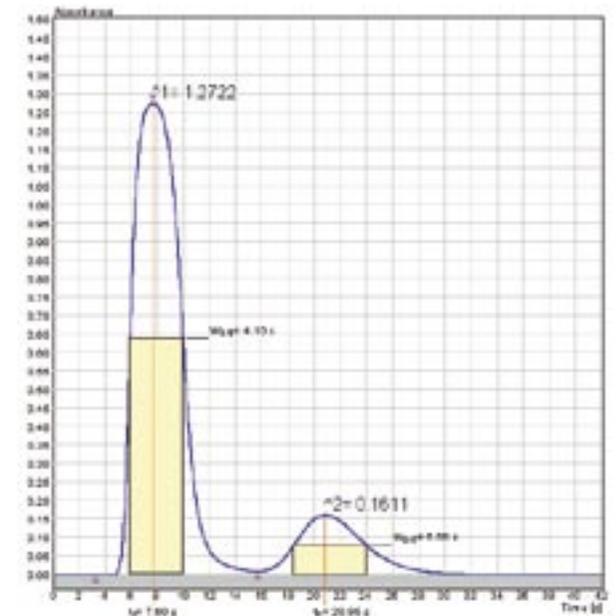
Mercury and other combustion products are released from the sample and they are carried to the catalyst section of the furnace, where nitrogen and sulfur oxides, as well as halogens and other interfering compounds, are eliminated.

Mercury is selectively trapped, in a separate furnace, through gold amalgamation.

Combustion by-products are flushed off.

The amalgamation furnace is heated and mercury is rapidly released.

Mercury is flown via the carrier gas into a unique block with a dual-cell or tri-cell arrangement, positioned along the optical path of the spectrophotometer, where it is quantitatively measured by atomic absorption at 253,65 nm.



Typical DMA-80 (with dual cell arrangement) absorbance profile. The 1st peak is related to the longer cell (more sensitive) while the 2nd peak corresponds to the shorter cell.



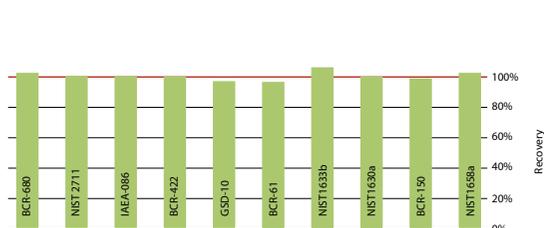
DMA-80 ANALYTICAL PERFORMANCE

ACCURACY

The DMA-80 produces accurate results over a wide dynamic range, on a variety of different matrices. The results below indicate analyses on certified reference materials with mercury concentrations ranging from 5 µg/kg to over 25 mg/kg.

Sample	Certified (µg/kg)	DMA-80 (µg/kg)
BCR-680 Polyethylene	24,3-26,3 mg/kg	25,8 ± 0,5 mg/kg
NIST 2711 Soil	6.250 ± 190	6.240 ± 70
IAEA-086 Human Hair	534-612	574 ± 12
BCR-422 Cod Muscle	543-575	558 ± 8
GSD-10 Stream Sediment	280 ± 40	270 ± 15
BCR-61 Aquatic Plant	210-250	221 ± 3
NIST 1633b Fly Ash	141 ± 19	149 ± 2
NIST 1630a Coal	93,8 ± 3,7	93,4 ± 2,4
BCR-150 Skim Milk Powder	7,7-11,1	9,2 ± 0,2
NIST 1568a Rice Flour	5,8 ± 0,5	5,9 ± 0,2

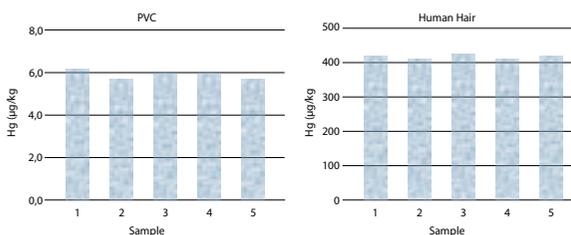
DMA-80 recovery on certified reference samples.



PRECISION

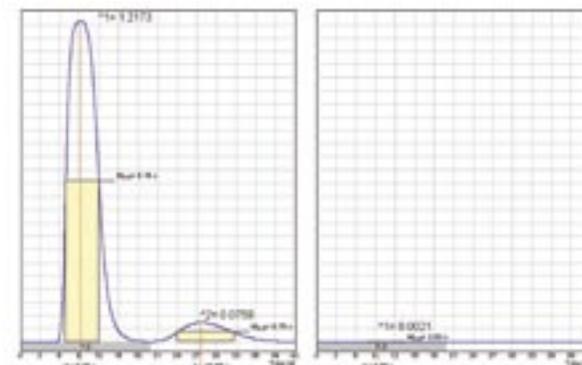
The DMA-80 provides reproducible results over a broad range of matrices, including polymers and biological samples, and over a wide concentration range.

Sample	PVC	Canned Tuna Fish	Human Hair
Run	Hg content (µg/kg)		
1	6,2	237,1	420
2	5,7	228,5	410
3	6,0	229,9	422
4	6,0	236,7	409
5	5,7	241,1	417
n	5	5	5
Average	5,9	234,7	416
sd	0,2	5,3	5,9
RSD	3,6%	2,2%	1,4%



MEMORY EFFECT

The DMA-80 does not suffer from memory effect; furthermore the instrument's operating software features the exclusive AUTOBLANK function, through which the operator presets a satisfactory blank level.

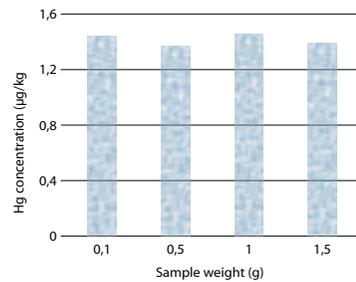


If that level is exceeded, the instrument will automatically run blank cycles until the preset blank level is obtained. This is a very important feature particularly when analyzing series of unknown samples. The graphic above (left) illustrates the absorbance peak for a 1 ppm mercury solution and (right) the subsequent profile of blank run.



SAMPLE WEIGHT

The DMA-80 can accommodate samples sizes of up to 1.5 grams. This is particularly important for the analysis of heterogeneous materials and for samples with a very low mercury content.

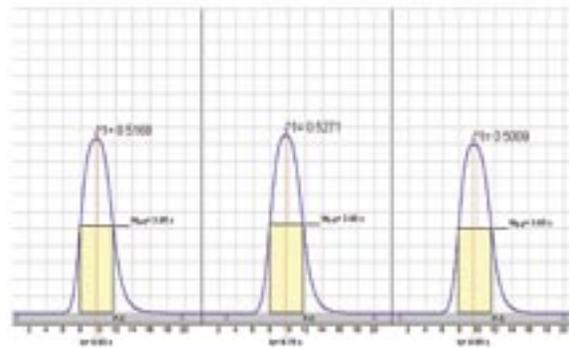


Analysis of NIST 2709 Soil.

The graphic above illustrates the results obtained analyzing NIST 2709 (San Joaquin Soil), a certified reference material with known mercury content of 1.32-1.48 mg/kg. All results obtained on the DMA-80 are within the certified range.

SAMPLE MATRIX

The DMA-80 produces quality results regardless of the sample matrix. The instrument can be calibrated using aqueous standards and then be used in the analysis of organic and inorganic solid samples. In most cases, one method can be used to analyze a variety of different matrices making the DMA-80 extremely easy to use.



A 10 ng aqueous mercury standard, NIST 2709 Soil and NIST 1632c, generate similar absorbance peaks.

DIFFICULT SAMPLES

Due to their high reactivity, the analysis of samples such as naphtha, lubricant oil and crude oil can be problematic.

The DMA-80's software allows the operator to create an appropriate temperature profile to ensure smooth sample analysis.



Typical drying/decomposition temperature profile for Naphtha samples.

VIRGIN NAPHTHA							
Replicate	1	2	3	n	Average	sd	RSD
Hg content (µg/kg)	5,4	5,1	5,2	3	5,2	0,15	2,9%

DMA-80 FEATURES

SYSTEM CONTROLLER



Terminal 1640.

The DMA-80 can be operated through a dedicated, proprietary touch screen terminal or by using a standard PC. The EasyCONTROL operating software controls all the system functions, and provides valuable feedback on the instrument's performances. The software is compatible with various Laboratory Information Management Systems (LIMS) and is fully compliant with FDA regulations 21 CFR Part 11.

QUARTZ SAMPLE BOATS



Quartz sample boats.

Large volume quartz samples boats (1500 μ L) are available for the DMA-80. They offer several benefits including: lower memory effect, better reproducibility, larger sample size and longer lifetime.

EASY MAINTENANCE



User friendly maintenance and cleaning

The DMA-80 has been designed and engineered to make routine maintenance and cleaning as easy as possible. Components like the catalyst and amalgamator have an extended lifetime and sample boats can be used for up to thousands of analyses. This, in combination with the fact that the DMA-80 only requires a carrier gas, results in low operating costs when compared to other mercury analysis techniques.



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