

RA-915M

Zeeman mercury analyzer



Direct mercury determination in crude oil and oil products

ASTM D6722
SN/T 4429.2



INTRODUCTION

The mercury concentration in naphtha and light petroleum products (condensate, gasoline and diesel fuel) should be determined, since the commercial price of the product depends on it. The mercury content in crude oil and petroleum products varies in a wide range of less than 0.1 ppb to dozens ppm. Direct mercury determination in crude oil and petroleum products at levels above 5 ppb can be carried out according to **ASTM D7622** and **SN/T 4429.2**. The complex organic matrix impedes conventional quantitative analysis for mercury.

MEASUREMENT METHOD

This method for mercury determination in coal is based on the atomization of mercury contained in the sample in **PYRO-915+** attachment and subsequent mercury determination by differential atomic absorption spectroscopy in **RA-915M** mercury analyzer. Interference from the remaining impurity compounds is eliminated due to the high selectivity of **RA-915M** analyzer with Zeeman background correction.

PRINCIPLE OF OPERATION

The principle of the method is based on the reduction of Hg (II) to the atomic state due to the thermal decomposition of the mercury compounds and the follow-up transporting of mercury atoms into the analytical cell of the analyzer by the air flow. The mercury concentration is then determined from the absorption of the 254-nm resonance radiation by mercury atoms measured by the RA-915M mercury analyzer combined with PYRO-915+ thermal decomposition attachment using differential atomic absorption spectroscopy with Zeeman correction for background absorption.

A sample is placed into the sample boat and is inserted into the first chamber of the atomizer, where the sample is heated at a temperature of 200–800°C depending on the selected operation mode of the PYRO-915+ attachment. The mercury compounds are evaporated and partially dissociated, forming elemental mercury. All the gaseous products formed are transported into the second chamber of the atomizer by a carrier gas (Hg-free ambient air). Mercury compounds are totally dissociated and the organic matrix of the sample is burnt out. Downstream from the atomizer the gas flow enters the analytical cell heated up to 700°C, and the mercury atoms are detected by the RA-915M analyzer.

This approach does not involve preconcentration on a gold trap and “cooling step”, thereby eliminating ensuing problems. The use of ZAAS combined with a “dry” converter provides the highest sensitivity with no interferences from the sample matrix. The ambient air is used as a carrier gas, so that no cylinders with oxygen, argon, or other compressed gases are required.

ANALYTICAL CHARACTERISTICS

Sample composition	crude oil, condensate, naphtha, gasoline, diesel fuel, lubricants, etc.	
Sample mass	20–150 mg	
Measurement range	ASTM D7622	from 5 to 350 ppb
	Lumex Instruments method	from 5.0 to 10000 ppb
Measurement time	1–5 min	

ANALYSIS FEATURES

- Rapid analysis (1–5 min).
- Direct mercury determination without preliminary accumulation on a gold trap.
- No sample pre-treatment, no gold traps nor compressed gases: very low operating costs.
- Wide dynamic measurement range, no «memory effect».
- The certified SRM of any composition can be used for calibration and QA/QC.
- Control of the non-selective absorption during the measurement excludes analysis errors.
- No need for cylinders with compressed oxygen or other carrier gases.
- Low running cost.

EQUIPMENT AND REAGENTS

The following equipment and materials are used for analysis:

- RA-915M mercury analyzer combined with PYRO-915+ attachment;
- PC with Windows® OS and RAPID software;
- Any solid or liquid certified SRM of mercury;
- Lumex Instruments kit, order No 0300003044.

EXAMPLES OF ANALYSIS

Direct measurements of the mercury concentration in crude oil and naphtha.

Samples	C _{Hg} , ppb	C _{Hg} (av.), ppb	RSD, %	Samples	C _{Hg} , ppb	C _{Hg} (av.), ppb	RSD, %
Crude 01	760 769 752	760	0.9	Crude 06	56.9 54.8 53.9	55.2	2.3
Crude 02	19.2 16.4 17.3	17.6	6.6	Crude 07	20.4 21.8 19.9	20.7	3.9
Crude 03	8.5 7.8 7.0	7.8	7.8	Crude 08	82.3 85.0 83.9	83.7	1.3
Crude 04	74.9 68.6 65.9	69.8	5.4	Crude 09	159.5 161.9 163.2	161.5	0.9
Crude 05	1.5 1.7 1.2	1.5	14	Naphtha 115-135	21.1 21.5 22.3	21.6	2.3

Direct mercury determination in sample Crude 01.

