LUMEX INSTRUMENTS

Analytical Equipment

ZEEMAN MERCURY ANALYZER **RA-915M**

# DIRECT MERCURY DETERMINATION IN CRUDE OIL AND OIL PRODUCTS

**ASTM D7622-10(2015)**
**SN/T 4429.2-2016**

## INTRODUCTION

The mercury concentration in crude oil and petroleum products can vary in a wide range of less than 0.1 ppb to dozens ppm. Direct mercury determination in crude oil and petroleum products at the range above 5 ppb is covered by **ASTM D7622-10(2015) "Standard test method for total mercury in crude oil using combustion and direct cold vapor atomic absorption method with Zeeman background correction"**and **SN/T 4429.2-2016 "Determination of total mercury in crude oil – Zeeman correction – Cold atomic absorption spectrometry".** The complex organic matrix impedes conventional quantitative analysis for mercury.

## MEASUREMENT METHOD

The Lumex Instruments method specifies a practical guidance for the standard method implementation for crude oil and petroleum products analysis using Lumex Instruments mercury analyzers.
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** or **RA-915+ mercury analyzer** combined with **PYRO-915+ attachment** or by **RA-915F mercury analyzer** using differential atomic absorption spectroscopy with Zeeman correction for background absorption.

## ANALYTICAL CHARACTERISTICS

| | | |
|---|---|---|
| **Sample composition** | | crude oil, condensate, naphtha, gasoline, diesel fuel, lubricants, etc. |
| **Sample mass** | | 20–150 mg |
| **Measurement range** | ***ASTM D7622-10 (2015)*** | from 5 to 350 ppb |
| | ***Lumex Instruments method*** | from 5.0 to 10000 ppb |
| **Measurement time** | | 1–5 min |

## ANALYSIS FEATURES

- Direct rapid analysis (1–5 min).
- Wide dynamic measurement range, no "memory effect".
- The 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 gas.
- Low running cost.

## EQUIPMENT AND REAGENTS

The following equipment and materials are used for analysis:

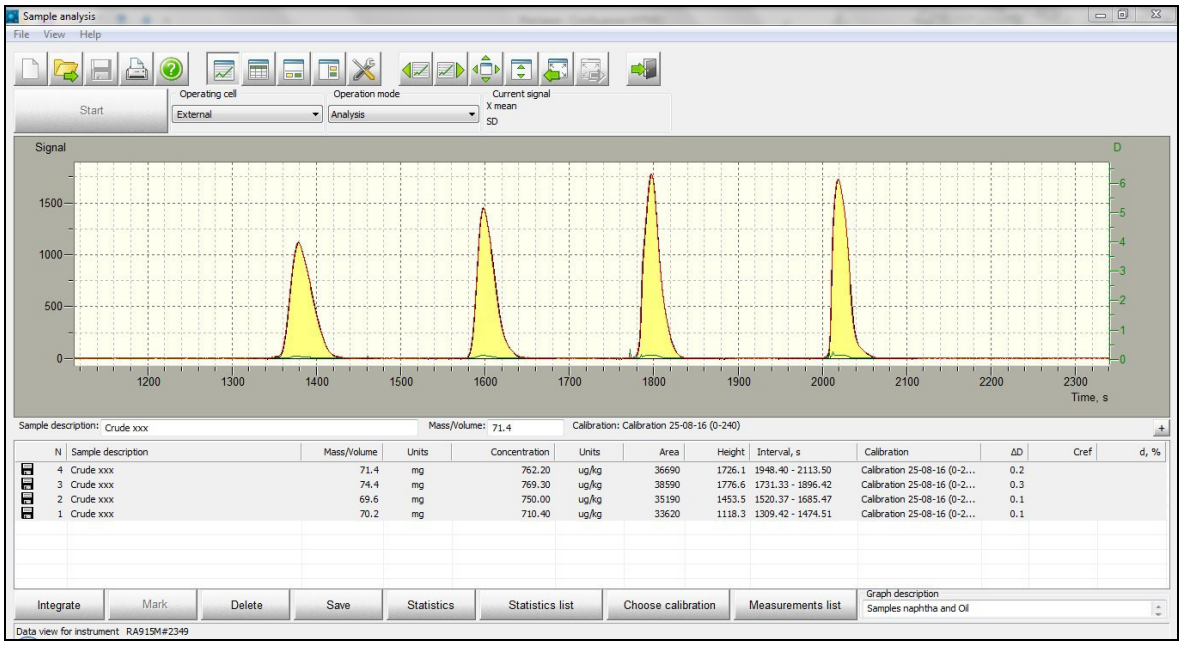
- Mercury analyzer RA-915M or RA-915+ combined with PYRO-915+ attachment or RA-915F mercury analyzer;
- PC with Windows® XP/Vista/7/8/10 and RAPID software;
- Lumex Instruments kit, order **No 0300003044**.

## EXAMPLES OF ANALYSIS
### Direct measurements of the mercury concentration in crude oil and naphtha

| Samples | $C_{Hg}$, ppb | $C_{Hg}$(av.), ppb | RSD, % |
|---|---|---|---|
| Crude 01 | 760<br>769<br>752 | 760 | 0.9 |
| Crude 02 | 19.2<br>16.4<br>17.3 | 17.6 | 6.6 |
| Crude 03 | 8.5<br>7.8<br>7.0 | 7.8 | 7.8 |
| Crude 04 | 74.9<br>68.6<br>65.9 | 69.8 | 5.4 |
| Crude 05 | 1.5<br>1.7<br>1.2 | 1.5 | 14 |

| Samples | $C_{Hg}$, ppb | $C_{Hg}$(av.), ppb | RSD, % |
|---|---|---|---|
| Crude 06 | 56.9<br>54.8<br>53.9 | 55.2 | 2.3 |
| Crude 07 | 20.4<br>21.8<br>19.9 | 20.7 | 3.9 |
| Crude 08 | 82.3<br>85.0<br>83.9 | 83.7 | 1.3 |
| Crude 09 | 159.5<br>161.9<br>163.2 | 161.5 | 0.9 |
| Naphtha 115-135 | 21.1<br>21.5<br>22.3 | 21.6 | 2.3 |

### Direct mercury determination in sample Crude 01




| N | Sample description | Mass/Volume | Units | Concentration | Units | Area | Height | Interval, s | Calibration | ΔD | Cref | d, % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | Crude xxx | 71.4 | mg | 762.20 | ug/kg | 36690 | 1726.1 | 1948.40 - 2113.50 | Calibration 25-08-16 (0-2... | 0.2 | | |
| 3 | Crude xxx | 74.4 | mg | 769.30 | ug/kg | 38590 | 1776.6 | 1731.33 - 1896.42 | Calibration 25-08-16 (0-2... | 0.3 | | |
| 2 | Crude xxx | 69.6 | mg | 750.00 | ug/kg | 35190 | 1453.5 | 1520.37 - 1685.47 | Calibration 25-08-16 (0-2... | 0.1 | | |
| 1 | Crude xxx | 70.2 | mg | 710.40 | ug/kg | 33620 | 1118.3 | 1309.42 - 1474.51 | Calibration 25-08-16 (0-2... | 0.1 | | |