

DIRECT MERCURY DETERMINATION IN NAPHTHA

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"**. Mercury determination in naphtha and light petroleum products (condensate, gasoline and diesel fuel) at a level below 5 ppb is a vital problem for the oil refining and petrochemical industry. The complex organic matrix impedes conventional quantitative analysis for mercury.

MEASUREMENT METHOD

The ASTM D7622-10(2015) method implementation for naphtha analysis using Lumex Instruments mercury analyzers can be carried out for direct analysis of the condensate, naphtha and other products of oil distillation, including gasoline and diesel fuel. For the low mercury content (<5 ppb) preconcentration by the solid-phase extraction on the aluminium oxide should be used.

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** 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

	Direct analysis	Analysis with preconcentration
Sample volume	20–200 µl	1–5 ml
Detection limit	5 ppb	0.1 ppb
Upper limit of the measurement range	1000 ppb	20 ppb
Measurement time	1–2 min	5–6 min

ANALYSIS FEATURES

- Direct rapid analysis (1–5 min).
- No sample preparation is necessary in the case of mercury concentration above 5 ppb. Preconcentration from a 1–5 ml sample is required for mercury determination at a sub-ppb level.
- 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:

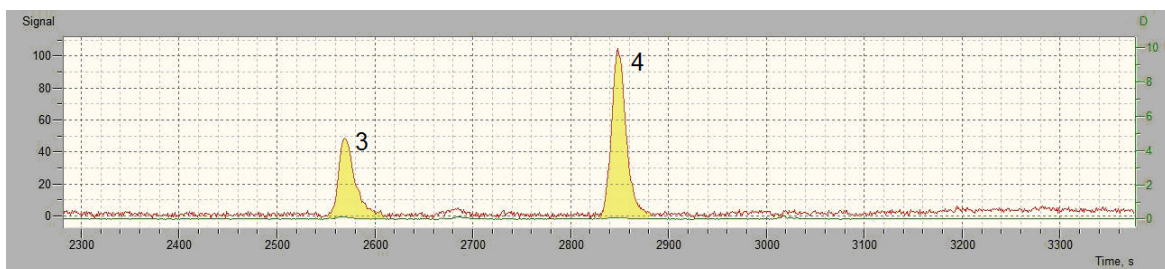
- Mercury analyzer RA-915M or RA-915+ combined with PYRO-915+ attachment or RA-915F mercury analyzer;
- PC with Windows® XP/Vista/7/8 and RAPID software;
- Lumex Instruments kit, order **No 0300002285 (with vacuum manifold)**;
- Lumex Instruments kit, order **No 0300002328 (without vacuum manifold)**.



EXAMPLES OF ANALYSIS

Measuring mercury concentration in naphtha using the preconcentration step

No	Sample weight, mg	C, ppb	No	Sample weight, mg	C, ppb
1	2537	0.70	6	1855	0.79
2	2679	0.77	7	2137	0.78
3	1447	0.72	8	3106	0.72
4	3034	0.70	9	1743	0.68
5	3906	0.74	10	3717	0.70
Cav, ppb			0.730		
SD			0.037		
RSD, %			5.1		



3 – sample weight 1.45 g; (measured value is 0.72 ppb)

4 – sample weight 3.03 g; (measured value is 0.70 ppb)

Analysis of the spiked naphtha using Lumex Instruments vs. UOP938-10

Spike, ppb	Found, ppb		Δ (UOP – Lumex Instruments), %	Recovery of the spike (UOP), ppb (%)	Recovery of the spike (Lumex Instruments), ppb (%)
	UOP	Lumex Instruments			
0.0	0.497	0.450	+9.4	–	–
0.1	0.561	0.530	+5.5	0.064 (64)	0.080 (80)
0.3	0.705	0.705	0.0	0.208 (69)	0.255 (85)
0.5	0.964	0.925	+4.0	0.467 (93)	0.475 (95)
1.0	1.53	1.46	+4.6	1.03 (103)	1.01 (101)

The contents of this paper are subject to change without notice.

To get more specific information, please contact the representative at sales@lumexinstruments.com