RA-915 Series

Zeeman mercury analyzer

Direct mercury determination in naphtha

INTRODUCTION

The presence of mercury in refinery hydrocarbon streams results in detrimental effects, including catalyst poisoning, corrosion, failures in cryogenic equipment, health and safety issues. The Hg content varies in a wide range of less than 0.1 ppb to dozens ppm.

Direct mercury determination in crude oil and petroleum products according to ASTM D7622 method can be carried out at the range above 5 ppb. Lumex Instruments proposes the solution for mercury determination in light petroleum products from 0,1 ppb level.

MEASUREMENT METHOD

The ASTM D7622 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 implemented. The special vacuum manifold is used in this case.

The RA-915 series mercury analyzers use thermal decomposition method that provides direct determination of mercury concentration and allows to omit elaborate and time-consuming procedures of the sample preparation. The sample is heated in the thermal decomposition chamber. The mercury compounds are evaporated and dissociated forming elemental mercury. All the gaseous products are transported into the heated analytical cell by Hg-free ambient air, and the mercury atoms are detected by differential atomic absorption spectroscopy. This method does not involve intermediate preconcentration of mercury on a gold trap, thereby eliminating ensuing problems. Zeeman background correction provides the highest selectivity without interference from the sample matrix.

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

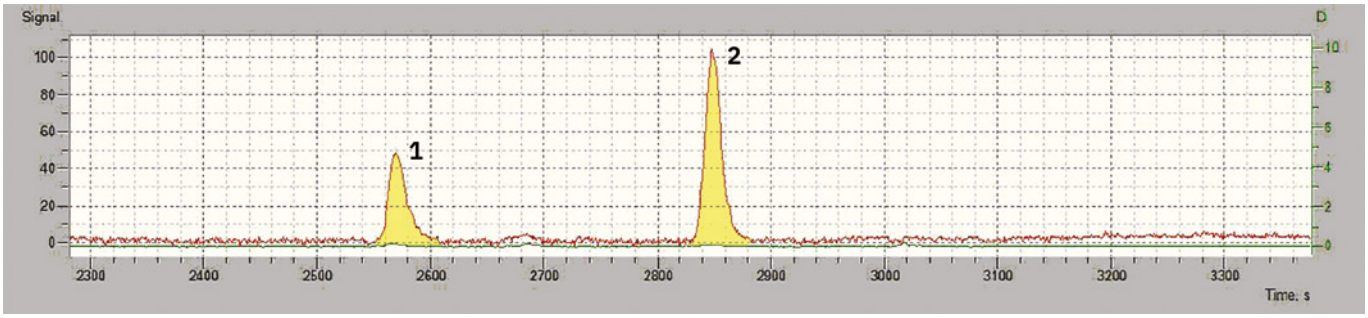
- high analysis throughput;
- direct mercury determination without preliminary accumulation on a gold trap, in contrast to the method prescribed in UOP938;
- low limit of detection, high selectivity;
- no need for sample pretreatment in the case of mercury concentration above 5 ppb; preconcentration from 1–5 ml sample required for mercury determination at a sub-ppb level;
- wide dynamic measurement range;
- no memory effect;
- the CRM of any matrix 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-915 series mercury analyzer (RA-915 Lab, RA-915M combined with PYRO-915+ attachment, or RA-915F);
- PC with Windows® and RAPID software;
- any solid or liquid CRM of mercury ;
- Lumex Instruments kit, order **No 0300002285 (with vacuum manifold)** or Lumex Instruments kit, order **No 0300002328 (without vacuum manifold)**.

EXAMPLES OF ANALYSIS

Measurement of mercury concentration in naphtha using the preconcentration step



1 – sample weight 1.45 g; (measured value is 0.72 ppb)
2 – sample weight 3.03 g; (measured value is 0.70 ppb)

Analysis of the spiked naphtha using Lumex Instruments vs. UOP938

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)

RA-915M with PYRO-915+

RA-915 Lab

RA-915F