MERCURY DETERMINATION IN NATURAL GAS

INTRODUCTION

The natural gas is a significant source of ingress of mercury in the environment. The typical mercury concentration in natural gas may vary from 0.01 to 200 μg/m^3. Mercury, being present in hydrocarbon gas, initiates corrosion of pipelines and catalyst poisoning during gas transportation and processing, and these effects have serious implications for the gas-processing industry. Mercury extraction and purification of gases, as well as processing the products of gas deposits, which involve mercury separating as a fairly toxic element, is very important for the environment protection. It is important even in cases when mercury is not an appreciable component in the natural gas: the huge amounts of world annual gas consumption should be taken into account.

The use of a mercury analyzer RA-915M/RA-915+ with Zeeman background correction of nonselective absorption provides direct real-time mercury determination in natural gas at a ng/m^3 level.

MEASURING METHOD

The method of atomic mercury concentration measuring in natural gas is based on the use of atomic absorption spectrometry with Zeeman background correction employed in a **mercury analyzer RA-915M/RA-915**+. The use of the Zeeman background correction and a multipath analytical cell provides high selectivity and sensitivity of measurements, essentially reducing the effect of interfering compounds. Thus, even with 25% hydrogen sulfide content in the gas (whose non-selective absorption amounts to 93%) the detection limit doesn't exceed 0.5 μg/m^3.

As a result, the analyzer provides direct determination of mercury in a hydrocarbon gas due to the elimination of preliminary precipitation and collection of mercury in absorption traps. Therefore, analyses can be carried out with the ultra low detection limit (0.01 μg/m^3) in real time.

To perform a measurement, the analyzer is placed near a gas well or other sampling point (gas pipeline, string, separator, etc). The gas flows continuously through Teflon hoses into the **RP-91NG attachment** and then arrives to the analytical cell. The gas flow rate is controlled by a valve. The blank signal is regularly checked by passing the gas through a special filter with the Hg absorption efficiency of 98–99%.

If necessary, a simple device is mounted upstream of the instrument to separate the gas from a liquid phase (water, condensate or oil). The mercury concentration is measured once per second and is processed by a computer with a simultaneous data display.

If it is impossible to carry out direct analysis near a sampling point, the gas can be analyzed in a laboratory. In this case, it is recommended to deliver the gas samples to the laboratory in special bags made of materials that don't absorb mercury (e.g., Tedlar® gas sampling bags).

MEASUREMENT RANGE

The measurement ranges of the mass concentration of mercury in natural gas are as follows:

0.01–20 μg /m^3 (RA-915+ with a multipath cell)

0.5–2,000 μg/m^3 (RA-915+/RA-915M with a single-path cell).

ANALYSIS FEATURES

- No sample preparation is necessary.
- Direct mercury determination without its preliminary accumulation on a gold sorbent.
- Wide dynamic measurement range: more than 3 orders of magnitude.
- The measurement results don't much depend on the gas flow rate in a wide speed range.
- Capability to carry out analysis in the field.
- Analysis without a PC is possible.

EQUIPMENT AND REAGENTS

The following equipment and materials are used for analysis:

- Mercury analyzer RA-915M (RA-915+) with RP-91NG attachment.

Mercury content in natural gas measured by RA-915+ analyzer (with a single-path sell)

1, 3, 5 – Zero check
2 – Natural gas (measured value 3.1 ng/l, RSD 0.1 ng/l)
4 – Natural gas (measured value 3.1 ng/l, RSD 0.1 ng/l)