

DETERMINATION OF MERCURY IN SOIL, BOTTOM SEDIMENTS AND GEOLOGICAL MATERIALS USING RA-915+ MERCURY ANALYZER WITH RP-91C ATTACHMENT

Analysis of soils and bottom sediments for mercury content is one of the most common analyses in the monitoring of environmental pollution. Background mercury concentrations in these objects are 10-100 µg/kg and in the polluted areas they exceed 10 000 µg/kg, the ultimate tolerable mercury concentration in soil being 2 100 µg/kg (in Russia).

MEASURING METHOD

This method of mercury determination in soil is based on the atomization of mercury contained in the sample in an RP-91C attachment and subsequent mercury determination by flameless AAS in a mercury analyzer RA-915+. The mercury AAS analyzer RA-915+ with the Zeeman background correction equipped with a thermal decomposition attachment RP-91C allows determination of mercury in soil and other similar samples without sample preparation and mercury accumulation on a sorbent.

Mercury content in the sample is determined from the integrated analytical signal with due account of the preset calibration coefficient (from any reference mercury sample).



ANALYSIS FEATURES

- No sample preparation is necessary.
- Mercury determination without its preliminary accumulation on a gold sorbent.
- Wide dynamic measurement range: more than 3 orders of magnitude.
- The detection limit is by a factor of several tens lower than the background mercury content in soil and bottom sediments.
- Possible use of a special analytical cell for analysis of heavily polluted samples (up to 1 000 000 µg/kg)
- No cylinders with compressed oxygen or other gas are necessary.
- Visualization of mercury release from the sample via a user-friendly computer interface.
- The calibration coefficient is preset from a reference mercury sample of any composition.

ANALYTICAL CHARACTERISTICS

| | |
|--------------------------------------|--------------|
| Sample weight | Up to 500 mg |
| Detection limit | 0.5–1 µg |
| Upper limit of the measurement range | 10 000 µg* |
| Measurement time | < 2 min |
| Air flow rate | 1 l/min |

* It is possible to analyze samples with concentration up to 1 000 000 µg/kg using special analytical cell with a path length of 0.7 cm.

MEASUREMENT PROCEDURES

The sample is weighed and put into the injection spoon of the RP-91C attachment. Integration of the analytical signal is turned on and the injection spoon is placed into the attachment. After the analytical signal comes back to the baseline (for 20-30 s), the integration is completed.

The validity of the method is proved by agreement between the measured and certified mercury concentrations in various reference samples

| No | Reference sample code | Sample weight, mg | C, μg | C _{CO} , μg | Δ , % |
|----|--------------------------------|-------------------|------------------|---------------------------------|--------------|
| 1 | Soil | 240 | 40.0 | 41 \pm 7 | -2.5 |
| 2 | Bottom sediments IAEA 356 | 115 | 6720 | 7620 \pm 450 | -12 |
| 3 | Dump sites sludge VKI Sludge A | 97 | 560 | 650 \pm 120 | -14 |
| 4 | Bottom sediments IAEA 405 | 271 | 803 | 810 \pm 40 | -1 |
| 5 | Sewage sediments CRM 143R | 53 | 1050 | 1100 \pm 70 | -5 |

Results of mercury determination in reference samples of soil and bottom sediments

| | Soil | | Bottom sediments | |
|---|--|----------------------------|--|----------------------------|
| | Sample weight, mg | C, $\mu\text{g}/\text{kg}$ | Sample weight, mg | C, $\mu\text{g}/\text{kg}$ |
| 1 | 121 | 39 | 98 | 768 |
| 2 | 240 | 43 | 163 | 794 |
| 3 | 119 | 39 | 83 | 805 |
| 4 | 240 | 40 | 271 | 803 |
| 5 | 305 | 41 | 410 | 785 |
| 6 | 270 | 38 | 471 | 789 |
| | Average value 5.6 μg SD 0.7 μg RSD 12% | | Average value 793 μg SD 13 μg RSD 1.5% | |