

DETERMINATION OF A TOTAL MERCURY CONTENT IN BLOOD

Blood is one of the most complex substances for determination of the Hg content. At the same time, blood is the most important diagnostic medium used for monitoring the effect of Hg vapor on the human organism. In almost all the countries, personnel of mercury-involving production facilities are regularly examined for the Hg content in blood, which should not exceed 20–50 µg/l, whereas in the case of a person unexposed to mercury vapor the blood normally contains 1–3 µg/l of Hg.

MEASURING METHOD

Determination of the Hg content in blood involves microwave digestion of the sample and reducing Hg cations in the digested sample by a SnCl₂ solution in a bubbler of the RP-91 attachment ("cold vapor" method), followed by the AAS determination of atomic mercury in the multipath cell of an RA-915+ analyzer.



METHOD FEATURES

- Analysis is done with preliminary sample digestion in a microwave digester, which greatly reduces the consumption of chemical reagents and the sample preparation time; a small signal from the blank sample substantially lowers the detection limit.
- Mercury determination is performed without its preliminary accumulation on a gold sorbent.
- Wide dynamic measurement range (2 orders of magnitude without diluting the sample).
- The detection limit is lower than the background Hg content in blood.
- Visualization of the mercury release from the sample via a user-friendly computer interface.
- Stable calibration coefficient.

ANALYTICAL CHARACTERISTICS

| | |
|--------------------------------------|-----------------------------|
| Detection limit | 0.5 µg/l |
| Upper limit of the measurement range | 100 µg/l (without diluting) |
| Blood sample volume | 0.5 ml |
| Air flow rate | 4 l/min |

MEASUREMENT PROCEDURE

To obtain digested blood sample, 5 ml of concentrated nitric acid and 1 ml of hydrogen peroxide are added to 0.5 ml of the initial blood sample. Then follows the two-stage decomposition of the sample in a microwave digester at 8 atm for 20 minutes. The solution obtained thereby is diluted with distilled water up to a volume of 10 ml and 4 ml of the reducing solution is poured into the reaction vessel. After the analytical signal comes to a steady state, integration is turned on and 4 ml of the digested blood sample is added into the vessel. The integration is completed when the analytical signal comes back to the baseline.

The Hg concentration is computed with due account of the signals from a blank sample. The stability of the calibration coefficient is checked against the calibration solution before the operation.

TYPICAL HG CONTENTS IN BLOOD SAMPLES

| Sample | Hg content, µg/l | Average, µg/l | RSD, % |
|---|------------------------------|---------------|--------|
| Clean Check (Level-1), 2.9±1.0 µg/l | 3.0, 2.6, 2.8, 3.6, 3.4, 2.4 | 3.0 | 15 |
| BI-2 (blood of a person who was exposed to mercury vapor) | 6.8, 7.0, 6.1, 7.4, 6.6, 7.2 | 6.9 | 6.7 |