

DIRECT AA MERCURY DETERMINATION IN BIOLOGICAL MATERIALS

Direct atomic absorption mercury determination (without any pre-treatment procedures) in the samples with complex matrix (foods, vegetation, oil and its products, soils, sediments, various biological materials) is complicated by presence of organic compounds. When such samples are atomized much smoke is produced and practically in all cases the total absorption in the cell is out of the working range of the spectrometer. Using a spectrometer with background correction – Zeeman atomic absorption mercury spectrometer **RA-915+** and a developed two-chamber catalyst atomizer (**PYRO-915**), the direct mercury determination problem is solved.

After inserting the sample in the first chamber of the atomizer it is heated up to 800 C (all mercury compounds are known to be dissociated at such temperatures). Less volatile mercury compounds are dissociated but more volatile species, e.g. mercury organic compounds, can leave the first chamber as compounds during warming up of the chamber. In addition presented organic compounds of the matrix originate much smoke and variously compounds, which are able to produce strong background absorption in the analytical cell. All products are transported from the first chamber to the second one by the carried gas (in our case it is air). The second chamber is continuously heated about 800 C. There, all mercury compounds are dissociated and smoke and interference compounds are burst producing mostly carbon dioxide and water. Zeeman corrector of the spectrometer eliminates the rest background absorption. The catalyst improves the efficiency of oxidation and dissociation in the second chamber.



The validity of the method is proved by the agreement between the measured and certified concentrations in various standard complex-matrix samples (see the table below). Note the excellent consistency of the method: the discrepancies between concurrent measurements do not exceed 10% for different sample weights.

Reference material	Mass, mg	Measured value, ppb	Certificate value, ppb	Deviation, %
NIST 1630a (Coal)	60	99	105±23	-9
	140	92		
DOLT-2 (Fish liver)	50	1860	2140±240	-8
	110	2070		
DORM-1 (Fish)	50	860	798±74	+4
	100	780		
IAEA 140 (Sea plant)	80	28	29±7	0
	170	32		

A table shows analytical features of the developed system for biological samples. It is seen from the table that the detection limit (DL) is lower than the Threshold Limit Value (TLV) of mercury contents accepted in Russia (e.g. for fish the DL is lower than AL in a factor of 30). In this case, a representative sample weight of more than 100 mg is ensured. This Method has also a wide dynamic range from 0.5 to 10 000 ppb

Sample	TLV, ppb	DL, ppb	SW, mg
Blood	50	0,5	300
Hair	5000	2	120
Nail		2	120
Urine	10	0.5	300

Mercury determination in a rat liver sample

- 1 – Reference material SORT2 (HgO in quartz sand, 31 ppb). Sample weight 110 mg
- 2 – Rat liver. Sample weight 50 mg (Measured value – 32 ppb),
- 3 – Rat liver. Sample weight 125 mg (Measured value – 28 ppb).

