



Direct mercury determination in coal

INTRODUCTION

According to the UNEP Global Mercury Assessment (2018), coal combustion is the second largest anthropogenic source of mercury air emissions, accounting for 21% of global emissions. To reduce atmospheric emissions and effectively manage the process of stack gas cleaning, it is necessary to control the mercury content in coal prior to combustion.

The RA-915 series mercury analyzers use direct thermal decomposition for the determination of total mercury in coal, minimizing sample preparation and avoiding time-consuming wet-chemical procedures. Established direct-combustion methods such as ASTM D6722, EPA Method 7473, and DL/T 2296 combine thermal decomposition with catalytic conversion and mercury collection by amalgamation, typically using high-purity oxygen as the combustion and carrier gas.

Lumex Instruments offers the procedure and instrumentation for rapid direct analysis using a different analytical configuration. Mercury released during thermal decomposition is transported by mercury-free ambient air directly to the analytical cell and measured by atomic absorption spectrometry with Zeeman background correction, without an intermediate amalgamation step.

The procedure should be validated by the laboratory for the intended coal matrices, concentration range, and applicable reporting requirements.

MEASUREMENT METHOD

The sample is heated in the thermal decomposition chamber. The mercury compounds are evaporated and dissociated forming elemental mercury. All the gaseous products formed 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.

Detection limit: 1 ppb (1 µg/kg).

ANALYSIS FEATURES

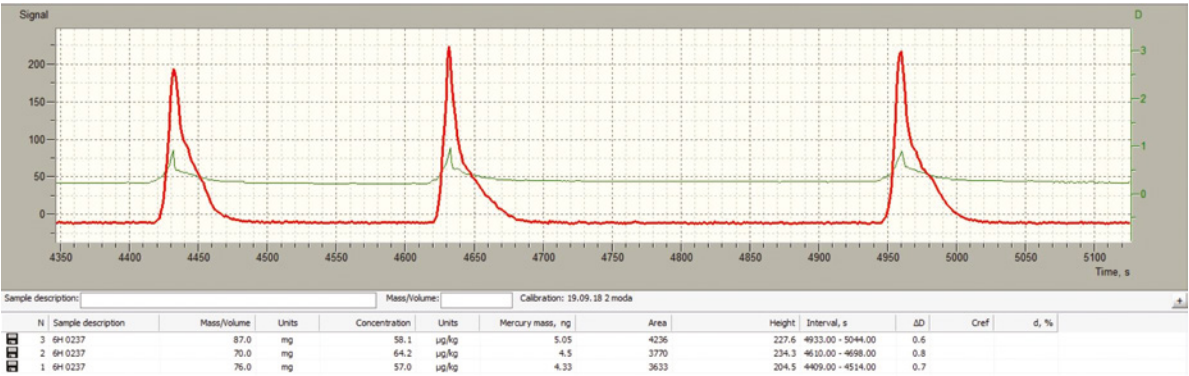
- no sample pretreatment with wet chemistry;
- low limit of detection, high selectivity;
- wide dynamic measurement range: more than 5 orders of magnitude;
- no amalgamation step;
- high analysis throughput (1–3 minutes per sample);
- no need for reagents and cylinders of oxygen, argon or other compressed gases;
- low running cost;
- no «memory» effect;
- the CRM of any matrix can be used for calibration and QA/QC.
- a special gradual heating mode allows the determination of mercury thermospecies in coal.

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 0300003293.

EXAMPLES OF ANALYSIS



Samples:
Coal sample 6H 0237 (m1 = 87 mg, C1 = 58 ppb; m2 = 70 mg, C2 = 64 ppb; m3 = 76 mg, C3 = 57 ppb), Cav = 60 ppb, RSD = 6%



RA-915M mercury analyzer with PYRO-915+ attachment



RA-915 Lab mercury analyzer



RA-915F mercury analyzer

