

The Determination of Mercury in Copper Concentrates by Thermal Decomposition, Amalgamation and Cold Vapor Atomic Absorption

INTRODUCTION

Mercury is a toxic, persistent pollutant found in many native ores rich in copper, silver and gold. As such ores are processed mercury can be released to the environment. This can be either during the “stamping” process (crushing rocks to “sand”) where mercury rich tailings can enter the local watershed or during smelting where volatile mercury can be released into the atmosphere. It is for these reasons and their potential impact on the environment that it is important to be able to reliably measure mercury.

ANALYTICAL APPROACH

Four samples of copper concentrates were acquired and analyzed using a direct analysis technique. The technique involves thermal decomposition of mercury compounds present in the sample through combustion followed by pre-concentration via gold amalgamation and subsequent detection using cold vapor atomic absorption (Figure 1).

INSTRUMENTAL

Table 1 shows the instrumental parameters for the analysis. Oxygen was used as the carrier gas at a flow rate of 350 ml/min. Signal integration was set at 100 seconds.

The *Hydra II_c* provides two optical paths of differing lengths to extend its dynamic range, producing both low and high calibration curves.

These calibration curves were generated using weighed deposits of aqueous standards in concentrations of 0.1, 1.0 and 10.0 ppm (w/w) mercury. All samples and standards were analyzed using nickel boats.



Figure 1

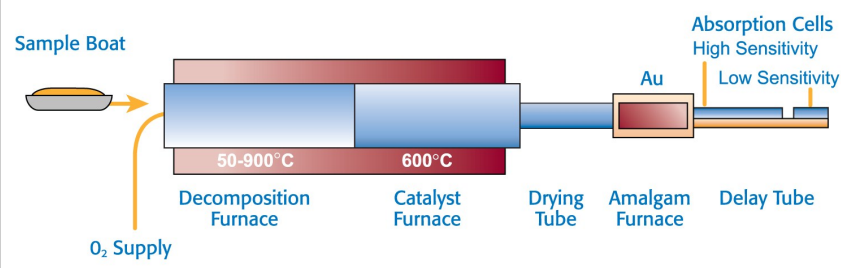
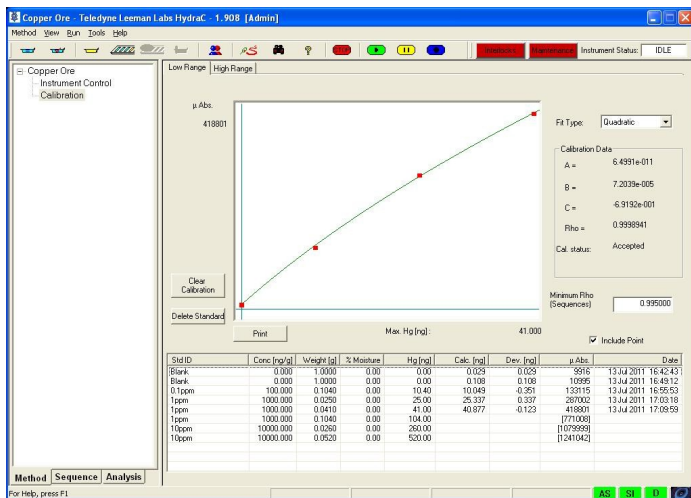


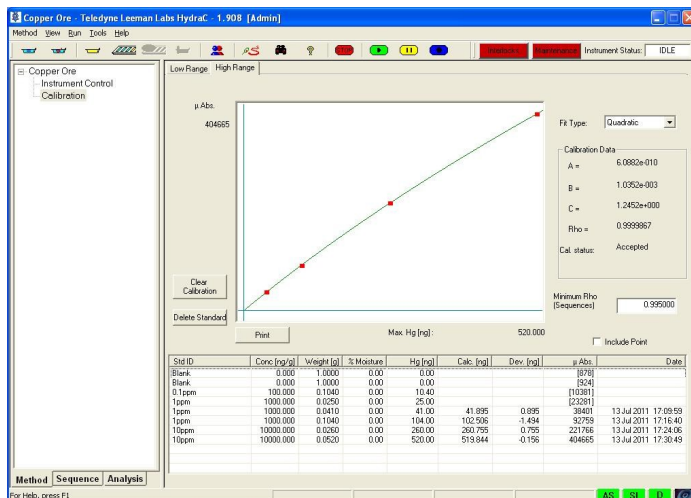
Table 1. System Parameters

Stage	Temperature (°C)	Time (sec.)
Dry	300	30
Decompose	800	150
Catalyst Wait	600	60
Amalgamation	600	30

Low Range Calibration (0-40 ng)



High Range Calibration (to 520 ng)



The low range calibration extended to 40 ng and the high range calibration to 520 ng. Both calibrations delivered linear correlation coefficients better than 0.997; however, a quadratic curve provided a slightly more precise fit for the standards.

RESULTS

Each of the submitted samples was introduced 5 times. Individual results and statistics appear in Table 2. Carryover was determined to be less than 1% by re-measuring the same sample boat with sample residue untouched. A 250 ng standard was run between sample replicates to ensure that no shift in sensitivity had occurred.

CONCLUSIONS

The **Hydra II_c** was able to accurately and reproducibly quantify a variety of copper concentrates without any catalyst deterioration. Precision appeared acceptable for all samples, even when the analysis required very small aliquots of sample.

MORE ABOUT THE HYDRA II_c

The **Hydra II_c** provides a 70-position autosampler and has on-the-fly loading capability for virtually unlimited capacity. Additionally, a conversion kit is available which employs chemical reduction to satisfy the monitoring of drinking water in accordance with USEPA Method 245.1 and European Standards EN1483 and EN13806.

Table 2: Sample Results

ID	Mean (ug/g)	Standard Deviation (ug/g)	Weight (g)	Conc. (ug/g)
15766	45.4	3.7	0.00654	51.8
			0.01039	43.3
			0.00751	43.7
			0.00836	45.1
			0.00711	43.0
118	112.1	2.9	0.00225	114.9
			0.00342	113.9
			0.00324	114.5
			0.00393	108.1
			0.00484	109.3
23798	1.48	0.09	0.0033	1.45
			0.0049	1.35
			0.0050	1.60
			0.0033	1.52
			0.0035	1.49
17416	0.188	0.011	0.037	0.188
			0.052	0.187
			0.060	0.172
			0.056	0.203
			0.066	0.191