

APLICACIÓN 037

The Determination of Mercury in Food Grade Plastics by Thermal Decomposition, Amalgamation and Cold Vapor Atomic Absorption

INTRODUCTION

The accurate determination of mercury in food grade plastics is of interest because it's a toxic element that can be leached into foodstuffs that come in direct contact with those materials. Using the **Hydra IIc** Direct Mercury Analyzer provides simple and convenient analyses of these materials in about 7 minutes without sample digestion or production of hazardous chemical waste.

The **Hydra IIc** heats samples in an oxygen stream to decompose any mercury compounds which are then collected on an 'amalgamator'. Once all of the sample's mercury has been collected, the amalgamator is quickly heated and the mercury is released for determination by cold vapor atomic absorption (Figure 1).

SAMPLE AND STANDARD PREPARATION

Samples of the plastic materials were cut into small pieces and approximately 0.05 gm was placed into tared sample "boats". Aqueous standards were prepared in 1% HNO₃ for system calibration.

INSTRUMENTAL

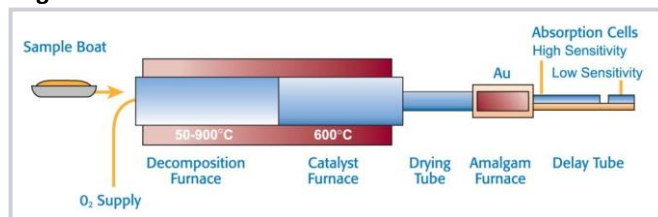
The **Hydra IIc** employs two optical paths of differing lengths for extended dynamic range. Its software automatically selects the best analytical signal for each measurement. The calibration curves are displayed in Figures 2 and 3 as micro absorbance vs. total mercury injected.

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. Tared nickel boats were used for analysis.

Table 1 shows the instrument parameters employed for the calibration and sample analysis.



Figure 1



www.TeledyneLeemanLabs.com

Table 1: Operating Conditions

| Parameter | Setting |
|----------------------|--------------------|
| Dry | 300°C for 30 sec. |
| Decomposition | 550°C for 250 sec. |
| Catalyst | 600°C |
| Catalyst Wait Period | 60 sec. |
| Gold Trap | 600°C for 30 sec. |
| Measurement | 100 sec. |
| Oxygen Flow | 350 ml/min |

analysis are presented in Table 3.

Figure 2. Hydra IIc low concentration range (0-2ng)

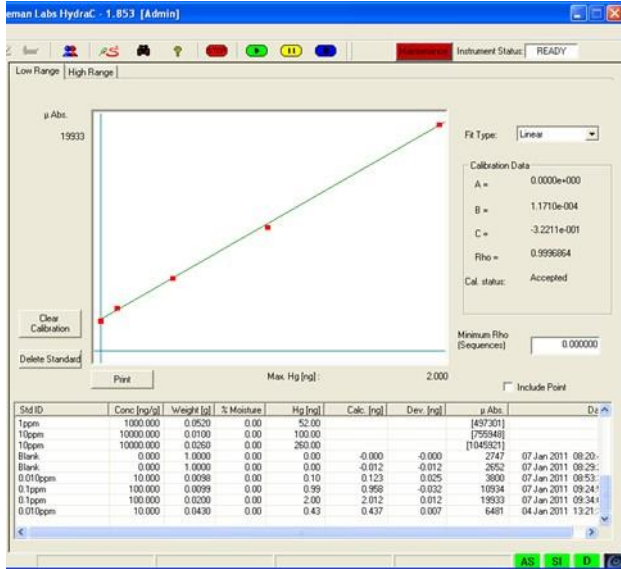
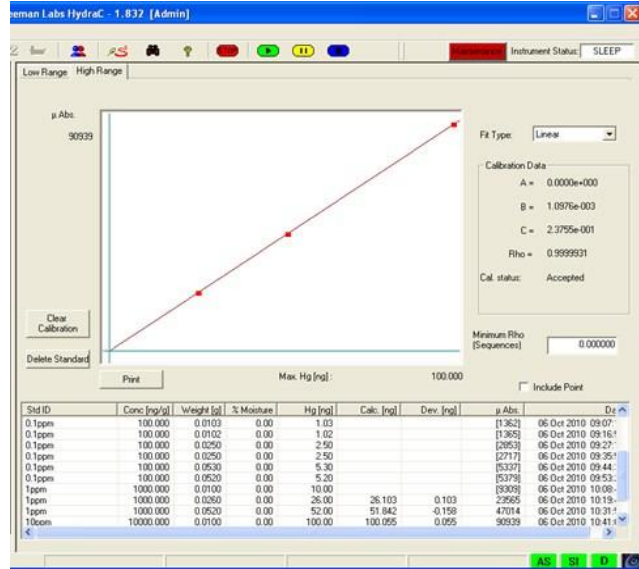


Figure 3. Hydra IIc high concentration range (30-100ng)



Due to the low mercury concentration of

Table 2: Sample Results all the samples tested the instrument was only calibrated to 2 ng on the 'low' curve for maximum accuracy while the 'high' curve was calibrated to 100ng for the analysis of the higher concentrations found in the CRM's.

RESULTS

Samples of polyethylene terephthalate (PET), highdensity polyethylene (HDPE), low-density polyethylene (LDPE), polypropylene (PP), and polystyrene (PS) were obtained for analysis. Each sample

| Sample | Average sample weight (grams) | Measured Concentration (PPM) | Standard Deviation (PPM) |
|--------|-------------------------------|------------------------------|--------------------------|
| PET | 0.035 | 0.00068 | 0.00019 |
| HDPE | 0.045 | 0.02244 | 0.00261 |
| LDPE | 0.044 | 0.02487 | 0.00443 |
| PP | 0.042 | 0.03212 | 0.00093 |
| PS | 0.042 | 0.02326 | 0.00365 |

Table 3: CRM sample

results was analyzed in triplicate. The sample results, including the average sample weight, mean and standard deviation of the three replicates are presented in

Table 2. Reference materials ERM-EC680k and ERMEC681k (LDPE spiked with mercury) were also analyzed to check for method bias. The results of that

CONCLUSIONS

The *Hydra IIc* successfully analyzed the plastics without pretreatment in about 7 minutes per sample. Analysis results were in excellent agreement with certified reference values. No hazardous chemicals were employed and there was no toxic waste produced.

MORE ABOUT THE HYDRA IIc

The **Hydra IIc** 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 the European Standards EN1483 & EN13806.

| Sample | Average sample results (PPM) | Certified mercury concentration (PPM) | Recovery (%) |
|------------|------------------------------|---------------------------------------|--------------|
| ERM-EC680k | 4.60 | 4.64 | 99.2 |
| ERM-EC681K | 24.1 | 23.7 | 101.8 |