



# Measurement of Waters of Hydration with Pyris 6 TGA

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## Introduction

The Pyris 6 TGA from PerkinElmer Instruments is a high performance, top loading thermogravimetric analyzer. TGA is one the family of techniques in the thermal analysis family and measures sample weight loss as a function of temperature and/or time.

The Pyris 6 TGA offers the following desirable features and benefits:

- High sensitivity for the detection of small weight loss transitions
- High resolution for the better separation of overlapping transitions
- Top loading balance design for ruggedness and durability
- Robust design for reliable, long term use
- Built in gas switching accessory and purge gas flow regulator for convenience and ease of use
- 45 position autosampler for reliable, unattended operation
- Pyris Player software for user friendliness and ease of use
- Ability to easily capture and export data



*Pyris 6 TGA*

The autosampler featured with the Pyris 6 TGA offers state-of-the-art design with shape memory alloy grippers. This ensures reliable, long term operation.

The built-in gas switching accessory and flow regulator is a highly desirable feature on a TGA instrument from a convenience standpoint. Many TGA experiments require the switching of an inert purge gas (e.g., nitrogen) to an oxidizing gas, such as air or oxygen. The built-in switching device makes this easy to perform. In addition, the Pyris 6 TGA provides for the control of the flow of the purge gas directly via the Pyris operating software and this is useful to ensure that the proper flow of gas is obtained and controller. This is a far more accurate and precise means of regulating and

controlling the flow of the purge gas as compared to

manual flow regulators. The purge gas conditions can be permanently stored with the method making the Pyris 6 TGA a reliable instrument for multiple operators. The incorporation of the digital flow system into the Pyris 6 TGA and software minimizes the chances that the purge gas flow rate could be inadvertently altered, as can easily happen with the manual flow regulators.

In the example presented here, the dehydration of copper sulfate pentahydrate ( $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ ) was studied using the Pyris 6 TGA. Hydrated materials are commonly used for pharmaceutical and food applications and is important to be able to properly characterization the dehydration event(s) of food and pharmaceutical materials.

## Experimental

The following conditions were used to study the dehydration of copper sulfate pentahydrate by TGA.

Experimental Conditions	
Instrument	Pyris 6 TGA with autosampler
Sample pan	Open ceramic pan
Sample mass	Approximately 6 mg
Heating rate	10 C/min
Temperature range	25 to 350 C
Purge gas	nitrogen

The TGA instrument was calibrated for temperature response using the Curie points of alumel, perkalloy and iron.

## Results

Displayed in Figure 1 are the TGA results obtained on the copper sulfate pentahydrate salt. The plot shows the percent mass along with the derivative (rate of mass loss) as a function of sample temperature. The TGA results show that the sample loses its waters of hydration in the following ratio of 2:2:1. This is what is expected for the copper sulfate pentahydrate salt. The Pyris 6 TGA provides very good resolution between the first two water loss transitions at 62.7 C and

108.7 C. The derivative trace shows that there is very good resolution between the first two TGA water loss transitions.

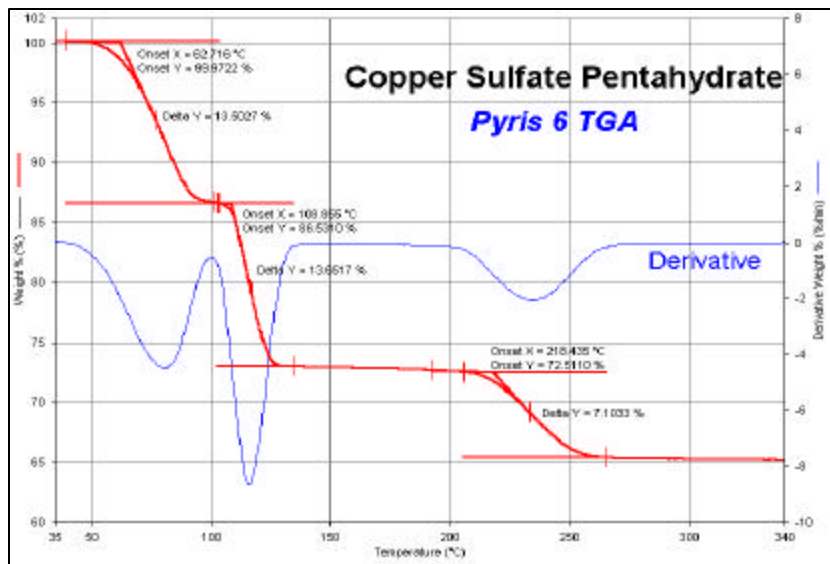


Figure 1. TGA results obtained on copper sulfate pentahydrate

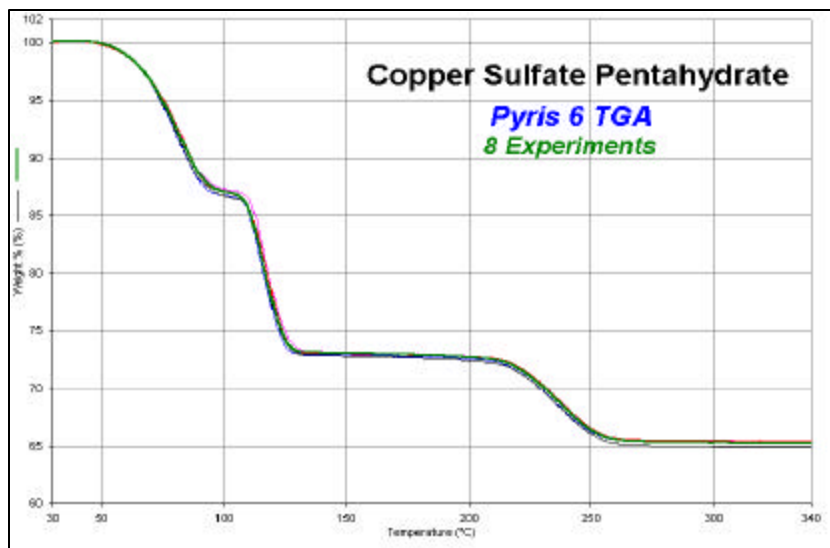


Figure 2. TGA results performed from eight experiments on  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$

Displayed in Figure 2 are the results obtained by performing multiple

experiments (8 runs) on the copper sulfate pentahydrate salt.

As the results in Figure 2 demonstrate, the Pyris 6 TGA with autosampler yields outstanding reproducibility on the copper sulfate pentahydrate salt material.

## **Summary**

The PerkinElmer Pyris 6 TGA instrument provides outstanding results on the decomposition characteristics of materials. The unit offers both high performance and reliability. The TGA features a state-of-the-art autosampler, capable of handling up to 45 samples, for unattended operation. The Pyris 6 TGA also features a built-in gas switching accessory and flow regulation system for convenience and ease of use. This built-in gas controller ensures the most accurate TGA results on samples or applications, which are sensitive to the flow rate of the purge gas.

