

Measuring Moisture of Plastic Pellets

Accurate and Easy with HR83

Moisture control is an important aspect for the production of high quality plastic parts. Measuring moisture content with the METTLER TOLEDO HR83 Halogen Moisture Analyzer is a practical and precise procedure.



HR83
Halogen Moisture Analyzer

Introduction

This application note illustrates the accurate determination of moisture content in plastics with the METTLER TOLEDO HR83 Moisture Analyzer.

The following example for the application of HR83 in injection molding demonstrates this fast, simple and cost-saving measurement during the production process.

Moisture in plastics

Moisture content of resins, such as Polyamides or Polycarbonates is an important factor for processing, product appearance and product properties. Injection molding of too moist plastic pellets results in processing problems and loss in quality of the final product. Typical symptoms are well known: splaying, formation of flash as well as impaired mechanical properties such as reduced impact and tensile strength.

Many plastics easily absorb moisture during transportation and storage. Therefore, the control of moisture content is crucial for the manufacturing of high quality products.

HR83 offers accurate results

The industry reference method is Karl Fischer titration^{1,2}, a common titration method for determining the water content of a sample. However, this method requires a well-equipped laboratory and well-trained personnel to provide accurate and reliable results.

In contrast, with the HR83 you obtain the same results without the need for elaborate facilities or expensive reagents.^{3,4}

Moisture determination for PA6

The manufacturer of this Polyamide 6 (PA6)⁵ resin recommends moisture below 0.2% for processing. However, the resin absorbs 2.5% moisture in 24 hours (23°C, 50% relative humidity).

A moisture check of the pellets prior to drying helps the injection molder to optimize drying time, e.g. 1 hour drying instead of 4 hours and thus achieving significant energy cost savings.

In addition, quality systems (e.g. ISO 9001) often require the moisture content of the pellets to be measured periodically to verify proper functioning of the dryer. Finally, the injection molder may want to verify the moisture content of each batch before starting the molding machine to maximize machine uptime.⁶



Injection molding machine
(courtesy of Wild & Küpfer AG Switzerland)

¹ ASTM D 6869 – 03: Standard Test Method for Coulometric and Volumetric Determination of Moisture in Plastics Using the Karl Fischer Reaction (the Reaction of Iodine with Water)

² DIN 53715:1991-05: Testing of plastics; determination of water content by titration according to Karl Fischer

³ ASTM D 6980 – 04: Standard Test Method for Determination of Moisture in Plastics by Loss in Weight

⁴ Application Solutions Plastics: Methods for HR83, ME-11795881

⁵ Schulamid[®] 6 MV, A. Schulman Inc.

⁶ METTLER TOLEDO, ChemicalsNews 2, 2007: "Victorinox fits in every pocket"

Material and Methods

- HR83 Halogen Moisture Analyzer, METTLER TOLEDO
- PA6 plastic pellets: Schulamid® 6 MV, A. Schulman Inc.

Instructions how to use HR83 to determine moisture content

1. Press "method" button and select PA6 method:

- Vibration adapter: High
- Resolution: High
- Standby temperature: 100°C
- Drying program: step drying
 - Step 1: 5 min at 130°C
 - Step 2: 0 min at 130°C
 - Final temperature: 130°C



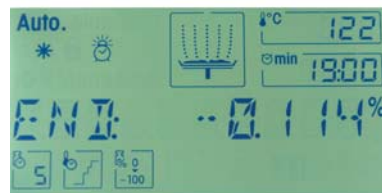
2. Tare the sample pan and weigh in about 30g of plastic pellets.



3. Press "Start" button to begin the measurement.



4. The result shows the moisture content of the plastic pellets.



Results and Discussion

Moisture content of PA6 pellets is determined using the HR83. The result obtained in the measurement is 0.114% moisture content and fulfills the recommended

maximum limit for processing of 0.2%. Therefore, the pellets do not need further drying and you can start the injection molding process.

Correlation HR83 versus Karl Fischer titration

To prove precision of HR83 results, a correlation study with 3 different moisture levels of PA6 is performed. Results are compared to those of the reference method Karl Fischer titration.*

The study shows that HR83 achieves at all 3 moisture levels highly repeatable results corresponding to Karl Fischer titration table 1, figure 1).

* METTLER TOLEDO DL39 Karl Fischer titrator with Stromboli oven sample changer

PA6	HR83			Karl Fischer titration		
	Mean [% MC]	SD	CV	Mean [% MC]	SD	CV
condition 1	0.194	0.007	3.44	0.1991	0.0061	3.07
condition 2	0.362	0.006	1.70	0.3649	0.0032	0.87
condition 3	0.782	0.007	0.94	0.7723	0.0024	0.31

Table 1: Results of moisture content determination by HR83 (6 measurements) and by Karl Fischer titration (3 measurements).
MC = moisture content, SD = standard deviation, CV = coefficient of variation.

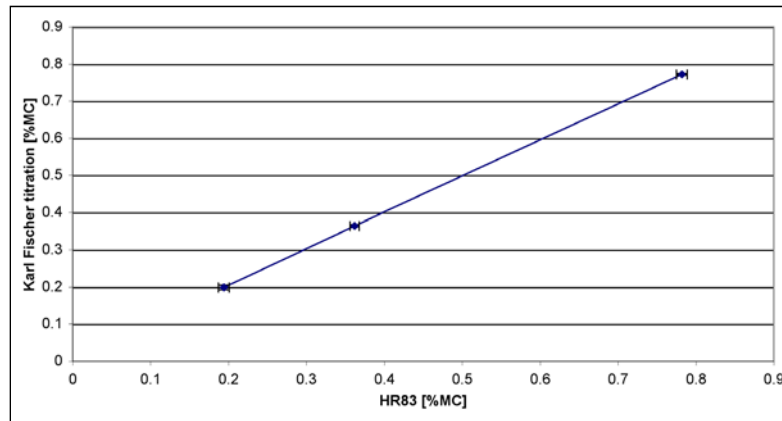


Figure 1: Correlation graph of Schulamid® 6MV at 3 different moisture levels, determination by HR83 and Karl Fischer titration. Horizontal (HR83) and vertical (Karl Fischer titration) bars represent standard deviations.

Conclusion

The HR83 provides a fast and uncomplicated procedure for moisture determination with accurate and reliable measurement performance. Furthermore, there is no need for chemicals or specialized lab per

sonnel. These characteristics, together with the ease of use offer injection molding companies a good solution for the quick and simple verification of moisture content next to the molding machine.

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