Moisture control is an important aspect for the production of high quality plastic parts. Measuring moisture content with the METTLER TOLEDO HX204 Halogen Moisture Analyzer is a practical and precise procedure.
This application note illustrates the accurate determination of moisture content in plastics with the METTLER TOLEDO HX204 Moisture Analyzer.

The following example for the application of HX204 in injection molding demonstrates this fast, simple and cost-saving measurement during the production process.

Moisture in plastics
Moisture content of many 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.

HX204 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 HX204 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 2.3% moisture in 24 hours (23°C, saturation). A moisture check of the pellets prior to drying allows 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.\(^6\)

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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
5. Schulamid® 6 MV, A. Schulman Inc.
6. METTLER TOLEDO, ChemicalsNews 2:
   “Victorinox fits in every pocket”
Material and Methods

- HX204 Halogen Moisture Analyzer, METTLER TOLEDO
- PA6 plastic pellets: Schulamid® 6 MV, A. Schulman Inc.

Instructions how to use HX204 to determine moisture content

1. Press "shortcut for PA6 method"
   - Resolution: High
   - Standby temperature: 100°C
   - Drying program: standard
     - SOC-Delay: 5 min
     - Drying temperature: 130 °C

2. Weigh about 30g plastic pellets into the tared sample pan

3. Press "Start drying" 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 HX204. The result obtained in the measurement is 0.129% and fulfills the recommended maximum limit for processing of 0.2% moisture content. Therefore, the pellets do not need further drying and you can start the injection molding process.
Correlation HX204 versus Karl Fischer titration

To prove precision of HX204 results, a correlation study with 2 different moisture levels of PA6 is performed. Results are compared to those of the reference method Karl Fischer titration.*

The study shows that HX204 achieves at all 2 moisture levels highly repeatable results corresponding to Karl Fischer titration (table 1, figure 1).

* METTLER TOLEDO C30 Karl Fischer titrator with Stromboli oven sample changer

<table>
<thead>
<tr>
<th>PA6</th>
<th>HX204</th>
<th>Karl Fischer titration</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Mean [% MC]</td>
<td>SD</td>
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<tr>
<td>condition 1</td>
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<tr>
<td>condition 2</td>
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<td>0.002</td>
</tr>
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</table>

Table 1: Results of moisture content determination by HX204 (6 measurements) and by Karl Fischer titration (6 measurements), (MC = moisture content, SD = standard deviation).

Conclusion

The HX204 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 personnel.

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

www.mt.com/moisture

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