Less Gels Mean More Peace of Mind

Gels Cannot Hide from This State-of-the-Art Technology

Consistency, Reliability, Quality. These are the characteristics customers want in the products delivered by The Dow Chemical Company (Dow). They are also the drivers behind the new gel detection process for NORDEL™ Hydrocarbon Rubber.

Gels reduce productivity and can result in an end product far below consumer standards. This often means waste, product delivery delays, and reduced profits. Dow’s new state-of-the-art equipment is designed to detect gels more accurately and, therefore, improve the quality of NORDEL IP and MG products that are delivered to processing sites around the world.

Traditional detection methods have typically been incapable of reliably identifying the gel content of the whole product. In an effort to improve customer service, and maintain consistency with our company-wide Six Sigma goal of virtually zero defects, Dow has significantly improved its gel detection process for ethylene propylene diene terpolymers (EPDM).

Leveraging technology used successfully within Dow for plastic resins, we invested in machine vision equipment to measure gel content. We also changed the sample collection process, as well as how gel content is reported on the Certificate of Analysis (COA).

We are very excited about these changes and pleased to share the benefits with NORDEL Hydrocarbon Rubber customers. In fact, the new methods of sample gathering and gel analysis are now in place at all NORDEL manufacturing sites.

Pioneering Chemistry and Processes Yield Unmatched Quality

The distinct catalyst and process technology pioneered by Dow for EPDM production are fundamentally low gel processes. Consequently, gels are rare events which require frequent testing and statistically large enough samples to predict processing and end-use performance with accuracy.

The new gel detection technology includes a process of frequent sampling of the production line and evaluating the gel content directly to ensure high quality production. Sample frequency is sufficient to ensure that every batch produced is analyzed for gels. In some cases, multiple samples are taken to ensure statistically significant characterization.

Improving the sampling process is just the beginning. The way gels are measured has also been greatly improved. To determine the total gel level, state-of-the-art cameras are used to scan the sample. Each gel is measured and digitized to determine its actual size.

Gels typically appear as an array of distorted shapes. The methodology of characterizing them in Dow’s new process is to convert the non-uniform surface area into an equivalently sized circle. The diameter of this circle is called the equivalent circular diameter (ECD). Based on the ECD, the volume of each gel is estimated using simple geometry, then added together and reported as a total gel volume. The result is a much more accurate picture of the total gel content of the entire production lot.

State-of-the-art equipment helps ensure quality by systematically inspecting for gels in the naturally clean NORDEL™ products.

®™Trademark of The Dow Chemical Company (“Dow”) or an affiliated company of Dow

(1)A quality discipline throughout Dow that focuses on product and service excellence
If the total gel content of a test sample is too high, Dow has the ability to react quickly, diverting product from the prime designation, so customers consistently receive only top quality product.

**More Accurate Results**

In addition to detecting and totaling the actual sizes of each gel, the new method has the capability of detecting very small gels, which are also factored into the total gel area.

Using the volume of measured gels and the dimensions of the test strip (length, width, thickness), an actual volume of gels is calculated and reported as parts per million by volume (ppmv). Table 1 shows test results using the old and new methods.

Note that it is possible for two or more samples to have the same gel count while having very different gel volumes.

Under the old system, products A, B, and C would have passed gel count standards and been shipped as prime product. However, only products B and C would be acceptable by the new, more stringent gel volume standards. Product A, despite having the same gel count as B and C, would be unacceptable and therefore not sold as NORDEL™ Hydrocarbon Rubber because of the high gel volume.

<table>
<thead>
<tr>
<th>Product</th>
<th>Large</th>
<th>Medium</th>
<th>Small</th>
<th>Total Gel Count</th>
<th>ppmv</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>6</td>
<td>13.4</td>
</tr>
<tr>
<td>B</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>6</td>
<td>6.2</td>
</tr>
<tr>
<td>C</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>6</td>
<td>3.3</td>
</tr>
</tbody>
</table>

Table 1: Comparison of Gel Detection Results

**A New Industry Standard**

NORDEL Hydrocarbon Rubber expands the range of possibilities beyond traditional EPDM products. Dow's continued innovation and newly defined gel volume standards are setting the pace for high-quality hydrocarbon rubber products. Contact your Dow representative for more information.

**Figure 1:** Sample Certificate of Analysis (COA)\(^1\) with the new gel volume maximum showing the batch was less than 12 ppmv.

---

\(1\) Specific COA content may vary slightly by geographic region.

---

**For additional information** regarding NORDEL™ Hydrocarbon Rubber, contact your Dow Technical Service & Development professional, your Dow Elastomers seller, or call the Dow Customer Information Group (CIG) at 1-800-441-4369. Find out more about Dow Elastomers and Dow products for EPDM applications at www.dowelastomers.com.

**NOTICE:** While this state-of-the-art technology helps ensure quality by systematically inspecting for gels in NORDEL Hydrocarbon Rubber, it's important to keep in mind that gels can also be commonly formed in the shipping, handling, and/or final processing of EPDM. As a result, customers may wish to review their own operations to help maintain the low gel levels in the products as manufactured and shipped.

**For inquiries please contact** Customer Service or local sales.

Quality Systems Specialist

Jane Doe

The information herein is supplied upon condition that the persons receiving same will make their own determination as to its suitability for their purposes prior to use. In no event will Dow be responsible for damages of any nature whatsoever resulting from the use of or reliance upon the information herein or the product to which that information refers. Nothing contained herein is to be construed as a recommendation to use any product, process, equipment, or formulation in conflict with any patent, and Dow makes no representation or warranty, express or implied, that the use thereof will not infringe any patent. NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR ANY OTHER NATURE ARE MADE HEREBUNDER WITH RESPECT TO INFORMATION OR THE PRODUCT TO WHICH INFORMATION REFERS.