Creating bio-based polyols for adhesives and sealants
RENUVA™ Renewable Resource Technology Creates Bio-based Polyols for Adhesive and Sealant Applications

Dow Polyurethanes is committed to expanding markets and transforming technologies into solutions that help customers differentiate themselves from their competitors. In today’s adhesive and sealant markets, that means offering products and technologies designed to enhance your sustainability efforts, without compromising performance at any stage. That goal can now be accomplished through the innovative capabilities of RENUVA™ Renewable Resource Technology.

What is key to creating exceptional solutions for adhesives and sealants? Dependable, high-performing polyols to be sure. Now, with RENUVA Renewable Resource Technology, Dow has created a natural oil-based polyol that delivers the desired performance found in traditional polyols with the environmental benefits our customers expect and without unwanted odors that can detract from the end product.

Building a Better Polyol

Dow Polyurethanes has engineered a bio-based polyol that doesn’t compromise performance. Bio-based polyols made with RENUVA™ Renewable Resource Technology dispel unwanted odors and address the needs of the industry by offering excellent performance and high levels of renewable content.

RENUVA Renewable Resource Technology breaks down natural oil and functionalizes it, then uses a distinct process to polymerize the molecules into designed polyols with control of

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functionality and molecular weight for greater quality and consistency. 
RENUVA™ Technology is giving birth to an enhanced generation of greener performance-based, polyols. The distinct chemistry allows Dow to work with you as a polyol architect, designing polyols with a variety of specifications and attributes to help achieve consistent performance in your applications.

Cleaner, Greener Solutions
Dow is building better polyols so you can build better, more sustainable products. According to life-cycle analysis, the manufacturing of bio-based polyols with RENUVA™ Technology is greenhouse gas neutral and uses 60% fewer fossil fuel resources than the manufacturing of conventional polyols. With the help of bio-based polyols made with RENUVA Technology, you can differentiate your company while reducing the impact on the environment.

RENUVA™ Technology for Adhesives & Sealants
Dow’s tailor-made, bio-based polyols offer benefits that cover numerous applications within the adhesives and sealants marketplace. Key among these are:

- Improved water resistance
- Excellent chemical resistance
- Ease of application
- Good adhesion on a variety of substrates
- High flexibility

Additionally, bio-based polyols made via this revolutionary process have virtually no odor, and their low viscosity reduces the need for solvents, resulting in a reduction in volatile organic compounds (VOCs) in your applications.

Add to these advantages high levels of renewable content, reduced environmental impact, and exceptional product performance, and it’s easy to see that bio-based polyols made with RENUVA™ Technology are poised to help you in many ways.

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Adhesive & Sealant Applications from RENUVA™ Technology

Bio-based polyols created via RENUVA™ Renewable Resource Technology can be tailored to meet the needs of many applications for one- and two-component urethane adhesives and sealants, including:

- Construction Adhesives and Sealants
- Automotive/Transport Adhesives and Sealants
- Flexible Packaging Adhesives
- Footwear Adhesives
- General Assembly Adhesives
- Structural Adhesives
- Wood/Furniture Adhesives
- Rubber, Foam, Cork Binders

### Adhesives

RENUVA™ Renewable Resource Technology enables customized polyols that offer benefits for a wide variety of adhesive applications, with high levels of renewable content and exceptional product performance. Plus, Dow’s natural oil-based polyols don’t have the odor often associated with bio-based polyols. Polyols made with RENUVA Technology can bring your applications the following potential features and benefits:

- Acid resistance
- Excellent low-temperature flexibility
- Good balance of mechanical properties
- Good wetting of low energy substrates
- Hydrolytic resistance
- Useful in making stable, low-viscosity urethane prepolymers
- Good ultraviolet and oxidative stability

Table 1 presents details regarding current Dow polyol offerings for adhesive applications utilizing RENUVA Technology.

### TABLE 1: Developmental bio-based polyols for adhesive applications*

<table>
<thead>
<tr>
<th>Product</th>
<th>Functionality</th>
<th>OH # (typical)</th>
<th>Approximate Renewable Content (% wt.)</th>
<th>Water (ppm)</th>
<th>Typical Users and Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>DWD 2215.01</td>
<td>2.0</td>
<td>40</td>
<td>40%</td>
<td>&lt;400 ppm</td>
<td>Sealants and Elastomeric Adhesives</td>
</tr>
<tr>
<td>DWD 2220.01</td>
<td>2.0</td>
<td>56</td>
<td>40%</td>
<td>&lt;400 ppm</td>
<td>Sealants and Elastomeric Adhesives</td>
</tr>
<tr>
<td>DWD 2208.01</td>
<td>2.0</td>
<td>125</td>
<td>40%</td>
<td>&lt;400 ppm</td>
<td>Adhesives</td>
</tr>
<tr>
<td>DWD 2342.01</td>
<td>3.0</td>
<td>67</td>
<td>35%</td>
<td>&lt;400 ppm</td>
<td>Adhesives</td>
</tr>
</tbody>
</table>

*If products are described as “experimental” or “developmental”: (1) product specifications may not be fully determined; (2) analysis of hazards and caution in handling and use are required; (3) there is greater potential for Dow to change specifications and/or discontinue production; and (4) although Dow may from time to time provide samples of such products, Dow is not obligated to supply or otherwise commercialize such products for any use or application whatsoever.

NOTE: The products listed may not yet be available in all geographies where Dow is represented. The claims made may not have been approved for use in all countries. Please contact your local Dow representative for regulatory approval and technical information applicable in your respective geography.
RENUVA™ Technology enables the design of polyurethane structures to meet mechanical performance requirements such as modulus and tensile strength. As shown in Figure 1, products made with RENUVA Technology offer bond strength that is comparable to, or even exceeds, conventional polyether-based polyols. The natural-oil-derived components also provide increased resistance to water, enhancing weatherability and environmental resistance.

**FIGURE 1: Performance in Model Urethane Elastomeric Adhesive**

![Graph showing performance comparison between conventional polyether and RENUVA™ Technology]

Description: Comparison of cured properties of prepolymer based on monomeric methylene diphenyl disocyanate (MMDI) and 1000 equivalent weight polyether diol/triol versus prepolymer based on MMDI and RENUVA™ Technology-based natural oil-based/polyether hybrid solution. Both systems cured with stoichiometric ratio of diethylene glycol.

RENUVA™ Renewable Resource Technology enables the creation of natural oil-based polyols for use in a wide range of adhesive and sealant applications across diverse substrates.

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Sealants
Bio-based polyols made with RENUVA™ Renewable Resource Technology can be used in a variety of sealant applications. Key benefits for sealants include:

- Acid resistance
- Excellent low-temperature flexibility
- Good balance of mechanical properties including low modulus and high elongation

Sealants made with polyols from RENUVA™ Renewable Resource Technology offer excellent low-temperature flexibility, good UV and oxidative stability, and high elongation with low modulus.

Table 2 presents details regarding current Dow polyol offerings for sealant applications utilizing RENUVA Technology.

**TABLE 2: Developmental bio-based polyols for sealant applications**

<table>
<thead>
<tr>
<th>Product</th>
<th>Functionality</th>
<th>OH # (typical)</th>
<th>Approximate Renewable Content (% wt.)</th>
<th>Water (ppm)</th>
<th>Typical Uses and Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>DWD 2215.01</td>
<td>2.0</td>
<td>40</td>
<td>40%</td>
<td>&lt;400 ppm</td>
<td>Sealants and Elastomeric Adhesives</td>
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<tr>
<td>DWD 2220.01</td>
<td>2.0</td>
<td>56</td>
<td>40%</td>
<td>&lt;400 ppm</td>
<td>Sealants and Elastomeric Adhesives</td>
</tr>
</tbody>
</table>

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Dow recognizes that the limited supply of petroleum-based resources, growth in population, and the influence of human activity on the environment are potential causes for concern to future generations. Dow believes that being a good corporate neighbor and a responsible steward of the world’s resources means providing innovative solutions to help address these issues.

Using the Triple Bottom Line of Sustainable Development, Dow focuses on three fundamental areas – economics, environment, and society – where companies impact the quality of life. The Triple Bottom Line provides a framework that directs Dow activities to ensure that we continue on the course prescribed by our mission statement, to “constantly improve what is essential to human progress by mastering science and technology.”

The introduction of high-performance, bio-based polyols via RENUVA™ Renewable Resource Technology from Dow further demonstrates our commitment to this mission and to helping our customers find ways to create more sustainable products and a more sustainable future.

**Dow Polyurethanes**

Dow Polyurethanes, a business group of The Dow Chemical Company, offers a broad product portfolio comprising rigid and flexible foams, coatings, adhesives, sealants and more. Dow Polyurethanes serves a variety of markets, including appliances, automotive, bedding, carpet backing, construction, furniture, packaging, and recreation.

As a world-leading supplier of innovative polyurethane solutions, Dow Polyurethanes is committed to customer success. This is realized every day through products that meet the quality, consistency, and performance needs of customers around the world. It’s shown through on-time delivery and a focus on safety and the environment—and demonstrated through local sales and technical support that offer the potential to help our customers grow.

**Start Collaborating Today**

Dow is ready to work with you today, and the sooner we begin collaborating, the quicker you can bring your products to market. Our exceptional process technology and standing as a reliable global supply source help us to provide you with the materials you need for economic and environmental sustainability. In addition, our ongoing research and development promises even more exciting possibilities for tomorrow.

So contact us today to discuss how natural oil-based polyols made with RENUVA™ Renewable Resource Technology can meet your current needs and help you differentiate your product offerings well into the future.
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