**Description**

Using Sasol North America’s patented narrow range ethoxylation catalyst technology, referred to as NOVEL®, ethoxylates of excellent quality can be produced with up to 100 moles using a variety of alcohol feedstocks. Sasol manufactures ethoxylates from Ziegler, oleo-based, and oxo-based alcohols. When compared with conventional (KOH) catalyzed ethoxylates (which Sasol produces under the tradename ALFONIC®), the NOVEL® Ethoxylates yield surfactants that:

- Have a narrow distribution of ethoxylate homologs
- Exhibit lower melting points, which leads to easier handling at lower temperatures
- Better mimic Alkylphenol Ethoxylate (APEO) properties
- Contain less residual alcohol, which reduces or eliminates VOCs
- Have significantly lower polyethylene glycol content (NOVEL® <1.5 wt.%; conventional catalyst <5 wt.%)
- Display improved color of high mole ethoxylates
- Have a very low 1,4-dioxane content (<1 ppm)
- Are 100% active products

**Ethoxylate Homolog Distribution Comparison**

The following graph demonstrates the differences in the ethoxylate homolog distribution between linear lauryl-9 mole ethoxylate (1214-9) produced with conventional catalyst and NOVEL® Catalyst. This narrower distribution of the NOVEL® product gives a closer match to nonylphenol-9 mole ethoxylate when compared to conventional catalysts.

![Ethoxylate Homolog Distribution Graph](image-url)

- **NOVEL® decreases high mole ethoxymers yielding lower melting points.**
- NOVEL® ethoxylates have lower free alcohol
Ecological Properties
NOVEL® 23 and TDA Ethoxylates meet the 28 day criteria for biodegradation and will not break down to toxic metabolites. As examples, data for some products is listed below (specific information for each surfactant and additional ecological information is available upon request).

### Biodegradation:

<table>
<thead>
<tr>
<th>NOVEL® 23E7 Ethoxylate</th>
<th>NOVEL® TDA-3 Ethoxylate</th>
<th>NOVEL® 23E30 Ethoxylate</th>
<th>NOVEL® TDA-30 Ethoxylate</th>
</tr>
</thead>
<tbody>
<tr>
<td>28 days, Degradation</td>
<td>&gt;60%¹</td>
<td>&gt;60%²</td>
<td>&gt;60%³</td>
</tr>
<tr>
<td>Biodegradation Status</td>
<td>Readily</td>
<td>Readily</td>
<td>Readily</td>
</tr>
</tbody>
</table>

¹Gledhill test (OPPTS 835.3100) ²Modified Sturm Test (OECD 301B) ³Manometric Respirometry Test (OECD 301F)

### NOVEL® vs. ALFONIC® Ethoxylate Property Comparison

The following chart demonstrates the effectiveness of Sasol’s NOVEL® Catalyst technology. The properties of ethoxylates prepared using conventional KOH (ALFONIC®) and NOVEL® Catalyst are compared below. A nonylphenol-9 mole ethoxylate has been included to demonstrate the similarities between NPEs and the NOVEL® Ethoxylates.

<table>
<thead>
<tr>
<th>Product</th>
<th>Moles of EO</th>
<th>HLB</th>
<th>Free Alcohol (wt.%)</th>
<th>Melting Point (°C)</th>
<th>Cloud Point (1% in H₂O)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALFONIC® TDA-9</td>
<td>9</td>
<td>13.2</td>
<td>4</td>
<td>25</td>
<td>55</td>
</tr>
<tr>
<td>NOVEL® TDA-9</td>
<td>9</td>
<td>13.2</td>
<td>2</td>
<td>3</td>
<td>58</td>
</tr>
<tr>
<td>NPE-9</td>
<td>9</td>
<td>12.7</td>
<td>0</td>
<td>-5</td>
<td>54</td>
</tr>
<tr>
<td>ALFONIC® 23E7</td>
<td>7</td>
<td>12.4</td>
<td>3</td>
<td>12</td>
<td>53</td>
</tr>
<tr>
<td>NOVEL® 23E7</td>
<td>7</td>
<td>12.4</td>
<td>0.5</td>
<td>5</td>
<td>57</td>
</tr>
<tr>
<td>ALFONIC® 1216CO-7</td>
<td>7</td>
<td>12.2</td>
<td>2</td>
<td>18</td>
<td>55</td>
</tr>
<tr>
<td>NOVEL® 1216CO-7</td>
<td>7</td>
<td>12.2</td>
<td>0.5</td>
<td>12</td>
<td>83</td>
</tr>
</tbody>
</table>

### Contact Information

For further information on these or other Sasol products, contact a sales representative at:

**Sasol North America**

900 Threadneedle, Suite 100
Houston, TX 77079-2990
P: (281) 588-3000
E-Mail: info@us.sasol.com

For technical inquiries or samples contact:

**Sasol North America**

Melanie Sharp
2201 Old Spanish Trail
Westlake, LA 70669
P: (337) 494-5095
E-Mail: Melanie.Sharp@us.sasol.com

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For detailed safety and handling information regarding these products, please refer to the respective Sasol North America Material Safety Data Sheet.