Tailor-Made Solutions for Animal Feed
Enabling Competitive Supply
Dow provides a customized propylene glycol grade for animal feed.* This product has a specified purity of greater than 99.7 percent, which helps provide the performance and cost-efficiency at high and consistent quality as demanded in animal feed applications. It features exceptional stability, high flash and boiling points, low vapor pressure and broad solvency power. Hence, Dow’s Propylene Glycol Animal Feed (PG AF) may offer the following exceptional benefits to manufacturers and the end application:

- Provides a ready source of energy
- Serves as a readily available energy source in ketosis treatment and prevention
- Helps increase and maintain moisture content
- Helps increase product shelf life
- Helps enhance palatability of animal feeds
- Is an excellent solvent for animal feed ingredients like flavors
- Facilitates the handling of molasses, reducing buildup and subsequent stickiness of equipment
- Acts as a lubricant for processing equipment

Dow recommends using its PG AF grade because it is tailor made for animal feed applications regarding its production, analytical testing, ensurance of traceability and handling, and transportation in compliance with existing feed safety standards.

Dow does not support the use of Propylene Glycol Industrial or Technical Grades (PGI and PG TG) for this application, as these grades are not subject to the manufacturing, handling and distribution practices required for uses in animal feed. This recommendation is supported by The European Chemical Industry Council (Cefic) PO/PG sector group, composed of European propylene glycol manufacturers.

*Based on the production of Propylene Glycol in USP quality
Benefits of Propylene Glycol in Animal Feed Applications

Propylene glycol is an aliphatic organic compound with the molecular formula \( \text{CH}_3\text{CH(OH)}\text{CH}_2\text{OH} \). In animal feed applications, some of its beneficial physical properties** include:

- **Readily available energy source** with a caloric value of 4.0 calories\(^1\) per gram (food calories) when defined as a carbohydrate, and measured value of 5.7 calories per gram in chicks\(^2\) – up to 1.5 times the caloric value of molasses, according to the general definition for a carbohydrate as given in the U.S. Food and Drug Administration (U.S.FDA) 21 CFR § 101.9(c)(1)(i)(B).

- **Prevention and treatment of fatty liver and ketosis (acetonaemia)** in dairy cows and sheep – providing a prophylactic impact on these deficiency symptoms. Fatty liver precedes ketosis and is the result of greater fat mobilization from adipose tissue and uptake of non-esterified fatty acids by the liver. Ketosis is a metabolic condition normally associated with high milk-producing cows shortly after calving (48-72 hours), when feed intake can be abnormally depressed. Over-conditioned, sick cows, and cows fed diets high in fiber or poor quality forage, are the most likely candidates for this condition. The common signs of this condition are going “off-feed,” decreased milk production, rapid loss of body fat, a drop in the blood glucose level and the smell of ketones on the cow’s breath, milk and urine.\(^3\) For recommendations on an appropriate treatment for these conditions using propylene glycol, please consult a veterinarian.

- **Excellent humectant** – a substance with the ability to attract and hold water in a formulation (see Table 1)\(^4\).

- **Natural antimicrobial** against a wide range of bacterial and fungal species – mold growth is inhibited in most feed when propylene glycol is added at concentrations of 10-15 percent (w/w), while lower concentrations retard the growth (see Table 2).

- **Effective solvent** for many oils and organic compounds: Many water-immiscible materials can be carried into clear water solutions by means of propylene glycol’s coupling action. It enhances the penetration of the two most common liquid feed ingredients – fats and/or molasses – into the dry ingredients of the feed.

- **Acting as a wetting agent** when mixed with molasses in the range of 1-2 pounds (0.5-1 kg) PG per ton of molasses, increasing the absorption of molasses by the feed ingredients and improving the handling characteristics of the final feed mix.

- **Acting as a lubricant** for processing equipment at concentrations as low as 1-2 percent, resulting in a prolonged pellet mill die life as well as reducing cleaning time intervals and power consumption.

- **Freezing point depressant**, simplifying bulk handling by maintaining the feed at lower temperatures.

- **Helps control ingredient segregation** and dustiness without the rancidity issue associated with commonly used vegetable oils in mineral and vitamin-drug mixes.

- **Safe history of use** demonstrated during more than 50 years in health sensitive applications and underlined with studies proving a very low degree of toxicity.

**See Product Technical Data Sheet for full property details
Table 1: Humectancy of Propylene Glycol

<table>
<thead>
<tr>
<th>Air Temperature</th>
<th>Relative Humidity</th>
</tr>
</thead>
<tbody>
<tr>
<td>°C</td>
<td>°F</td>
</tr>
<tr>
<td>-6.7</td>
<td>20</td>
</tr>
<tr>
<td>4.4</td>
<td>40</td>
</tr>
<tr>
<td>15.6</td>
<td>60</td>
</tr>
<tr>
<td>26.7</td>
<td>80</td>
</tr>
<tr>
<td>37.8</td>
<td>100</td>
</tr>
<tr>
<td>48.9</td>
<td>120</td>
</tr>
</tbody>
</table>

Percentage by weight values of glycol in water solutions that will be in equilibrium with air at various temperatures and humidity. This information can be used to calculate the amount of Dow PG AF needed to maintain a feed at a desired water content.

Table 2: Effect of Propylene Glycol on Mold Growth in Feeds

<table>
<thead>
<tr>
<th>Ratios to Make Additive</th>
<th>Molasses</th>
<th>Propylene Glycol</th>
<th>% Mold Inhibition After 18 Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>2.5</td>
<td>1</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>1.7</td>
<td>1</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>1.25</td>
<td>1</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>Complete</td>
<td></td>
</tr>
</tbody>
</table>

*Molasses – PG AF mixture added to feed at a 4 percent by weight level

Feed incubated at 95°F (35°C)

For an acceptable animal feed shelf life, humectancy and mold inhibition are important, for example in semi-moist dog feeds with moisture contents of 15-40 percent.

Robust Supply Chain for Global Reach

With over 60 years of experience as a worldwide leading propylene glycol manufacturer and supplier, Dow has built a robust supply chain network that provides:

- One of the world’s largest propylene glycol production facilities in Stade, Germany.
- Reliable global supply from strategically located manufacturing sites in the U.S., Brazil, Germany, Australia and Thailand.
- Inventory management solutions from strategically located terminals around the world to help meet changing customer needs.
- Quality storage, packaging and transportation according to the world’s most stringent standards and documentation requirements for PG AF, including marine transportation capabilities.
Backed by Excellent Service and Customer Support:
- TS&D support for technical and EH&S experience to support customer application needs. In addition, customers can contact Dow for assistance in proper handling, storage and use of Dow PG AF, in keeping with Dow’s commitment to Responsible Care®.
- Dedicated customer service representatives (CSRs) who are helping customers to use Dow PG AF effectively, and providing support according to the customer’s region.
- Sales professionals who are committed to serving customers and championing their needs throughout the sales process.
- Education and training, including an Online Answer Center, available to customers 24 hours a day, seven days a week at www.dowpg.com.
- Easy access to area Customer Information Groups (see phone numbers on last page).
- Distributor review, qualification and training program.

Regulatory Status
European Union (EU):
- Propylene glycol is listed in Regulation (EU) No 68/2013 of 16 January 2013 on the Catalogue of Feed Materials (Part C; No 13.11.1).
- The production and handling of PG AF at Dow Stade/Germany complies with the requirements of Regulation (EC) 183/2005 of the European Parliament and of the Council of 12 January 2005 laying down requirements for feed hygiene. These EU directives cited have been incorporated into national legislation within specific EU member states.
- Propylene glycol is not on the list of approved additives for cat foodstuffs.

- Regional authorities have inspected and approved Dow’s propylene glycol manufacturing facility in Stade, Germany, as an animal feed material producer based on EU® and corresponding German legislation (identification number DE NI 359003).
- The quality management system complies with current FAMI-QS® European Code of Practice for Feed Additive and Premixture Operators by FEFANA (the European Association of Feed Additive Manufacturers), as confirmed by a current FAMI-QS® certificate.

United States:
- The U.S. FDA lists propylene glycol as an emulsifying agent that is “generally recognized as safe” (GRAS) according to 21 CFR § 582.4666 and as a general food additive according to 21 CFR § 582.16669 (except for use in cat food).
- No tolerances or use limitations are listed other than those dictated by Good Manufacturing Practices.
- Propylene glycol is not GRAS for cat foods and should not be used in that application, according to 21 CFR § 500.50 and § 589.1001.9
The information in this brochure is intended as a general guideline and is not necessarily complete. Applicable local government regulations should be consulted for details on approved and appropriate applications for Dow PG AF. Dow sales representatives can work closely with animal feed manufacturers to help determine and follow the necessary actions required to meet state mandates where the feed product is processed.

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Material Safety Data Sheets (MSDS) and Technical Data Sheets (TDS) available at www.dowpg.com

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