Alkyl Polyglucosides (APG®)

Benefits of Glucopon®-Types in Hard Surface Cleaning
Alkyl Polyglucosides

Content

Chemical Structure

Product Overview of Cognis APG®

Product Properties
- Soil Removal
- Emulsifier Potential
- Plastic Compatibility
- Foaming Properties new
- Filming Properties new
- Anti-Streaking new
- Skin Compatibility

Summary
Alkyl Polyglucosides

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Summary
Alkyl Polyglucosides

Chemical Structure

R is based on natural, renewable resources

\[ X = DP \]
\[ DP = 1.3 - 1.7 \]
Alkyl Polyglucosides

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Summary
## Alkyl Polyglucosides

*Cognis Glucopon®- Line for Home Care / I&I (EU Production)*

<table>
<thead>
<tr>
<th>Product Properties</th>
<th>215 CS UP</th>
<th>225 DK</th>
<th>425 N/HH</th>
<th>600 CS UP</th>
<th>650 EC</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-Chain</td>
<td>C8-10</td>
<td>C8-10</td>
<td>C8-14</td>
<td>C12-14</td>
<td>C8-14</td>
</tr>
<tr>
<td>DP (approx.)</td>
<td>1,5</td>
<td>1,7</td>
<td>1,5</td>
<td>1,4</td>
<td>1,5</td>
</tr>
<tr>
<td>Appearance</td>
<td>yellowish, slightly cloudy liquid</td>
<td>brownish liquid</td>
<td>yellowish liquid</td>
<td>yellowish, slightly cloudy paste</td>
<td>yellowish, slightly cloudy liquid</td>
</tr>
<tr>
<td>Active substance [%]</td>
<td>62 - 65</td>
<td>68 - 72</td>
<td>48 - 52</td>
<td>50 - 53</td>
<td>50 - 53</td>
</tr>
<tr>
<td>Water content [%]</td>
<td>35 - 38</td>
<td>28 - 32</td>
<td>48 - 52</td>
<td>47 - 50</td>
<td>47 - 50</td>
</tr>
<tr>
<td>Viscosity</td>
<td>3.000 – 4.000 mPa.s, 20°C</td>
<td>3.500 – 5.000 mPa.s, 20°C</td>
<td>300 - 600 mPa.s, 20°C</td>
<td>2.000 – 4.000 mPa.s, 40°C</td>
<td>1.500 – 3.000 mPa.s, 20°C</td>
</tr>
<tr>
<td>pH value</td>
<td>11.5 - 12.5 (10%)</td>
<td>6.0 - 9.0 (10%)</td>
<td>7.0 - 9.5 (20%)</td>
<td>11.5 - 12.5 (20%)</td>
<td>11.5 - 12.5 (20%)</td>
</tr>
<tr>
<td>Storage Temperature [°C]</td>
<td>&lt; 40°C</td>
<td>&lt; 40°C</td>
<td>&lt; 40°C</td>
<td>&lt; 50°C</td>
<td>&lt; 40°C</td>
</tr>
<tr>
<td>Biodegradation (OECD 301 A-F)</td>
<td>readily</td>
<td>readily</td>
<td>readily</td>
<td>readily</td>
<td>readily</td>
</tr>
<tr>
<td>Compliant with EU-Detergent Regulation</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>
## Alkyl Polyglucosides

*Cognis Glucopon®- Line for Home Care / I&I (US Production)*

<table>
<thead>
<tr>
<th>Product Properties</th>
<th>APG®</th>
<th>Glucopon® Line</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>325 N</td>
<td>220 UP</td>
</tr>
<tr>
<td>C-Chain</td>
<td>C9-11</td>
<td>C8-10</td>
</tr>
<tr>
<td>DP (approx.)</td>
<td>1,5</td>
<td>1,5</td>
</tr>
<tr>
<td>Appearance</td>
<td>light yellow, clear liquid</td>
<td>hazy liquid</td>
</tr>
<tr>
<td>Active substance [%]</td>
<td>48 - 52</td>
<td>58 - 62</td>
</tr>
<tr>
<td>Viscosity [cps,25°C]</td>
<td>4.000</td>
<td>2.800</td>
</tr>
<tr>
<td>pH value [10%]</td>
<td>7.0 - 9.5</td>
<td>11.5 - 12.5</td>
</tr>
<tr>
<td>Storage Temperature [°C]</td>
<td>&lt;43°C</td>
<td></td>
</tr>
<tr>
<td>Biodegradation (OECD 301 A-F)</td>
<td>readily</td>
<td>readily</td>
</tr>
<tr>
<td>Compliant with EU- Detergent Regulation</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>
Alkyl Polyglucosides

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Product Overview of Cognis APG®

Product Properties
  • Soil Removal
  • Emulsifier Potential
  • Plastic Compatibility
  • Foaming Properties
  • Filming Properties
  • Anti-Streaking
  • Skin Compatibility

Summary
Alkyl Polyglucosides

*Product Properties*

*Soil Removal*

Alkyl Polyglucosides

Product Properties
Soil Removal

Test Conditions for Automatic Test Equipment

Application of diluted solution of 2 % AM in water.

Soil for Diluted Application (83/21)

<table>
<thead>
<tr>
<th>%</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>17,0</td>
<td>Myritol 318 (caprylic / capric triglyceride)</td>
</tr>
<tr>
<td>40,0</td>
<td>Telura 310 (mineral oil, naphthenic)</td>
</tr>
<tr>
<td>36,0</td>
<td>Benzine (80/110)</td>
</tr>
<tr>
<td>7,0</td>
<td>Pigment Black 7 (Degussa Cl 77266)</td>
</tr>
</tbody>
</table>
**Alkyl Polyglucosides**

*Product Properties*

*Soil Removal*

![Bar Chart](chart.png)

### Soil Removal [%]

- Glucopon® 215 CS UP
- Glucopon® 650 EC
- Glucopon® 425 N/HH
- Glucopon® 225 DK
- Glucopon® 600 CS UP
- Glucopon® 625 UP
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Summary
Alkyl Polyglucosides

Product Properties

Emulsifier Potential

Testing of Emulsification Properties by Observation of Mixture of Olive Oil and Surfactant Solution.

Test Method

50 ml of olive oil and 50 ml of surfactant solution (2% AM in water) is mixed 1200 +/-3 rpm for 2 minutes. After 1 and 4 hours observation of the level of remaining test solution.

Principle

The lower the remaining level, the better the emulsification properties of the test solution.
Alkyl Polyglucosides

Product Properties
Emulsifier Potential

![Graph showing emulsifier potential of Alkyl Polyglucosides](graph.png)

- Glucopon® 215 CS UP
- Glucopon® 225 DK
- Glucopon® 425 N/HH
- Glucopon® 600 CS UP
- Glucopon® 650 EC
- Glucopon® 625 UP

**Surfactant Solution [ml]**

- after 1 h
- after 4 h
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Product Properties
Plastic Compatibility

Testing of Plastic Compatibility Spline / Corrosion Test
According to the Hansgrohe Method

Methodology
The plastic test stripe, containing a stainless steel pin in a hole (tension), is dipped five
days in a row shortly into the test solution. The test strip is checked visually after
• 4 hours
• 3 days
• 7 days and
• 14 days test period.

Assessment Range

unchanged  fissures  through-cracks  fraction
Alkyl Polyglucosides

Product Properties
Plastic Compatibility

Nonionic surfactants
Concentration: 5 % active substance
Plastic: Plexiglas (PMMA)
Alkyl Polyglucosides

Actual Adverts
Plastic Compatibility

Plastic is a common element in nowadays households. APG® perfectly matches the necessity for plastic compatibility of household cleaner.
Alkyl Polyglucosides

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Product Overview of Cognis APG®

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• Soil Removal
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• Foaming Properties new
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Summary
Alkyl Polyglucosides

Product Properties

Foaming Behavior

**Test Conditions**
Trigger spray application. Formulations were tested on ceramic tiles. Observation of foaming behavior without rinsing and wiping the test solution.

**Time Intervals**
- after application
- after 50 seconds
- after 2 minutes
- after 3 minutes

**Comparative Foaming Test**

Formulation 1
with Fatty Alcohol Ethoxylate (FAEO)

vs.

Formulation 2
with Glucopon® 215 CS UP
Alkyl Polyglucosides

Product Properties

Foaming Behavior

Used test formulations

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Formulation 1</th>
<th>Formulation 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatty Alcohol Ethoxylate (C9-11, 8EO)</td>
<td>2.0</td>
<td>-</td>
</tr>
<tr>
<td>Glucopon® 215 CS UP</td>
<td>-</td>
<td>3.0</td>
</tr>
<tr>
<td>Citric Acid</td>
<td>4.0</td>
<td>4.0</td>
</tr>
<tr>
<td>NaOH (31%)</td>
<td>2.2</td>
<td>2.2</td>
</tr>
<tr>
<td>IPA (Isopropyl Alcohol)</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Colour, Fragrance, Preservative</td>
<td>q.s</td>
<td>q.s.</td>
</tr>
<tr>
<td>De-ionized Water</td>
<td>add to 100</td>
<td>add to 100</td>
</tr>
<tr>
<td>Total Active Matter [%]</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Both formulations are clear liquid in their appearance and have a pH value of 3.0 - 3.5.
Alkyl Polyglucosides

Product Properties

Foaming Behavior

Foaming Properties

Formulation 1  Formulation 2
(with FAEO)    vs.    (with Glucopon® 215 CS UP)
Alkyl Polyglucosides

Product Properties

Foaming Behavior

Results

• Foaming behavior of formulation with Glucopon® 215 CS UP is better than the formulation containing FAEO. Foam is relatively stable throughout the tested time interval.

• Formulation with Glucopon® 215 CS UP left nearly no residues on ceramic tile after foam has finally disappeared, while the formulation with FAEO clearly left spots and stains of the test solution.
Alkyl Polyglucosides

Actual Adverts

Foaming Behavior

Stable foaming behavior of product
to promote better cleaning
properties
Alkyl Polyglucosides

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• Soil Removal
• Emulsifier Potential
• Plastic Compatibility
• Foaming Properties
• Filming Properties new
• Anti-Streaking
• Skin Compatibility

Summary
Alkyl Polyglucosides

Product Properties

Filming Behavior

Test Conditions:
Tests were performed on ceramic tiles.
Observation of filming behavior by placing one drop of test solution and dispersing it on the surface with the same systematic.

Comparative Filming Tests:

I. Formulation 1 with Glucopon® 215 CS UP vs. Formulation 2 with Sodium Alkane Sulfate (SAS)
II. Formulation 1 with Glucopon® 215 CS UP vs. Formulation 3 with Sodium Lauryl Ether Sulfate (SLES)
III. Formulation 1 with Glucopon® 215 CS UP vs. Formulation 4 with Fatty Alcohol Ethoxylate (FAEO)
IV. Formulation 1 with Glucopon® 215 CS UP vs. Formulation 5 with Alkyl Polyglucoside (APG®)
**Alkyl Polyglucosides**  
*Product Properties*  
*Filming Behavior*

Used test formulations

<table>
<thead>
<tr>
<th>Ingredients (% AM)</th>
<th>Formulation 1</th>
<th>Formulation 2</th>
<th>Formulation 3</th>
<th>Formulation 4</th>
<th>Formulation 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glucopon® 215 CS UP Alkyl Poly Glucoside (APG®)</td>
<td>3.1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Sodium Alkane Sulfate (SAS)</td>
<td>-</td>
<td>3.3</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Texapon® N 70 Sodium Lauryl Ether Sulfate (SLES)</td>
<td>-</td>
<td>-</td>
<td>2.8</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Fatty Alcohol Ethoxylate (FAEO) with 8 EO</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2.0</td>
<td>-</td>
</tr>
<tr>
<td>Glucopon® 650 EC Alkyl Poly Glucoside (APG®)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3.6</td>
</tr>
<tr>
<td>IPA (Isopropanol Alcohol)</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Water</td>
<td>93.9</td>
<td>93.7</td>
<td>94.2</td>
<td>95.0</td>
<td>93.4</td>
</tr>
<tr>
<td>Dye</td>
<td>q.s.</td>
<td>q.s.</td>
<td>q.s.</td>
<td>q.s.</td>
<td>q.s.</td>
</tr>
<tr>
<td>Total Active Matter [%]</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

All formulations have a pH value of 7.0 – 8.0.
Alkyl Polyglucosides

Product Properties
Filming Behavior

<table>
<thead>
<tr>
<th>Filming Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formulation 1</td>
</tr>
<tr>
<td>(with Glucopon® 215 CS UP)</td>
</tr>
</tbody>
</table>
Alkyl Polyglucosides

Product Properties

Filming Behavior

Results

Formulation with Glucopon® 215 CS UP shows the best filming behavior. The test formulation spreads equally on the surface / ceramic tile.
Alkyl Polyglucosides

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• Foaming Properties
• Filming Properties
• Anti-Streaking new
• Skin Compatibility

Summary
Alkyl Polyglucosides

Product Properties

Anti - Streaking

Visibility of Residues

• Streaks are drops of surfactant aligned in rows.
• Streaks / droplets are always present on the treated surface.
• Constant / streak free films exhibit significantly smaller droplets.

APG® on glass, 10x

FAEO on glass, 10x
Alkyl Polyglucosides

Product Properties

Anti-Streaking

Comparative Anti-Streaking Test:

Formulation 1  
with Fatty Alcohol Ethoxylate (FAEO)  

Formulation 2  
vs.  
with Glucopon® 215 CS UP

Test Conditions:

Trigger spray application.

Formulations were tested on ceramic tiles.

Observation of streaking behavior by wiping the surface after application of the test solution.
Alkyl Polyglucosides

Product Properties

Anti-Streaking

Used test formulations

<table>
<thead>
<tr>
<th>Ingredients</th>
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<th>Formulation 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatty Alcohol Ethoxylate (C9-11, 8EO)</td>
<td>2,0</td>
<td>-</td>
</tr>
<tr>
<td>Glucopon® 215 CS UP</td>
<td>-</td>
<td>3,0</td>
</tr>
<tr>
<td>Citric Acid</td>
<td>4,0</td>
<td>4,0</td>
</tr>
<tr>
<td>NaOH (31%)</td>
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<tr>
<td>Colour, Fragrance, Preservative</td>
<td>q.s</td>
<td>q.s</td>
</tr>
<tr>
<td>De-ionized Water</td>
<td>add to 100</td>
<td>add to 100</td>
</tr>
<tr>
<td>Total Active Matter [%]</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Both formulations are clear liquid in their appearance and have a pH-value of 3.0 - 3.5.
Alkyl Polyglucosides

Product Properties

Anti-Streaking

Streak-free Cleaning

Formulation 1  vs.  Formulation 2

(with FAEO)  vs.  (with Glucopon® 215 CS UP)
Alkyl Polyglucosides

Product Properties

Anti-Streaking

Results

• Formulation with Glucopon® 215 CS UP has better anti-streaking effects than the formulation containing FAEO.

• Formulation with Glucopon® 215 CS UP leaves nearly no streaks on ceramic tile after wiping, while the formulation with FAEO left clearly spots and stains of the test solution.
Alkyl Polyglucosides

Actual Adverts
Anti-Streaking

Anti-Streaking properties of window cleaner for easy cleaning and more convenience.
Alkyl Polyglucosides

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Product Properties

Skin Compatibility (I)

Test Method:
Arm Flex Wash Test

Tested Surfactants:
1 = Sodium Lauryl Ether Sulfate (FAES)
2 = Sodium Lauryl Ether Sulfate : Decyl Glucoside (APG®) (3:1)

APG®: Glucopon® 600 CSUP
FAES: Texapon® NSO

Test Conditions:
Mode of Application: open, two times per day, for 30 seconds
The concentration of the test solution was 1% active substance.
Alkyl Polyglucosides

Product Properties

Skin Compatibility (I)

Erythema

Sensorial evaluation
Alkyl Polyglucosides

Product Properties

Skin Compatibility (II)

Test Method:
Modified Duhring - Chamber Test

Tested Surfactants:
• Alkyl Poly Glucoside - APG®
• Linear Alkylbenzene Sulphonate - LAS
• Fatty Alcohol Ether Sulfate - FAES
• Sodium Alkene Sulfate - SAS
• Fatty Alcohol Sulfate – FAS
• Mixtures of other surfactants with APG®

Test Conditions:
20 subjects (male and female).
Mode of Application: once, occlusive, for 24 hours
The concentration of the test solution was 1% active substance.
Alkyl Polyglucosides

Product Properties

Skin Compatibility (II)

<table>
<thead>
<tr>
<th></th>
<th>Relative irritation score %</th>
</tr>
</thead>
<tbody>
<tr>
<td>APG® C12/14</td>
<td></td>
</tr>
<tr>
<td>LAS</td>
<td></td>
</tr>
<tr>
<td>FAES</td>
<td></td>
</tr>
<tr>
<td>SAS</td>
<td></td>
</tr>
<tr>
<td>FAS C12/14</td>
<td></td>
</tr>
<tr>
<td>LAS / APG® (1:1)</td>
<td></td>
</tr>
<tr>
<td>FAES / APG® (1:1)</td>
<td></td>
</tr>
<tr>
<td>SAS / APG® (1:1)</td>
<td></td>
</tr>
<tr>
<td>FAS / APG® (1:1)</td>
<td></td>
</tr>
</tbody>
</table>
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Summary
Alkyl Polyglucosides

Summary

- Excellent cleaning performance.
- Perfect plastic compatibility by showing no stress-cracking behavior.
- Foaming properties of Glucopon® are significantly better than those of FAEO – not only when being applied on a surface, but also afterwards.
- Tests show the excellent filming behavior of Glucopon® -types in contrast to other nonionic surfactants by equally covering the surface / spreading over the surface.
- Significant anti-streaking properties of Glucopon® is proven by wiping the surface after application of the test solution. No streaks on the treated surface.
- Glucopon® surfactants are significantly less skin irritating than comparable nonionic surfactants. Moreover Glucopon® has the property to even reduce the skin irritation factor of other surfactants when being used in combination. Perfect mildness to skin.