Cleaning Applications
1. Introduction
Customer oriented around the globe

Global reach, local focus.
This catalog contains information about specialty chemicals offered by Nouryon, and in particular the product list of the Cleaning segment for the Europe, the Middle East, India and Africa (EMEIA) region.

Our product portfolio includes nonionic narrow range ethoxylates, fatty amine derivatives, amine salts, quaternary ammonium compounds, amine oxides, amides and others.

In addition, a range of polymeric products is also available, covering polyacrylic acid homo and copolymers and their salts, specialty copolymers and modified polysaccharide hybrid products.

We offer the formulator a robust portfolio of surface active agents and intermediates to choose from. Our chemical technology expertise, efficient manufacturing facilities, research and development support, and commitment to providing quality products help fulfill our promise to deliver effective cleaning solutions for our customers in both household and industrial and institutional applications.
2. Specialty surfactants and co-surfactants
Boosting your cleaning performance

Many formulations, especially those used in heavy degreasing operations required in industrial and institutional processes, are made in concentrated form. This minimizes space demands in storage and transport, reduces packaging waste and offers the formulator the ability to produce a concentrated product that may be diluted to different strengths for different demands. Preparing such products poses the challenge of keeping the whole formulation together in order to obtain a stable solution.

To overcome this, hydrotropes are used. With hydrotropes, the lipophilic chain is relatively small compared with the hydrophilic head unlike surfactants where the opposite applies. This structure enables the hydrotrope molecules to aggregate with the surfactant molecules and become a part of the micelle structure.

In addition to solubilization, co-surfactants bring additional value to formulations in synergy with the primary surfactant. Such multifunctional hydrotropes can boost degreasing, increase the tolerance to caustic and electrolytes, or provide foam control.

Our product portfolio includes several types of co-surfactants, which can be used in different conditions (very alkaline and high concentrations of electrolytes, low and high foaming, etc.). Through our core competence in nitrogen chemistry we have developed very effective cationic and nonionic co-surfactants.

Both Berol R648 NG and Berol R648 PO are readily biodegradable multifunctional hydrotropes. Both have excellent solubilization power and in combination with nonionic surfactants delivers outstanding degreasing performance even at very low concentrations. The unique chemistry enables superior cleaning performance of your formulations, ranging from household cleaners to the most demanding industrial degreasers.

Berol SurfBoost AD15 is a non-classified co-surfactant which has the primary benefit to be readily aerobically and anaerobically biodegradable. It is a moderate foaming alkylamide ethoxylate designed particularly for environmentally friendly household products.

Berol SurfBoost AD2M is an alkyl N,N-dimethylamide with excellent solubilizing properties designed to boost cleaning performance.

Our surfactant blends, optimized for peak performance, provide single surfactant systems for easy handling and cost-effective cleaning solutions.

In addition to formulating your own degreasers with our cutting-edge components, we provide optimized, highly effective and cost-efficient surfactant blends for specific applications. They are well known in the market for being easy to formulate and able to achieve the best performance in challenging soils. Our nonionic surfactant blends are particularly stable in harsh environments.
**Specialty surfactants**

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Appearance</th>
<th>Active Content 20°C</th>
<th>Surface Tension mN/m*</th>
<th>Wetting Power sec**</th>
<th>Solubility in 5% water</th>
<th>Property/Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Armohib Cl-28 (a)</td>
<td>Optimized blend, containing amine ethoxylate</td>
<td>Liquid</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Berol ENV226 Plus</td>
<td>Alcohol ethoxylates and co-surfactants</td>
<td>Liquid</td>
<td>55</td>
<td>27</td>
<td>15</td>
<td>S</td>
<td>●     ●</td>
</tr>
<tr>
<td>Berol 226 (a)</td>
<td>Alcohol ethoxylates and co-surfactants</td>
<td>Liquid</td>
<td>100</td>
<td>27</td>
<td>15</td>
<td>S</td>
<td>●     ●</td>
</tr>
<tr>
<td>Berol DGR 81 φ</td>
<td>Alcohol ethoxylates and co-surfactants</td>
<td>Liquid</td>
<td>95</td>
<td>27</td>
<td>20</td>
<td>S (b)</td>
<td>●     ●</td>
</tr>
<tr>
<td>Berol LFG 61 φ</td>
<td>Alcohol ethoxylates and co-surfactants</td>
<td>Liquid</td>
<td>95</td>
<td>31</td>
<td></td>
<td>S</td>
<td>●</td>
</tr>
<tr>
<td>Berol EZ-1 φ</td>
<td>Alcohol ethoxylates and co-surfactants</td>
<td>Liquid</td>
<td>23</td>
<td></td>
<td></td>
<td></td>
<td>●     ●</td>
</tr>
<tr>
<td>Berol LS</td>
<td>Alcohol ethoxylates, co-surfactants and nano silicas</td>
<td>Liquid</td>
<td>30</td>
<td></td>
<td></td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>Berosol EC</td>
<td>Alcohol ethoxylates, co-surfactants and nano silicas</td>
<td>Liquid</td>
<td>50</td>
<td>30</td>
<td>95</td>
<td>S</td>
<td></td>
</tr>
</tbody>
</table>

**Key**
- * according to du Noüy, 25°C, 0,1% DIN 53914
- ** according to Draves, 25°C, 0,1%
- (a) not sold within EU
- S soluble
- (b) less than 5% Berol DGR 81 is dispersible in water
- φ EU Ecolabel compliant
The smart chemistry of Berol ENV226 Plus provides the best solution for industrial and household cleaning applications. It is an industry-leading readily biodegradable and powerful surfactant system delivering highly efficient cleaning. A versatile product, Berol ENV226 Plus is the heart of high performance cleaning formulations.

Berol DGR 81 and Berol LFG 61 are easy to formulate in very alkaline conditions. Berol DGR 81 is a strong degreaser with medium foam and Berol LFG 61 is a very low foam nonionic surfactant blend.

Berol LS combines degreasing and low streaking into one product. This novel technology also provides easy-clean benefits to a cleaning formulation.

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### Co-surfactants

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Appearance</th>
<th>Active Content %</th>
<th>Surface Tension mN/m*</th>
<th>Wetting Power sec**</th>
<th>Solubility in 5% water</th>
<th>Application</th>
<th>Property/Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Berol EP 25</td>
<td>C8 alcohol ethoxylate</td>
<td>Liquid</td>
<td>70</td>
<td>50</td>
<td>&gt;600</td>
<td>S</td>
<td>● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ⋯</td>
<td></td>
</tr>
</tbody>
</table>
3. Nonionic surfactants
Our nonionic surfactants get surfaces clean

Nonionic surfactants by definition contain no structural element that has a formal charge. Surface activity derives from a balance of hydrophobic and hydrophilic structures contained in the surfactant molecule. Altering the balance towards more hydrophobic or more hydrophilic influences the surfactant’s functional properties to achieve a desired effect.

Our unique portfolio with essential cleaning ingredients provides the best cost performance solution for the customer. Efficient and sustainable cleaning formulations begin with these products.

The following figure illustrates the process chemistries we employ.

**Nonionic process chemistries**

<table>
<thead>
<tr>
<th>Alcohol</th>
<th>Polyol</th>
<th>Amines</th>
<th>Acids</th>
<th>Alkoxylates</th>
<th>Ethoxylated alcohol</th>
<th>EO-PO Copolymer</th>
<th>Alkanolamides</th>
<th>Amine Ethoxylates</th>
<th>Alkylglucosides</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohols</td>
<td>Polyols</td>
<td>Amines</td>
<td>Acids</td>
<td>Alkoxylates</td>
<td>Ethoxylated alcohol</td>
<td>EO-PO Copolymer</td>
<td>Alkanolamides</td>
<td>Amine Ethoxylates</td>
<td>Alkylglucosides</td>
</tr>
</tbody>
</table>

The nitrogen based nonionic surfactants are presented on pages 14-22.

Below are listed the trademarks we use to identify the nonionic surfactants we market.

<table>
<thead>
<tr>
<th>Trademark</th>
<th>Surfactant Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>AG™</td>
<td>Alkylglucosides</td>
</tr>
<tr>
<td>Berol®, Ethylan®</td>
<td>Narrow range, EO, EO/PO alkoxylation and mixtures</td>
</tr>
<tr>
<td>Ethomeen®</td>
<td>Amine ethoxylates</td>
</tr>
</tbody>
</table>

Nonionic surfactants have attributes that make their use advantageous over other surfactant types. Due to their lack of charge, nonionic surfactants are compatible with both cationic and anionic surfactants, as well as other nonionic surfactants.

A narrow range ethoxylated alcohol, also called ‘a peaked ethoxide’, has a distribution curve that is narrower than the equivalent standard alcohol ethoxylate with a considerably lower content of unreacted alcohol and lower foam than standard ethoxylates.

Narrow range ethoxylates have targeted properties to improve degreasing performance at lower use concentration, while eliminating the need for hazardous solvents in the final formulation.

At the same time narrow range ethoxylates are compatible with most commonly used surfactants and builder grades.

Functionalities that can be optimized with our nonionic surfactants:

- Detergency
- Defoaming
- Wetting
- Viscosifying
- Emulsification
- Solubilization
- Foam boosting

Nouryon is working on expanding the portfolio of natural, vegetable-based surfactants to meet customer need and enhance the sustainability aspirations of end users.
# Alcohol ethoxylates - Narrow range

R—O(CH₂CH₃O)ₙH

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Appearance</th>
<th>Active Content %</th>
<th>Surface Tension mN/m*</th>
<th>Wetting Power sec**</th>
<th>Cloud Point °C</th>
<th>HLB</th>
<th>Solubility in 5% water</th>
<th>Property/Function</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Berol 266</td>
<td>C9-C11 alcohol ethoxylate</td>
<td>Liquid</td>
<td>99</td>
<td>27</td>
<td>15</td>
<td>24-29 (b) &amp; 54-59 (b)</td>
<td>12</td>
<td>S</td>
<td>Degreaser, Emulsifier, Low Foam, Wetting</td>
<td>Aircraft/trains/boats/aluminium cleaning, Alkaline cleaning, Automatic dishwashing, Car wash/wax/polish, CIP cleaning, General and household cleaning, Industrial and institutional cleaning, Laundry/liquid/manual dishwash, Degreaser, Emulsifier, Low foam, Wetting</td>
</tr>
<tr>
<td>Berol 360 (c)</td>
<td>C10 natural alcohol ethoxylate</td>
<td>Liquid</td>
<td>99</td>
<td>27</td>
<td>11</td>
<td>55-59 (a)</td>
<td>10.5</td>
<td>D</td>
<td>Degreaser, Emulsifier, Low Foam, Wetting</td>
<td>Aircraft/trains/boats/aluminium cleaning, Alkaline cleaning, Automatic dishwashing, Car wash/wax/polish, CIP cleaning, General and household cleaning, Industrial and institutional cleaning, Laundry/liquid/manual dishwash, Degreaser, Emulsifier, Low foam, Wetting</td>
</tr>
<tr>
<td>Berol 366 (c)</td>
<td>C10 natural alcohol ethoxylate</td>
<td>Liquid</td>
<td>99</td>
<td>27</td>
<td>15</td>
<td>24-29 (b) &amp; 54-59 (b)</td>
<td>12</td>
<td>S</td>
<td>Degreaser, Emulsifier, Low Foam, Wetting</td>
<td>Aircraft/trains/boats/aluminium cleaning, Alkaline cleaning, Automatic dishwashing, Car wash/wax/polish, CIP cleaning, General and household cleaning, Industrial and institutional cleaning, Laundry/liquid/manual dishwash, Degreaser, Emulsifier, Low foam, Wetting</td>
</tr>
<tr>
<td>Berol 840</td>
<td>C8 alcohol ethoxylate</td>
<td>Liquid</td>
<td>99</td>
<td>32</td>
<td>90</td>
<td>49-54 (a)</td>
<td>11.5</td>
<td>D</td>
<td>Degreaser</td>
<td>Aircraft/trains/boats/aluminium cleaning, Alkaline cleaning, Automatic dishwashing, Car wash/wax/polish, CIP cleaning, General and household cleaning, Industrial and institutional cleaning, Laundry/liquid/manual dishwash, Degreaser</td>
</tr>
</tbody>
</table>

**Key**

* according to du Nouy, 25°C, 0.1% DIN 53914

** according to Draves, 25°C, 0.1%

(a) 5 g product in 25 ml 25% butyldiglycol

(b) 1% in water

(c) Certified RSPO source

S soluble

D dispersible

Ø EU Ecolabel compliant

<table>
<thead>
<tr>
<th>Application</th>
<th>Aircraft/trains/boats/aluminium cleaning</th>
<th>Alkaline cleaning</th>
<th>Automatic dishwashing</th>
<th>Car wash/wax/polish</th>
<th>CIP cleaning</th>
<th>General and household cleaning</th>
<th>Industrial and institutional cleaning</th>
<th>Laundry/liquid/manual dishwash</th>
<th>Degreaser</th>
<th>Emulsifier</th>
<th>Low foam</th>
<th>Wetting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol ethoxylates - Narrow range</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Alcohol Alkoxylates

![Chemical Structure](image)

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Appearance</th>
<th>Active Content %</th>
<th>Surface Tension mN/m*</th>
<th>Wetting Power sec**</th>
<th>Cloud Point °C</th>
<th>HLB</th>
<th>Solubility in 5% water</th>
<th>Application</th>
<th>Property/Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Berol 048</td>
<td>Tridecyl alcohol ethoxylate</td>
<td>Liquid</td>
<td>85</td>
<td>28</td>
<td>11</td>
<td>65-73 (b)</td>
<td>14</td>
<td>S</td>
<td>Car wash/rinse/polish</td>
<td>Defoamer</td>
</tr>
<tr>
<td>Berol 087</td>
<td>C12-C16 alcohol ethoxylate/propoxylate</td>
<td>Liquid</td>
<td>100</td>
<td>31</td>
<td>13</td>
<td>39-43 (b)</td>
<td>11.5</td>
<td>S</td>
<td>CIP cleaning, General and household cleaning</td>
<td>Degreaser</td>
</tr>
<tr>
<td>Berol 175</td>
<td>C12-C16 alcohol ethoxylate</td>
<td>Liquid</td>
<td>90</td>
<td>29</td>
<td>15</td>
<td>58-64 (b)</td>
<td>12.5</td>
<td>S</td>
<td>Industrial and institutional cleaning, Industrial metal cleaning</td>
<td>Emulsifier</td>
</tr>
<tr>
<td>Berol 185</td>
<td>Alcohol ethoxylate propoxylate</td>
<td>Liquid</td>
<td>90</td>
<td>30</td>
<td>10</td>
<td>64-70 (b)</td>
<td>13.5</td>
<td>S</td>
<td>Industrial metal cleaning</td>
<td>Emulsifier</td>
</tr>
<tr>
<td>Berol 185 PO</td>
<td>Alcohol ethoxylate propoxylate</td>
<td>Liquid</td>
<td>90</td>
<td>30</td>
<td>10</td>
<td>64-70 (b)</td>
<td>13.5</td>
<td>S</td>
<td>Industrial metal cleaning</td>
<td>Emulsifier</td>
</tr>
<tr>
<td>Ethylan 1008</td>
<td>C10 alcohol ethoxylate</td>
<td>Liquid</td>
<td>100</td>
<td>29</td>
<td>11</td>
<td>60-68 (b)</td>
<td>14</td>
<td>S</td>
<td>Automatic dishwashing</td>
<td>Defoamer</td>
</tr>
<tr>
<td>Ethylan 1008W</td>
<td>2-Proplyheptanol ethoxylate</td>
<td>Liquid</td>
<td>90</td>
<td>30</td>
<td>15</td>
<td>60-67 (b)</td>
<td>14</td>
<td>S</td>
<td>High pressure cleaning, Industrial metal cleaning</td>
<td>Emulsifier</td>
</tr>
<tr>
<td>Ethylan CPC7545</td>
<td>C12-C16 alcohol ethoxylate/propoxylate</td>
<td>Liquid</td>
<td>99</td>
<td>32</td>
<td>14</td>
<td>35-38 (b)</td>
<td>S</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethylan HB4</td>
<td>Phenol ethoxylate</td>
<td>Liquid</td>
<td>100</td>
<td>49</td>
<td>&gt;300</td>
<td>66-68 (c)</td>
<td>S</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethylan TB345 (d)</td>
<td>Block EO/PO copolymer</td>
<td>Liquid</td>
<td>100</td>
<td>-</td>
<td>-</td>
<td>74 (e)</td>
<td>17.9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethylan TD1085</td>
<td>Isotridecyl alcohol ethoxylate</td>
<td>Liquid</td>
<td>85</td>
<td>28</td>
<td>11</td>
<td>65-73 (b)</td>
<td>14</td>
<td>S</td>
<td>Laundry/liquids/manual dishwash, Foam boosting</td>
<td></td>
</tr>
</tbody>
</table>

**Key**

* according to du Nouy, 25°C, 0,1% DIN 53914  
** according to Draves, 25°C, 0,1%  
(b) 1% in water  
(c) 10% w/v in water  
S soluble  
(d) unsuitable for inclusion in formulations dictated by the European Detergent Directive  
(e) 1% in 10% NaCl  
Ø EU Ecolabel compliant
Alkylglucosides

\[
\text{CH}_2\text{OH} \\
\text{O—R} \\
\text{OH} \\
\text{OH} \\
n
\]

**Application**
- Alkaline cleaning
- Automatic dishwashing
- Car wash/rinse/polish
- CIP cleaning
- High pressure cleaning
- Industrial and institutional cleaning

**Property/Function**
- Co-surfactant/hydrotrope
- Dispersant
- Foam booster
- Low foam

**Key**
- * according to du Noüy, 25°C, 0,1% DIN 53914
- ** according to Draves, 25°C, 0,1%
- *** according to Ross-Miles, 50°C, 0.05%
- (a) 30°C
- S soluble
- Ø EU Ecolabel compliant

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Appearance 20°C</th>
<th>Active Content %</th>
<th>Surface Tension mN/m*</th>
<th>Wetting Power sec**</th>
<th>Foam Height mm***</th>
<th>Solubility in 5% water</th>
<th>Application</th>
<th>Property/Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>AG 6202</td>
<td>C8 alkylglucoside</td>
<td>Liquid (a)</td>
<td>65</td>
<td>&gt;300</td>
<td>8</td>
<td>0</td>
<td>S</td>
<td>1</td>
<td>S</td>
</tr>
<tr>
<td>AG 6206</td>
<td>C6 alkylglucoside</td>
<td>Liquid</td>
<td>75</td>
<td>&gt;300</td>
<td>0</td>
<td>0</td>
<td>S</td>
<td>1</td>
<td>S</td>
</tr>
<tr>
<td>AG 6210</td>
<td>C8-C10 alkylglucoside</td>
<td>Liquid</td>
<td>61</td>
<td>200</td>
<td>100</td>
<td>90</td>
<td>S</td>
<td>1</td>
<td>S</td>
</tr>
</tbody>
</table>

**Product Description**
- AG 6202 C8 alkylglucoside: Liquid (a), 65% active content, surface tension >300 mN/m, wetting power sec immediately 8, foam height mm immediately 0, solubility in 5% water S, application: 1, property/function: S.
- AG 6206 C6 alkylglucoside: Liquid, 75% active content, surface tension >300 mN/m, wetting power sec immediately 0, foam height mm immediately 0, solubility in 5% water S, application: 1, property/function: S.
- AG 6210 C8-C10 alkylglucoside: Liquid, 61% active content, surface tension 200 mN/m, wetting power sec immediately 100, foam height mm immediately 90, solubility in 5% water S, application: 1, property/function: S.
4. Nitrogen derivatives
Nitrogen based surfactants – a science for cleaning

Functional properties of fatty amines and derivatives

The molecular structure of fatty amines and derivatives is characterized by one or more C8 to C22 aliphatic alkyl groups, with one or more amine or quaternary ammonium functionalities. In cationic surfactants the hydrophilic group carries a positive ionic charge usually associated with a nitrogen atom contained in an amine or quaternary ammonium group.

The surface active properties of many fatty amines and derivatives are responsible for e.g. emulsification, foaming, wetting and thickening functionalities.

Substantivity refers to the adsorptive properties of cationic surfactants and related nitrogen derivatives. Adsorption, particularly onto solid surfaces, results from the attraction between the positive charge on the nitrogen atom and the negative charge characteristic of most surfaces. Consequently, substantivity leads to surface modification and to the following functions: softening, corrosion inhibition, adhesion, anti-static properties, lubrication and hydrophobization.

Selection criteria for fatty amines and derivatives

Solubility

Solubility of surfactants is a primary criterion for their selection. The table below summarizes the solubility behavior of surfactants in water.

Water solubility increases:

<table>
<thead>
<tr>
<th>Influence of</th>
<th>Change in solubility</th>
</tr>
</thead>
<tbody>
<tr>
<td>alkyl chain</td>
<td>by decrease in chain length (or molecular mass)</td>
</tr>
<tr>
<td></td>
<td>by increase in unsaturation</td>
</tr>
<tr>
<td>nitrogen moiety</td>
<td>by increase in number of functional groups</td>
</tr>
<tr>
<td></td>
<td>by increase in degree of ethoxylation</td>
</tr>
<tr>
<td></td>
<td>by formation of salts by quaternization</td>
</tr>
<tr>
<td>medium</td>
<td>by decreasing pH</td>
</tr>
</tbody>
</table>

Alkylamines of C8-C22 chain length are insoluble in water at neutral pH. In acidic media, the amine group is protonated and the resulting amine salt is much more soluble. In general, one protonated amino group is sufficiently hydrophilic to solubilize a C12 alkyl chain. Solubilization of a C18 alkyl chain requires two protonated amino groups as provided in Duomeen OL at low pH, for example. Monoalkyl trimethyl ammonium chlorides are soluble in water up to a concentration range of 30% (for C18) to 40% (for C12). Above this concentration level, the surfactant forms a liquid crystalline phase. The solubility of dialkyl dimethyl ammonium chlorides is at much lower levels, as low as 0.001% for di(hydrogenated tallowalkyl) ammonium chloride (Arquad 2HT-75). This quaternary salt, however, can form stable dispersions as a result of molecular aggregation into vesicles.

Water solubility is increased by the introduction of neutral hydrophilic groups such as polyoxyethylene groups. Ethoxylation of aliphatic amines yields the Ethomeen series. Solubility of Ethomeen products is dependent upon the degree of ethoxylation. Ethomeen C/12, for example, contains two oxyethylene units per molecule and is insoluble in water, whereas Ethomeen C/25 contains fifteen oxyethylene units per molecule and is water soluble.
Hydrophile-lipophile balance
Surfactants are often characterized by their hydrophilic/lipophilic balance or HLB. High HLB values indicate good water, or polar solvent solubility, of the surfactant while low HLB values are indicative of good solubility in nonpolar systems, such as oil. Nouryon uses Griffin formulas for nonionic surfactants and Davis formulas for ionic surfactants.

The hydrophilic character of a surfactant is determined by the polarity of the head group. Typical head groups found in Nouryon surfactant products include amine, quaternary ammonium, ethoxylate, sulfate, phosphate and carboxylate. The polarity of the head group may be altered in some cases by adjusting the pH or by changing the degree of ethoxylation. An increase of ethoxylation levels will increase the HLB. Conversely, increasing the size of the fatty tail will decrease the HLB.

Emulsions may be classified as oil-in-water (O/W), in which hydrophobic material is dispersed in water, or as water-in-oil (W/O), in which water is dispersed in hydrophobic material. Formation of O/W emulsions is favored by emulsifiers having a high HLB value such as Ethomeen C/15 and Ethomeen C/25. For W/O emulsions, low HLB surfactants such as Ethomeen T/12 are more effective.
Cleaning formulations are thickened to increase the contact time on inclined or vertical surfaces like toilet bowls and tiled walls.

The longer adherence results in an improved removal of soil, limescale and microorganisms as well as extended perfume release for better air-freshening.

The higher viscosity generated by these products allows an improved control of dosage and increases the safety of your formulations by avoiding splashes and leaking.

The guiding principle in understanding the function of cationic surfactants as thickening agents is the model of rod micelle formation. Viscosity increase is due to chaotic rod-like arrangement of the surfactant molecules in solution. The viscosity level that can be achieved gets higher as the alkyl chain length of the surfactant hydrophobe gets longer.

The rheology profile of the final formulation can be controlled with small amounts of additives. This also decreases the amount of cationic surfactant needed to achieve the desired viscosity level.

Organic salts such as SXS, SCS, soaps, as well as electrolytes (NaOH, NaCl) act as desolubilizers which promote rod-like micelle formation and consequently an increase in viscosity.

Ethoxylated alcohols, e.g. Berol 175, have a solubilization effect which helps to avoid the viscoelastic region where the formulation does not flow and has no practical use.

Cationic surfactants for effective thickening

The desired viscosity is achieved by optimizing the ratio of the components and the concentration of the blend. Formulations with cationic surfactant blends exhibit thixotropic behavior (shear thinning formulations). The cleaning product becomes thinner when it is squeezed out of the bottle, making it easy to dispense, but becomes thicker when it hits the surface allowing it to cling and prevent run off.

Ethomeen T/12 and Arquad T-50 blends provide an efficient thickening system at low and high hydrochloric acid concentration.

Effective thickening systems for specific applications can be obtained with blends of cationic surfactants.

Cationic surfactants provide effective thickening across the whole pH range for enhanced product performance plus stability in chlorine and hydrogen peroxide bleach.
### Amines / Diamines

\[ R\text{—NH}_2 \]
\[ R\text{—NH—CH}_2\text{CH}_2\text{CH}_2—\text{NH}_2 \]

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Appearance 20°C</th>
<th>Amine Number Total mg KOH/g</th>
<th>Iodine Number gl/100 g</th>
<th>Water %</th>
<th>Diamine %</th>
<th>Colour Gardner</th>
<th>Melting Point °C</th>
<th>Viscosity mPa·s at 60°C</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Armeen C</td>
<td>Cocoamine Liquid</td>
<td>266-287</td>
<td>8</td>
<td>&lt;0.1</td>
<td>max 2</td>
<td></td>
<td></td>
<td>15-20</td>
<td>4</td>
<td>● ● ● ●</td>
</tr>
<tr>
<td>Armeen OL</td>
<td>Oleylamine Liquid</td>
<td>201-212</td>
<td>min 85</td>
<td>max 0.5</td>
<td>max 4</td>
<td></td>
<td></td>
<td>10-20</td>
<td>6</td>
<td>● ● ● ●</td>
</tr>
<tr>
<td>Duomeen C</td>
<td>N-Coco-1,3-diaminopropane Liquid/Paste</td>
<td>388-443</td>
<td>6</td>
<td>max 1</td>
<td>min 89</td>
<td>max 8</td>
<td>20-30</td>
<td>4</td>
<td>● ● ● ●</td>
<td></td>
</tr>
<tr>
<td>Duomeen CD</td>
<td>N-Coco-1,3-diaminopropane Solid/Paste</td>
<td>388-450</td>
<td>6</td>
<td>max 0.5</td>
<td>min 89</td>
<td>max 3</td>
<td>24-30</td>
<td>4</td>
<td>● ● ● ●</td>
<td></td>
</tr>
<tr>
<td>Duomeen O</td>
<td>N-Oleyl-1,3-diaminopropane Liquid/Paste</td>
<td>313-349</td>
<td>min 65</td>
<td>max 0.5</td>
<td>min 90</td>
<td>max 8</td>
<td>9-20</td>
<td>11</td>
<td>● ● ● ●</td>
<td></td>
</tr>
<tr>
<td>Duomeen OV</td>
<td>N-Oleyl-1,3-diaminopropane Liquid/Paste</td>
<td>311-347</td>
<td>75-95</td>
<td>&lt;0.2</td>
<td>min 90</td>
<td>max 7</td>
<td>9-20</td>
<td>11</td>
<td>● ● ● ●</td>
<td></td>
</tr>
</tbody>
</table>
Polyamines

R—NH—(CH₂CH₂CH₂NH)ₙCH₂CH₂CH₂NH₂  R—N(CH₂CH₂CH₂NH₂)₂

Triamines:  n = 1  Triameen YT
Tetramines:  n = 2

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Appearance 20°C</th>
<th>Colour Gardner</th>
<th>Iodine Number gl/100 g</th>
<th>Water %</th>
<th>Typical Data Density kg/m³ (a)</th>
<th>Melting Point °C</th>
<th>Application</th>
<th>Corrosion inhibitor</th>
<th>Dispersant</th>
<th>Emulsifier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tetrameen OV</td>
<td>Oleyl (vegetable) tripropylene tetramine</td>
<td>Solid</td>
<td>max 5</td>
<td>min 25</td>
<td>&lt;0.5</td>
<td>850</td>
<td>56</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Triameen OV</td>
<td>Oleyl (vegetable) dipropylene triamine</td>
<td>Liquid</td>
<td>max 3</td>
<td>min 50</td>
<td>&lt;0.5</td>
<td>855</td>
<td>17</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Triameen T</td>
<td>Tallow dipropylene triamine</td>
<td>Solid</td>
<td>max 3</td>
<td>30</td>
<td>&lt;0.5</td>
<td>830</td>
<td>30-45</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Triameen YT</td>
<td>Tallow dipropylene triamine</td>
<td>Liquid/Paste</td>
<td>max 12</td>
<td>33</td>
<td>&lt;0.5</td>
<td>845</td>
<td>15-25</td>
<td>•</td>
<td>•</td>
<td>•</td>
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</tr>
</tbody>
</table>

Key
(a) at 60°C
## Amphotericics

![Chemical structures of amphotericics](image)

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Appearance</th>
<th>Solids %</th>
<th>Surface Tension mN/m*</th>
<th>Wetting Power sec**</th>
<th>Foam Height mm***</th>
<th>Colour Hazen</th>
<th>Pour Point °C</th>
<th>pH 20% in water</th>
<th>Sodium Chloride %</th>
<th>Solubility in 5% water</th>
<th>Application</th>
<th>Car washing/polish</th>
<th>GIP cleaning</th>
<th>Industrial cleaning</th>
<th>Laundry (liquids/manual dishwash)</th>
<th>Co-surfactant/hydrotrope</th>
<th>Dispersant</th>
<th>Low foam</th>
<th>Biodegradable</th>
<th>EU Ecolabel compliant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ampholak 7CX/C</td>
<td>Sodium cocoampho-polycarboxyglycinate sodium chloride</td>
<td>Liquid</td>
<td>39.5-41</td>
<td>&gt;300</td>
<td>150</td>
<td>Immediately</td>
<td>150</td>
<td>max 70</td>
<td>-16</td>
<td>8.6-9.4</td>
<td>10.5-12.0</td>
<td>S</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ampholak 7TX</td>
<td>Sodium tallowampho-polycarboxyglycinate</td>
<td>Liquid</td>
<td>39-41</td>
<td>40</td>
<td>&gt;300</td>
<td>150</td>
<td>120</td>
<td>max 100</td>
<td>-20</td>
<td>8.5-9.5</td>
<td>9.8-10.8</td>
<td>S</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ampholak XCE</td>
<td>Coco iminodiglycinate</td>
<td>Liquid</td>
<td>39-41</td>
<td>36</td>
<td>150</td>
<td>150</td>
<td>150</td>
<td>max 500</td>
<td>-17</td>
<td>8-10</td>
<td>S</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ampholak YCE</td>
<td>Sodium cocopropylenediaminepropionate</td>
<td>Liquid</td>
<td>29-30</td>
<td>39</td>
<td>300</td>
<td>125</td>
<td>120</td>
<td>max 250</td>
<td>0</td>
<td>6-7</td>
<td>S</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ampholak YJH-40</td>
<td>Sodium capryliminodipropionate</td>
<td>Liquid</td>
<td>38-42</td>
<td>64</td>
<td>&gt;300</td>
<td>15</td>
<td>0</td>
<td>max 500</td>
<td>-8</td>
<td>8.5-9.5</td>
<td>S</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

**Key**
- * according to du Noüy, 25°C, 0.1% DIN 53914
- ** according to Draves, 25°C, 0.1%
- *** according to Ross-Miles, 50°C, 0.05%
- S soluble
- EU Ecolabel compliant
# Amine oxides / Amide ethoxylates

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Appearance</th>
<th>20°C</th>
<th>Surface Tension mN/m*</th>
<th>Wetting Power sec**</th>
<th>Foam Height mm***</th>
<th>Solubility in 5% water</th>
<th>Application</th>
<th>Property/Function</th>
<th>Emulsifier</th>
<th>Foam booster</th>
<th>Thicker</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aromox 14D-W970</td>
<td>Tetradecyldimethyl-amine oxide</td>
<td>Liquid</td>
<td>30</td>
<td>20</td>
<td>167</td>
<td>163</td>
<td>S</td>
<td>Acid cleaning</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Aromox MCD-W</td>
<td>(Fractionated coco) dimethylamine oxide</td>
<td>Liquid (25°C)</td>
<td>30</td>
<td>20</td>
<td>165</td>
<td>160</td>
<td>S</td>
<td>Acid cleaning</td>
<td>●●</td>
<td>●</td>
<td>●</td>
<td>●●</td>
</tr>
<tr>
<td>Aromox T/12</td>
<td>Tallowbis (2-hydroxyethyl) amine oxide</td>
<td>Paste</td>
<td>30</td>
<td>&gt;300</td>
<td>10</td>
<td>5</td>
<td>D</td>
<td>Emulsifier</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Aromox T/12 HFP</td>
<td>Tallowbis (2-hydroxyethyl) amine oxide</td>
<td>Paste/slightly cloudy liquid</td>
<td>30</td>
<td>&gt;300</td>
<td>20</td>
<td>15</td>
<td>S</td>
<td>Car wash/rinse/polish</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>OMA 4</td>
<td>Bis (2-hydroxyethyl) oleyl amine</td>
<td>Liquid</td>
<td>30</td>
<td>95</td>
<td>20</td>
<td>18</td>
<td>D</td>
<td>EU Ecolabel compliant</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

Key

* according to du Nouy, 25°C, 0.1% DIN 53914
** according to Draves, 25°C, 0.1%
*** according to Ross-Miles, 50°C, 0.05%
S soluble
D dispersible
Ø EU Ecolabel compliant
## Amine ethoxylates

![Structure of amine ethoxylates](structure.png)

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Appearance</th>
<th>Active Content %</th>
<th>Equivalent Mass</th>
<th>Surface Tension mN/m*</th>
<th>Wetting Power sec**</th>
<th>Solubility in 5% water</th>
<th>Application</th>
<th>Property/Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Berol 302</td>
<td>Bis (2-hydroxyethyl) oleyl amine</td>
<td>Liquid</td>
<td>100</td>
<td>344-365</td>
<td>29</td>
<td>&gt;300</td>
<td>D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethomeen C/12</td>
<td>Bis (2-hydroxyethyl) cocoalkylamine</td>
<td>Liquid</td>
<td>100</td>
<td>275-300</td>
<td>27</td>
<td>100</td>
<td>D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethomeen C/15</td>
<td>Coco alkylamine ethoxylate</td>
<td>Liquid</td>
<td>100</td>
<td>408-440</td>
<td>30</td>
<td>85</td>
<td>S</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethomeen C/22</td>
<td>Coco alkylamine ethoxylate</td>
<td>Liquid</td>
<td>min 96</td>
<td></td>
<td></td>
<td></td>
<td>S</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethomeen O/12</td>
<td>Bis (2-hydroxyethyl) oleyl amine</td>
<td>Liquid</td>
<td>100</td>
<td>345-365</td>
<td>28</td>
<td>&gt;300</td>
<td>D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethomeen OV/17</td>
<td>Oleyl amine ethoxylate</td>
<td>Liquid</td>
<td>100</td>
<td>540-585</td>
<td>31</td>
<td>160</td>
<td>S</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethomeen T/12</td>
<td>Bis (2-hydroxyethyl) tallow alkylamine</td>
<td>Liquid/Paste</td>
<td>100</td>
<td>340-360</td>
<td>28</td>
<td>&gt;300</td>
<td>D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethomeen T/15</td>
<td>Tallow alkylamine ethoxylate</td>
<td>Liquid</td>
<td>100</td>
<td>471-506</td>
<td>31</td>
<td>80</td>
<td>S</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethomeen T/25</td>
<td>Tallow alkylamine ethoxylate</td>
<td>Liquid</td>
<td>100</td>
<td>869-952</td>
<td>39</td>
<td>&gt;300</td>
<td>S</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Key**

* according to du Noüy, 25°C, 0.1% DIN 53914
** according to Draves, 25°C, 0.1%
S soluble
D dispersible
# Quaternary ammonium compounds (QAC)

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Appearance</th>
<th>Active Content %</th>
<th>Free amine+ Amine HCl, %</th>
<th>Colour Gardner</th>
<th>pH 5% in 50/50 2-propanol/water</th>
<th>Solubility in 5% water</th>
<th>Application</th>
<th>Antistatic</th>
<th>Thickening</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Arquad 2C-75</td>
<td>Dicocoldimethyl ammonium chloride, 2-propanol</td>
<td>Liquid</td>
<td>74-77</td>
<td>max 2</td>
<td>max 5</td>
<td>6-9</td>
<td>S</td>
<td>Acid cleaning</td>
<td>D</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>Arquad 2HT-75</td>
<td>Di(hydrogenated tallow) dimethyl ammonium chloride, 2-propanol</td>
<td>Liquid</td>
<td>74-76</td>
<td>max 2</td>
<td>max 4</td>
<td>6-9</td>
<td>D</td>
<td>Alkaline cleaning</td>
<td>D</td>
<td>D</td>
<td></td>
</tr>
<tr>
<td>Arquad T-50</td>
<td>Tallowtrimethyl ammonium chloride, 2-propanol</td>
<td>Liquid</td>
<td>49-52</td>
<td>max 2</td>
<td>max 5</td>
<td>6-9</td>
<td>S</td>
<td>Car wash/rim/and polish</td>
<td>D</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>Arquad T-50 HFP</td>
<td>Tallowtrimethyl ammonium chloride, 2-propanol</td>
<td>Liquid</td>
<td>49-52</td>
<td>max 2</td>
<td>max 6</td>
<td>6-9 (a)</td>
<td>S</td>
<td>General and household cleaning</td>
<td>S</td>
<td>S</td>
<td></td>
</tr>
</tbody>
</table>

Key
(a) 1% in water
S soluble
D dispersible
5. Biocides
Microbial control

Nouryon is one of the leading producers of biocides based on fatty amines and derivatives. A number of these products, especially quaternary ammonium compounds (QAC) and dodecyldipropylene triamine, are widely used in formulations for control of bacteria, fungi, viruses and algae in disinfection or preservation applications.

Quaternary ammonium compounds have been presented from a chemical point of view in the corresponding chapter of this brochure. Our trade name for the QACs is Arquad.

Dodecyldipropylene triamine does not have an ionic charge like the QACs. Depending on the pH value there can be a partial positive charge at the nitrogen atoms of the amine groups. Our trade name of the dodecyldipropylene triamine is Triameen Y12D.

Structure of Triameen Y12D molecule:

\[
\begin{align*}
\text{H}_2\text{C} & \quad \text{N} & \quad \text{NH}_2 \\
& & \quad \text{NH}_2
\end{align*}
\]

In the EU, biocidal products are specifically regulated by the Biocidal Products Regulation (BPR). In force since September 1, 2013. It replaces the Biocidal Products Directive (BPD) from 2000.

Due to the registration process of active ingredients not all actives on the market before the BPR was established will be finally registered. The following active substances have been selected for registration according to the following product types:

- **BKC** = benzalkonium chloride (CAS 68424-85-1) for PT 1,2,3,4,8,10,11,12:
  - Arquad MCB-50, Arquad MCB-50 PO, Arquad MCB-80

- **DDAC** = didecyldimethylammonium chloride (CAS 7173-51-5) for PT 1,2,3,4,8,10,11,12, 13:
  - Arquad 2.10-50, Arquad 2.10-70 HFP, Arquad 2.10-80

- **TMAC** = trimethylalkylammonium chloride (CAS 61789-18-2) for PT 8:
  - Arquad C-35

- Dodecyldipropylene triamine (CAS 2372-82-9) for PT 2,3,4,6,11,12, 13:
  - Triameen Y12D, Triameen Y12D-30

Information on the status of each substance in the BPR registration process as well as more details on the product types can be found in our Fact Sheet which is regularly updated and available on request.

In addition to these strong biocides there are substances which also have some weak biocidal/biostatic effect but are not in the BPR registration process. Often these substances are used for non-biocidal applications. Outside of Europe it depends on the national legislation if they may be used as biocides or not. These products are listed in a separate table. Please note that the biocidal/biostatic effect of these products is mainly known from literature. We do not have data supporting these claims.
## Biocides

![Chemical structures](image)

### Product Description

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Appearance 20°C</th>
<th>Active Content %</th>
<th>Solvent</th>
<th>Colour Gardner</th>
<th>pH 10% in water</th>
<th>Flash point °C</th>
<th>BPR supported</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arquad 2.10-50</td>
<td>Didecyldimethyl ammonium chloride</td>
<td>Liquid</td>
<td>49-51</td>
<td>Water/2-propanol</td>
<td>max 2</td>
<td>6-9</td>
<td>28</td>
<td>Yes</td>
</tr>
<tr>
<td>Arquad 2.10-70 HFP</td>
<td>Didecyldimethyl ammonium chloride</td>
<td>Liquid</td>
<td>69-71</td>
<td>Water/ethylene glycol</td>
<td>max 3</td>
<td>6-9 (a)</td>
<td>&gt;100</td>
<td>Yes</td>
</tr>
<tr>
<td>Arquad 2.10-80</td>
<td>Didecyldimethyl ammonium chloride</td>
<td>Liquid</td>
<td>79-81</td>
<td>Water/2-propanol</td>
<td>max 3</td>
<td>6-9</td>
<td>28</td>
<td>Yes</td>
</tr>
<tr>
<td>Arquad C-35</td>
<td>Cocotrimethyl ammonium chloride</td>
<td>Liquid</td>
<td>33-37</td>
<td>Water</td>
<td>max 2</td>
<td>6-9</td>
<td>&gt;100</td>
<td>Yes</td>
</tr>
<tr>
<td>Arquad MCB-50</td>
<td>C12-C16 alkybenzyl dimethyl ammonium chloride</td>
<td>Liquid</td>
<td>49-52</td>
<td>Water</td>
<td>max 1</td>
<td>6-9</td>
<td>&gt;100</td>
<td>Yes</td>
</tr>
<tr>
<td>Arquad MCB-50 PO (d)</td>
<td>C12-C16 alkybenzyl dimethyl ammonium chloride</td>
<td>Liquid</td>
<td>49-52</td>
<td>Water</td>
<td>max 1</td>
<td>6-9</td>
<td>&gt;100</td>
<td>Yes</td>
</tr>
<tr>
<td>Arquad MCB-80</td>
<td>C12-C16 alkybenzyl dimethyl ammonium chloride</td>
<td>Liquid</td>
<td>80-81</td>
<td>Water/ethylene glycol</td>
<td>max 4</td>
<td>6-9</td>
<td>&gt;100</td>
<td>Yes</td>
</tr>
<tr>
<td>Triameen Y12D</td>
<td>Dodecyl dipropylene triamine</td>
<td>Liquid</td>
<td>98-100 (b)</td>
<td>(b)</td>
<td>max 2</td>
<td>11,6</td>
<td>&gt;100</td>
<td>Yes</td>
</tr>
<tr>
<td>Triameen Y12D-30</td>
<td>Dodecyl dipropylene triamine</td>
<td>Liquid</td>
<td>29-31</td>
<td>Water</td>
<td>max 1</td>
<td>11,5</td>
<td>&gt;100</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### Key
- (a) 5% in 50/50 2-propanol/water
- (b) residual water max 2%
- (c) for details see text
- (d) Certified RSPO source
### Fatty amine based products with some biocidal properties

![Chemical structures](image)

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Appearance</th>
<th>Active Content %</th>
<th>Colour Gardner</th>
<th>BPR approved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Armeen CD</td>
<td>Cocoamine</td>
<td>Liquid</td>
<td>min 98, max 2</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>Arquad 16-29</td>
<td>Hexadecyltrimethyl ammonium chloride</td>
<td>Liquid</td>
<td>28-30, max 2</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>Arquad 16-50</td>
<td>Hexadecyltrimethyl ammonium chloride, 2-propanol</td>
<td>Liquid</td>
<td>49-52, max 4</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>Arquad 2C-75</td>
<td>Dicocoldimethyl ammonium chloride, 2-propanol</td>
<td>Liquid</td>
<td>74-77, max 5</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>Duomeen C</td>
<td>N-Coco-1,3-diaminopropane</td>
<td>Liquid/Paste</td>
<td>min 89, max 8</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>Duomeen CD</td>
<td>N-Coco-1,3-diaminopropane</td>
<td>Solid/Paste</td>
<td>min 89, max 3</td>
<td></td>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Application</th>
<th>Acid cleaning</th>
<th>Car wash/Polish</th>
<th>Chain Lubricant</th>
<th>Disinfectant/Preservative</th>
<th>Fabric Softening</th>
<th>General and household cleaning</th>
<th>Industrial and institutional cleaning</th>
<th>Industrial metal cleaning</th>
<th>Property/function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Armeen CD</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arquad 16-29</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arquad 16-50</td>
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<td></td>
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<tr>
<td>Arquad 2C-75</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duomeen C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Duomeen CD</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Property/function</th>
<th>Antistatic</th>
<th>Biocidal/biostatic</th>
<th>Corrosion inhibitor</th>
<th>Emulsifier</th>
<th>Thickener</th>
</tr>
</thead>
<tbody>
<tr>
<td>Armeen CD</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arquad 16-29</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arquad 16-50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arquad 2C-75</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duomeen C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duomeen CD</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
6. Anionic surfactants
Energize your detergent formulations

The surfactant portfolio is completed with some special anionics useful in a range of specific applications.

### Phosphate esters

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Appearance</th>
<th>Active Content %</th>
<th>Surface Tension mN/m*</th>
<th>Wetting Power sec**</th>
<th>Solubility in 5% water</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phospholan PE169</td>
<td>Isotridecyl alcohol ethoxylate phosphate ester</td>
<td>Liquid</td>
<td>100</td>
<td>28</td>
<td>23</td>
<td>D</td>
<td>• Alkaline cleaning • Industrial and institutional cleaning • Industrial metal cleaning • Co-surfactant/hydrotrope • Emulsifier • High foam • Low to medium foam</td>
</tr>
<tr>
<td>Phospholan PE65</td>
<td>Alcohol ethoxylate phosphate ester</td>
<td>Liquid</td>
<td>100</td>
<td>&gt;300</td>
<td></td>
<td>D</td>
<td>• Corrosion inhibitor • Emulsifier • High foam • Low to medium foam</td>
</tr>
<tr>
<td>Phospholan PHB14</td>
<td>Phenol ethoxylate phosphate ester</td>
<td>Liquid</td>
<td>100</td>
<td>55</td>
<td>23</td>
<td>D</td>
<td>• Co-surfactant/hydrotrope • Emulsifier • High foam • Low to medium foam</td>
</tr>
</tbody>
</table>

**Key**

* according to du Noüy, 25°C, 0,1% DIN 53914  
** according to Draves, 25°C, 0,1%  
D dispersible
7. Performance polymers
Nouryon is a global leader in the synthesis of water soluble polymers designed to meet the unique requirements of our customers. We have developed a diverse portfolio of specialty additives to provide cost-effective solutions to suit individual customer needs.

Our product line offers a broad array of polymers that provide benefits in the formulation, production and performance of cleaning and care products around the globe. Our scientists are continually seeking new ways to improve the performance and cost structure of laundry, dish wash and hard surface cleaning formulations in consumer and in industrial and institutional environments.

Alcosperse polymers find application in liquid and powdered dishwasher detergents, laundry detergents and hard surface cleaners. The polymers act as co-builders in helping the detergents work more effectively by removing water hardness ions. They also serve as antiredeposition agents, compatibility and process aids in the manufacturing of powdered laundry formulations.

The hybrid polymers offer an environmentally conscious choice without compromising on performance. They help in achieving:

- less dependency on synthetic polymers
- avoidance of fluctuations in the petro chemical feedstock
- greater sustainability thanks to natural, renewable feedstocks
- favorable environmental impact (high biodegradability profile and 500 kgs reduction of CO2 for each ton of synthetic replaced)
- high cleaning performance similar to traditional synthetic polymers and easy to formulate

Novel hybrid polymers are being used in several formulations in laundry, automatic dishwashing and also in hard surface cleaning.

Provide formulation flexibility

Alcoguard polymers offer extreme scale control in zero phosphate formulations. These products prevent film from forming on hard as well as soft surfaces. Other applications include opacifiers and fabric stiffening aids.

A new platform of hybrid polymers based on poly-saccharides has been developed.
# Polymers

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Appearance</th>
<th>Solids %</th>
<th>Molecular weight</th>
<th>pH 20% in water</th>
<th>Solubility in 5% water</th>
<th>Application</th>
<th>Property/Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcoguard 4160</td>
<td>Sulfonated multipolymer</td>
<td>Liquid</td>
<td>39-41</td>
<td></td>
<td>4-5</td>
<td>S</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Alcosperse 408</td>
<td>Acrylic/maleic copolymer</td>
<td>Liquid</td>
<td>42-44</td>
<td>3,000</td>
<td>5-6</td>
<td>S</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Alcosperse 412</td>
<td>Acrylic/maleic copolymer</td>
<td>Liquid</td>
<td>40-42</td>
<td>2,500</td>
<td>10-11</td>
<td>S</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Alcosperse 602N</td>
<td>Sodium polyacrylate</td>
<td>Liquid</td>
<td>44-46</td>
<td>5,000</td>
<td>7-8</td>
<td>S</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Alcosperse 747</td>
<td>Acrylic/styrene copolymer</td>
<td>Liquid</td>
<td>39-41</td>
<td>3,000</td>
<td>8-10</td>
<td>S</td>
<td>• • • •</td>
<td></td>
</tr>
<tr>
<td>Aquatreat AR-257B</td>
<td>Sodium polyacrylate</td>
<td>Liquid</td>
<td>53-55</td>
<td>2,500</td>
<td>5.3-5.7 (10%)</td>
<td>S</td>
<td>• • • •</td>
<td></td>
</tr>
</tbody>
</table>

## Hybrid bio-polymer

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Appearance</th>
<th>Solids %</th>
<th>Molecular weight</th>
<th>pH 20% in water</th>
<th>Solubility in 5% water</th>
<th>Application</th>
<th>Property/Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcoguard H 5941</td>
<td>Hybrid bio-polymer</td>
<td>Liquid</td>
<td>39-41</td>
<td></td>
<td>4-6</td>
<td>S</td>
<td>•</td>
<td></td>
</tr>
</tbody>
</table>

**Key**
- **S** soluble
- **EU Ecolabel compliant**
8. Sustainability
Our approach to sustainability

At Nouryon, sustainability is a cornerstone of our overall strategy to achieve long-term success. We have long been an industry leader in sustainability and our commitment to sustainability remains unchanged going forward. We take pride in improving our environmental impact and maximizing our positive societal impact.

On a daily basis we strive to do more with less, reducing carbon emissions through a combination of improved energy efficiency, increased use of renewable energy, and higher use of bio-based raw materials in production. Downstream, we focus on expanding our portfolio of eco-premium products, which have a significant sustainability benefit over common alternatives.

Sustainable actions may not always be obvious to the customer. Some specific examples of actions we are taking in the market today include:

- Offering a broad portfolio of ingredients that conform to higher standards of chemical sustainability i.e. EU Ecolabel and Nordic Ecolabel (Svanen) standards
- Membership of the Roundtable on Sustainable Palm Oil (RSPO)
- Choosing to use natural, renewable and preferably vegetable-based raw materials (including RSPO MB) in our finished products whenever possible
- Providing high activity products to customers to minimize packaging and transportation impacts
- Developing low toxicity, and preferably non-label products that allow our customers to develop mild formulations for use
- Innovation of higher performance products i.e. with our nonionic, narrow range ethoxylate technology, where less surfactant is needed for the same performance versus standard ethoxylates

We understand that the needs of the market are dynamic and changing. Our innovation team and supply chain continue to work to maintain and enhance our offerings into the future.

We are always ready to listen to and empower our partners to make our industry more sustainable in all dimensions. If you have any questions or comments regarding our sustainability philosophy or have unmet sustainability needs that we might be able to help address, please contact your Nouryon sales representative.

We see sustainability not just as the right thing to do, but as a true business opportunity that delivers value to everyone involved.
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