Cationic Surfactant Thickeners

Effective thickening for enhanced product performance

Effective thickening across the whole pH range for enhanced product performance plus stability in chlorine and hydrogen peroxide bleach

Choose from our broad portfolio of cationic surfactants to provide a cost effective thickening solution for your customers. High performance cleaning formulations begin with these products!

Cationic surfactant thickeners
- Can be used at any pH
- Are stable in chlorine and hydrogen peroxide bleach
- Enable fragrance solubilization
- Enhance cleaning and foaming
- Support disinfection
- Provide corrosion inhibition

Moderate to extreme thickening
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, limestone 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.

How does this work?
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.

Unimers — Spherical micelles — Rod micelles — Rod micelles, entangled

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 (sodium chloride, sodium carbonate) 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 surfactant thickener portfolio

<table>
<thead>
<tr>
<th>Product</th>
<th>Application</th>
<th>Key features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethoxylated amines</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethomeen C/12</td>
<td>Toilet Bowl Cleaner (TBC), acidic bathroom cleaners</td>
<td>pH &lt;5, versatile thickening systems that are stable in strong and weak acids</td>
</tr>
<tr>
<td>Ethomeen O/12</td>
<td></td>
<td>Effective in thickening blends with hydrophobic components</td>
</tr>
<tr>
<td>Ethomeen T/12</td>
<td></td>
<td>Liquid at room temperature for easy handling</td>
</tr>
<tr>
<td>Ethomeen HT/12</td>
<td></td>
<td>Paste, cost effective option for thickening strong acids</td>
</tr>
<tr>
<td>Quaternary ammonium salts</td>
<td></td>
<td>Hydrophobic product effective for thickening weaker acids</td>
</tr>
<tr>
<td>Ethomeen T/12</td>
<td>TBC, acidic and alkaline bathroom cleaners</td>
<td>All pH, stable in hydrogen peroxide bleach</td>
</tr>
<tr>
<td>Arquad 16-29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arquad T-50</td>
<td></td>
<td></td>
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<tr>
<td>Amine oxides</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aromox 14D-W970</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aromox T/12</td>
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</tr>
</tbody>
</table>

Optimizing performance by blending products

Effective thickening systems for specific applications can be obtained with blends of cationic surfactants. 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, and becomes thicker when it hits the surface allowing it to cling and preventing run off.

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

Ethomeen HT/12 and Ethomeen C/12 blends provide an efficient thickening system for weaker acids.

Natural polymers (xanthan gum, guar gum) are not stable at extreme pHs. Synthetic polymers such as polyacrylates are less stable in strong acidic conditions. In addition to being very stable across the whole pH range, cationic surfactant thickeners can also contribute to cleaning, foaming, solubilisation and stability of the formula.
Formulations
Our broad portfolio of cationic surfactants provides flexible thickening solutions for a wide range of applications. All formulations are expressed in percent of product by weight as supplied.

### Strong acids

<table>
<thead>
<tr>
<th>Ingredients, % w/w</th>
<th>Hydrochloric acid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrochloric acid 37%</td>
<td>10 10 10 10 25.6 25.6 25.6</td>
</tr>
<tr>
<td>Ethomeen O/12</td>
<td>1.5 1.5 3</td>
</tr>
<tr>
<td>Ethomeen T/12</td>
<td>2 1 1.5</td>
</tr>
<tr>
<td>Aromox T-50</td>
<td>1.5 1.5 1 1</td>
</tr>
<tr>
<td>Berol 175</td>
<td>1</td>
</tr>
<tr>
<td>Water</td>
<td>q.s. q.s. q.s. q.s. q.s. q.s.</td>
</tr>
<tr>
<td>Viscosity cps sp 3 at 30 RPM</td>
<td>420 480 320 360 630 700 1500</td>
</tr>
</tbody>
</table>

### Weak acids

<table>
<thead>
<tr>
<th>Ingredients, % w/w</th>
<th>Citric</th>
<th>Phosphoric acid</th>
<th>Oxalic acid</th>
<th>Sulfamic acid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citric acid 100%</td>
<td>5 5 10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phosphoric acid 30%</td>
<td>5 10 5 10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oxalic acid 100%</td>
<td>5 5 10 10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulfamic acid 100%</td>
<td>5 10 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethomeen O/12</td>
<td>1 2 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethomeen T/12</td>
<td>1.5 2 2 1.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aromox T-50</td>
<td>2 2 1.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sodium Xylene Sulfonate (SXS)</td>
<td>1 1.5 1.5 1 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NaCl</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Berol 175</td>
<td>0.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>q.s. q.s. q.s. q.s. q.s. q.s. q.s. q.s. q.s. q.s.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Viscosity cps sp 3 at 30 RPM</td>
<td>400 290 110 1350 320 470 510 1290 580 470</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Alkaline and bleaching agents

<table>
<thead>
<tr>
<th>Ingredients, % w/w</th>
<th>NaOH</th>
<th>Hydrogen peroxide</th>
<th>Sodium hypochlorite</th>
</tr>
</thead>
<tbody>
<tr>
<td>NaOH 100%</td>
<td>10</td>
<td>5 5 16.7 16.7</td>
<td></td>
</tr>
<tr>
<td>Hydrogen peroxide 30%</td>
<td>5 5 16.7 16.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sodium hypochlorite 15%</td>
<td>3 70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Citric acid 100%</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulfamic acid 100%</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sodium Xylene Sulfonate (SXS)</td>
<td>1.5 1 1.5 1.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aromox 14D-W970</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>q.s. q.s. q.s. q.s. q.s. q.s.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Viscosity cps sp 3 at 30 RPM</td>
<td>180 350 580 670 400</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Typical procedure for using cationic surfactant thickeners:
1. Add acid or NaOH to water. Add also bleaching agent if required.
2. Predilute fragrance in the surfactant (thickener) and add the mixture to the acid/caustic solution.
3. Add desolubilizer (SXS) to increase the viscosity.
4. Adjust flow behavior with Berol 175.
Europe, Middle East, India, Africa
Akzo Nobel Surface Chemistry AB
Stenunge allé 3
444 85 Stenungsund
Sweden
T +46 303 85 000
E cleaning@akzonobel.com

US, Canada, Mexico
Akzo Nobel Surface Chemistry LLC
525 West Van Buren Street
Chicago, IL 60607-3823
USA
T +1 (800) 906-9977
+1 (312) 544-7000
E csrusa@akzonobel.com

South America
Akzo Nobel Ltda - Divisao Quimica
Rodovia AkzoNobel 707
Bairro Sao Roque da Chave
Itupeva, Sao Paulo 13295-000
Brazil
T +55 1145918939
E cleaning@akzonobel.com

China
Akzo Nobel (Shanghai) Ltd.
22F Eco City
No 1788 West Nan Jing Road
Shanghai, 200040
P.R. China
T +86 2122205000
E cleaning@akzonobel.com

South East Asia
Akzo Nobel Surface Chemistry PTE Ltd
AkzoNobel House
3 Changi Business Park Vista, #05-01
Singapore 486051
T +65 66355100
E cleaning@akzonobel.com

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