

## Amine-based Surfactant Thickeners

### Effective thickening for enhanced product performance

With amine-based surfactant thickeners, effective thickening across the whole pH range can be achieved plus stability in chlorine and hydrogen peroxide bleach. Choose from our broad portfolio of amine-based surfactants to provide a cost effective thickening solution for your customers. High performance cleaning formulations with custom rheology begin with these products.

Amine-based surfactants include amine oxides, ethoxylated amines and quaternary ammonium surfactants.

#### Amine-based 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

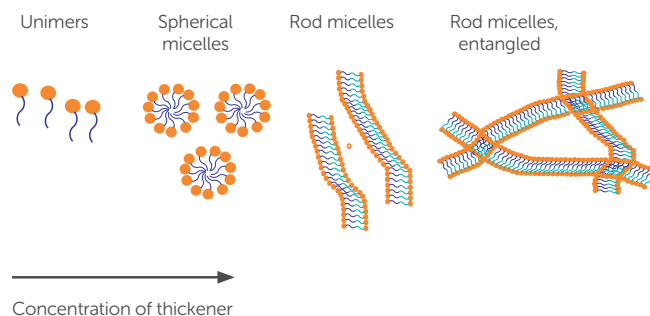
Cleaning formulations are thickened to increase the contact time on inclined or vertical surfaces like toilet bowls and tiled walls. The longer adherence results in an improved removal of soil, limescale and microorganisms as well as extended perfume release for better air-freshening.



The higher viscosity generated by these products allows for 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 amine-based surfactants as thickening agents is the model of rod micelle formation. Viscosity increase is due to entanglement of the rod-like micelles which spontaneously form in solution with these surfactant products. 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 amine-based 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. Bero<sup>®</sup> 175 or Ethylan<sup>®</sup> 1008 have a solubilization effect which helps to avoid the viscoelastic region where the formulation does not flow and has no practical use.

# Amine-based surfactant thickener portfolio

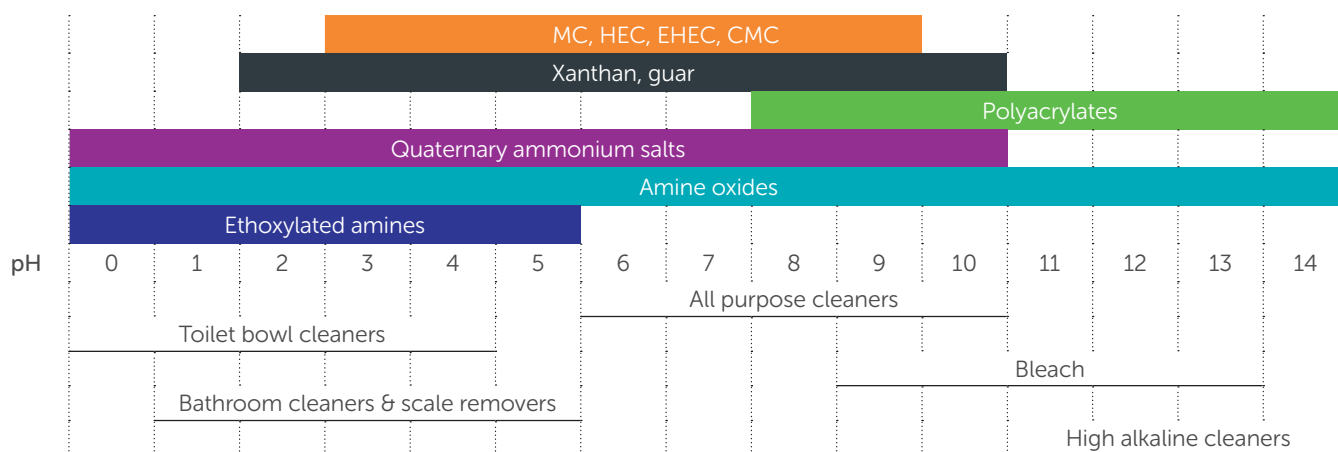
Product	Application	Key features
<b>Ethoxylated amines</b>	Toilet Bowl Cleaner (TBC), acidic bathroom cleaners	Use for pH <5 – versatile thickening systems that are stable in strong and weak acids
Ethomeen® C/12		Effective in thickening blends with hydrophobic components
Ethomeen® O/12, O/12LC		Liquid at room temperature for easy handling (LC for low color)
Ethomeen® T/12		Paste, cost-effective option for thickening strong acids
Ethomeen® HT/12		Hydrophobic product effective for thickening weaker acids
<b>Quaternary ammonium salts</b>	TBC, acidic and alkaline bathroom cleaners	Suitable for use at all pH's
Arquad® 16-29, 16-50		Stable in hydrogen peroxide containing bleach
Arquad® T-50		
<b>Amine oxides</b>	High alkaline and hypochlorite cleaners, acidic, alkaline and neutral cleaners	Suitable for use at all pH's
Aromox® 14D-W970		Stable in alkaline and chlorine-containing bleach
Aromox® T/12, T/12 HFP		Effective for thickening NaOH

## Optimizing performance by blending products

Effective thickening systems for specific applications can be obtained with blends of amine-based surfactants. The desired viscosity is achieved by optimizing the ratio of the components and the concentration of the blend.

Formulations with amine-based surfactant blends exhibit shear thinning behavior. 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 prevent run off.

- Ethomeen T/12 and Arquad T-50 blends provide efficient thickening for hydrochloric acid at up to 15%, avoiding unwanted fluid elasticity
- 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, amine-based surfactant thickeners can also contribute to cleaning, foaming, solubilization and stability of the formula.

# Formulations

Our broad portfolio of amine-based surfactants provides flexible thickening solutions for a wide range of applications. All formulations are expressed in percent of product by weight as supplied.

## Weak acids

Ingredients, % w/w	Citric acid			Phosphoric acid				Oxalic acid				Sulfamic acid		
Citric acid 100%	5	5	10											
Phosphoric acid 30%				5	10	5	10							
Oxalic acid 100%								5	5	10	10			
Sulfamic acid 100%												5	10	5
Ethomeen O/12	1			2	2			2	2	2				
Ethomeen T/12											1.5	2	2	1.5
Arquad T-50		2	2			1.5	2							
Sodium Xylene Sulfonate (SXS)	1	1.5	1.7	1.5	1	1	1	1	1	1	1	1	1	1
Berol 175									0.3					
Water	q.s.	q.s.	q.s.	q.s.	q.s.	q.s.	q.s.	q.s.	q.s.	q.s.	q.s.	q.s.	q.s.	q.s.
<b>Viscosity, cps sp 3 at 30 RPM</b>	<b>400</b>	<b>290</b>	<b>110</b>	<b>1350</b>	<b>320</b>	<b>470</b>	<b>510</b>	<b>1290</b>	<b>580</b>	<b>470</b>	<b>560</b>	<b>550</b>	<b>790</b>	<b>550</b>

## Strong acids

Ingredients, % w/w	Hydrochloric acid								
Hydrochloric acid 37%	10	10	10	10	25.6	25.6	25.6		
Ethomeen O/12	1.5	1.5			3				
Ethomeen T/12				2		1	1.5		
Aromox T/12			1.5						
Arquad T-50		1.5	1.5			1	1		
Berol 175				1					
Water	q.s.	q.s.	q.s.	q.s.	q.s.	q.s.	q.s.		
<b>Viscosity, cps sp 3 at 30 RPM</b>	<b>420</b>	<b>480</b>	<b>320</b>	<b>300</b>	<b>630</b>	<b>700</b>	<b>1500</b>		



## Alkaline and bleaching agents

Ingredients, % w/w	NaOH			Hydrogen peroxide		Sodium hypochlorite	
NaOH 100%	10	5	5			0.5	
Hydrogen peroxide 30%				16.7	16.7		
Sodium hypochlorite 15%						70	
Citric acid 100%				3			
Sulfamic acid 100%					3		
Sodium Xylene Sulfonate (SXS)	1.5		1	1.5	1.5		
Aromox 14D-W970	3					4	
Aromox T/12		1					
Arquad T-50			2.5		3.5		
Arquad 16-29				3.5			
Sodium carbonate						4	
Water	q.s.	q.s.	q.s.	q.s.	q.s.	q.s.	
<b>Viscosity, cps sp 3 at 30 RPM</b>	<b>180</b>	<b>350</b>	<b>580</b>	<b>670</b>	<b>400</b>	<b>600</b>	

### Typical procedure for formulating amine-based 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 or Ethylan 1008.

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