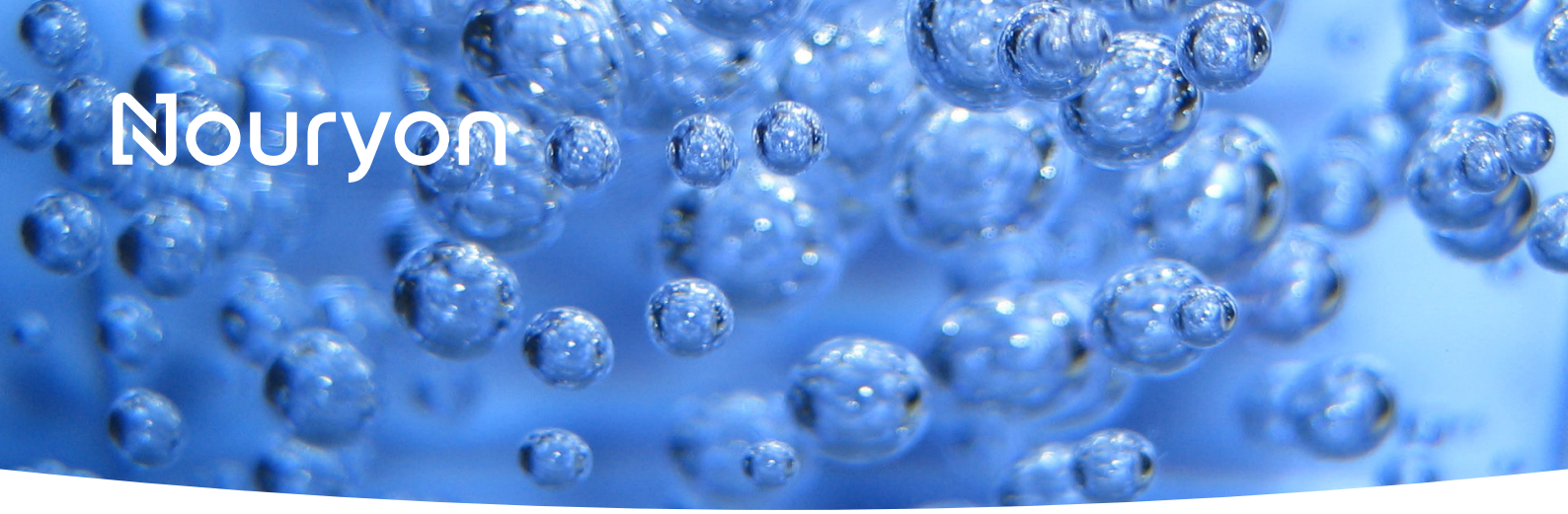


Nouryon

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

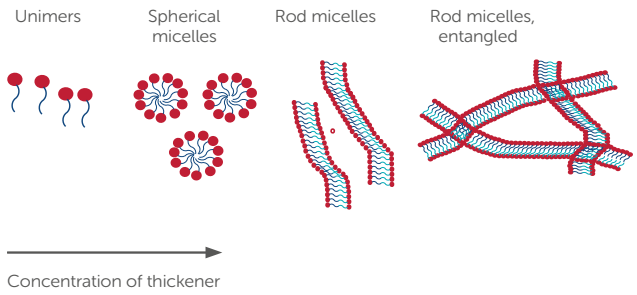
Moderate to extreme thickening

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. Berol® 175 or Ethylan® 1008 surfactants 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

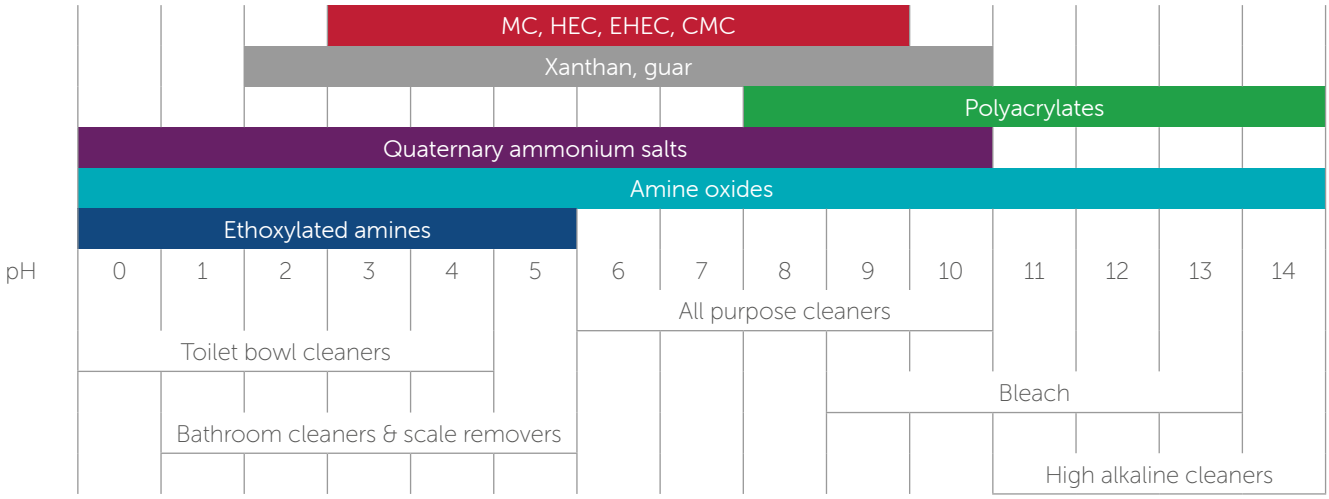
Product	Application	Key features
Ethoxylated amines	Toilet Bowl Cleaner (TBC), acidic bathroom cleaners	Use for pH <5 – versatile thickening systems that are stable in strong and weak acids
Ethomeen® C/12		Effective in thickening blends with hydrophobic components
Ethomeen® O/12, O/12LC		Liquid at room 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
Quaternary ammonium salts	TBC, acidic and alkaline bathroom cleaners	Suitable for use at all pH's Stable in hydrogen peroxide containing bleach
Arquad® 16-29, 16-50		
Arquad® T-50		
Amine oxides	High alkaline and hypochlorite cleaners, acidic, alkaline and neutral cleaners	Suitable for use at all pH's Stable in alkaline and chlorine-containing bleach
Aromox® 14D-W970		Low heavy metal content, does not decompose chlorine 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 surfactant blends provide efficient thickening for hydrochloric acid at up to 15%, avoiding unwanted fluid elasticity
- Ethomeen® HT/12 and Ethomeen® C/12 surfactants 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.
Viscosity, cps sp 3 @30 rpm	400	290	110	1350	320	470	510	1290	580	470	560	550	790	550

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.
Viscosity, cps sp 3 @30 rpm	420	480	320	300	630	700	1500

Alkaline and bleaching agents

Ingredients, % w/w	NaOH			Hydrogen peroxide		Sodium hypochlorite
NaOH, 100%	10	5	5			0.5
Hydrogen peroxide, 100%				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.
Viscosity, cps sp 3 @30 rpm	180	350	580	670	400	600

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 surfactants

Contact us directly for detailed product information and sample request
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Nouryon

Nouryon is a global, specialty chemicals leader. Markets and consumers worldwide rely on our essential solutions to manufacture everyday products, such as personal care, cleaning goods, paints and coatings, agriculture and food, pharmaceuticals, and building products. Furthermore, the dedication of approximately 8,200 employees with a shared commitment to our customers, business growth, safety, sustainability and innovation has resulted in a consistently strong financial performance. We operate in over 80 countries around the world with a portfolio of industry-leading brands. Visit our website and follow us @Nouryon and on LinkedIn.

May 2026

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