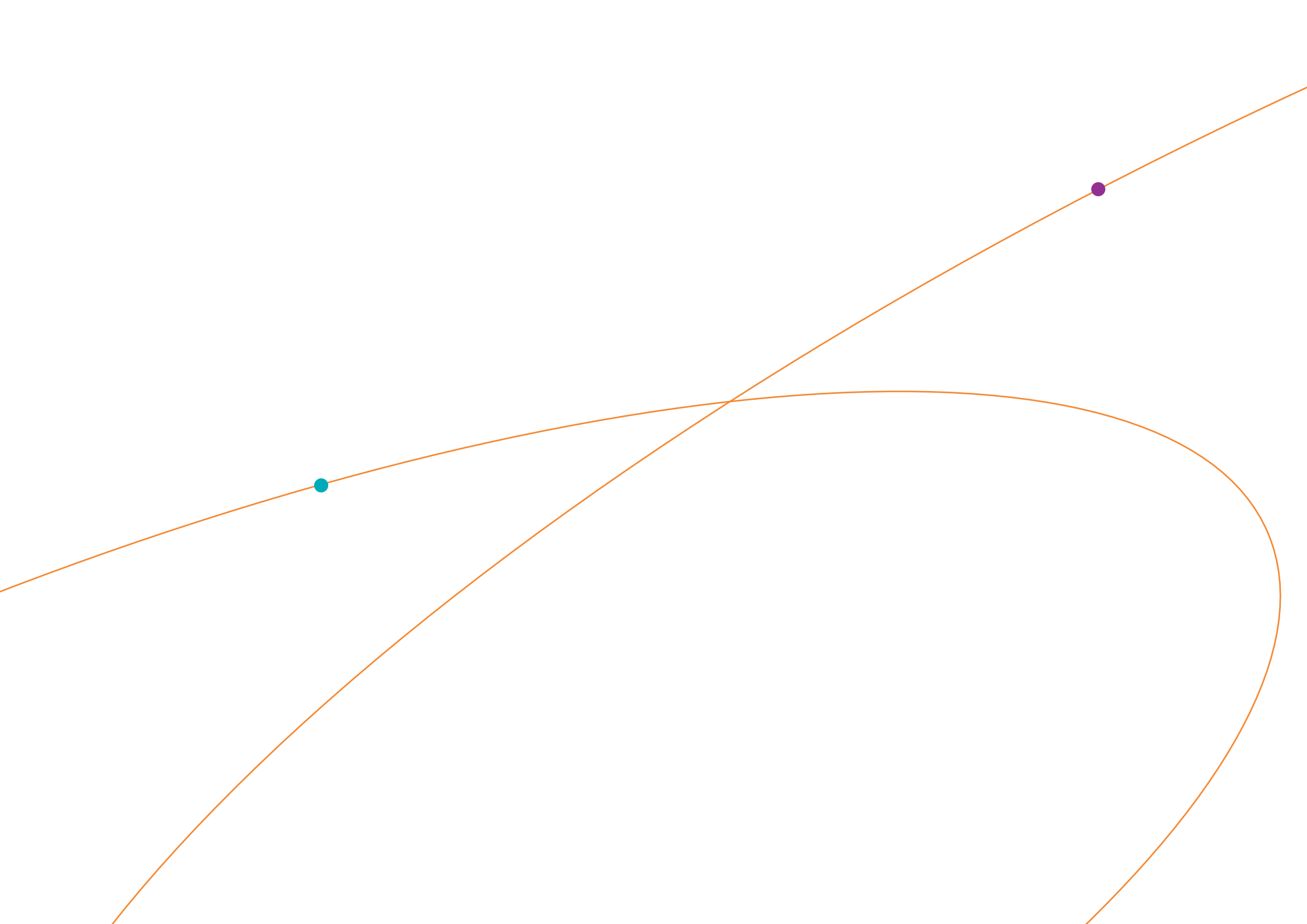
Surface Chemistry

Cleaning Applications

Nouryon



Contents

1. Introduction

Customer oriented around the globe

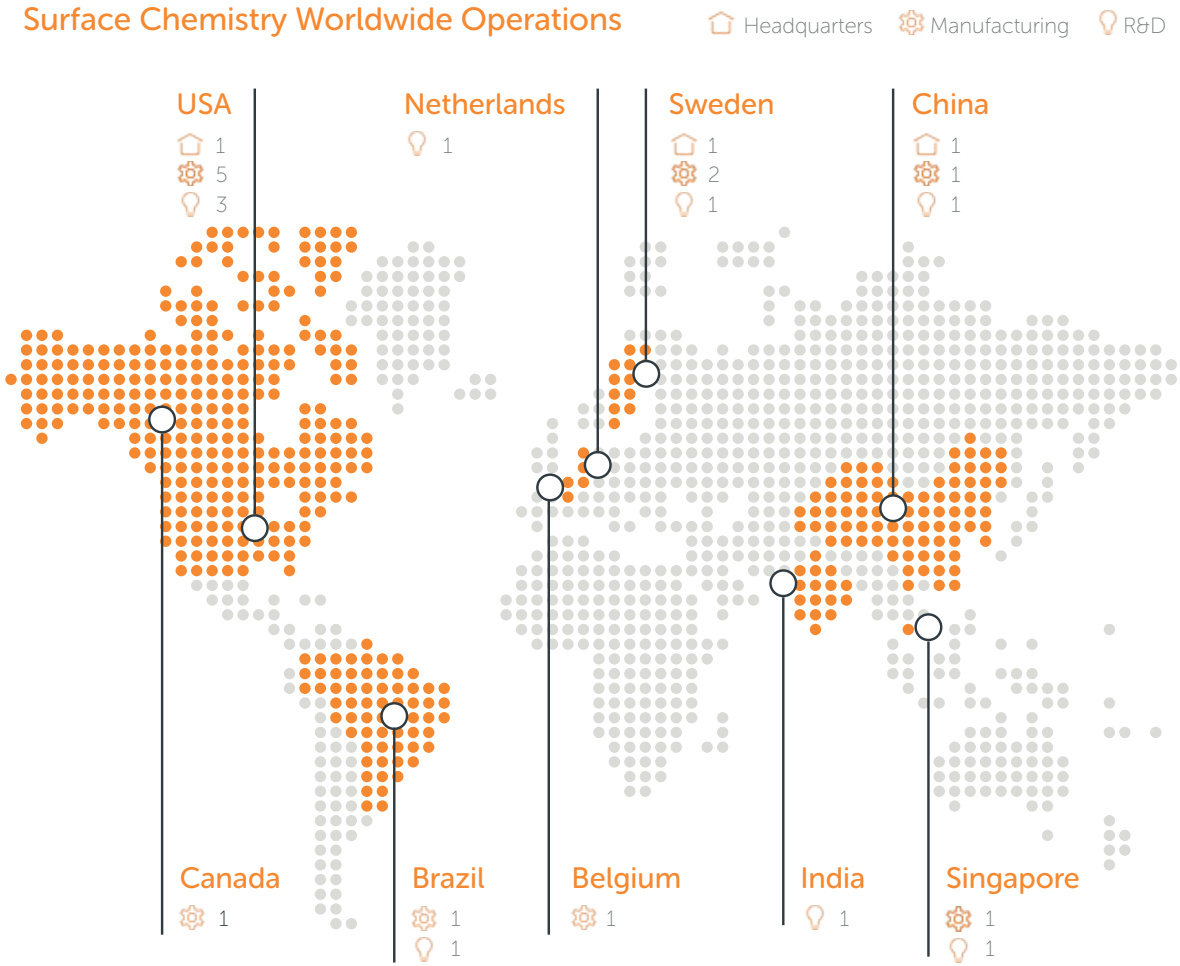
Global reach, local focus.

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.

A co-surfactant is often added to the formulation of a cleaning product to increase the solubilization power of the surfactant system and boost its cleaning performance.

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

Product	Description	Appearance 20°C	Active Content %	Surface Tension mN/m*	Wetting Power sec**	Solubility in 5% water	Application	Aircraft/trains/boats/aluminium cleaning	Alkaline cleaning	Automatic dishwashing	Car wash/rinse/polish	CIP cleaning	Dry cleaners/carpet cleaning	General and household cleaning	High pressure cleaning	Industrial and institutional cleaning	Laundry liquids/manual dishwash	Industrial metal cleaning	Property/Function	Degreaser	Emulsifier	Low foam	Wetting
Armohib CI-28 (a)	Optimized blend, containing amine ethoxylate	Liquid	Corrosion inhibitor product for metal treatment at low pH													•		•					
Berol ENV226 Plus	Alcohol ethoxylates and co-surfactants	Liquid	55	27	15	S		•	•		•			•	•	•	•	•		•	•		•
Berol 226 (a)	Alcohol ethoxylates and co-surfactants	Liquid	100	27	15	S		•	•		•			•	•	•	•	•		•	•		•
Berol DGR 81	Alcohol ethoxylates and co-surfactants	Liquid	95	27	20	S (b)		•	•		•			•	•	•		•		•	•		•
Berol LFG 61	Alcohol ethoxylates and co-surfactants	Liquid	95	31		S			•	•		•		•	•							•	
Berol EZ-1	Alcohol ethoxylates and co-surfactants	Liquid		23		S		•	•		•			•	•	•				•	•		•
Berol LS	Alcohol ethoxylates, co-surfactants and nano silicas	Liquid		30		S			•				•	•						•			•
Berosol EC	Alcohol ethoxylates, co-surfactants and nano silicas	Liquid	50	30	95	S			•		•			•		•				•			

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

EU Ecolabel compliant

Co-surfactants

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.

Product	Description	Appearance 20°C	Active Content %	Surface Tension mN/m*	Wetting Power sec**	Solubility in 5% water	Application	Acid cleaning	Alkaline cleaning	Car wash/rinse/polish	General and household cleaning	Industrial and institutional cleaning	Laundry liquids/manual dishwash	Property/Function	Co-surfactant/hydrotrope
Berol EP 25	C8 alcohol ethoxylate	Liquid	70%	50	>600	S		•	•	•	•	•	•		•
Berol R648 NG	Quaternary C12-C14 alkyl methyl amine ethoxylate methyl chloride	Liquid	60	36	>300	S		•	•	•	•	•			•
Berol R648 PO (a)	Quaternary C12-C14 alkyl methyl amine ethoxylate methyl chloride	Liquid	60	36	>300	S		•	•	•	•	•			•
Berol SurfBoost AD15 (a)	Alkyl amide ethoxylate	Liquid	65	32	>300	S		•	•	•	•	•	•		•
Berol SurfBoost AD2M	N,N-Dimethyldecan amide	Liquid	100	26	7-8	I		•	•	•	•	•	•		•

Key

* according to du Noüy, 25°C, 0,1% DIN 53914
** according to Draves, 25°C, 0,1%
(a) Certified RSPO source
S soluble
I insoluble
EU Ecolabel compliant

3. Nonionic surfactants

Our nonionic surfactants get surfaces clean

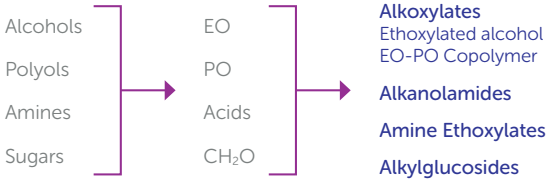
Nonionic surfactants by definition contain no structural element that has a formal charge. Surface activity derives from a balance of hydrophobic and hydrophilic structures contained in the surfactant molecule. Altering the balance towards more hydrophobic or more hydrophilic influences the surfactant's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

Nonionic surfactants for degreasing – highly targeted performance, effective at very low concentrations, excellent low temperature handling.

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



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.

Trademark	Surfactant Type
AG™	Alkylglucosides
Berol®, Ethylan®	Narrow range, EO, EO/PO alkoxylated and mixtures
Ethomeen®	Amine ethoxylates

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 ethoxylate", 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
- Wetting
- Emulsification
- Foam boosting
- Defoaming
- Viscosifying
- Solubilization

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

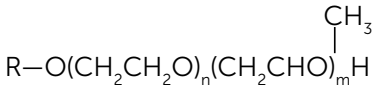
$R—O(CH_2CH_2O)_nH$

Product	Description	Appearance 20°C	Active Content %	Surface Tension mN/m*	Wetting Power sec**	Cloud Point °C	HLB	Solubility in 5% water	Application	Aircraft/trains/boats/aluminium cleaning	Alkaline cleaning	Automatic dishwashing	Car wash/rinse/polish	CIP cleaning	General and household cleaning	High pressure cleaning	Industrial and institutional cleaning	Laundry liquids/manual dishwash	Property/Function	Degreaser	Emulsifier	Low foam	Wetting
Berol 260	C9-C11 alcohol ethoxylate	Liquid	99	27	11	55-59 (a)	10.5	D		•	•		•		•	•	•			•	•	•	•
Berol 266	C9-C11 alcohol ethoxylate	Liquid	99	27	15	24-29 (b) & 54-59 (b)	12	S		•	•		•		•		•	•		•	•		•
Berol 360 (c)	C10 natural alcohol ethoxylate	Liquid	99	27	11	55-59 (a)	10.5	D		•	•		•		•	•	•			•	•	•	•
Berol 366 (c)	C10 natural alcohol ethoxylate	Liquid	99	27	15	24-29 (b) & 54-59 (b)	12	S		•	•		•		•		•	•		•	•		•
Berol 840	C8 alcohol ethoxylate	Liquid	99	32	90	49-54 (a)	11.5	D			•			•	•		•			•		•	
Ethylan 1003	C10 alcohol ethoxylate	Liquid	99	27	4	31-34 (a)	10	D			•		•	•	•	•	•			•	•	•	•
Ethylan 1005	C10 alcohol ethoxylate	Liquid	99	27	3	47-53 (a)	11.6	D			•	•	•	•	•	•	•			•	•	•	•

Key

* according to du Noüy, 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
EU Ecolabel compliant

Alcohol Alkoxylates

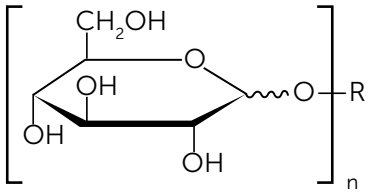


Product	Description	Appearance 20°C	Active Content %	Surface Tension mN/m*	Wetting Power sec**	Cloud Point °C	HLB	Solubility in 5% water	Application	Automatic dishwashing	Car wash/rinse/polish	CIP cleaning	General and household cleaning	High pressure cleaning	Industrial and institutional cleaning	Laundry liquids/manual dishwash	Industrial metal cleaning	Property/Function	Defoamer	Degreaser	Dispersant	Emulsifier	Foam boosting	Low foam	Wetting
Berol 048	Tridecyl alcohol ethoxylate	Liquid	85	28	11	65-73 (b)	14	S			•				•					•	•		•		•
Berol 087	C12-C16 alcohol ethoxylate/ propoxylate	Liquid	100	31	13	39-43 (b)	11.5	S		•	•	•								•		•		•	•
Berol 175	C12-C16 alcohol ethoxylate	Liquid	90	29	15	58-64 (b)	12.5	S					•		•	•						•			•
Berol 185	Alcohol ethoxylate propoxylate	Liquid	90	30	10	64-70 (b)	13.5	S			•		•		•	•				•	•	•			•
Berol 185 PO	Alcohol ethoxylate propoxylate	Liquid	90	30	10	64-70 (b)	13.5	S			•		•		•	•				•	•	•			•
Ethylan 1008	C10 alcohol ethoxylate	Liquid	100	29	11	60-68 (b)	14	S			•		•	•		•				•		•			•
Ethylan 1008W	2-Propylheptanol ethoxylate	Liquid	90	30	15	60-67 (b)	14	S			•		•	•		•				•		•			•
Ethylan CPG7545	C12-C16 alcohol ethoxylate/ propoxylate	Liquid	99	32	14	35-38 (b)		S		•		•		•	•		•			•				•	•
Ethylan HB4	Phenol ethoxylate	Liquid	100	49	>300	66-68 (c)		S			•										•				
Ethylan TB345 (d)	Block EO/PO copolymer	Liquid	100	-	-	74 (e)	17.9	S		•	•	•			•				•						
Ethylan TD1085	Isotridecyl alcohol ethoxylate	Liquid	85	28	11	65-73 (b)	14	S			•				•						•		•		•

Key

* according to du Noüy, 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
EU Ecolabel compliant

Alkylglucosides



Product	Description	Appearance 20°C	Active Content %	Surface Tension mN/m*	Wetting Power sec**	Foam Height mm*** Immediately	Foam Height mm*** After 5 min	Solubility in 5% water	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
AG 6202	C8 alkylglucoside	Liquid (a)	65	33	>300	8	0	S	•	•	•	•		•	•			•
AG 6206	C6 alkylglucoside	Liquid	75	34	>300	0	0	S	•	•	•	•	•	•	•			•
AG 6210	C8-C10 alkylglucoside	Liquid	61	27	200	100	90	S	•		•			•		•	•	

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
EU Ecolabel compliant

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:	
a. influence of alkyl chain	by decrease in chain length (or molecular mass) by increase in unsaturation
b. influence of nitrogen moiety	by increase in number of functional groups by increase in degree of ethoxylation by formation of salts by quaternization
c. influence of medium	by decreasing pH

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.

Cationic surfactants for effective 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 an improved control of dosage and increases the safety of your formulations by avoiding splashes and leaking.

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

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.

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, 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.

Amines / Diamines

$R—NH_2$

$R—NH—CH_2CH_2CH_2—NH_2$

Product	Description	Appearance 20°C	Amine Number Total mg KOH/g	Iodine Number gI/100 g	Water %	Diamine %	Colour Gardner	Melting Point °C	Viscosity mPa·s at 60°C	Application	Automatic dishwashing	Car wash/rinse/polish	CIP cleaning	Property/Function	Degreaser	Dispersant	Emulsifier
Armeen C	Cocoamine	Liquid	266-287	8	<0.1		max 2	15-20	4			•	•		•		•
Armeen OL	Oleylamine	Liquid	201-212	min 85	max 0.5		max 4	10-20	6			•	•		•		•
Duomeen C	N-Coco-1,3-diaminopropane	Liquid/Paste	388-443	6	max 1	min 89	max 8	20-30	4		•	•	•		•		•
Duomeen CD	N-Coco-1,3-diaminopropane	Solid/Paste	388-450	6	max 0.5	min 89	max 3	24-30	4		•	•	•		•		•
Duomeen O	N-Oleyl-1,3-diaminopropane	Liquid/Paste	313-349	min 65	max 0.5	min 90	max 8	9-20	11		•	•	•		•	•	•
Duomeen OV	N-Oleyl-1,3-diaminopropane	Liquid/Paste	311-347	75-95	<0.2	min 90	max 7	9-20	11		•	•	•		•	•	•

Polyamines

$R—NH—(CH_2CH_2CH_2NH)_nCH_2CH_2CH_2NH_2$

Triamines: n = 1
Tetramines: n = 2

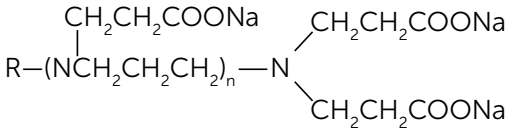
$R—N(CH_2CH_2CH_2NH_2)_2$

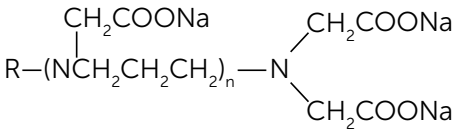
Triameen YT

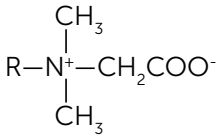
Product	Description	Appearance 20°C	Colour Gardner	Iodine Number gl/100 g	Water %	Typical Data Density kg/m³	Melting Point °C	Application	Industrial metal cleaning	Corrosion inhibitor	Property/Function	Dispersant	Emulsifier
Tetrameen OV	Oleyl (vegetable) tri-propylene tetramine	Solid	max 5	min 25	<0.5	850 (a)	56		•	•		•	•
Triameen OV	Oleyl (vegetable) di-propylene triamine	Liquid	max 3	min 50	<0.5	855	17		•	•		•	•
Triameen T	Tallow dipropylene triamine	Solid	max 3	30	<0.5	830	30-45		•	•		•	•
Triameen YT	Tallow dipropylene triamine	Liquid/Paste	max 12	33	<0.5	845 (a)	15-25		•	•		•	•

Key
(a) at 60°C

Amphoterics







Product	Description	Appearance 20°C	Solids %	Surface Tension mN/m*	Wetting Power sec**	Foam Height mm*** Immediately	Foam Height mm*** After 5 min	Colour Hazen	Pour Point °C	pH 20% in water	Sodium Chloride %	Solubility in 5% water	Application	Alkaline cleaning	Car wash/rinse/polish	CIP cleaning	Industrial and institutional cleaning	Laundry liquids/manual dishwash	Property/Function	Corrosion inhibitor	Co-surfactant/hydrotrope	Dispersant	Foam booster	Low foam	Mildness to skin
Ampholak 7CX/C	Sodium cocoampho-polycarboxyglycinate sodium chloride	Liquid	39.5-41		>300	150	150	max 70	-16	8.6-9.4	10.5-12.0	S						•			•		•		•
Ampholak 7TX	Sodium tallowampho-polycarboxyglycinate	Liquid	39-41	40	>300	130	120	max 100	-20	8.5-9.5	9.8-10.8	S			•		•				•		•		•
Ampholak XCE	Coco iminodiglycinate	Liquid	39-41	36	150	150	150	max 500	-17	8-10		S		•	•		•				•	•	•		
Ampholak YCE	Sodium cocopropylene-diaminepropionate	Liquid	29-30	39	300	125	120	max 250	0	6-7		S		•	•		•			•	•		•		
Ampholak YJH-40	Sodium caprylimino-dipropionate	Liquid	38-42	64	>300	15	0	max 500	-8	8.5-9.5		S		•	•	•	•				•			•	

Key

* according to du Noüy, 25°C, 0,1% DIN 53914

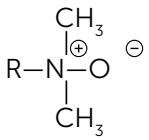
** according to Draves, 25°C, 0,1%

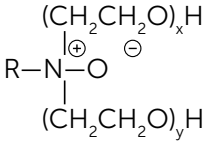
*** according to Ross-Miles, 50°C, 0.05%

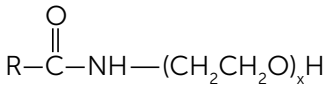
S soluble

EU Ecolabel compliant

Amine oxides / Amide ethoxylates





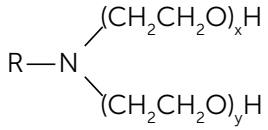


Product	Description	Appearance 20°C	Surface Tension mN/m*	Wetting Power sec**	Foam Height mm*** Immediately	Foam Height mm*** After 5 min	Solubility in 5% water	Application	Acid cleaning	Alkaline cleaning	Car wash/rinse aid/polish	General and household cleaning	Industrial and institutional cleaning	Property/Function	Emulsifier	Foam booster	Thickener
Aromox 14D-W970	Tetradecyldimethyl-amine oxide	Liquid	30	20	167	163	S			•			•			•	•
Aromox MCD-W	(Fractionated coco) dimetylamine oxide	Liquid (25°C)	30	20	165	160	S			•	•	•	•			•	•
Aromox T/12	Tallowbis (2-hydroxyethyl) amine oxide	Paste	30	>300	10	5	D		•	•			•				•
Aromox T/12 HFP	Tallowbis (2-hydroxyethyl) amine oxide	Paste/slightly cloudy liquid	30	>300	20	15	S			•	•						•
OMA 4	Bis (2-hydroxyethyl) oleyl amine	Liquid	30	95	20	18	D			•			•		•		

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
D dispersible
EU Ecolabel compliant

Amine ethoxylates



Product	Description	Appearance 20°C	Active Content %	Equivalent Mass	Surface Tension mN/m*	Wetting Power sec**	Solubility in 5% water	Application	Acid cleaning	Industrial and institutional cleaning	Industrial metal cleaning	Property/Function	Corrosion inhibitor	Degreaser	Dispersant	Emulsifier	Thickener
Berol 302	Bis (2-hydroxyethyl) oleyl amine	Liquid	100	344-365	29	>300	D		•		•		•			•	•
Ethomeen C/12	Bis (2-hydroxyethyl) cocoalkylamine	Liquid	100	275-300	27	100	D		•	•	•		•			•	•
Ethomeen C/15	Coco alkylamine ethoxylate	Liquid	100	408-440	30	85	S				•		•			•	
Ethomeen C/22	Coco alkylamine ethoxylate	Liquid	min 96				S				•			•		•	
Ethomeen O/12	Bis (2-hydroxyethyl) oleyl amine	Liquid	100	345-365	28	>300	D		•		•		•			•	•
Ethomeen OV/17	Oleyl amine ethoxylate	Liquid	100	540-585	31	160	S				•					•	
Ethomeen T/12	Bis (2-hydroxyethyl) tallow alkylamine	Liquid/Paste	100	340-360	28	>300	D		•		•		•			•	•
Ethomeen T/15	Tallow alkylamine ethoxylate	Liquid	100	471-506	31	80	S				•		•			•	
Ethomeen T/25	Tallow alkylamine ethoxylate	Liquid	100	869-952	39	>300	S				•			•		•	

Key

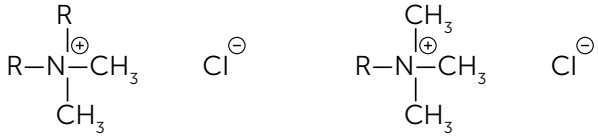
* according to du Noüy, 25°C, 0,1% DIN 53914

** according to Draves, 25°C, 0,1%

S soluble

D dispersible

Quaternary ammonium compounds (QAC)



Product	Description	Appearance 20°C	Active Content %	Free amine+ Amine HCl, %	Colour Gardner	pH 5% in 50/50 2-propanol/water	Solubility in 5% water	Application	Acid cleaning	Alkaline cleaning	Car wash/rinse aid/polish	Fabric softeners	General and household cleaning	Property/Function	Antistatic	Thickening
Arquad 2C-75	Dicocoldimethyl ammonium chloride, 2-propanol	Liquid	74-77	max 2	max 5	6-9					•	•			•	
Arquad 2HT-75	Di(hydrogenated tallow) dimethyl ammonium chloride, 2-propanol	Liquid	74-76	max 2	max 4	6-9	D					•			•	
Arquad T-50	Tallowtrimethyl ammonium chloride, 2-propanol	Liquid	49-52	max 2	max 5	6-9	S		•	•			•			•
Arquad T-50 HFP	Tallowtrimethyl ammonium chloride, 2-propanol	Liquid	49-52	max 2	max 6	6-9 (a)	S		•	•			•			•

Key

(a) 1% in water
S soluble
D dispersible

5. Biocides

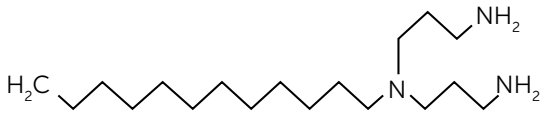
Microbial control

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:



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.

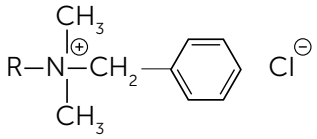
Due to the registration process of active ingredients not all actives on the market before the BPR was established will be finally registered. The following active substances have been selected for registration according to the following product types:

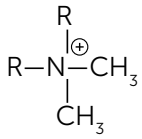
- BKC = benzalkonium chloride (CAS 68424-85-1) for PT 1,2,3,4,8,10,11,12:
  - Arquad MCB-50, Arquad MCB-50 PO, Arquad MCB-80
- DDAC = didecyldimethylammonium chloride (CAS 7173-51-5) for PT 1,2,3,4,8,10,11,12:
  - Arquad 2.10-50, Arquad 2.10-70 HFP, Arquad 2.10-80
- TMAC = trimethylalkylammonium chloride (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

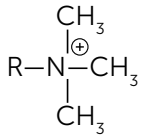
Information on the status of each substance in the BPR registration process as well as more details on the product types can be found in our Fact Sheet which is regularly updated and available on request.

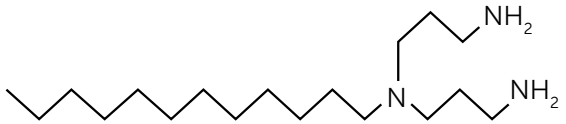
In addition to these strong biocides there are substances which also have some weak biocidal/biostatic effect but are not in the BPR registration process. Often these substances are used for non-biocidal applications. Outside of Europe it depends on the national legislation if they may be used as biocides 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







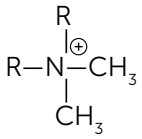


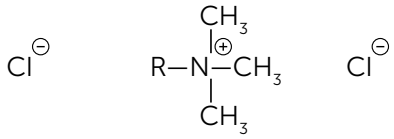
Product	Description	Appearance 20°C	Active Content %	Solvent	Colour Gardner	pH 10% in water	Flash point °C	BPR supported (c)	Application	Disinfectants	Preservatives	Property/Function	Algicide	Bactericide	Fungicide	Selective virucide	Tuberculocide
Arquad 2.10-50	Didecyldimethyl ammonium chloride	Liquid	49-51	Water/ 2-propanol	max 2	6-9	28	Yes		•	•		•	•	•	•	
Arquad 2.10-70 HFP	Didecyldimethyl ammonium chloride	Liquid	69-71	Water/ ethylene glycol	max 3	6-9 (a)	>100	Yes		•	•		•	•	•	•	
Arquad 2.10-80	Didecyldimethyl ammonium chloride	Liquid	79-81	Water/ 2-propanol	max 3	6-9	28	Yes		•	•		•	•	•	•	
Arquad C-35	Cocotrimethyl ammonium chloride	Liquid	33-37	Water	max 2	6-9	>100	Yes		•	•		•	•	•	•	
Arquad MCB-50	C12-C16 alkylbenzyl dimethyl ammonium chloride	Liquid	49-52	Water	max 1	6-9	>100	Yes		•	•		•	•	•	•	
Arquad MCB-50 PO (d)	C12-C16 alkylbenzyl dimethyl ammonium chloride	Liquid	49-52	Water	max 1	6-9	>100	Yes		•	•		•	•	•	•	
Arquad MCB-80	C12-C16 alkylbenzyl dimethyl ammonium chloride	Liquid	80-81	Water/ ethylene glycol	max 4	6-9	>100	Yes		•	•		•	•	•	•	
Triameen Y12D	Dodecyl dipropylene triamine	Liquid	98-100	(b)	max 2	11,6	>100	Yes		•	•		•	•	•	•	•
Triameen Y12D-30	Dodecyl dipropylene triamine	Liquid	29-31	Water	max 1	11,5	>100	Yes		•	•		•	•	•	•	•

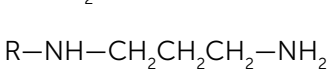
Key

(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







Product	Description	Appearance 20°C	Active Content %	Colour Gardner	BPR approved	Application	Acid cleaning	Car wash/rinse/polish	Chain lubricants	Disinfectants/preservatives	Fabric softening	General and household cleaning	Industrial and institutional cleaning	Industrial metal cleaning	Property/Function	Antistatic	Biocidal/biostatic	Corrosion inhibitor	Emulsifier	Thickener
Armeen CD	Cocoamine	Liquid	min 98	max 2	No				•	•							•	•		
Arquad 16-29	Hexadecyltrimethyl ammonium chloride	Liquid	28-30	max 2	No		•			•		•					•			•
Arquad 16-50	Hexadecyltrimethyl ammonium chloride, 2-propanol	Liquid	49-52	max 4	No		•			•		•					•			•
Arquad 2C-75	Dicocoldimethyl ammonium chloride, 2-propanol	Liquid	74-77	max 5	No			•		•	•					•	•		•	
Duomeen C	N-Coco-1,3-diaminopropane	Liquid/Paste	min 89	max 8	No				•	•			•	•			•	•	•	
Duomeen CD	N-Coco-1,3-diaminopropane	Solid/Paste	min 89	max 3	No				•	•			•	•			•	•	•	

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

Product	Description	Appearance 20°C	Active Content %	Surface Tension mN/m*	Wetting Power sec**	Solubility in 5% water	Application	Alkaline cleaning	Industrial and institutional cleaning	Industrial metal cleaning	Property/Function	Corrosion inhibitor	Co-surfactant/hydrotrope	Emulsifier	High foam	Low to medium foam
Phospholan PE169	Isotridecyl alcohol ethoxylate phosphate ester	Liquid	100	28	23	D		•	•	•		•				•
Phospholan PE65	Alcohol ethoxylate phosphate ester	Liquid	100		>300	D		•	•	•		•		•	•	
Phospholan PHB14	Phenol ethoxylate phosphate ester	Liquid	100	55	23	D		•	•				•			

Key

* according to du Noüy, 25°C, 0,1% DIN 53914

** according to Draves, 25°C, 0,1%

D dispersible

7. Performance polymers

Provide formulation flexibility

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.

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.

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.

Polymers

Product	Description	Appearance 25°C	Solids %	Molecular weight	pH 20% in water	Solubility in 5% water	Application	Automatic dishwashing	General and household cleaning	Industrial and institutional cleaning	Laundry liquids/manual dishwash	Laundry powder	Property/Function	Antistatic	Corrosion inhibitor	Co-surfactant/hydrotope	Dispersant	Low foam
Alcoguard 4160	Sulfonated multipolymer	Liquid	39-41		4-5	S		•	•		•			•			•	
Alcosperse 408	Acrylic/maleic copolymer	Liquid	42-44	3,000	5-6	S					•			•			•	
Alcosperse 412	Acrylic/maleic copolymer	Liquid	40-42	2,500	10-11	S						•		•			•	
Alcosperse 602N	Sodium polyacrylate	Liquid	44-46	5,000	7-8	S			•					•				
Alcosperse 747	Acrylic/styrene copolymer	Liquid	39-41	3,000	8-10	S			•	•	•			•	•	•		•
Aquatreat AR-257B	Sodium polyacrylate	Liquid	53-55	2,500	5.3-5.7 (10%)	S		•	•	•				•			•	

Hybrid bio-polymer

Product	Description	Appearance 25°C	Solids %	Molecular weight	pH 20% in water	Solubility in 5% water	Application	Automatic dishwashing	General and household cleaning	Industrial and institutional cleaning	Laundry liquids/manual dishwash	Laundry powder	Property/Function	Antistatic	Corrosion inhibitor	Co-surfactant/hydrotope	Dispersant	Low foam
Alcoguard H 5941	Hybrid bio-polymer	Liquid	39-41		4-6	S		•	•		•			•			•	

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.

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

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.

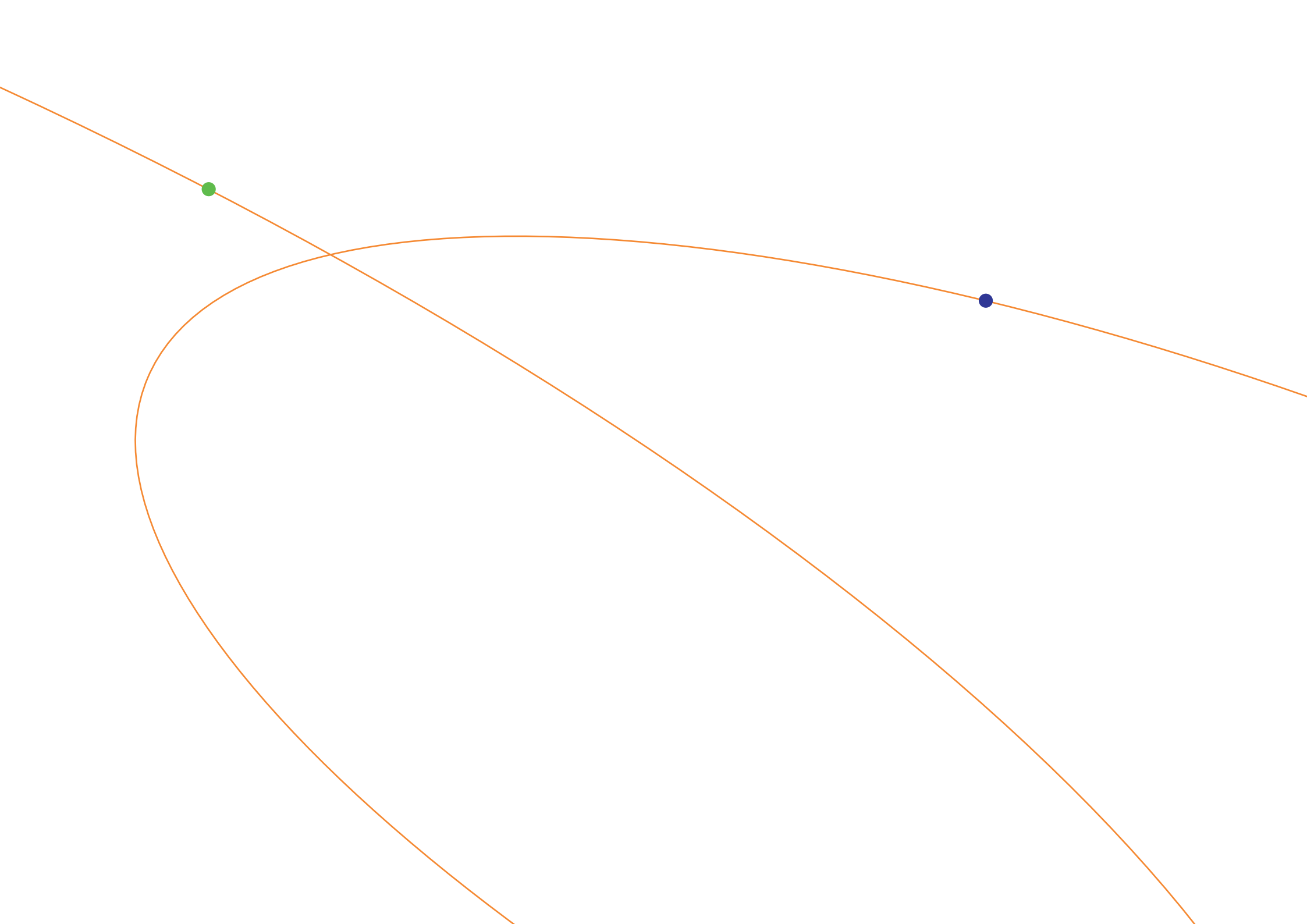
We are always ready to listen to and empower our partners to make our industry more sustainable in all dimensions. If you have any questions or comments regarding our sustainability philosophy or have unmet sustainability needs that we might be able to help address, please contact your Nouryon sales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

Your partner in essential chemistry for a sustainable future

Index

Key

EU Ecolabel compliant



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About Nouryon

We are a global specialty chemicals leader. Markets worldwide rely on our essential chemistry in the manufacture of everyday products such as paper, plastics, building materials, food, pharmaceuticals, and personal care items. Building on our nearly 400-year history, the dedication of our 10,000 employees, and our shared commitment to business growth, strong financial performance, safety, sustainability, and innovation, we have established a world-class business and built strong partnerships with our customers. We operate in over 80 countries around the world and our portfolio of industry-leading brands includes Eka, Dissolvine, Trigonox, and Berol.

For more information visit **surfacechemistry.nouryon.com**

Nouryon

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