Cleaning applications

North America edition

Nouryon

Contents

1. Introduction

Customer oriented around the globe

Global reach, local focus

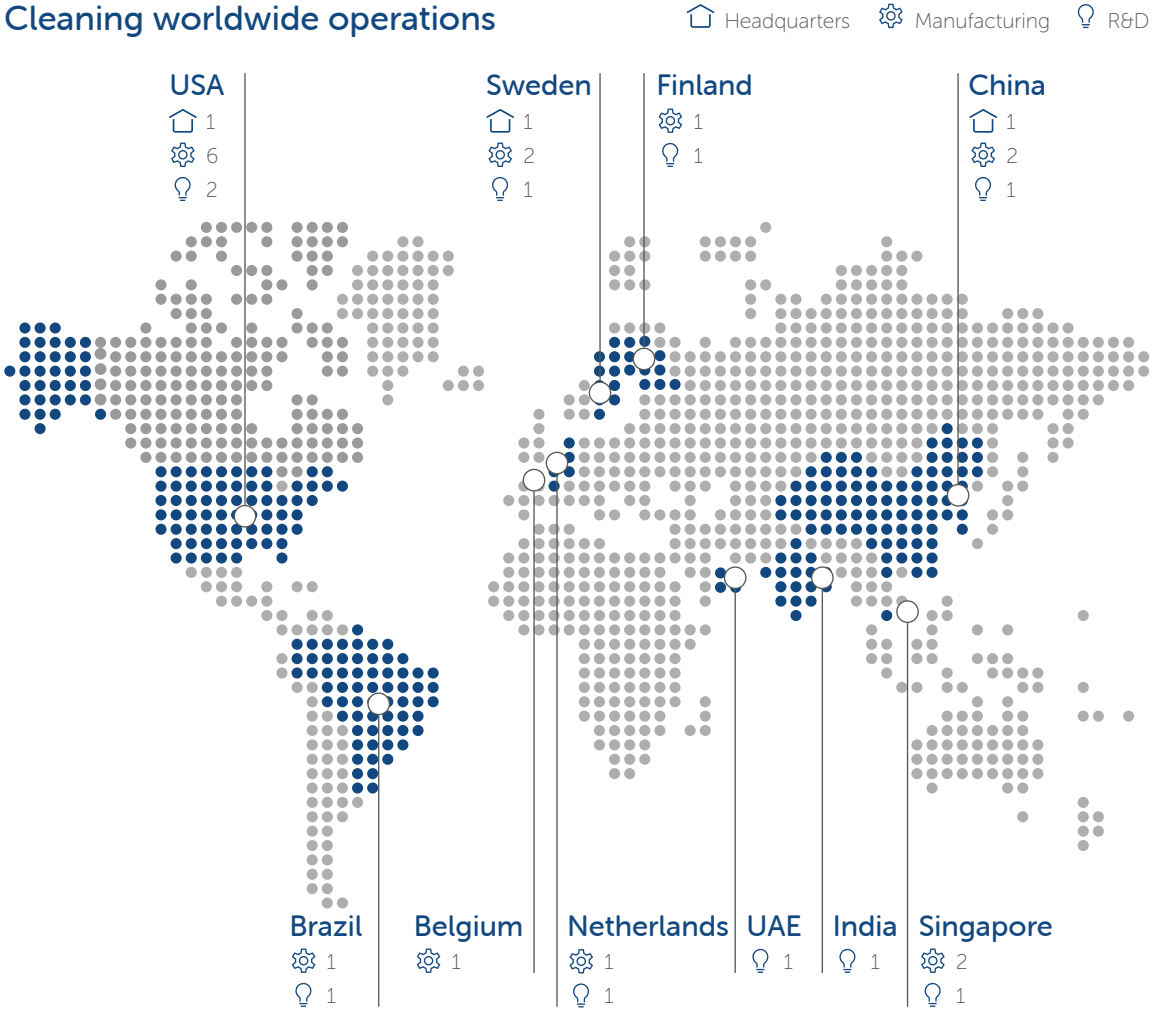
This catalog contains information about the specialty chemicals offered by Nouryon for the cleaning segment in North America.

Our product portfolio includes chelating agents, specialty surfactants (anionic, cationic and nonionic), as well as co-surfactants with excellent soil removal capabilities.

In addition, a range of natural, hybrid and synthetic polymeric products are available offering rheology modification, dispersancy, scale inhibition and anti redeposition benefits. Finally, our biocides and bleaching products portfolio offer differentiated and enhanced cleaning and disinfection benefits to cleaning formulations.

We offer the formulator a robust portfolio of sustainable ingredients to choose from. Many of our products meet regional and global eco-labeling standards. Our chemical technology expertise, efficient manufacturing facilities, research and development support help fulfill our promise to deliver quality products to customers. This enables our customers to formulate superior cleaning solutions in both household and industrial and institutional application.

Cleaning worldwide operations



2. Chelating agents

The world of Dissolvine® chelating agents

Dissolvine® chelating agent (also called chelant or sequeestering agent) is our brand name for products known as chemicals that control the reactivity of metal ions. Metal ions have a powerful influence on chemical processes as well as on the performance of many products. A wide range of problems associated with metal ions can be solved using Dissolvine® chelating agents, from improving the efficiency of pulp bleaching to cleaning dairies, from increasing crop quality and yields to preserving food quality. The good performance of chelating agents in cleaning such as automatic dish washing, laundry, hard surface cleaning and machine dish washing has contributed to the wide-spread use of these products.

The hard water metal cations calcium and magnesium, but also metals like iron or barium can form low water-soluble salts with hydroxides, carbonates, sulfates and phosphates that precipitate out of aqueous systems. These precipitates form scales that are extremely difficult to remove and reduce the efficiency of boilers and chemical processing equipment.

When Dissolvine® chelating agents are added to these systems, they complex the metal ions into a water-soluble form and dissolve the scale deposit so that it is removed in the cleaning process. In virtually any industrial process which uses water, Dissolvine® chelants can add or remove metals ions or alter metal ions properties in a controlled way.

Cleaning and detergents

Dissolvine® chelating agents are powerful builders. They enhance the cleaning power of a cleaner/detergent by catching the hard water ions, calcium and magnsium, and removing those based residues which bind most dirt to surfaces. They also prevent the deactivation of anionic surfactants from hard water metal ions, so less surfactant can be used.

Dissolvine® chelating agent is our brand name for products known as chemicals that control the reactivity of metal ions.

Besides this, Dissolvine® chelating agents deactivate the unwanted transition metal ions that are often introduced through raw materials in the manufacture of soap and of detergents that contain peroxides like hydrogen peroxide, percarbonates and perborates. In biocidal detergents chelating agents greatly enhance the effectiveness of biocides so the amount needed to be effective can be reduced. They also boost the performance of preservatives in liquid detergents. Therefore, less can be used and cost savings can be made.

Industrial cleaning

Metal salts can cause scaling problems in boilers, heat exchangers and other water circulation systems found in the power, brewing, sugar and dairy industries. Dissolvine® chelating agents form stable, water-soluble metal complexes with all potentially harmful metal ions, dissolving existing scale formations and preventing new scales from forming.

Growing market share for green chelants

EDTA chelating agent

EDTA is the most well-known, widespread used chelating agent. It is highly efficient in sequestering metal ions. The physical properties of EDTA chelating agents, in combination with a good performance and strong chelation power, have resulted in many products based on EDTA. The EDTA chelating agent is available in acid form as crystalline solid and as disodium and tetra sodium crystals. Various counter ions can be applied influencing the solubility of the EDTA chelating agent. The solid form of EDTA could be amorphous (powder) or crystalline.

The metal complexes of EDTA are applied in food (Ca-EDTA), in Agriculture (various EDTA metal complexes) and in industrial applications such as gas sweetening. The list of applications in which EDTA or its metal complex plays a role varies from feed additive, food fortification, cleaning detergents, personal care and pharma. EDTA is inherently biodegradable.

Sustainable chelating agent

The focus on sustainability by the industry and its customers created the need for a readily biodegradable product. Innovation and supplying high performing products with a low environmental impact is important for Nouryon and this triggered the search for what is known as the product range being called green chelating agents. Those chelating agents are readily biodegradable, based on a renewable feedstock and they should preferably be non-hazardous. We produce several of these green chelating agents; GLDA (glutamic acid diacetic acid sodium salt) and MGDA (methylglycine diacetic acid sodium salt) being the most well-known representatives.

Innovation and supplying higher performing products with a low environmental impact is important for us.

GLDA chelating agent

GLDA is a very exceptionally water soluble chelant which is available at 3 different concentrations, Dissolvine® GL-38 chelating agent (38% assay), Dissolvine® GL-47-S chelating agent (47% assay, a high purity grade) and Dissolvine® GL Premium chelating agent (55% assay, high purity). Dissolvine® GL Premium chelating agent is very compatible with polyvinyl alcohol (PVA), has no transport classification or labeling and due to its high concentration, a preferred candidate for use in concentrates. More data can be found in the table "readily biodegradable chelating agents" on the next page.

MGDA chelating agent

MGDA is available as solution, Dissolvine® M-40 chelating agent (40% MGDA-Na3), and as crystalline solid, called Dissolvine® M-X chelating agent (81% MGDA-Na3). Dissolvine® M-X chelating agent is a storage stable granule, the product is free flowing when stored properly. Details on MGDA are available in the MGDA brochure and technical data leaflet.

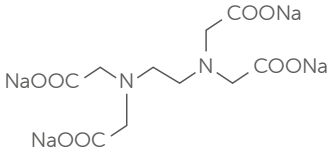
Outlook GLDA and MGDA

Both GLDA and MGDA are an ideal replacement for ingredients under regulatory pressure, they can act as a drop-in replacement for NTA in industrial and institutional cleaners. In cleaning both chelates will outperform widely used builders such as phosphonate, citrates and gluconates due to their strong bonds with hard water ions. GLDA and MGDA are chemically stable under both acidic and alkaline conditions, and they possess a good thermal stability.

The chelating capacity of MGDA, expressed as mg of the chelated metal ion per gram Dissolvine® M-40 chelating agent is comparable with that of NTA. At higher concentrations, chelants will ensure anionic surfactants remain active by softening the water. The high cleaning power and good solubility of Dissolvine® M-40 / M-X and particularly Dissolvine® GL chelating agents enable production of compact liquid detergents that will reduce costs for transport and packaging.

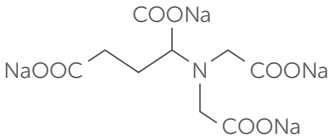
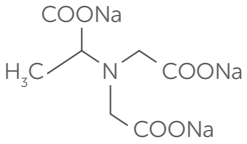
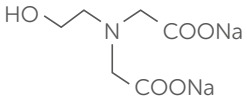
Both GLDA and MGDA are an ideal replacement for ingredients under regulatory pressure.

EDTA chelating agents

Structure and chemical name	Product	Chemical formula	Physical form	Molecular mass	Density* lb/gallon lb/ft^3	pH typical value**	Specific properties
 Ethylenediaminetetraacetic tetrasodium salt EDTA-Na_4	Dissolvine® E-39	EDTA-Na_4	Liquid (39%)	380.2	10.9	11.5	Most widely used liquid chelating agent
	Dissolvine® 100-S	EDTA-Na_4	Liquid (38%)	380.2	10.6	11.5	High purity (NTA free)
	Dissolvine® Na	EDTA-Na_4	Micro-granular	380.2	37	11.5	Most widely used solid chelating agent
	Dissolvine® Na-X	EDTA-Na_4 Tetrahydrate	Crystalline	452.2	56	11.5	High purity (low NTA)
	Dissolvine® 220-S	EDTA-Na_4 Tetrahydrate	Crystalline	452.2	47	11.5	High purity (NTA free)
	Dissolvine® Na3-36	EDTA-Na_3H	Liquid (36%)	358.2	10.4	9.5	High purity (NTA free), lower pH without inorganic salt
	Dissolvine® Na2	EDTA-Na_2H_2 dihydrate	Crystalline	372.2	37	4.5	Slightly acidic without inorganic salt
	Dissolvine® Na2-P	EDTA-Na_2H_2 dihydrate	Crystalline	372.2	34	4.5	High purity, NTA free (< 0.1wt%) (a)
	Dissolvine® Na2-S	EDTA-Na_2H_2 dihydrate	Crystalline	372.2	37	4.5	High purity, NTA free (< 0.1wt%)
	Dissolvine® Am4-50	EDTA-$(NH_4)_4$	Liquid (50%)	360.4	9.9	9	Sodium free
	Dissolvine® Am3-40	EDTA-$(NH_4)_3H$	Liquid (40%)	343.3	9.6	7	Sodium free
	Dissolvine® Am2-45	EDTA-$(NH_4)_2H_2$	Liquid (45%)	326.3	10.0	5	Sodium free
	Dissolvine® K4-50	EDTA-K_4	Liquid (50%)	444.6	10.9	11.5	Sodium free
	Dissolvine® K4-100-S	EDTA-K_4	Liquid (45%)	444.6	10.6	11.5	Sodium free, high purity
	Dissolvine® K3-123-S	EDTA-K_3H	Liquid (50%)	406.5	10.9	8	Sodium free, high purity
	Dissolvine® Z	EDTA-H_4	Crystalline	292.2	44	2.5	High purity, low pH, solid
	Dissolvine® Z-S	EDTA-H_4	Crystalline	292.2	44	2.5	High purity (NTA free)

* poured bulk density for solids, note: 8.35 lb/gal (for liquids) and 62.43 lb/ft^3 (for solids)
** as 1% solution or saturated solution if solubility is <1%
(a) meeting the Pharmacopeia (USP/FCC/EP/96-77-EC) test requirements

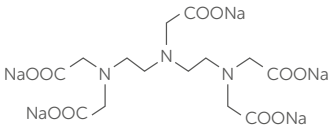
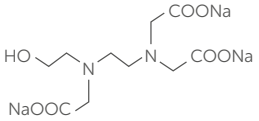
Readily biodegradable chelating agents

Structure and chemical name	Product	Chemical formula	Physical form	Molecular mass	Density* lb/gallon lb/ft³	pH typical value**	Specific properties
 Glutamic acid, N,N-diacetic tetrasodium salt, GLDA-Na_4	Dissolvine® GL-47-S	GLDA-Na_4	Liquid (47%)	351.1	11.7	11.5	Highly soluble, high purity (NTA free)
	Dissolvine® GL Premium	GLDA-Na_4	Liquid (55%)	351.1	11.95	10.2	Highly soluble, high purity (NTA free)
 Methylglycine N,N-diacetic trisodium salt, MDGA-Na_3	Dissolvine® M-40	MDGA-Na_3	Liquid (40%	271.1	83.2	11.5	Highly soluble, NTA free
	Dissolvine® M-X	MDGA-Na_3	Granular	271.1	50	11.5	Highly soluble
 Ethanoldiglycinic disodium salt, EDG-Na_2	Dissolvine® EDG	EDG-Na_2	Liquid (27.5%)	221.1	9.9	11.5	Also referred to as HEIDA

* poured bulk density for solids, note: 8.35 lb/gal (for liquids) and 62.43 lb/ft³ (for solids)
** as 1% solution or saturated solution if solubility is <1%
US EPA Safer Choice CleanGredients
Direct release

Separate brochures are available on the complete product line chelating agents and for our green chelants GLDA and MGDA

Special chelating agents

Structure and chemical name	Product	Chemical formula	Physical form	Molecular mass	Density* lb/gallon lb/ft³	pH typical value**	Specific properties
 Diethylenetriaminepentaacetic pentasodium salt DTPA-Na_5	Dissolvine® D-40	DTPA-Na_5	Liquid (40%)	503.3	10.7	11.5	
	Dissolvine® D-50	DTPA-Na_5	Liquid (50%)	503.3	11.4	11.5	Regular DTPA
	Dissolvine® D-K5-45	DTPA-K_5	Liquid (45%)	583.3	10.6	11.5	High purity (sodium free)
	Dissolvine® DZ	DTPA-H_5	Crystalline	393.4	37	2	High purity
 Hydroxyethylethylenediaminetriacetic trisodium salt HEDTA-Na_3	Dissolvine® H-40	HEDTA-Na_3	Liquid (43%)	344.2	10.7	11.5	Chelating agent for iron at low alkalinity
	Dissolvine® H-50-GS	HEDTA-Na_3 / HEDTA-H_3	Liquid (50%)	-	11.0	5-9	Chelating agent for iron at low alkalinity
	Dissolvine® H-88-X	HEDTA-Na_3 2.5 hydrate	Crystalline	389.2	37	11-5	Chelating agent for iron at low alkalinity

* poured bulk density for solids, note: 8.35 lb/gal (for liquids) and 62.43 lb/ft³ (for solids)
** as 1% solution or saturated solution if solubility is <1%

Separate brochures are available on the complete product line chelating agents and for our green chelants GLDA and MGDA

Choosing the right Dissolvine® chelant

Dissolvine® chelating agents can be used directly in chemical processes or formulated as water soluble products.

The type and quantity of metal ions as well as the anions involved in the process need to be considered. An important factor is the strength of the complex formed between the metal ion and the chelating agent. This determines whether the complex will be formed in the presence of competing anions. The stability or equilibrium constant (K), expressed as log K, has been determined for many metals and chelating agents. For each metal complex there is an optimum pH in which the metal complex is stable.

We supply the following Dissolvine® chelating agents.

GLDA: A strong, and the greenest chelate in our product range. Safe and readily biodegradable chelating agent that can be used as alternative for NTA, EDTA, phosphates and phosphonates, especially in cleaning applications. It has a high solubility over a wide pH range. It is soluble in acids and in several non aqueous solvents. The largest part of the molecule originates from a natural sustainable source.

MGDA: A safe and readily biodegradable strong chelating agent available in a solid and liquid form that can be used as alternative for NTA, EDTA, phosphates and phosphonates, especially in short contact time cleaning applications.

EDTA: The most widely used, very strong, cost effective and general purpose chelating agent.

EDG: A readily biodegradable chelating agent, effective when a relatively weak chelating agent can be used.

DTPA: Recommended when an exceptional strong chelating agent is needed, such as during peroxide bleaching of pulp. It remains more effective under oxidizing conditions. It is also especially suitable for descaling in oilfield applications.

HEDTA: A chelating agent with similar efficacy to EDTA, but labelled with less hazard phrases and pictograms. Particularly useful when high solubility is needed at low pH and for stabilizing iron ions at high pH.

Metals to control	High acidity	Low acidity	Low alkalinity	High alkalinity
Divalent metals	GLDA, MGDA, EDTA, DTPA, HEDTA			
Water hardness	No chelant applicable	GLDA, MGDA, HEDTA	GLDA, MGDA, EDTA, DTPA, EDG, HEDTA	
Iron control	GLDA	GLDA, MGDA, HEDTA, EDTA, DTPA	DTPA, HEDTA	

3. Specialty surfactants and co-surfactants

Boosting your cleaning performance

Surfactants are an essential ingredient in most cleaning formulations. They increase the penetration of the cleaning solution by reducing surface tension. They also help to emulsify and suspend soils so that they are more easily dispersed into solution and removed from the soiled surface.

The type of surfactant chosen for a cleaning formulation depends on multiple factors such as pH, the type of soil, the substrate and other ingredients included in the formulation. We offer a broad portfolio of specialty surfactants for household and Industrial applications.

Our nonionic surfactants provide good compatibility with most formulations and provide degreasing benefits at low concentrations. At the heart of our specialty surfactant portfolio are the narrow range ethoxylates. Narrow range ethoxylates offer superior cleaning, low foam, easier handling and lower odor than the standard range counterparts.

We offer a broad range surfactants and hydrotropes for your sustainable cleaning applications.

Demand for alcohol ethoxylates is growing due to increasing needs for liquid detergents and concentrated unit dosage forms. Ethoxylates can be used at higher concentrations, which is preferable for producing new forms of liquid laundry detergents. Nitrogen based nonionic surfactants are used in a variety of applications.

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 to obtain a stable solution.

Our specialty surfactants are a unique portfolio of materials that have been optimized to meet effective soil removal, meeting the cleaning industry needs for sustainable and cost effective solutions.

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. 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 highly effective cationic and nonionic co-surfactants.

3.1 Nonionic surfactants

Our nonionic surfactants get surfaces clean

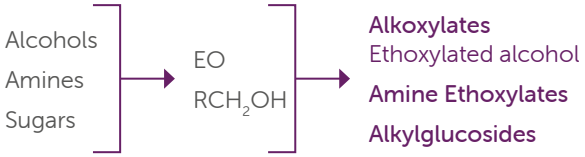
Nonionic surfactants by definition contain no structural element that has a formal charge. Surface activity derives from a balance of hydrophobic and hydrophilic structures contained in the surfactant molecule. Altering the balance towards more hydrophobic or more hydrophilic influences the surfactant's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



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

Brand	Surfactant type
AG™	Alkylglucosides
Berol®, Ethylan®	Narrow and standard range ethoxylated alcohols
Ethomeen®	Amine ethoxylates

Nonionic surfactants have attributes that make their use advantageous over other surfactant types.
Due to their lack of charge, they 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:
- Detergency
- Wetting
- Emulsification
- Foam boosting
- Defoaming
- Viscosifying
- Solubilization

We are 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	C_9-C_{11} alcohol ethoxylate	Liquid	100	27	11	58 (a)	10.5	D		•	•		•		•	•	•			•	•	•	•
Berol® 266	C_9-C_{11} alcohol ethoxylate	Liquid	100	27	15	26 (a) & 58 (b)	12	S		•	•		•		•	•	•	•		•	•		•
Berol® 840	C_8 alcohol ethoxylate	Liquid	100	32	90	52 (a)	11.5	D			•			•	•		•			•		•	
Ethylan® 1005	C_{10} alcohol ethoxylate	Liquid	100	27	3	47-53 (a)	11.6	D			•	•	•	•	•	•	•			•	•		•

* 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
S soluble
D dispersible
US EPA Safer Choice CleanGredients
Direct release

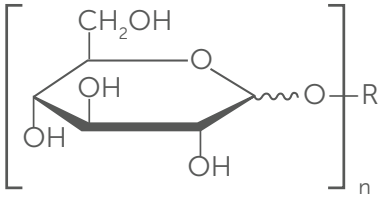
Alcohol ethoxylates

$$R—O(CH_2CH_2O)_n(CH_2CHO)_mH$$

Product	Description	Appearance 20°C	Active content %	Surface tension mN/m*	Wetting power sec**	Cloud point °C	HLB	Solubility in 5% water	Application	Acid cleaning	Car wash/rinse/polish	General and household cleaning	High pressure cleaning	Industrial and institutional cleaning	Industrial metal cleaning	Laundry liquids/manual dishwash	Property / Function	Degreaser	Dispersant	Emulsifier	Low foam	Wetting
Berol® 609	Alcohol ethoxylate	Liquid	90	28.3	7	52-60 (a)	11.8	S		•				•	•	•		•				•
Berol® OX 91-6	C_9-C_{11} alcohol ethoxylate	Liquid	100	27	10	51-58 (a)	10.5	S			•	•	•	•		•		•		•		•
Ethylan® 1008 SA	C_{10} alcohol ethoxylate	Liquid	100	29	11	60-68 (a)	14	S			•	•	•	•		•		•		•	•	•
Ethylan® HB4	Phenol ethoxylate	Liquid	100	49	>5 min	66-68 (b)	8.8	S			•								•			

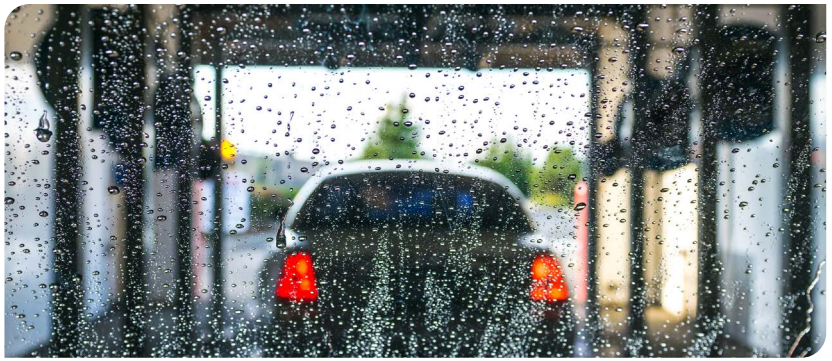
* according to du Noüy, 25°C, 0.1% DIN 53914
** according to Draves, 25°C, 0.1%
(a) 1% in water
(b) 10% w/v in water
S soluble
US EPA Safer Choice CleanGredients
Direct release

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	General and household cleaning	High pressure cleaning	Industrial and institutional cleaning	Property / Function	Co-surfactant/hydrotrope	Low foam
AG™ 6206	C_6 alkylglucoside	Liquid	75	34	>300	0	0	S		•	•	•	•	•	•	•		•	•

* 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
US EPA Safer Choice CleanGredients
Direct release



Nitrogen based nonionic surfactants – a science for cleaning

Functional properties

The molecular structure of fatty amines and derivatives is characterized by one or more C_8 to C_{22} aliphatic alkyl groups, with one or more amine functionalities.

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, softening, corrosion inhibition, adhesion, anti-static properties, lubrication and hydrophobization.

Selection criterias

Solubility

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

Water solubility of amine surfactants is enhanced in the following ways	
alkyl chain	by decrease in chain length (or molecular mass) by increase in unsaturation
nitrogen moiety	by increase in number of functional groups by increase in degree of ethoxylation by formation of salts by quaternization
medium	by decreasing pH

Alkylamines of C_8-C_{22} 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 C_{12} alkyl chain.

Solubilization of a C_{18} alkyl chain requires two protonated amino groups as provided in Duomeen® OL surfactant at low pH, for example.

Water solubility is increased by the introduction of neutral hydrophilic groups such as polyoxyethylene groups. Ethoxylation of aliphatic amines yields the Ethomeen® surfactant series.

Solubility of Ethomeen® surfactants are dependent upon the degree of ethoxylation. Example, Ethomeen® C/12 surfactant contains two oxyethylene units per molecule and is insoluble in water, whereas Ethomeen® C/25 surfactant 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. We use 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 our surfactant products include amine, quaternary ammonium, ethoxylate 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.

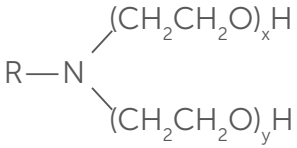
Emulsions may be classified as oil-in-water (O/W), in which hydrophobic material is dispersed in water, or as water-in-oil (W/O), in which water is dispersed in hydrophobic material. Formation of O/W emulsions is favored by emulsifiers having a high HLB value like Ethomeen® C/15 and Ethomeen® C/25 surfactants. For W/O emulsions, low HLB surfactants such as Ethomeen® T/12 surfactant are more effective.

Diamines

$$R—NH—CH_2CH_2CH_2—NH_2$$

Product	Description	Appearance 20°C	Amine number total mg KOH/g	Iodine number gI/100 g	Water %	Color Gardner	Melting point °C	Viscosity mPa.s at 60°C	Application	Automatic dishwashing	Car wash/rinse/polish	CIP cleaning	Chain lubricants	Industrial and institutional cleaning	Industrial metal cleaning	Property / Function	Degreaser	Dispersant	Emulsifier	Lubrication
Duomeen® CD	N-coco-1,3-diaminopropane	Solid/Paste	409-442	0-12	max 1	0-2	21	4		•	•	•	•	•	•		•		•	•
Duomeen® OL	N-oleyl-1,3-diaminopropane	Liquid	320-350	<70	max 1	0-5	12	6		•	•	•	•	•	•		•	•	•	•

Amine ethoxylates



Product	Description	Appearance 25°C	Active content %	Amine number total mg KOH/g	Equivalent mass	Surface tension mN/m*	Color Gardner	Solubility in 5% water	Application	Acid cleaning	Industrial and institutional cleaning	Industril metal cleaning	Property / Function	Corrosion inhibitor	Degreaser	Emulsifier	Thickener
Ethomeen® C/25A	Cocoalkylamine ethoxylate	Liquid	99	63-68	830-890	41.2***	0-10	S				•			•	•	
Ethomeen® O/12	Oleylalkylamine ethoxylate	Liquid	97	155-164	343-363	28	0-8	D		•	•	•		•		•	•
Ethomeen® SV/12	Soyalkylamine ethoxylate	Liquid	99	156-162	342-362	-	0-6	D			•			•		•	•
Ethomeen® SV/15	Soyalkylamine ethoxylate	Liquid	99	113-119	470-495	33	0-10	S			•					•	•
Ethomeen® T/12	Tallowalkylamine ethoxylate	Paste	96	156-165	340-360	28	0-6	D		•		•		•		•	•
Ethomeen® T/15	Tallowalkylamine ethoxylate	Liquid/Paste	99	113-119	470-495	31	0-7	S				•		•		•	

* according to du Noüy, 25°C, 0.1% DIN 53914
** according to Draves, 25°C, 0.1%
*** at 0.5%
S soluble
D dispersible

3.2 Anionic surfactants

Petro® surfactants, designed for applications with extreme requirements

All Petro® surfactants exhibit excellent wetting, detergency, hard water tolerance, hydrotroping/coupling and high/low temperature stability. They also exhibit high water solubility, compatibility with strong acids/alkalis, and are electrolyte tolerant.

Rinsability/friability

Petro® surfactants are easily removed from surfaces with rinsing. Formulations can dry to a hard brittle residue (solid, crystalline anionic powder) and capture the soil, which can be easily removed during the drying stage of carpet cleaning, or by vacuuming. Standard high-foaming surfactants leave sticky, gummy residues which can gain redeposition of soil.

Petro® surfactants are used as processing aids for mineral coatings by uniforming the particle size which speeds up filtration. They can also be added to powders as dispersants to reduce/eliminate solidification and improve flow.

Foaming

Low foam (Petro® 22N surfactant)

Petro® 22N surfactant is a low foaming surfactant with excellent hydrotropic, fast foam dissipation and wetting properties for applications such as steam cleaning or soak formulations. The product is used in high pressure spray cleaning applications and it will not clog spray nozzles.

Medium foam (Petro® AG Special, Petro® BA, Petro® LBA surfactants)

These products are used in many I&I type applications like floor cleaning, hard surface cleaning, metal cleaning, rust removers, carpet cleaning, vehicle cleaning and food processing (fruit & vegetable wash). The recommended use level is 1 to 10% by weight, as anticaking agent 0.4 to 4.5 lb/ton. Petro® LBA surfactant is low color. The optimum medium foam product depends upon formulation specifics.

High foam (Petro® LBAF surfactant)

Petro® LBAF surfactant is well suited for rug and upholstery shampoos based on sodium lauryl sulfate and can improve freeze thaw stability on the formula and give a friable residue that is easily removed from the soft surface. Due to stability in both high and low pH, this product can be used in acid or alkaline cleaners. This includes toilet bowl cleaners (acidic), cement floor cleaners, industrial transportation cleaners, metal cleaners/degreasers and oven cleaners. The recommended use level is 1 to 15% by weight. This is a low color product.

Anionic surfactants improve wetting, detergency, hydrotroping and coupling for many applications including floor, hard surface, metal, carpet and food processing.

Napthalene sulfonates / Sulfonates surfactants

Energize your detergent formulations with a surfactant portfolio that is completed with some special anionics useful in a range of specific applications.

Product	Description	Appearance 25°C	Active content %	Surface tension dynes/ cm*	Wetting power sec**	Foam height mm***	Solubility in 5% water	Application	Acid cleaning	Aircraft/trains/boats/aluminium cleaning	Alkaline cleaning	All purpose cleaner	Automatic dishwashing	Dry cleaners/carpet cleaning	Floor cleaning	Food processing (fruit/vegetable wash)	Hard surface cleaning	High pressure cleaning	Industrial metal cleaning	Liquid detergents	Powdered detergents	Property / Function	Co-surfactant/hydrotrope	Detergency	Dispersant	High foam	Hydrotroping/coupling	Low foam	Medium foam	Wetting
Petro® 22N Liquid	Alkylnapthalenesulfonc acid, sodium salts	Clear amber liquid	50	51	9	30	S		•		•		•	•				•						•			•	•		•
Petro® 22N Powder	Alkylnapthalenesulfonc acid, sodium salts	Tan powder	>95	51	9	30	S		•		•		•	•				•			•			•			•	•		•
Petro® AG Special Liquid	Alkylnapthalenesulfonc acid, sodium salts	Clear amber liquid	50	34	20-30	106	S		•	•	•		•	•	•	•	•		•	•				•	•		•		•	•
Petro® AG Special Powder	Alkylnapthalenesulfonc acid, sodium salts	Tan powder	>95	34	20-30	106	S		•	•	•		•	•	•	•	•		•		•			•	•		•		•	•
Petro® BA Powder	Alkylnapthalenesulfonc acid, sodium salts	Tan powder	>95	43	20-30	113	S		•	•	•		•	•	•	•	•		•		•			•	•		•		•	•
Petro® LBA Liquid	Alkylnapthalenesulfonc acid, sodium salts	Clear amber liquid	50	59	103	70	S		•	•	•		•	•	•	•	•		•					•	•		•		•	•
Petro® LBAF Liquid	Alkylnapthalenesulfonc acid, sodium salts	Clear amber liquid	50	37	3	160	S		•	•	•		•	•					•							•				
Witconate® NAS-88	Sodium octanesulfonate	Clear to slightly hazy liquid	>36	25.5	-	-	S			•	•	•						•	•	•	•		•	•			•			•
Witconate® NAS-8HP	Sodium octanesulfonate	Clear to slightly hazy liquid	>35	25.5	-	-	S			•	•	•						•	•	•	•		•	•			•			•

* according to du Noüy, 25°C, 0.1% DIN 53914
** according to Draves, 25°C, 0.1%
*** according to Ross-Miles, 25°C, 0.25% (active)
S soluble
US EPA Safer Choice CleanGredients
Direct release

3.3 Cationic surfactants

Effective thickening benefits

Cationic surfactants deliver many unique properties to formulations. Due to the positive charge on the head group, this class of surfactants offers many unique functions such as softening, anti stat, surface modification and dispersancy. The cationic head group of cationic surfactants adheres to negatively charged surfaces, as most surfaces are, such as fabric, pigments, clays and other solids.

Cleaning formulations are thickened to increase the contact time on inclined or vertical surfaces like toilet bowls and tiled walls.

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

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

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.

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).

Provide effective thickening across the whole pH range for enhanced product performance as well as stability in chlorine and hydrogen peroxide bleach.

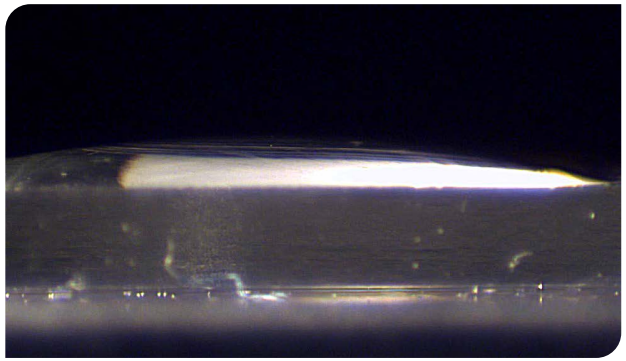
The cleaning product becomes thinner when it is squeezed out of the bottle, making it easy to dispense, but becomes thicker when it hits the surface allowing it to cling and prevent run off.

This portfolio of cationic surfactants offer a broad range of applications including fabric softening, anti-stats and rinse aids.

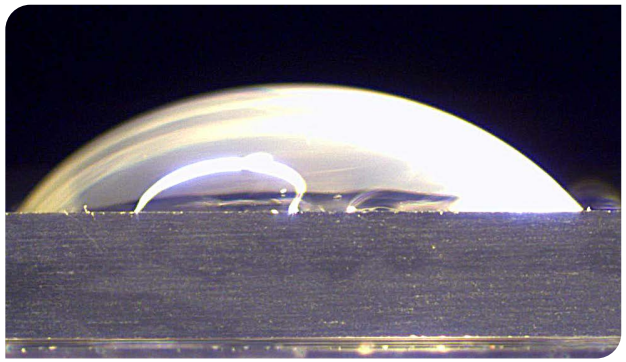
Dialkyl quaternary ammonium compounds are commonly used for surface modification. Armosoft® DEQ fabric softener is a high performing rinse cycle, fabric softening active. It can be formulated in a wide range of activities, up to 24%. Armosoft® DEQ fabric softener is readily biodegradable. Arquad® HTL8-MS surfactant is used as a fabric softener/antistat agent in many dry cleaning formulations. Arquad® 2C-75 surfactant is used to formulate high performing car rinse aids, for enhanced drying and minimal streaking.

Quaternary ammonium compounds are stable across the entire pH range. Combinations of Arquad® T-50 with Ethomeen® T/12 surfactants provide efficient thickening for hydrochloric acid solutions up to 15%. Arquad® T-50 surfactant is used as a mold release agent for polyvinyl alcohol films. Quaternary ammonium compounds are stable in the presence of chlorine and hydrogen peroxide bleaches.

Berol® 561 surfactant is an excellent hydrotrope for many types of materials including fabric softeners, nonionic ingredient surfactants and fragrances. It is listed as a Safer Choice ingredient. Berol® 561 surfactant will also boost the detergency of a cleaning formulation, especially on particulate soils.



Untreated glass surface (control)
Water sprayed on the untreated glass surface
Contact angle: untreated glass 19.5°



Treated glass surface with car rinse aid
Water sprayed after glass surface was rinsed with the premium solvent base car rinse
Contact angle: treated glass 43.9°

Quaternary ammonium compounds (QAC)

Product	Description	Appearance 25°C	Active content %	Free amine+ amine HCl %	Color Gardner	pH 5% in 50/50 2-propanol/ water	Solubility in 5% water	Application	Acid cleaning	Alkaline cleaning	Car wash/rinse/polish	Dry cleaners/carpet cleaning	Fabric softeners	General and household cleaning	Property / Function	Antistatic	Corrosion inhibitor	Co-surfactant/hydrotrope	Dispersant	Emulsifier	Thickener
Arquad® 2C-75	Dicocodimethyl ammonium chloride	Liquid	74-77	<1.5	0-3	6-9	D				•		•			•					
Arquad® 2HT-75	Dihydrogenatedtallowdimethyl ammonium chloride	Paste	74-77	<1.5	0-2	6-9	D						•			•					
Arquad® T-50	Tallowalkyltrimethyl ammonium chloride	Liquid	49-52	<2.0	0-4	6-9	S		•					•		•	•		•	•	•
Arquad® 12-50H	Dodecyltrimethyl ammonium chloride	Liquid	49-52	<2.0	0-2	6-9	S		•					•		•					
Arquad® 16-29	Hexadecyltrimethyl ammonium chloride	Liquid	27-30	<2.0	0-3	6-9	S		•					•		•			•	•	•
Arquad® 16-50	Hexadecyltrimethyl ammonium chloride	Liquid	49-52	<2.0	0-3	6-9	D		•					•		•			•	•	•
Arquad® HTL8-MS	Hydrogenatedtallow (2-ethylhexyl) dimethyl ammonium methosulfate	Liquid	81.5-84-5	<40	<5	6-9	S					•	•			•			•	•	
Armosoft® DEQ	Diethylesterdimethyl ammonium chloride	Paste	78-82	<1.5 (a)	0-3.5	6-8	D						•			•					
Berol® 561	Quaternary C_{12-14} alkylamine ethoxylate methylchloride	Liquid	100	9.2	<12	6-9	S		•	•	•			•		•		•	•		

(a) free amine value
S soluble
D dispersible
US EPA Safer Choice CleanGredients

3.4 Surfactant systems

High performance cleaning solutions

In addition to formulating your own degreasers with our cutting-edge components, we provide optimized, highly effective and cost-efficient surfactant systems 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 systems are particularly stable in harsh environments.

Our product portfolio includes several types of co-surfactants which can be used in different conditions (very alkaline, high to low salinity, low and high foaming, etc.).

Both Berol® 561 and AG™ 6206 surfactants are co-surfactants. Both have excellent solubilization power and in combination with nonionic surfactants deliver 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.

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.

The smart chemistry of Berol® 226 SA surfactant provides the best solution for industrial and household degreasing applications. It is an industry-leading and powerful surfactant system delivering highly efficient cleaning. A versatile product, Berol® 226 SA surfactant is the heart of high performance cleaning formulations.

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

Berol® 609 surfactant is specially formulated to be a direct replacement for nonyl phenol (NP) ethoxylate. It solubilizes much faster than NP-9. Berol® 609 surfactant is readily biodegradable and Safer Choice listed.

Berol® DR-B1 surfactant is approved by the United States Environmental Agency for Direct Release to the environment. This means that a formulator may be allowed to use the Safer Choice logo on a product that is intended for outdoor use. It is the most powerful degreasing agent in its class.

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	Car wash/rinse/polish	CIP cleaning	General and household cleaning	High pressure cleaning	Industrial and institutional cleaning	Industrial metal cleaning	Laundry liquids/manual dishwash	Property / Function	Degreaser	Emulsifier	Low foam	Wetting
Armohib® CI-31	Optimized blend, containing amine ethoxylate	Liquid	Corrosion inhibitor product for metal treatment at low pH											•	•						
Berol® 226 SA	Alcohol ethoxylates and co-surfactants	Liquid	85	26.8	16	S		•	•	•		•	•	•	•	•		•	•		•
Berol® 609	Alcohol ethoxylate	Liquid	90	28.3	7	S		•	•	•		•	•	•	•	•		•	•		•
Berol® DR-B1	Alcohol ethoxylates and co-surfactants	Liquid	62	33.2	29	S		•	•	•		•	•	•	•	•		•	•		•
Berol® DGR 81	Alcohol ethoxylates and co-surfactants	Liquid	95	27	20	S (a)		•	•	•		•	•	•	•	•		•	•		•
Berol® LFG 61	Alcohol ethoxylates and co-surfactants	Liquid	95	31	>600	S					•									•	

* according to du Noüy, 25°C, 0.1% DIN 53914
** according to Draves, 25°C, 0.1%
S soluble
(a) less than 5% Berol® DGR 81 surfactant is dispersible in water
US EPA Safer Choice CleanGredients
Direct release

Co-surfactants

Product	Description	Appearance 20°C	Active content %	Surface tension mN/m*	Wetting power sec**	Solubility in 5% water	Application	Alkaline cleaning	Automatic dishwashing	Car wash/rinse/polish	CIP cleaning	General and household cleaning	High pressure cleaning	Industrial and institutional cleaning	Property / Function	Co-surfactant/hydrotrope	Low foam
AG™ 6206	C_6 alkylglucoside	Liquid	75	34	>300	S		•		•		•	•	•		•	
Berol® 561	Quaternary C_{12-14} alkylamine ethoxylate methylchloride	Liquid	100	41	>600	S		•	•	•	•	•	•	•		•	•
Berol® Nexus	Amine alkoxylate derivative	Liquid	70			S		•	•	•	•	•	•	•		•	•

* according to du Noüy, 25°C, 0.1% DIN 53914
** according to Draves, 25°C, 0.1%
S soluble
US EPA Safer Choice CleanGredients
Direct release

4. Performance polymers

Provide formulation flexibility

We are 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 for a more sustainable option.

Our 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 petroleum chemical feedstock
- Greater sustainability thanks to natural, renewable feedstocks
- Favorable environmental impact (high biodegradability profile and 500 kgs reduction of CO_2 for each ton of synthetic polymer 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 20°C	Solids %	Molecular weight	pH 2% in water	Solubility in 5% water	Application	Aircraft/trains/boats/aluminium cleaning	Automatic dishwashing	Chain lubricants	General and household cleaning	Industrial and institutional cleaning	Industrial metal cleaning	Laundry liquids/manual dishwash	Laundry powder	Property / Function	Antiredeposition	Antistatic	Bleach opacifier	Corrosion inhibitor	Detergency	Dispersant	Hydrotroping/coupling	Low foam	Rheology modifier	Scale inhibitor/scale removal	Soil release agent
Alcoguard® 1195	Polymethacrylic acid, sodium salt	Clear liquid	15-17	150,000	8-9	S																					
Alcoguard® 5800	Hyrophobically modified alkalli swellabel emulasion	White emulsion	29-31	500,000	2.5-3.5	S								•											•		
Alcoguard® 7100	Styrene acrylic copolymer	Dispersion	37-39	1,000,000	6-8	S								•					•		•					•	
Alcosperse® 459	Polyacrylic acid	Hazy	47-49	5,000	3.2-5.0	S								•			•				•	•				•	
Alcosperse® 602N	Sodium polyacrylate	Liquid	44-46	5,000	7-8	S		•	•		•	•	•					•				•				•	
Alcosperse® 602N Dry	Sodium polyacrylate	Off-white powder	>95	5,000	7.5	S			•						•			•				•				•	
Alcosperse® 726	Acrylic / styrene copolymer	Clear liquid	36-38	3,000	9.5-11.9	S					•	•		•									•				•
Alcosperse® 747	Acrylic / styrene copolymer	Liquid	39-41	3,000	8-10	S					•	•		•				•		•			•	•		•	
Alcosperse® 125	Sodium polymethacrylate	Liquid	39-41	9,500	8-9	S																•				•	
Alcosperse® 149	Polyacrylic acid	Amber liquid	49-51	2,500	2.2-3.5	S					•	•														•	
Alcogum® 1370	Polyacrylate gum thickener	Liquid	13.5-15.8	1,000,000	9-11	S					•	•													•		
Versa-TL® 3 Dry	Sulfonated copolymer	Tan powder	>90	20,000	5-9	S					•	•										•					•
Versa-TL® 501	Sulfonated polystryene	Amber liquid	24-26.5	1,000,000	4-9	S				•		•		•				•							•		

S soluble

US EPA Safer Choice CleanGredients

Hybrid bio-polymers

Product	Description	Appearance 20°C	Solids %	pH 2% in water	Solubility in 5% water	RCI %	Application	Automatic dishwashing	General and household cleaning	Industrial and institutional cleaning	Laundry liquids/manual dishwash	Laundry powder	Property / Function	Antiredeposition	Dispersant	Scale inhibitor/scale removal
Alcoguard® H 5025 Dry	Bio polymer	Powder	>95	6-8		45		•		•	•	•			•	•
Alcoguard® H 5240	Bio polymer	Liquid	44-46		S	64		•	•	•	•			•	•	•

S soluble
US EPA Safer Choice CleanGredients

5. Biocides

Microbial control

We are one of the leading producers of biocides based on fatty amines and derivatives. Dodecyldipropylene triamine is widely used in formulations for control of bacteria, fungi, viruses and algae in sanitization and disinfection applications.

Dodecyldipropylene triamine does not have an ionic charge like the quaternary ammonium compounds (QAC). 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 antimicrobial.

Triameen® Y12D antimicrobial structure:

Triameen® Y12D antimicrobial was recently introduced into the US.

Triameen® Y12D antimicrobial is non-quat based and has a broad spectrum of efficacy against bacteria, fungi and enveloped viruses.

Triameen® Y12D antimicrobial is a well established biocide in regions outside of North America. It is also supported in EU BPR for many Product Types.

Triameen® Y12D antimicrobial has EPA registration for use in formulating end-use antimicrobial products. Main application is for formulation only into antimicrobial products for use on hard, non-porous non-food contact surfaces.

For more details on uses as well as regulatory obligations please view our EPA label. You can find this on the EPA website Pesticide Product and Label System | US EPA when searching for Registration No. 34688-85.

Triameen® Y12D antimicrobial is non-quat based and has a broad spectrum of efficacy. We have plenty of efficacy data based on European Standard tests proving this and currently preparing data according to US efficacy test procedures.

Triameen® Y12D antimicrobial is low odor and free of aldehydes and halogens.

The alkyl chain of Triameen® Y12D antimicrobial is of vegetable origin (coconut or palmkernel oil). As a result, it has a high renewable carbon index of 67%. We offer a RSPO-compliant version that is certified according to the Mass Balance (MB) model with the alternate brand name Triameen® Y12D PO antimicrobial.

Biocides

Product	Description	Appearance 20°C	Active content %	Solvent	Color Gardner	pH 10% in water	Flash point °C	BPR supported (a)	Application	Disinfectants	Preservatives	Property / Function	Algicide	Bactericide	Fungicide	Selective virucide	Tuberculocide
Triameen® Y12D	Dodecyl dipropylene triamine	Liquid	98-100	(b)	max 2	11.6	>100	Yes		•	•		•	•	•	•	•

(a) for details see text

6. Carboxymethyl cellulose (CMC)

Finnfix® CMC in powder detergents

Powder detergents have their own special requirements in terms of performance, shelf-life stability, delivery system and environmental friendliness. With our experience in biodegradable, nature-based, water-soluble polymers, we can help meet your needs with the best active aids and new technology developments.

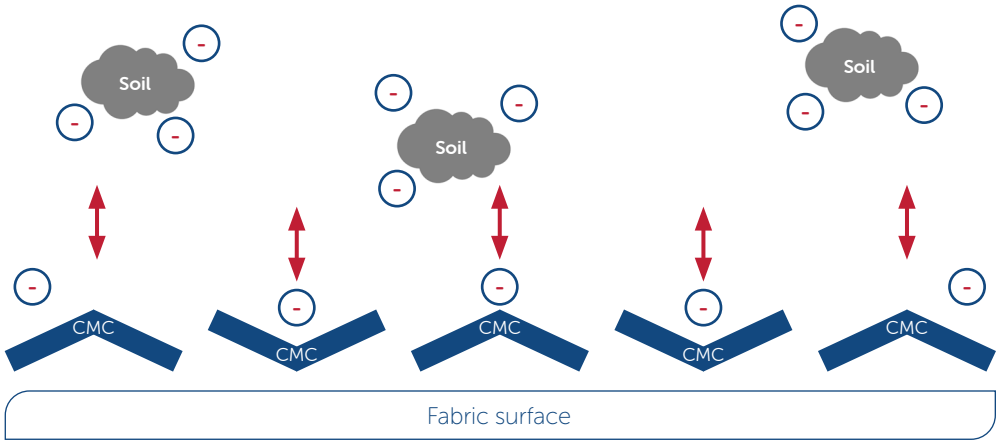
Carboxymethyl cellulose (CMC) is widely used in household detergent powder production. It is one of the oldest and most well-known applications of CMC.

Finnfix® CMC is a proven anti-redeposition aid that prevents dirt from reattaching to freshly washed fabric surfaces. With their cellulosic backbone and negative charge, Finnfix® CMC molecules adhere to fabric fibers through hydrogen bonding. Electrostatic and/or steric repulsion prevents the negatively charged soil particles in the wash water from re-depositing onto fibers.

Just a small amount of Finnfix® CMC can greatly improve the quality of soap, allowing it to be pliable and flexible with its emulsifying and protecting properties. In addition, the pH of the wash water and the presence of other surfactants do not affect the adsorption of Finnfix® CMC. During the rinse cycle, Finnfix® CMC releases cleanly from the fabric surface, for whiter whites.

Finnfix® CMC is a proven anti-redeposition aid that prevents dirt from reattaching to freshly washed fabric surfaces.

Question: How does CMC work as anti-redeposition agents?
Answer: CMC adsorbs on cotton surface and prevents the dirt to come back on the fabrics.

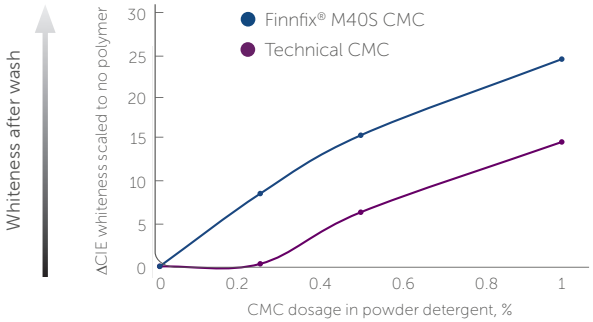


Carboxymethyl cellulose (CMC)

Product	Description	Viscosity mPa.s	Solution conc %	Purity %	Moisture max %	Specific properties
Finnfix® M40S	Carboxymethyl cellulose	100-700	4	>70	8	Optimized surface activity for powder laundry

US EPA Safer Choice CleanGredients
Direct release

Dose response curve



Reference, no CMC | Technical CMC | Finnfix® M40S CMC

- Clear anti-redeposition (ARD) benefit in ΔCIE whiteness is seen with CMC vs. no polymer
- Finnfix® CMC keeps the soil from depositing on fabrics much more efficiently than traditional CMC

7. Bleaching agents

Optimized, specialty oxidants for cleaning

Peroxy-Blend® PB33 oxidant is a formulated specialty oxidant containing hydrogen peroxide intended for use in a variety of water based cleaners. The product is efficient for formulation of alkaline cleaners. Cleaners made with Peroxy-Blend® PB33 oxidant will perform well on organic soils such as grease and oil, as well as protein soils.

When Peroxy-Blend® PB33 oxidant is used in acidic cleaning formulations (e.g. bathroom cleaners etc.) etching attack on metal fixtures is inhibited and short term passivation of these surfaces is achieved. This results in reduced corrosion of fixtures that are left brighter longer.

Peroxy-Blend® PB33 oxidant is an efficient source of active oxygen for your bleaching formulations. Its primary attribute is enhanced chemical stability combined with a significant contribution to cleaning. This is a combination benefit not seen with competitive products.

The chemical stability of the product transfers to your cleaning formulations and results in long lasting bleaching performance over a wide pH range.

Peroxy-Blend® PB33 oxidant is an optimized, specialty oxidant containing hydrogen peroxide for use in acidic to alkaline cleaning formulations.

Peroxy-Blend® PB33 oxidant is an optimized specialty oxidant designed for use in all types of aqueous based cleaners for hard surfaces, e g. cleaning in place, machine cleaning, RTU cleaners, heavy duty cleaners and cleaning concentrates. It can also be used in soft surface cleaning like laundry, pre-spotting upholstery and carpet. It is approved by the United States EPA for Safer Choice CleanGredients.

Peroxy-Blend® PB33 oxidant is intended for use with nonionic, cationic, anionic and amphoteric surfactants. This combination at neutral to alkaline pH provides excellent degreasing. The type of surfactant used will determine the foam characteristic of the cleaner.

Hydrogen peroxide

Product	Description	Appearance 20°C	Active content %	pH	Density g/cc 20°C	Freezing point °C	Boiling point °C	Application	Alkaline cleaning / degreasing	Hard surface all purpose cleaning	Liquid detergents	Low foam and de-foaming cleaning	Oxygen bleach	Neutral and acid bathroom cleaning	Property / Function	Bleaching agent	Cleaning agent	Metal passivation
Peroxy-Blend® PB33	Stabilized hydrogen peroxide solution	Clear	33	1.5	1.134	-33	108	•	•	•	•	•	•	•	•	•	•	•

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8. Sustainability

Our approach to sustainability

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:

- Offering a broad portfolio of ingredients that conform to higher standards of chemical sustainability i.e. suitable for EU Ecolabel and Nordic Ecolabel (Svanen)
- A portfolio of products listed with the EPA's SaferChoice/CleanGredient third party certification
- 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.

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5. Operator guidelines
6. Wipe down and purging
7. Shut down

Sustainable chemistry without performance compromise

We enable you to create sustainable, high-performing cleaning solutions

- Dishwashing
- Laundry
- Hard surface cleaning
- Industrial & institutional cleaning

Contact us directly for detailed product information and sample request
website | nouryon.com/markets/cleaning
email | cleaning@nouryon.com

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.

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