Solvay Novecare offer for Industrial Water Treatment

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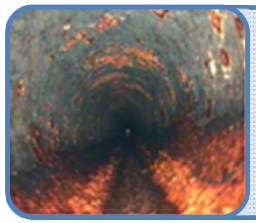
Versatile product range – focus on selected products

Aquarite® EC4020

Phosphonate end capped polymer that offers excellent silicate control under high temperature, high pressure conditions.

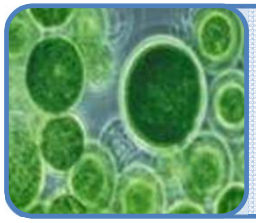


Aquarite® ESL

Phosphonate end capped polymer with outstanding salt tolerance under very high temperature and pressure conditions.

Rhodafac® BN936S

acts as an all round scale inhibitor for low temperature operating conditions. It has an environmentally acceptable profile.



Glokill® PQ

Poly quaternary ammonium chloride algaecide that is stable to oxidising agents. High cationic charge density helps to adsorb onto the algae for interfering with its functionality and ultimately causing cell death.

Tolcide® PS series

Halogen free, readily biodegradable formulation of Tetrakis Hydroxy Methyl Phosphonium salt with outstanding biocidal capabilities against bacteria and algae growth.

Surfactants and amines

Novecare offers surface modifiers that find use as corrosion inhibitors, emulsifiers, biocidal enhancers, biocidal penetrants, cleaning agents, lime soap dispersants, defoamers / anti-foam.

Antarox®	Catafor®	Fentamine®	Hyaea®	Lubrophos®
Mackadet®	Mackam®	Mackamide®	Mackamine®	Mackanate®
Mackine®	Miranol®	Rhodafac®	Rhodoline®	

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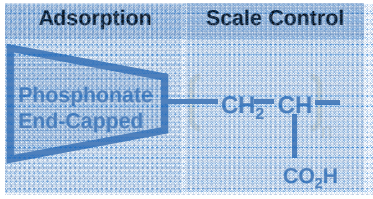
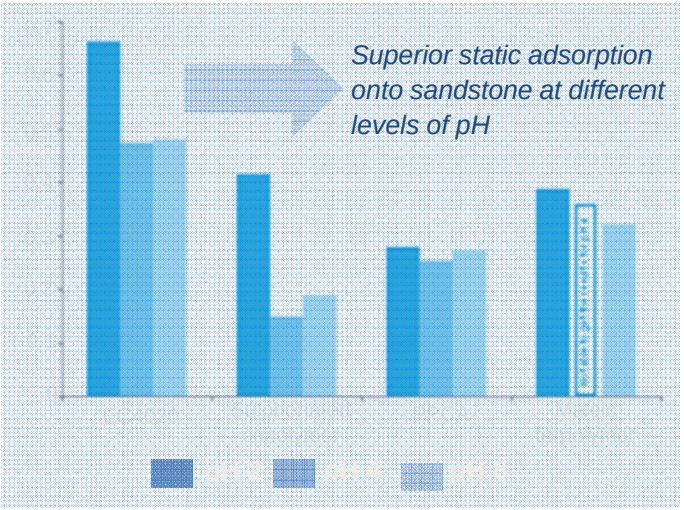
Aquarite® EC4020

Tailor made scale inhibitor for oil and gas environments.



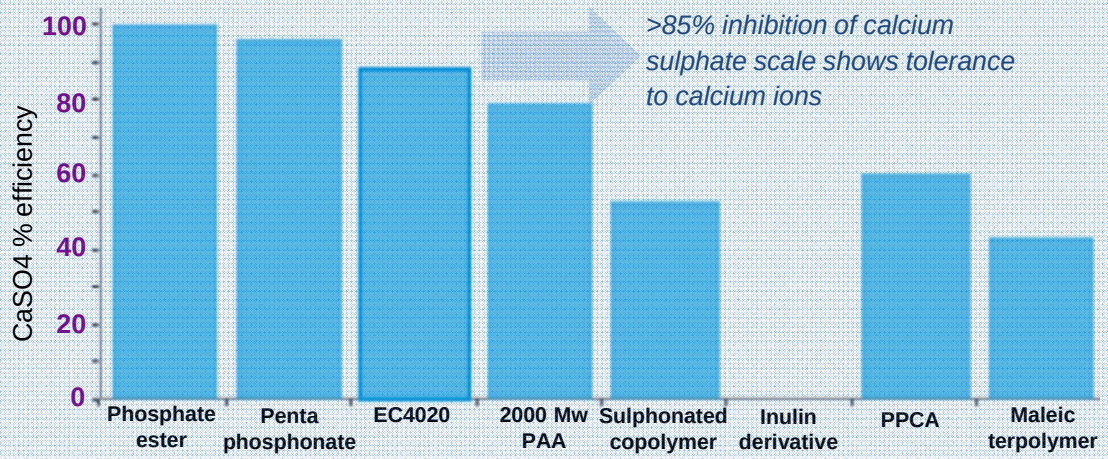
Novecare patented phosphonate end capped polyacrylate polymeric solution for scaling problems in extreme temperature and pressure conditions.

Outstanding adsorption capability



Superior static adsorption onto sandstone at different levels of pH

Exceptional calcium sulphate scale control

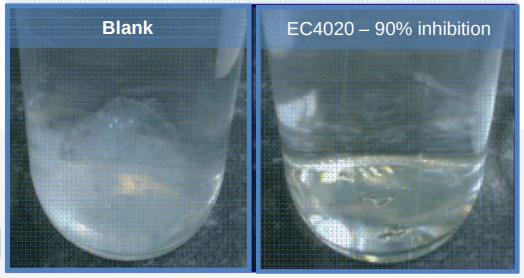


>85% inhibition of calcium sulphate scale shows tolerance to calcium ions

Calcium Sulphate inhibition : 90°C , pH 8, 6800 ppm $CaSO_4$ potential

Excellent silicate control

90 percent magnesium silicate scale inhibition versus only 75 percent for industry standard Accumer 5000



Additional benefits

- Halogen stable, low phosphorus 25 percent solids aqueous solution of VPA endcapped PAA Controls calcium carbonate and barium sulphate scale in high temperature, high pressure environment
- Excellent thermal stability ARC tests shows that degradation occurs >316°C
- Compatible with seawater, ethylene glycol, diethhylene glycol, and propyl glycol at different temperature and pH conditions
- Ideal for use as scale control dispersants in boilers and cooling towers
- Stabilises phosphate/ phosphonate formulations
- Potential to explore scale control opportunities in RO membranes
- Hydrolytic stability extends shelf life

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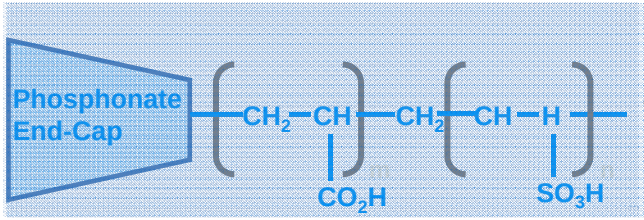
Aquarite® ESL

Niche scale inhibitor for extreme temperature conditions in oil and gas.



Rhodia patented phosphonate end capped polymeric solution that combines the benefits of sulphonate and phosphonate groups in one unique molecule

Delivering performance

Aquarite® ESL is 25 percent solids phosphonated vinyl sulphonate/ acrylic copolymer for extreme temperature and pressure conditions:

- ➲ Excellent sulphate and carbonate scale inhibitor
- ➲ High tolerance to saline environments
- ➲ Outstanding thermal stability up to 250°C
- ➲ Unlike phosphonates, doesn't solidify in cold conditions and remains fluid
- ➲ Environmentally friendly based on EU biodegradation standards
- ➲ Lower minimum inhibitory concentrations and high adsorption capability reduces number of required treatments and shutdowns
- ➲ Basic and novel detection methods are available

Structural benefits

VSA component	➲ Calcium and brine tolerance ➲ Good Iron tolerance
VDPA endcap	➲ Detectability ➲ Reduced number of treatments
VSA/AA and VDPA play synergistic roles	➲ Effective broad scale inhibitor

Compatibility with formulation additives and materials of construction	
Seawater	Desulphated seawater
Triethylene glycol	Ethyl digol
Propylene glycol	Methanol
Ethylene glycol	Isopropanol
Viton tubing	Nylon 11
PVC tubing	304L stainless steel
Low, medium & high density polyethylene	

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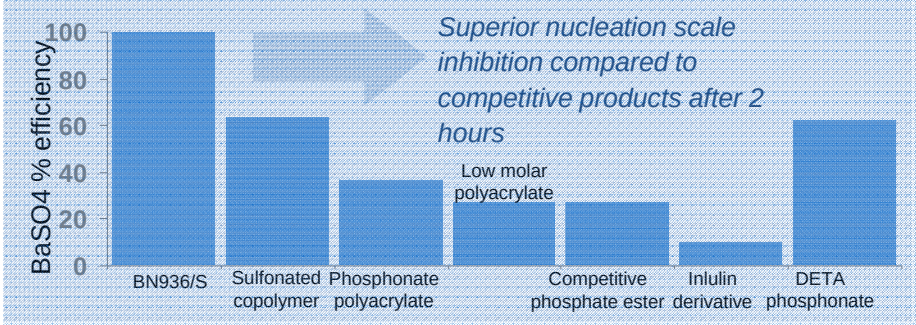
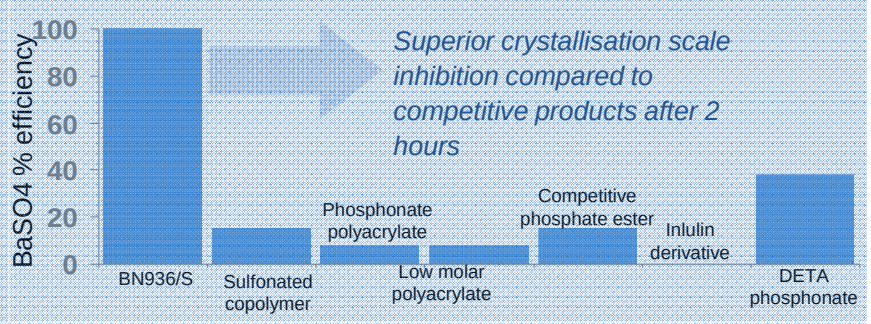
Rhodafac® BN936/S

Outstanding all round scale inhibitor

Outstanding barium sulphate scale control



Superior nucleation scale inhibition compared to competitive products after 2 hours



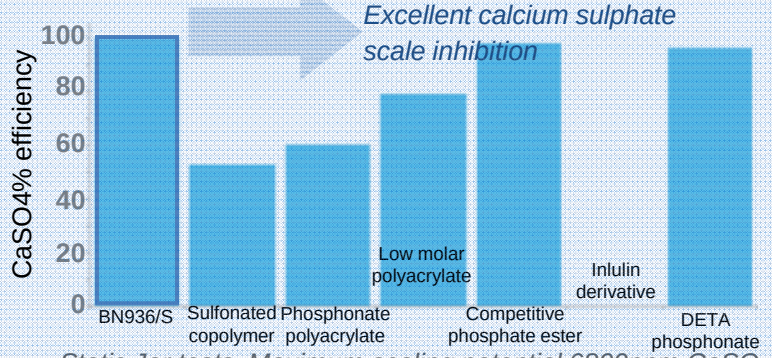
Superior crystallisation scale inhibition compared to competitive products after 2 hours

Static Jar tests, Maximum scaling potential 130ppm $BaSO_4$, 15ppm additive, Temperature = 95° C, Forties water, Sampled at 2hrs

Elastomer compatibility

Component	Compatibility (1 month @ 40° C)
HDPE	✓
H-NBR	✓
NBR	✓
EPDM	✓
LDPE	✓
PolyPropylene	✓
PTFE	✓
Nylon 11	✓
Viton B	✓
PVC	✓
C-PVC	✓

Tolerance to calcium sulphate



Excellent calcium sulphate scale inhibition

Static Jar tests, Maximum scaling potential 6800ppm $CaSO_4$, 10ppm additive, Temperature = 90° C, Sampled at 24hrs

Also provides inhibition to industry standard alkaline and non alkaline scales including calcium carbonate

Delivering performance

- ➲ Seawater compatible high performance scale inhibitor for severe scaling conditions
- ➲ Effectiveness at low doses makes it economical
- ➲ Biodegradable product with good eco- tox profile
- ➲ Optimum functionality achieved at temperatures <90°C – ideal for application in reverse osmosis membrane systems
- ➲ Synegeistic with variety of scale and corrosion inhibitors
- ➲ Easy to formulate commercially manufactured product with consistent high quality

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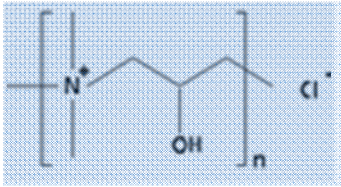
Glokill® PQ

Sytem persistent powerful algicide



Polyquaternary ammonium chloride - chlorine stable algaecide with high cationic charge density. Supported under PT11 and PT2 of the Biocidal Products Directive (98-8-EC).

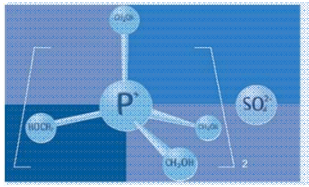
Highly effective algicide	Provides effective control of algae in water systems
Non foaming	Can be used in highly agitated systems. Unlike QAC it is long lasting, non corrosive and has low irritation
Good Toxicity Profile	Low acute toxicity, Non irritant, non sensitising and non-mutagenic
Stable to chlorine at use levels	Can be used in chlorinated systems. Compatible with Bricorr 288
System persistent	Stable to hydrolysis, it has biostatic effect on algae
Synergistic with other biocides	Used as a biocide enhancer, can be incorporated into microbiological control programmes
Other benefits	Does not interfere with the filtering equipment; Not sensitive to acidic and mildly alkaline pH.

Typical IWT programme for Glokill® PQ	
Contamination Bacteria /Algae/ Fungi	*-Inhibits growth of algae, bacteria and fungi in recirculating cooling water towers*
Cleaning, flushing and fresh water supply	*- Prevents growth of slime forming bacteria and fungi in heat exchangers*
Initial Dose; 10-25ppm Glokill® PQ	*- Compatible with Bricorr® 288 and Briquest® series*
Every 2-5 days Treatment 3-35 Glokill PQ	

Performance data (MIC)		
Green Algae		
Chlorella saccharophilia	unicellular	10 ppm
Chlorella emersonii	unicellular	12.5 ppm
Chlorella vulgaris	unicellular	15 ppm
Ulothrix minuta	filamentous	10 ppm
Chlamydomonas moewusii	Unicellular, flagellated	5 ppm
Chlorella pyrenoidosa	unicellular	10 ppm
Blue green Algae		
Chlorella pyrenoidosa	unicellular	10 ppm

Tolcide® PS

Biocide series for broad spectrum control of microbiological growth



Innovative proprietary formulations of Tetrakis Hydroxymethyl phosphonium sulphate optimised to provide all round protection against microbiological growth in industrial water processes.

Delivering performance*

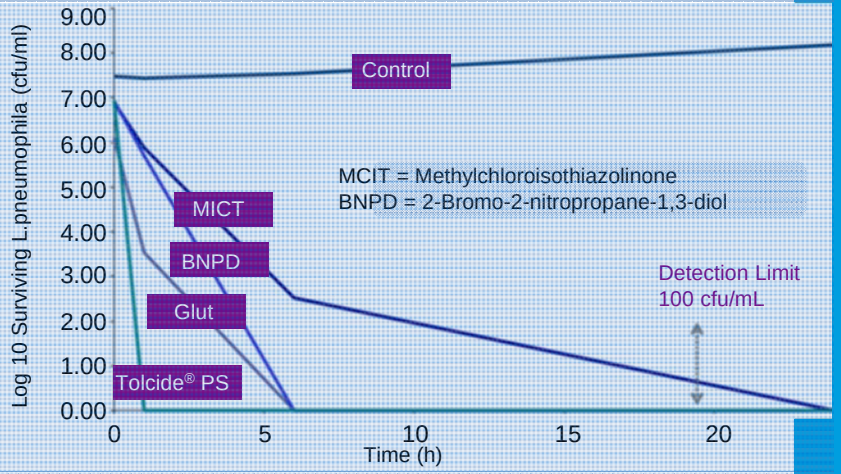
Tolcide® PS50A is a biodegradable, halogen free broad spectrum biocide

- Exhibits excellent planktonic bacteria control
- Enhanced sessile bacteria control
- Excellent algae control
- Stable in saline sea water conditions
- Non foaming with improved iron sulphide dissolution
- Effectiveness at low doses makes it economical to use
- Degrades to virtually inert compounds – reducing risk to people and environment
- Easy monitoring and optimisation – Tolcide® PS can be easily and accurately monitored using simple field test kits
- 23 percent active of Tolcide® does not carry R-50 label
- Compatible with anionic, cationic and amphoteric surfactants

Improves system efficiency by reducing equipment damage and health risks in open evaporative cooling systems, recirculating water systems and process water systems

*Not recommended for use in drinking water production

Enhanced Legionella control



Biocidal activity vs. Legionella pneumophila at 20 ppm active ingredient

Environmental benefits of chemical breakdown

	THPS	Oxid/hydrolysis	THPO
Rainbow Trout 96 Hr LC_{50} (m	119		>5,000
Daphnia 48Hr EC_{50} (mg/l)	19		>1,000

70% biodegradable after 21 days under EPA – 162-3/4

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Surface modifiers

mix and match to formulate a perfect blend for solving problems in water treatment systems.

Antarox® alkoxylated alcohol

- Low foam, nonionic wetting agent with stability to caustic solution
- Used in cleaning formulations with good eco-tox profile
- Antarox® FD36, Antarox® BL330, Antarox® FM63

Geropon® ethoxylated alcohol carboxylate

- Emulsifier in cleaners and dewatering agent for flotation concentrates
- Increases hard water stability of aqueous formulations
- Geropon® HW15, Geropon® HW25

Mackam® 2CY-75 amphoacetates

- Very low foam surface modifier, wetting and coupling agent with excellent stability in high alkalinity and electrolyte systems.
- Recommended for heavy duty cleaners

Mackamide® alkanolamides

- Oil soluble emulsifier and corrosion inhibitor for water treatment
- Foam booster stabiliser or viscosity builder for detergent formulations
- Mackamide® S, Mackamide® T, Mackamide® CD

Mackamine® amine oxides

- Used as hard surface cleaners, bio-film penetrants and disinfectants
- Fast wetting agent and dispersant with peroxide/ hypochlorite/ caustic stability
- Mackamine® CS, Mackamine® CAO(E) and Mackamine® C-8

Mackanate® Aerosol® sulfosuccinates

- Excellent wetter, dispersant, emulsifier and adjuvant biocide enhancer
- Mackanate® DOS-70, Mackanate® RM and Mackanate® OPV-N
- Aerosol grades

Mackine® amidoamines

- Suitable for use as cationic emulsifiers
- Corrosion inhibitors and bio-film penetrants that are soluble in oil
- Mackine® 301, Mackine® 401

Lubrophos® ethoxylated phosphates

- Multifunctional additive with emulsifying, corrosion inhibition and wetting properties under extreme pressure conditions
- Lubrophos® LB400E, Lubrophos® LM400E, Lubrophos® LP700E

Rhodafac®HA-70

Non foaming phosphate ester with good stability in extreme media. It is an excellent coupling agent that helps to control corrosion in water treatment systems.

Rhodafac®RA-600E

Phosphate ester with exceptional electrolyte and alkali stability provides outstanding corrosion control. It is an excellent wetting hydrotrope that offers flexibility to formulators for creating a suitable industrial cleaner.

Rhodoclean EFC

Non foaming ethoxylate with good stability in extreme media. Very good wetting agent. Used in industrial cleaners. Additional benefit: biodispersant.

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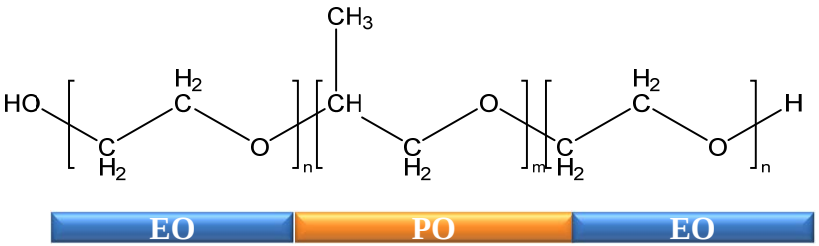
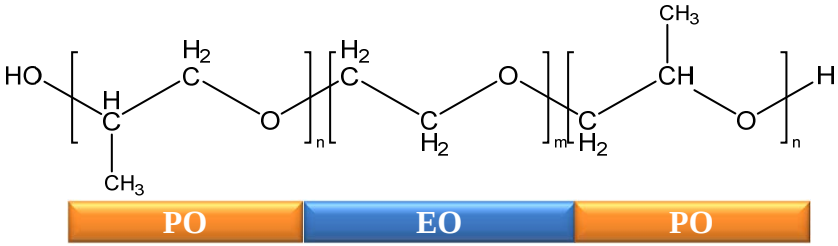
EO/PO block copolymers





Poloxamers,
Antarox L61 is available in all zones

Reverse block copolymers

	Functions						Applications						
	De foamer	Low foam	Lubricity	W/O emulsifier	Wetting agent	Detergent	MWF	Metal cleaning	Cleaning, other	Metal pre-treatment	Textile	Water treatment	EP
L61	●●	●	●	●	●		●	●	●		●	●	
L62	●	●	●		●●	●		●	●	●	●		●
L64		●			●	●●	●	●	●		●		●
17R2													
17R4													
25R2			●		●	●	●	●	●				
31R1													

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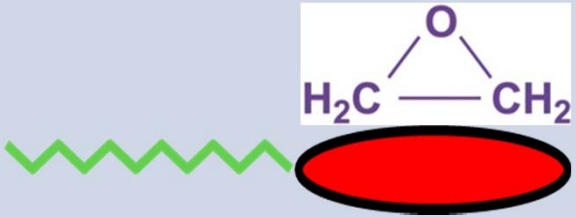
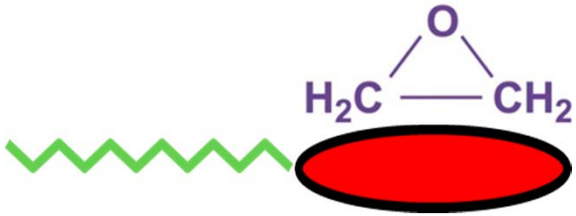
Novecare offer of surfactants

Type	Chemical structure	Brand name
Non-ionics 	Alcohol ethoxylates (EO)	Rhodasurf
	Alcohol alkoxylates (EO/PO)	Antarox
	Acid ethoxylates (EO)	Alkamuls
	Castor oil ethoxylates (EO)	Alkamuls
	TSP ethoxylates (EO)	Soprophor
	Terpene alkoxylates (EO/PO)	Rhodoclean
	Amine ethoxylates (EO)	Fentacare
	Alkanolamides	Mackamide
Anioinics	Phosphate-esters	Rhodafac, Lubrhophos
	SL(E)S	Rhodapon, Rhodapex
	Sulfonates	Rhodacal
	Sulfosuccinates	Geropon, Mackanate
Cationics	Amine oxides	Mackamine
	Imidazolines	Miramine, Mackazoline
Amphoterics	Amphoacetates	Miranol, Mackam
	Amphopropionates	Miranol, Mackam
	Aminopropionates	Mirataine, Makam
	Betaines	Mirataine, Mackam
	Sultaines	Mirataine, Mackam

Rhodasurf range

- Emulsifiers
- Wetting agents
- Detergents



This is a selection from the range. More surfactants are available on request.

	Chemical structure	HLB	Cloud point (°C)	Low foam
Rhodasurf LF5	Fatty alcohol EO/PO	6,2 – 9,0	15 [a]	●
Rhodasurf LA30	Lauryl alcohol 3 EO	8,0	60 [b]	
Rhodasurf LA40	Lauryl alcohol 4 EO	9,8		
Rhodasurf LA42	Lauryl alcohol 3,2 EO	8,6	60 – 64 [b]	
Rhodasurf B7	Lauryl alcohol 7 EO	12,1	58 – 60 [a]	
Rhodasurf TR 3,2	Isotridecyl alcohol 3EO		51,5 - 53,5 [b]	
Rhodasurf TR 5	Isotridecyl alcohol 5EO		64 – 66 [b]	
Rhodasurf TR 6	Isotridecyl alcohol 6EO	11,4	67 – 73 [b]	
Rhodasurf ROX	Isotridecyl alcohol 8EO	12,7	45 [a]	
Rhodasurf CET2	Cetyl oleyl alcohol 2 EO	5,0	33 – 35 [b]	●
Rhodasurf CET5	Cetyl oleyl alcohol 5 EO	9,2		●

a: 1% in water
b: 10% in BDG 25%

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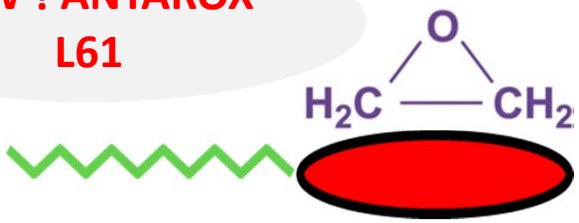
Antarox range

- Wetting agents
- Detergents

NEW ! ANTAROX L61



This is a selection from the range. More surfactants are available on request.

	Chemical structure	HLB	Cloud point (°C)	Low foam
Antarox B12DF	Lauryl alcohol EO/PO	5,4	18-22 [a]	●
Antarox BL 225-E	C8/C10 EO/PO	10,4	26 – 27 [a]	●
Antarox FD 36	C8/C10 EO/PO	8,6	34 – 38 [a]	●
Antarox FM 14	C10/C12 EO/PO	5,2	12 – 16 [a]	●
Antarox FM 23	C10/C12 EO/PO	10,1	21 – 25 [a]	●
Antarox FM 33	C10/C12 EO/PO	8	32 – 36 [c]	●
Antarox FM 63	C10/C12 EO/PO	10	43 – 47 [c]	●
Antarox LF 24	Lauryl alcohol EO/PO	3,3	35 – 40 [b]	●
Antarox LF 45	Lauryl alcohol EO/PO	5,3	20 – 22 [a]	●
Antarox LF 54	Lauryl alcohol EO/PO	7,1	28 – 31 [a]	●
Antarox V 27	C10 alcohol EO/PO	13,5	50 – 60 [a]	●

a: 1% in water
b: 10% in BDG 25%
c: 0,5% in water

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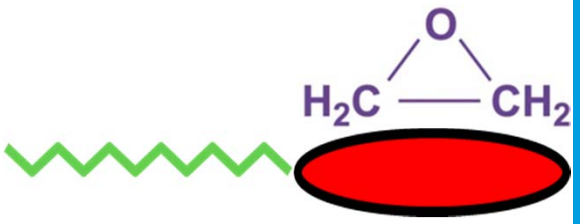
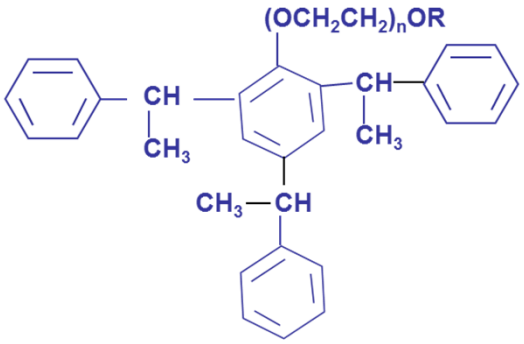
Soprophor range

- ❑ Emulsifiers
- ❑ Dispersants



Soprophor surfactants are based on an unique chassis



	Chemical structure	HLB	Cloud point (°C)
Soprophor TS10	Tristyrylphenol ethoxylate	10,4	
Soprophor TS16	Tristyrylphenol ethoxylate		58 – 62 [a]
Soprophor TS29	Tristyrylphenol ethoxylate		65,5 – 67,5 [d]
Soprophor TS54	Tristyrylphenol ethoxylate		72 – 74 [d]
Soprophor TS80	Tristyrylphenol ethoxylate	17,9	

a: 1% in water
d: 1% in NaCl 10%

Lubrhophos and Rhodafac ranges

- Emulsifiers
- Wetting agents
- Dispersants
- Hydrotropes

	Chemical structure	Emulsifier	Wetting agent	Dispersant	Hydrotrope
Lubrhophos LB400E	Cetyl Oleyl 5 EO, phosphate-ester	●			
Lubrhophos LP700E	Phenyl 6,5 EO, phosphate-ester				●
Lubrhophos RD510E	Lauryl 4 EO, phosphate-ester	●			
Rhodafac H 66-E	m,p cresol ethoxylate, phosphate-ester, potassium salt				●
Rhodafac HA 70	Phenyl 4EO, PE				●
Rhodafac PA15	Octyl 2 EO, phosphate-ester		●		
Rhodafac PA23	C10 – C12, 5 EO, phosphate-ester		●		
Rhodafac RA600E	C8 – C10 4 EO, phosphate-ester		●		
Rhodafac RS 610-E	Isotridecyl 6EO, phosphate-ester		●	●	
Rhodafac RS 710-E	Isotridecyl 9EO, phosphate-ester		●	●	

Selection of low foam amphoterics

	Chemical structure	Detergent	Wetting agent	Hydrotrope	Low foam
Mirataine JCHA	Sodium Octylaminopropionate	●		●	●
Miranol JBS	Disodium Capryloamphodipropionate		●		●
Mackam OAB	Capryl amidopropyl betaine	●		●	●
Miranol J2M	Disodium capryloampho diacetate	●			●
Mackam 2CY-75	Disodium capryloampho diacetate	●	●		●
Mackam BW139	Octyl betaine			●	●
Mackam OIP40	Sodium Ethylhexyliminodipropionate	●	●	●	●

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Surface modifiers

Effective management for corrosion in IWT

	Product name	Applications
FENTAMINE® A *Primary amines*	14 – tetradecyl amine 16 – hexadecyl amine 18 – octadecyl amine 86 – stearyl amine O – oleyl amine T – tallow amine	➲ **High resistance** to **temperature** ➲ **Film-forming** amines recommended for corrosion control in **heaters** and **boilers**
FENTAMINE® DA *Primary polyamines*	O – N-Oleyl-1,3-Diamino Propane T – N-Tallow-1,3-Diamino Propane CO – N-Coco-1,3-Diamino Propane	➲ **Film-forming** amines recommended for corrosion control in **cooling towers**
FLDMA series *Tertiary amines*	18 – dimethyl octadecyl amine O – dimethyl oleyl amine	➲ **Film-forming** amines that inhibit corrosion caused by dissolved oxygen and carbon dioxide
Quaternary ammoniums	Alkyl trimethyl ammonium chloride Alkyl benzyl ammonium chloride	➲ **Disinfection**
HYAEA® series *Ethoxylated fatty amines*	Ox – ethoxylated oleyl amine, x= 5, 10, 15, 30 EO Tx – ethoxylatad tallow amine, x= 5, 10, 15, 20 EO	➲ **Emulsifiers** to increase solubility of film-forming amines in water

Neutralizing amines or volatile amines: use of **MOPA (methoxypropylamine)** is growing at the expense of morpholine and cyclohexylamines

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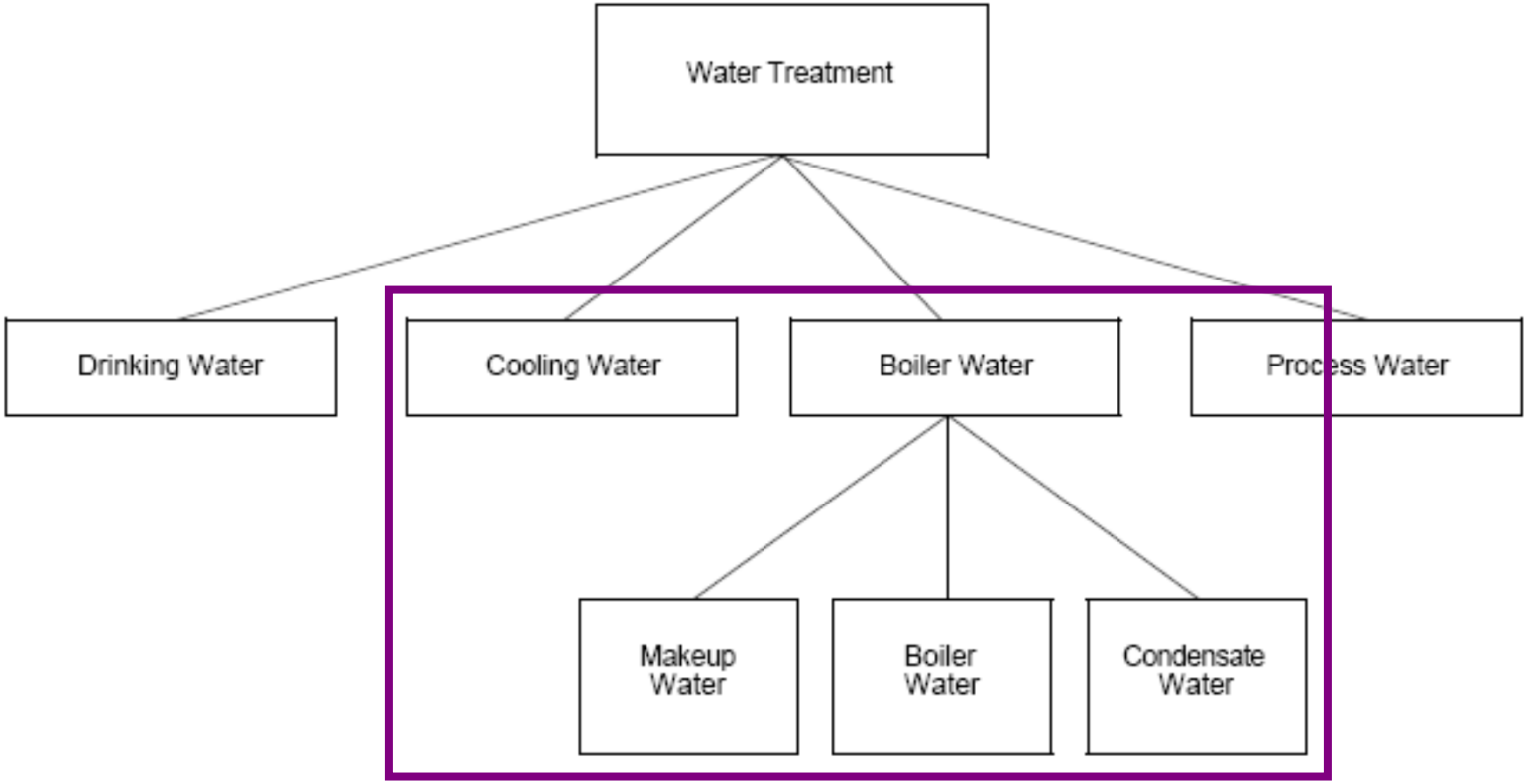
Amines for water treatment applications



Neutralizing amines
Film-forming amines
Ethoxylated amines

Film-forming amines for industrial water treatment

Filming amines are long chain organic compounds which, when added to the steam line, volatilize with the steam and then deposit in the form of a protective coating over metal surfaces that come in contact with the steam and the condensate.

They inhibit corrosion simply by imposing a waterproof barrier between the metal and the condensate. Corrosive agents which may be present in the condensate (dissolved oxygen and carbon dioxide, for example) are rendered ineffectual by the amine film that keeps water from directly touching the metal.

Boilers and heaters: **primary long chain monoamines**

Cooling towers: **primary long chain polyamines**

Recommendations

- Dosage: 1 to 500 ppm
- To ease preparation of feed solutions or dispersions, it is recommended to use:
  - the acetate salts of these amines,
  - the pure compound in combination with an emulsifier, such as **an ethoxylated fatty amine***
- Amines with narrow C chain distribution lead to films with higher density

* Ethoxylated fatty amines are used to increase solubility of film-forming amines in water. Commonly used products are **ethoxylated oleyl amines**

Neutralizing amines for industrial water treatment

Neutralizing amines or volatile amines are used to prevent corrosion caused by low pH. They neutralize carbonic acid and raise condensate pH.

Commonly used additives:

- Morpholine
- cyclohexylamine (CMR3)
- diethyl ethanolamine
- **methoxypropylamine (MOPA)**

Use of MOPA is growing at the expense of morpholine and cyclohexylamines

AEROSOL® OT Series

Product	Form	Solvent	Solids %	Solubility water g/100 ml@25°C	Flash Point °C	Key Feature
OT-100	Waxy solid	None	Min 98	1.5	NA	No solvents
OT-B	Granular solid	Sodium Benzoate*	85	1.0	NA	Dry granular form
OT-75	Liquid	Water/Ethanol	75	2.0	29	Standard grade
OT-70 PG	Liquid	Water/Propylene glycol	70	2.2	>102	High flash point
OT-75 PG **	Liquid	Water/Propylene glycol	75	2.0	>100	High flash point
OT-S/ OT-SE (ULA)	Liquid	Light petroleum distillate	70	-	53/76 (97)	For organic/oil based systems
OT-A (ND)	Liquid	Solvesso 150 (ND)	70	-	62°C (59°C)	Aromatic solvent
OT-85 AE	Liquid	Water	85	2.0	>99	Low VOC
OT-NV***	Liquid	Water	85	2.5	>102	USA version

* carrier, ** Available in USA only, *** Classified “VOC free” in USA only

Various grades of diesters are used by WT companies in various stages of their processess.

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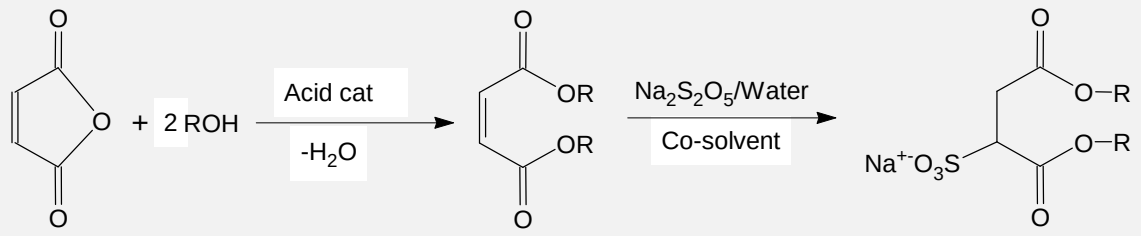
Diester Sulfosuccinates | OT Series
Paper sizing



Product	R Group	Solids %	CMC %	Min. S/T mN/m	Primary Function
OT-100	C8	min98%	0.12	26 - 28	Excellent wetting, rewetting and leveling agent. Good emulsifying and dispersing properties
OT-B		85			
OT-75		75			
OT-70 PG		70			
OT-75 PG		75			
OT-S		70			
OT-SE ULA		70			
OT-A (ND)		70			
OT-85 AE		70			
OT-NV		85	0.02	29	
		85	0.02	29	

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