Defoaming Surfactants

Surfadol -series

DDTM-based surfactants

Agenda

1. Introduction
2. Drop-ins
3. Generic Product Properties
4. Product List and Specific Features
5. Applications

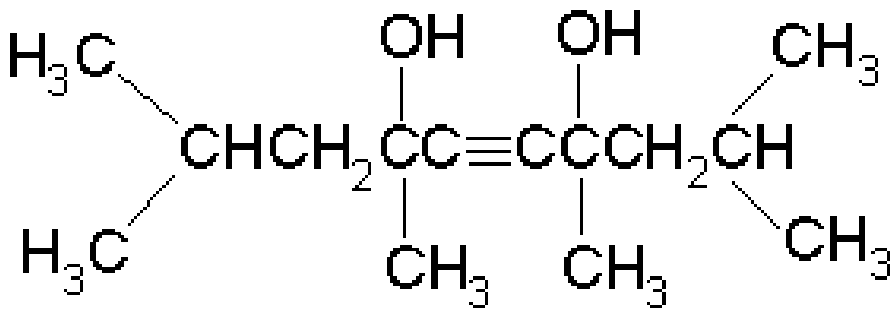
Surfadol 541

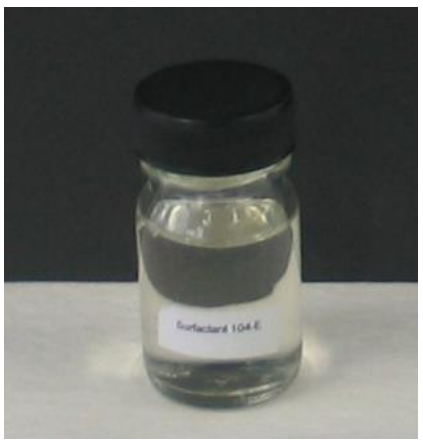
Multi-functional non-ionic Surfactant

Chemical name： 5-Decyne-4,7-diol-2,4,7,9-tetramethyl

CAS NO： 126-86-3

Structural Formula:





Surfadol 541-series

Surfactant	*Concen-tration*	*Solvent composition*
Surfadol 541-A	50	2-Ethyl-1-Hexanol
Surfadol 541-BC	50	2-Butoxyethanol
Surfadol 541-DPM	50	2-Methoxymethylethoxypropanol
Surfadol 541-E	50	Ethylene glycol
Surfadol 541-H	75	Ethylene glycol
Surfadol 541-NP	50	1-Propanol
Surfadol 541-PA	50	2-Propanol
Surfadol 541-PG	50	Propylene glycol
Surfadol 541-S	46	Synthetic Amorphous Silica

Surfadol 541-series

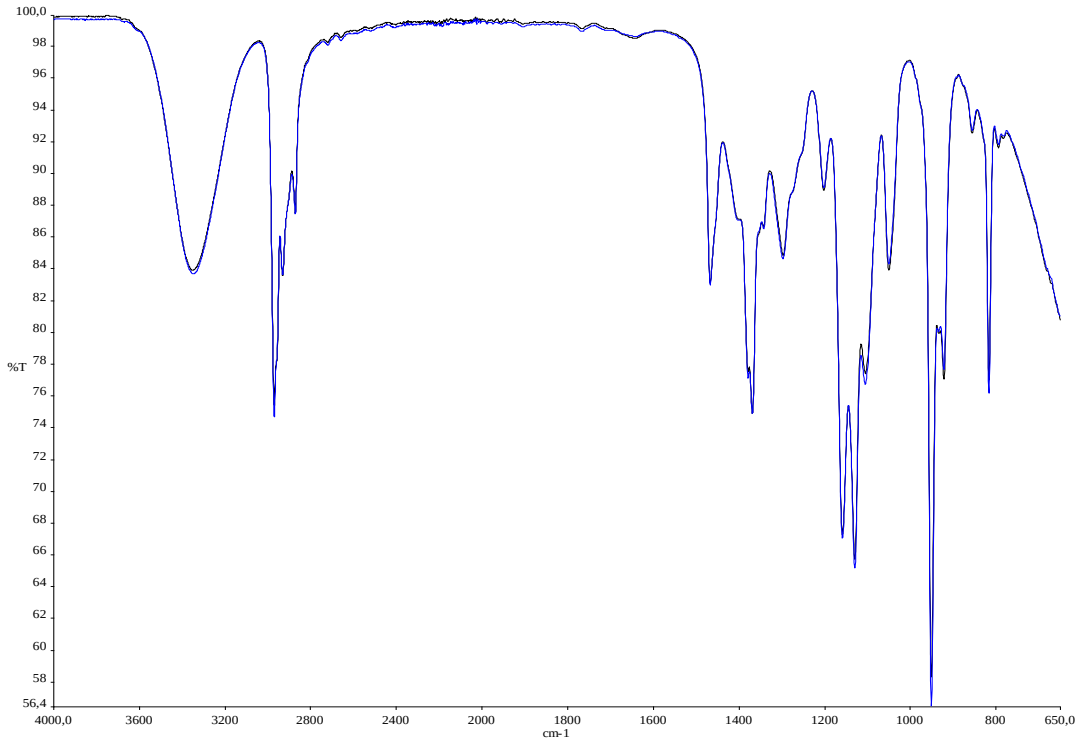
Surfactant	*Air Products' Code*
Surfadol 541-A	Surfynol® 104-A
Surfadol 541-BC	Surfynol® 104-BC
Surfadol 541-DPM	Surfynol® 104-DPM
Surfadol 541-E	Surfynol® 104-E
Surfadol 541-H	Surfynol® 104-H
Surfadol 541-NP	Surfynol® 104-NP
Surfadol 541-PA	Surfynol® 104-PA
Surfadol 541-PG 50	Surfynol® 104-PG 50
Surfadol 541-S	Surfynol® 104-S

Drop in replacements

IR spectrum: Surfadol 541 versus Benchmark Product 104

Surfynol® 104

Surfadol 541



Drop in replacements

Aspect	*Surfadol 541*	*SURFYNOL® 104*
Appearance	Waxy, off-white solid	Waxy, off-white solid
Odor	Characteristic (menthol)	Characteristic (menthol)
Specific gravity, kg/m^3	890	890
IR spectrum (104-PA)	>99% identical	>99% identical
Melting range	Approx. 37°C	Approx. 37°C
Solids content	>99%	>99%
Wetting speed: 0,5 gr. CB pigment in 0,1% a.m. 104-PA in water/ sec.	Approx. 4 sec	Approx. 4 sec
Defoaming activity, 1% DIOSS surfactant in water	Immediately, < 5 sec	Immediately, < 5 sec
Solubility in water	Approx. 0,1%	Approx. 0,1%
Stability, 1 week 50° C	Clear liquid, no discoloration	Clear liquid, no discoloration

Drop in replacements

Conclusion of comparative product performance evaluations:

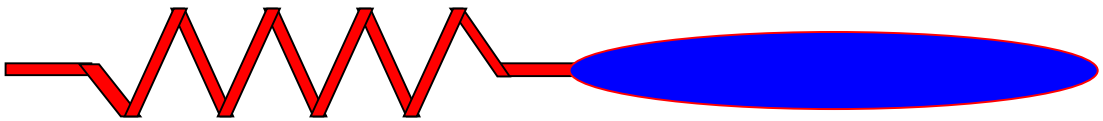
Surfadol 541* is equivalent to SURFYNOL® 104*

- Same appearance
- Same characteristic odor
- Same specific gravity
- Same IR spectra
- Same melting range (for the 100% versions)
- Same solids content (for the relative liquid versions)
- Same wetting activity
- Same defoaming activity
- Same solubility characteristics
- Same excellent stability

*: comparing equivalent products: Surfadol 541 E vs. SURFYNOL® 104 E / Surfadol 541 PA vs. SURFYNOL® 104 PA / etc. etc.

Surfactants

A particular type of molecular structure performs as a surfactant. This molecule is made up of a water soluble (hydrophilic) and a water insoluble **(hydrophobic)** component.

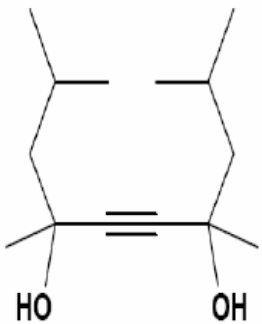


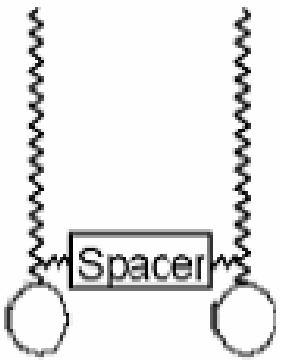
Hydrophobe	Hydrophilic
Lyophilic	Lyophobic
Fatty part	Water soluble part

Surfadol 541: 100%

- Solid material, melting range 54…56°C
- Purity : >= 98% % w/w
- Boiling point: 262 C. No-VOC (to European regulations)
- Water solubility 1,6 g/l
- Equilibrium surface tension 33,1mN/m

Gemini-surfactant structure:





Surfadol 541

Specific performance properties:

1. Strong surface tension reduction
2. Highest dynamic surface tension reduction
3. Destabilizing foam
4. Extreme low CMC
5. Lowest water sensibility
6. Non-ionic surfactant
7. Hydrophobic nature, HLB 4
8. Multifunctional: acts as a wetting agent, defoaming agent, dispersing agent, leveling agent.
9. Supplied as a 50% active liquid in various solvents

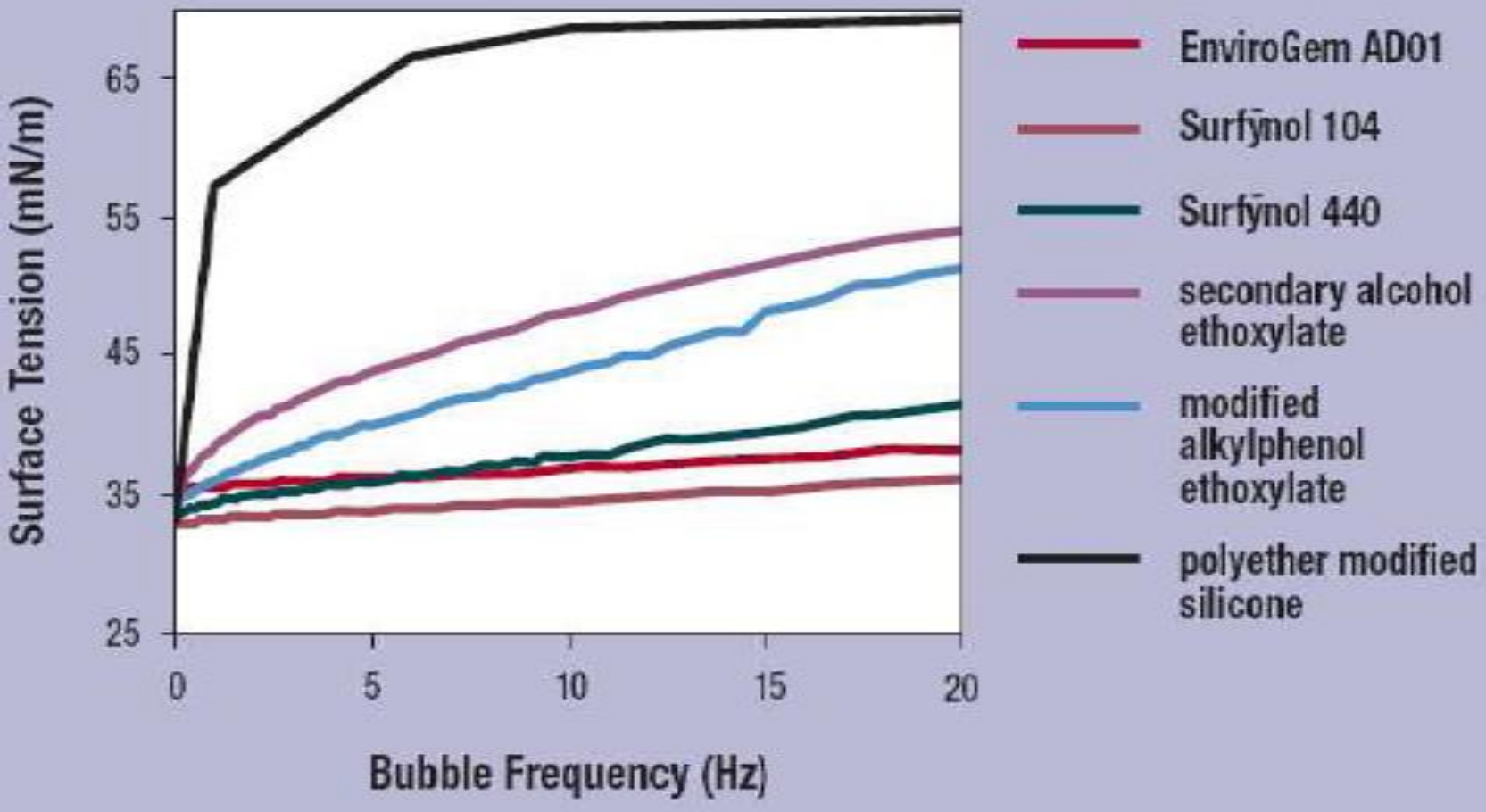
Surfadol 541

Surface tension

Low dynamic and static surface tension. It can lower the system's dynamic and static surface tension quickly, and move the surface tension to the system surface in order to assure the better wetting.

Concentration %	Static ST	Dynamic ST
0.01	51.1	55.3
0.05	37.1	39.0
0.1	33.1	36.4

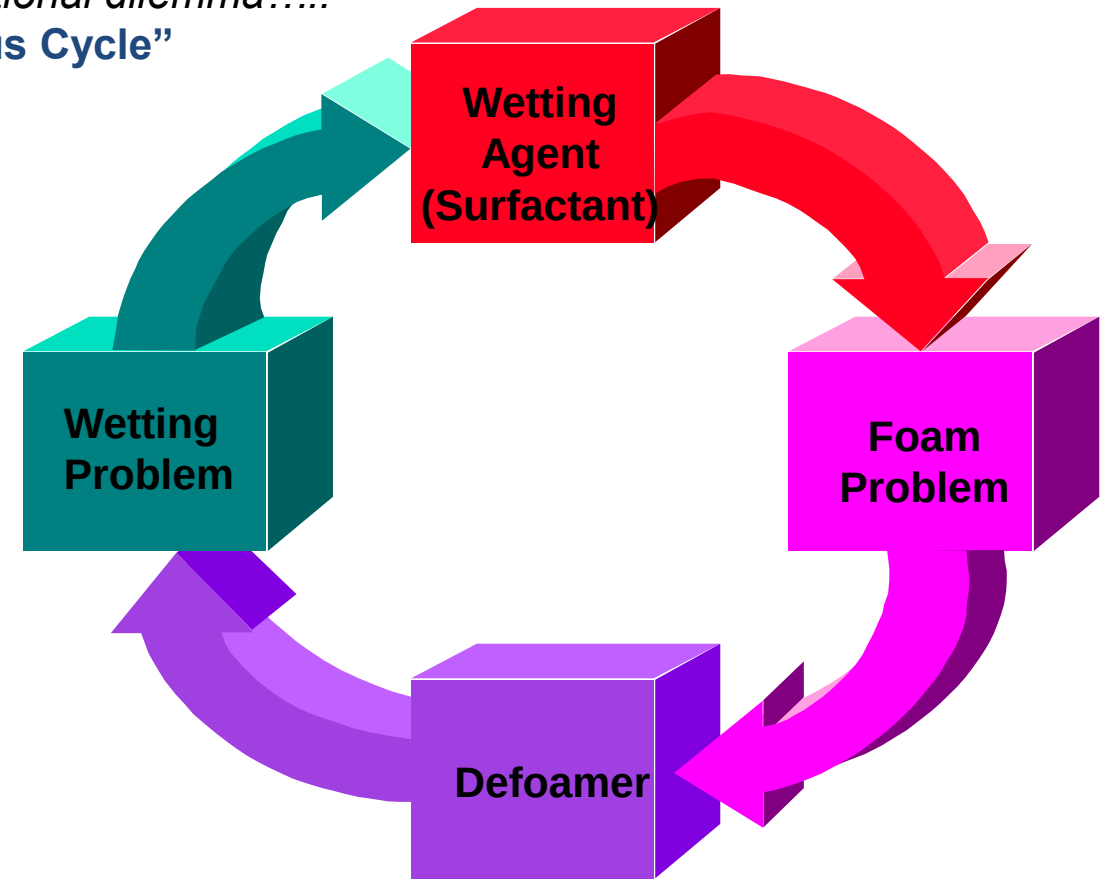
Comparison of the Dynamic Surface Tension of Various Surfactants (at concentrations of 0.1 wt.% in water)



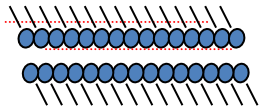
Surfadol 541

The conventional dilemma…..

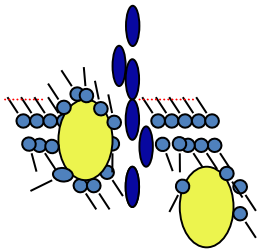
"The Vicious Cycle"



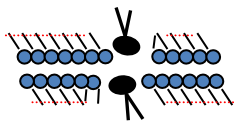
Surfadol 541



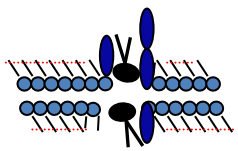
Stable foam lamella of interacting surfactant molecules



Conventional defoamer: hydrophobic particle adsorbing stabilizing surfactants



Surfadol 541 molecules, replacing the foam stabilizing surfactants. Weakening the cohesive strength molecules in the lamella



Foam collapses, as the lamella are disrupted by Surfadol 541

Surfadol 541 molecule

Foam stabilising surfactant

Air bubble

Surfadol 541-E

Specific application, performance:

1. Used in paints, coatings, inks, pigment manufacture, dispersion cement, metal working fluids
2. 50% active in Ethylene Glycol
3. Solubility in water: 0,2% at 20°C
4. Use levels are normally between 0,1 and 1,0%. A ladder study should be conducted in order to determine optimal level

Surfadol 541-PA

Specific application, performance:

1. Used in paints, coatings, inks, pigment manufacture, dispersion cement, metal working fluids
2. 50 % active in 2-Propanol
3. Solubility in water: 0,2% at 20°C
4. Use levels are normally between 0,1 and 1,0%. A ladder study should be conducted in order to determine optimal level

Surfadol 541-PG

Specific application, performance:

1. Used in paints, coatings, inks, pigment manufacture, dispersion cement, metal working fluids
2. 50 % active in Propylene Glycol
3. Solubility in water: 0,2% at 20°C
4. Use levels are normally between 0,1 and 1,0%. A ladder study should be conducted in order to determine optimal level

SURFACTANT 400-series

- Chemically modified 104
- Nonionic surfactants
- Increasing water solubility with increased number

Surfactant	*Concen-tration*	*Aspect*
SURFADOL 420	**100%**	**liquid**
SURFADOL 440	**100%**	**liquid**
SURFADOL 465	**100%**	**poor point 7° C**
SURFADOL 485	**100%**	**waxy Solid at R.T.**

400 series

- **SURFACTANT 420:** lowest degree of ethoxylation, for best defoaming
- **SURFACTANT 440:** low degree of ethoxylation
- **SURFACTANT 465:** medium degree of ethoxylation, watersoluble
- **SURFACTANT 485:** highest degree of ethoxylation, for highest hydrophylicity

Surfadol 541

Application areas:

1. Paints and Coatings
2. Printing Inks
3. Adhesives
4. Emulsion polymerisation
5. Detergents
6. Metal working fluids
7. Chemical Intermediate
8. Other Industrial Applications

Paints and Coatings

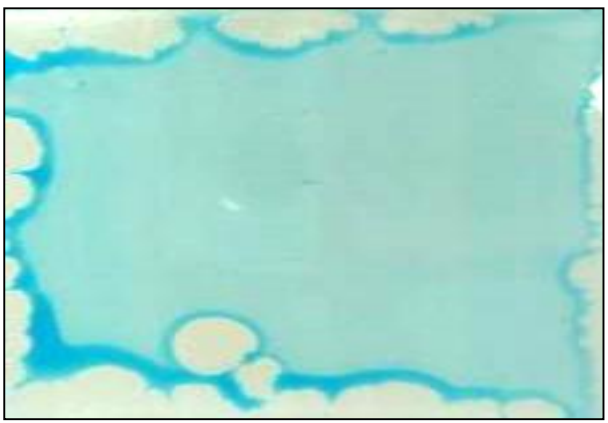
Features & Benefits Surfadol 541

- ✓ used are Surfadol 541-E,PA , -PG
- ✓Used in WB industrial-, protective-, wood-, automotive- as well as deco paints
- ✓Effective wetting agent, for pigments and substrates
- ✓Unlike other surfactants: defoaming properties
- ✓Low dynamic surface tension, optimizing spray-, roller- or dip coating.
- ✓Reduced risk of crawling in WB coatings, applied onto low surface tension substrates (plastics)
- ✓Enhances flow and leveling

Paint Surface Defects

Crawling & De-wetting

- tendency of a wet paint film to recede from certain areas of a painted surface leaving them apparently uncoated
- caused by an incompatible film on the surface or a substrate with too low surface tension (*e.g.* plastic)
- more pronounced in aqueous systems (higher intrinsic surface tension water + polar components) than solvent-based systems



coating over low energy surface

Surfadol 541 in Paints

- ✓Very low static and dynamic surface tension
- ✓Complete foam elimination during grind/dispersion
- ✓Rapid initial defoaming and sustained antifoaming
- ✓No significant viscosity increase
- ✓No influence on water fastness
- ✓Pigment grinding properties, reduced pigment particle size
- ✓Prevents re-agglomeration
- ✓Thermal stability over a broad temperture range
- ✓Chemical stability from pH 3 to pH 12

Printing Inks

*Features & Benefits Surfadol 541**

- ✓ * used are Surfadol 541-NP, -E, -H, -PA, -PG
- ✓Used in Flexo and offset inks, as well as in fountain solutions
- ✓Effective wetting agent, for pigments and substrates
- ✓Unlike other surfactants: defoaming properties
- ✓Low dynamic surface tension, optimizing printability
- ✓Reduced risk of crawling, applied onto low surface tension substrates (plastics)

Adhesives

*Features & Benefits Surfadol 541**

- ✓ * used are Surfadol 541-E, -H, -A, -BC, DPM, -PG
- ✓ Used in WB adhesives, pressure sensitive adhesives
- ✓Effective substrate wetting agent
- ✓Unlike other surfactants: defoaming properties
- ✓Low dynamic surface tension, optimizing roller and spray application
- ✓Enhances flow and leveling
- ✓Reduced risk of crawling, applied onto low surface tension substrates (plastics)

Emulsion Polymerisation

*Features & Benefits Surfadol **

- ✓ * used are SURFADOL 465, -485
- ✓ Effective wetting agent and emulsifier
- ✓ Wide range of compatibility with other surfactants
- ✓ Defoaming properties

Detergents

*Features & Benefits Surfadol 541**

- ✓ * used are Surfadol 541-E, -H, -A, -BC, -PG
- ✓Effective wetting agent
- ✓Defoaming
- ✓Low dynamic surface tension
- ✓Wide range of compatibility with other surfactants
- ✓Enhances flow and leveling, onto low surface tension substrates (plastics)

Metal Working Fluids

*Features & Benefits Surfadol 541**

- ✓ * used are SURFACTANT-E, -440
- ✓Excellent lubrification properties, interposing lubricant monolayers at metal interfaces.
- ✓Facilitate wetting of metal parts for more effective heat removal and lubricity
- ✓Improving metal workability explained by the rapid migration from the bulk liquid to the newly formed metal surfaces
- ✓Optimal heat transfer and cooling. Other surfactants typically form foam, which acts as heat insulator
- ✓Suspension and removal of metal fines
- ✓Eases cleanibility of the metal surfaces

Various Other Applications

*Features & Benefits Surfadol 541**

✓ Viscosity Reducer in high concentrated solutions of nonionic surfactants in water

- Associative Thickeners

✓Other compounds where surface tension reduction and de-airing properties are required