



**□ - BASF**

We create chemistry



**LUTENSOL®  
SURFACTANTS  
PRODUCT GUIDE**

---

**SUPERIOR PERFORMANCE WITH SUSTAINABLE INGREDIENTS**



# Table of Contents

<b>ABOUT BASF</b> .....	<b>3</b>
<b>CHEMICAL STRUCTURE AND NOMENCLATURE</b> .....	<b>6</b>
<b>LUTENSOL ALCOHOL ETHOXYLATES PRODUCT RANGE</b>	
<b>NATURAL ALCOHOL BASED</b>	
• LUTENSOL® A..N (C <sub>12-14</sub> ) .....	10
• LUTENSOL® LA (C <sub>12-14</sub> ) .....	10
• LUTENSOL® AT (C <sub>16-18</sub> ) .....	11
<b>SYNTHETIC BASED</b>	
• LUTENSOL® CS 6250 (Short chain) .....	12
• LUTENSOL® AO (C <sub>13</sub> C <sub>15</sub> OXO) .....	13
• LUTENSOL® TDA (C <sub>13</sub> OXO) .....	14
• LUTENSOL® TO (C <sub>13</sub> OXO) .....	15
• LUTENSOL® XP (C <sub>10</sub> Guerbet) .....	16
• LUTENSOL® XL (C <sub>10</sub> Guerbet) .....	16
<b>PERFORMANCE</b>	
• CLEANING .....	18
• CLOUD POINT .....	18
• HLB .....	19
• SURFACE TENSION .....	19
• WETTING .....	20
• FOAMING .....	21
<b>FORMULATION ADVANTAGE</b>	
• GELLING BEHAVIOR .....	21
• SOLUBILITY .....	23
• SUSTAINABILITY .....	25
<b>PHYSICAL AND PROPERTY TABLE</b> .....	<b>26</b>
<b>LOW 1,4-DIOXANE</b> .....	<b>29</b>

# About BASF

---

BASF Home Care and Industrial and Institutional Ingredients (HC I&I) is one of the leading suppliers in the Home Care, Industrial, and Institutional Cleaning industry. We offer a wide range of products, such as chelating agents, polymers, surfactants, optical brighteners, biocides, and enzymes.

Our ingredients are welcomed into homes and businesses around the globe because we deliver superior quality combined with an uncompromising commitment to sustainability. This commitment is at the core of what we do, and we have set transparent and verifiable global goals with regard to sustainable development. We offer a diverse portfolio of bio-based, biodegradable and CleanGredients-listed ingredients and are working to ensure that our renewable-based products are made from sustainably sourced raw materials.

Not only do we believe that quality and sustainability can coexist, but we take it a step further: We know that sustainability can't exist without innovation and superior quality. Our products deliver a win-win-win for you, for consumers, and for our collective future.

This brochure introduces you to our Lutensol® surfactants product line. In this guide, you can find the unique product characteristics, application areas, and performance advantages.



[epa.gov/saferchoice](http://epa.gov/saferchoice)



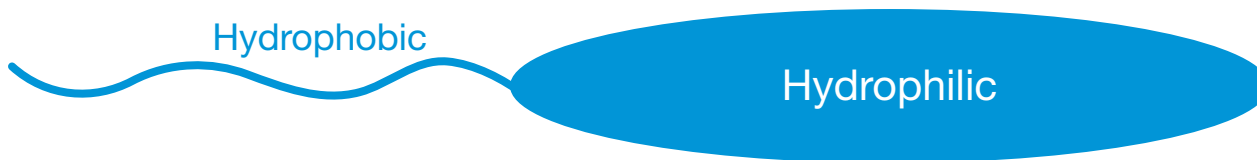
# LUTENSOL® NONIONIC SURFACTANTS

## What Are Nonionic Surfactants?

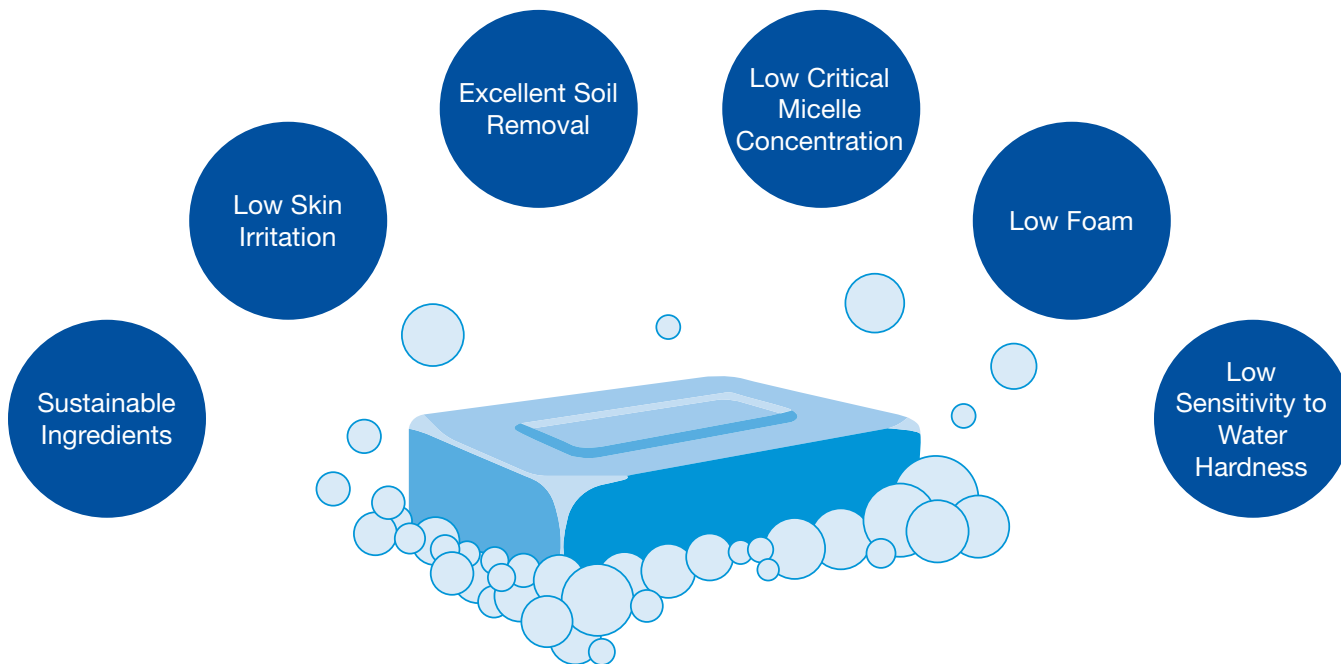
Nonionic surfactants are a class of surfactants that do not carry a charge on its hydrophilic head group.

Examples of nonionic surfactants are alcohol ethoxylates, alkylphenol ethoxylates, alkyl polyglucosides, and amine oxides. BASF Lutensol® surfactants are all alcohol ethoxylates and alkoxyates.

## Nonionic surfactants



## Alcohol Ethoxylates (AE)



## BASF LUTENSOL® SURFACTANTS ADVANTAGES

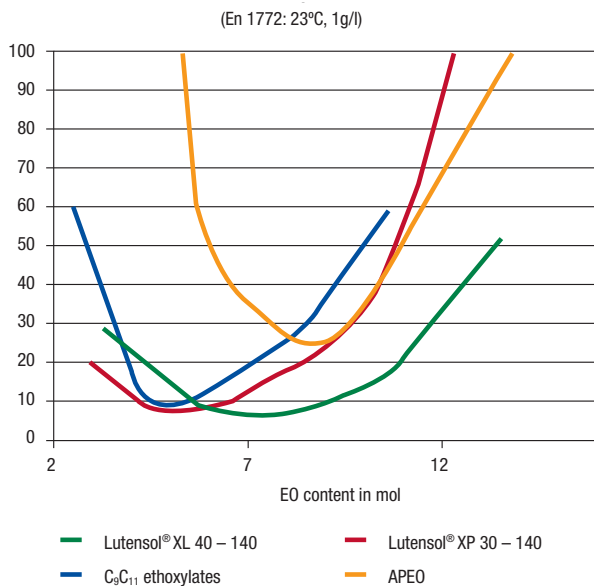


# BASF Lutensol® Surfactants vs. Standard Ethoxylates and NPE

The Lutensol surfactants include both synthetic and naturally-derived alcohols. These products are suitable for a variety of applications. Compared to Standard Ethoxylates and NPE, our BASF Lutensol® surfactants have various performance advantages such as fast wetting, excellent emulsification, sustainable ingredients, and safer choice listed. Our experienced technical team is constantly innovating to deliver effective solutions to our customers' needs.

## Lutensol® XP and Lutensol® XL exhibit faster wetting

### Faster Wetting on Cotton

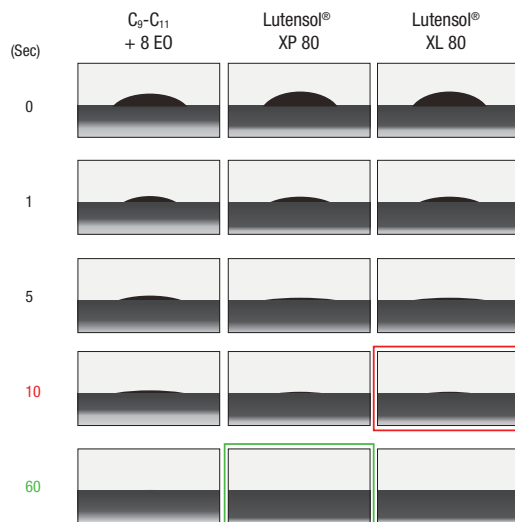


## Superwetting character

Physical Property	Lutensol® XP90	Commercial NP-9
Actives, wt%	100	100
Degree of Ethoxylation	9	9
Cloud pt, °C	70	54
HLB	14	13
Foam Height	100/20	105/90
Appearance	Hazy Liquid	Hazy Liquid
pH	5-8	6
Viscosity, cPs	1200	300
Surface Tension	28	32

Proven APE (alkylphenol ethoxylate) and LAE (linear alcohol ethoxylate) replacement

## Wetting on glass



Contact angle on glass (23°C; 0,5g/l)

**Lutensol® XP and Lutensol® XL Surfactants have faster wetting performance for hard surface cleaning**

# Chemical structure and Nomenclature





Lutensol® surfactants are named according to the identity of their hydrophobe and according to the degree of ethoxylation. The hydrophobe is indicated with a 2 or 3 letter abbreviation (ex. XP or TDA). Usually the degree of ethoxylation is equal to the number shown in the product (Lutensol TDA 9 has 9 moles of EO).

In the case of Lutensol XP and Lutensol XL, the degree of ethoxylation is indicated by the first digit in the name (Lutensol XL 90 has 9 moles EO).

Finally, some products are sold as solutions in water for convenient product handling. Products sold as solutions in water will have 2 digits and end in a 9 (ex. Lutensol XP 89).

R EO

R = 2 propyl heptanol (branched C<sub>10</sub>)

 Product Line	 Chemistry	 Natural/Synthetic	 Properties
Lutensol® XP	C <sub>10</sub> Guerbet alcohol ethoxylates, 3 – 9 moles EO	Synthetic	<ul style="list-style-type: none"> <li>• Excellent wetting</li> <li>• Dynamic wetting</li> <li>• High CMC</li> </ul>
Lutensol® XL	C <sub>10</sub> Guerbet alcohol alkoxyates, 4 – 10 moles EO	Synthetic	<ul style="list-style-type: none"> <li>• Top cleaning power</li> <li>• Excellent soil removal</li> <li>• Streak-free gloss</li> <li>• Solubilizes fats/ perfumes</li> </ul>

R EO

R = Linear, natural

Lutensol® A...N	C <sub>12/14</sub> fatty alcohol ethoxylates, 6.5, 9, 12 moles EO	Natural	<ul style="list-style-type: none"> <li>• Emulsification power</li> <li>• Solubility on oil</li> </ul>
Lutensol® LA	C <sub>12/14</sub> fatty alcohol ethoxylates, 7EO	Natural	<ul style="list-style-type: none"> <li>• Wetting</li> <li>• Soil removal</li> <li>• Emulsifier</li> </ul>





## Product Line



## Chemistry



## Natural/Synthetic



## Properties

R EO

R = Short chain alcohol

Lutensol® CS 6250

Alcohol ethoxylate

Synthetic

- Good Solubilizer and penetrating agent
- Low foam detergency

R EO

R = Linear C<sub>16</sub>-C<sub>18</sub> alcohol

Lutensol® AT

C<sub>16-18</sub> Ethoxylates, 25 EO Natural

- Moderate detergency
- Excellent dispersant
- Poor wetter

R EO

R = C<sub>13</sub>-C<sub>15</sub> Oxo Alcohol (~67% C<sub>13</sub>, ~33% C<sub>15</sub>)

Lutensol® AO

C<sub>13</sub>C<sub>15</sub> OXO alcohol ethoxylates, 3, 8 EO

Synthetic

- Good detergency

R EO

R = Branched tridecyl alcohol, C<sub>13</sub>

Lutensol® TDA

C<sub>13</sub> OXO alcohol ethoxylates, 3 – 12 EO

Synthetic

- High detergency
- Excellent emulsifier

R EO

R = Iso-C<sub>13</sub> alcohol

Lutensol® TO

C<sub>13</sub> OXO alcohol alkoxyates, 5 – 12, EO

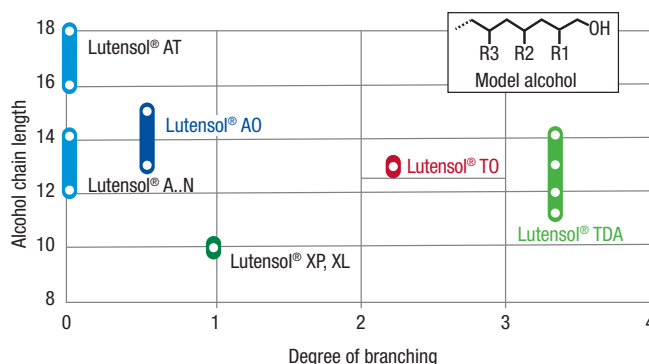
Synthetic

- Wetting
- Detergency
- Soil removal
- Emulsifier

# Lutensol® Product Line

## Branching

In describing alcohols used to make surfactants, we make a distinction between linear and branched alcohols. In a linear alcohol, all the carbons are arranged in a single chain (one primary carbon, with the remainder being bonded to no more than two other carbons). By contrast, branched alcohols will have one or more carbons bonded to three other carbon atoms creating a “branch” point or non-linear structure.



## Property Comparison: Branched vs. Linear Alcohol Ethoxylates

### Branched alcohol ethoxylates

- Lower gelling
- Lower odor
- Less aquatoxic
- Lower foam
- Better wetting
- More dynamic
- Better emulsifiers
- Improved properties under cold conditions

### Linear alcohol ethoxylates

- Usually slightly faster biodegradability
- higher aquatoxic
- Higher foam



## Applications

Product Name	Homecare				Fabric care	I & I		
	Manual Dish Wash	Automatic Dish Detergent	Hard Surface Cleaner	Cleaner Wipes	Home Care/ Commercial Laundry Detergent	Institutional Cleaner/ Sanitizer	Warewash	Industrial Cleaner
Lutensol® A..N					X			X
Lutensol® AT		X			X	X		
Lutensol® LA			X	X	X			X
Lutensol® CS 6250			X	X	X			X
Lutensol® AO					X			X
Lutensol® TDA			X	X	X	X		X
Lutensol® TO			X	X	X	X		X
Lutensol® XP			X	X	X	X		X
Lutensol® XL			X	X	X	X		X

Note: more detailed information on the product structure and application later in the brochure

# NATURAL ALCOHOL BASED

---

## LUTENSOL® A..N

Lutensol A..N surfactant is a 100% active non-ionic surfactant composed of ethylene oxide adduct of a linear lauryl myristyl alcohol.

### Product Characteristics

- Excellent detergency
- High wetting power
- Moderate foamer
- Readily biodegradable

### Applications

- Light-duty and heavy-duty laundry powders and liquids
- Industrial and household cleaners

## LUTENSOL® LA

Lutensol LA 60 is a 100% active lauryl alcohol ethoxylate

### Product Characteristics

- Excellent detergency
- Excellent wetting power
- Moderate foamer
- Highly compatible with other nonionic, cationic and anionic surfactants
- Readily biodegradable

### Applications

- Light duty liquids
- Heavy duty laundry powders and liquids
- Industrial and household cleaners





# LUTENSOL® AT

Lutensol AT surfactants are made from linear C<sub>16</sub>C<sub>18</sub> fatty alcohol with 11, 18, 25, 50 or 80 moles of EO.

## Product Characteristics

- Moderate detergency
- Excellent dispersant

## Performance Advantages

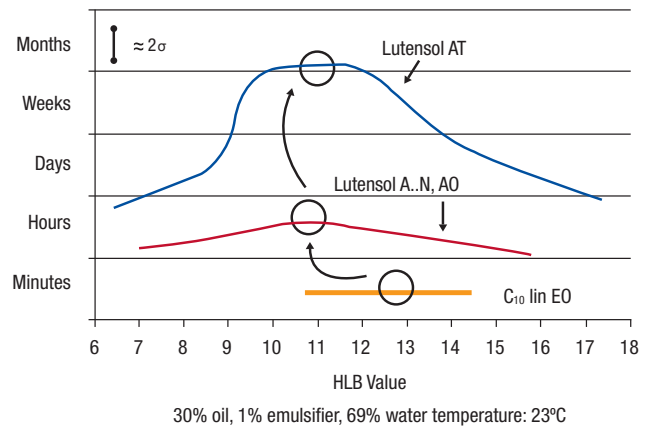
Highly Effective Oil Emulsifiers

## Applications

Carrier/Binder for solid formulations



## Stability of Sunflower Oil Emulsion



# LUTENSOL® CS 6250

Lutensol CS 6250 is an alcohol ethoxylate

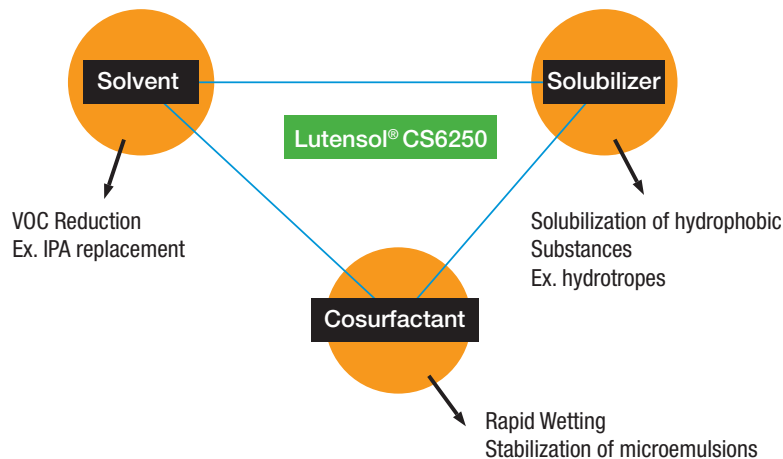
## Product Characteristics

- Good Solubilizer and penetrating agent
- Act as a co-solvent or co-surfactant
- Low foam detergency

## Application

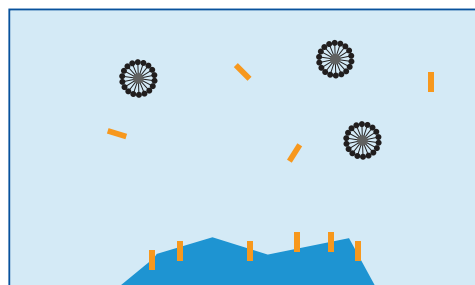
- Hard surface cleaning
- Washing
- Carpet cleaning
- Open plant cleaning
- Floor cleaning and care

## Performance Advantages



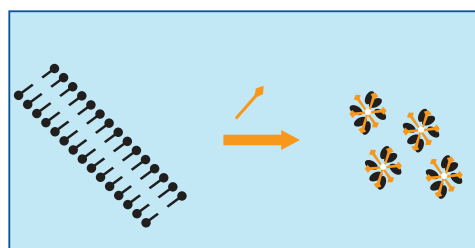
## CS 6250-New component for surfactant formulations

- Can accelerate the action of surfactants
- Can replace VOC-solvents
- Can replace cumene sulfonate
- Shows remarkable wetting synergism with certain surfactants



### Pioneer attack

- Penetrates the soil
- Surfactant encounters pre-conditioned surface
- Surfactant can act immediately



### Guerilla attack

- Surfactants organized in smaller units are faster and more effective at the interfaces

# LUTENSOL® AO

The Lutensol AO types are based on C<sub>13</sub>C<sub>15</sub> OXO alcohol that consists of ca. 67% C<sub>13</sub> and ca. 33% C<sub>15</sub>

## Product Characteristics

- Good detergency

## Performance Advantages

Strong detergency in laundry

## Application

- Detergents
- Laundry applications



# LUTENSOL® TDA

Lutensol TDA surfactants are based on a highly branched tridecyl alcohol and are available with 3, 6, 8, 9, or 10 moles of ethylene oxide.

## Product Characteristics

- Excellent rapid wetting properties
- Relatively low foaming levels
- Good detergency
- Versality as emulsifiers, Disperants and solubilizers

## Application

- Textile scouring and dyeing
- Industrial and institutional and specialties
- Chemical intermediates for conversion to anionic phosphate, sulfate and carboxylate surfactants

## Performance Advantages

Good emulsification and oily soil removal

## Lutensol® TDA Detergency Study

Conditions: hardness 150ppm, 120°F, surfactant con. = 0.10wt.%, equal actives, dirty motor oil



Visual Difference



# LUTENSOL® TO

Lutensol TO are moderately branched synthetic C<sub>13</sub> Ethoxylates (only EO containing)

## Product Characteristics

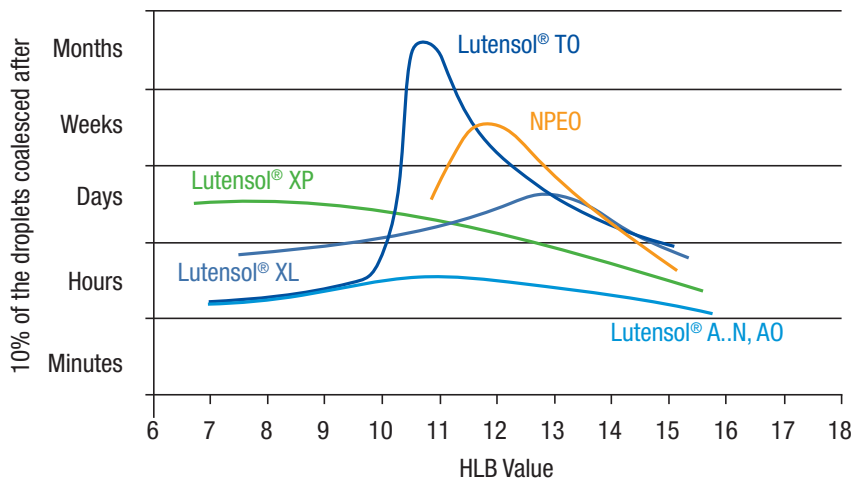
- Excellent wetting
- Low foam detergency
- Faster spreading in spray application
- Effective degreasing power at low concentrations
- High formulation stability

## Application

- Carpet cleaning
- Open plant cleaning
- Floor cleaning and care

## Performance Advantages

Good emulsification and oily soil removal



30% sunflower oil,  
1% emulsifier,  
69% water,  
storage at 23°C

Lutensol® TO is better performing as compared to NPE

# LUTENSOL® XP

Lutensol XP types are alcohol ethoxylates with 3-9 moles of ethylene oxide.

# LUTENSOL® XL

Lutensol XL surfactants include a small amount of propylene oxide to create a slightly extended hydrophobe for improved wetting and emulsification properties. Lutensol XL surfactants have 4-10 moles of ethylene oxide.

## Product Characteristics

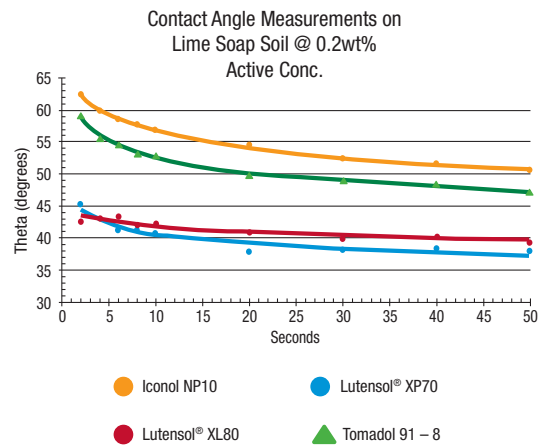
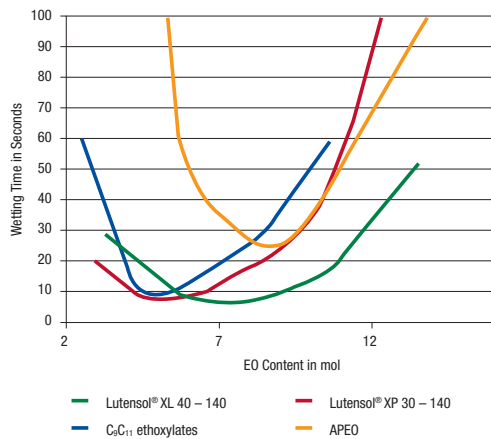
- Superior cleaning benefits
- Listed on Safer Choice
- Quicker manufacturing process due to low gelling vs. standard ethoxylates

## Application

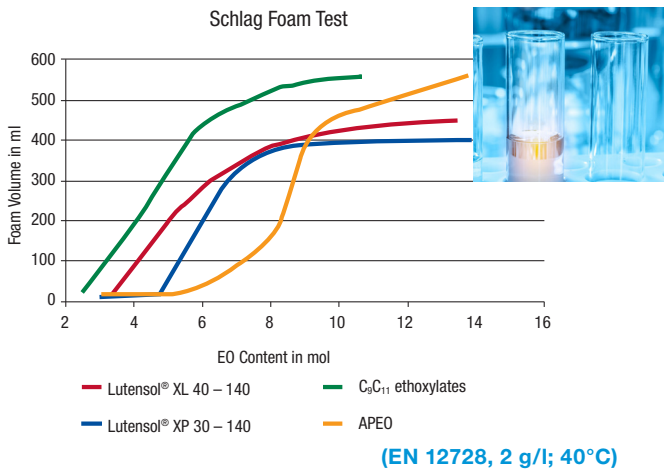
- Industrial & Institutional Cleaning
- Home Care
- Formulation Technologies

## Performance Advantages

### Faster Wetting

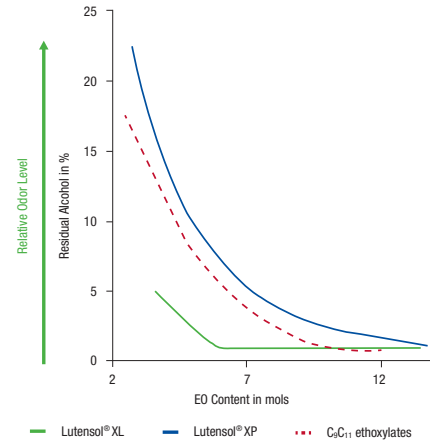


## Low Foaming

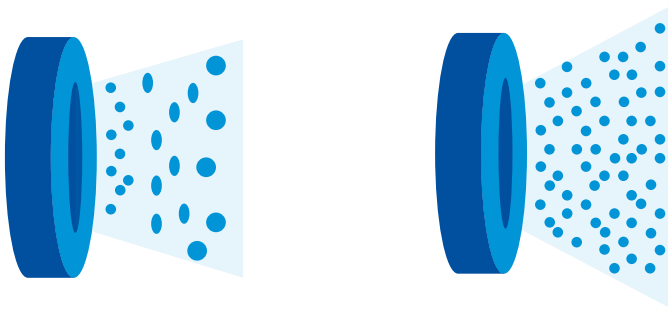


## Reduced Odor

Lutensol<sup>®</sup> XL products have further reduced odor than C<sub>9</sub>C<sub>11</sub> ethoxylates from lower residual alcohol content



## Improvement in Spraying Process



Reduced droplet size  
due to higher dynamics

Small droplets are formed directly behind the nozzle

→ Large Surface

Standard surfactant

→ Droplet Coalescence

Irregular spray result

Dynamic Surfactant

→ Stable Droplets

Regular spray result

# Performance Advantage

## CLEANING

Cleaning, by definition, is removal of soils or stains from a surface. This could include lifting a stain from a soft fabric surface to scrubbing scale from a hard surface in the bathroom.

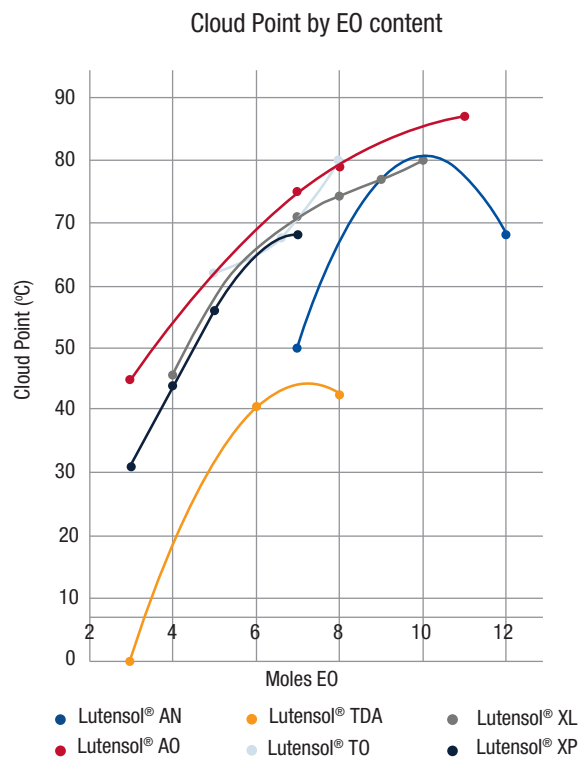


## CLOUD POINT

The cloud point is the temperature above which a nonionic surfactant becomes insoluble in solution. Most compounds tend to have increased solubility at higher temperatures. However, the water solubility of nonionic surfactants is dependent on weak hydrogen bonding. As the temperature increases, kinetic energy is

enough to disrupt the weak hydrogen bonds resulting in insolubility. Nonionic surfactants with higher degrees of ethoxylation and shorter alkyl chains will have relatively higher cloud points.

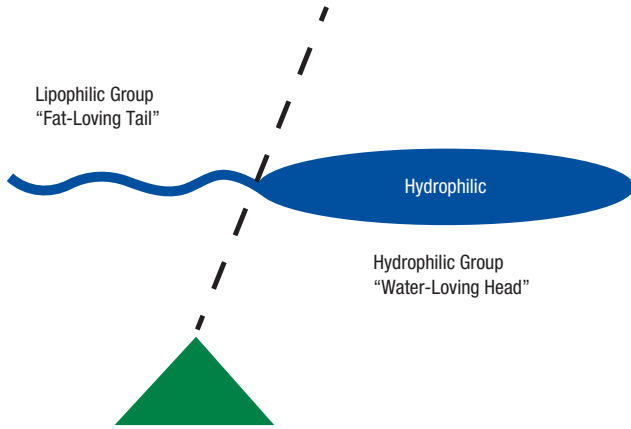
- Cleaning power tends to be better near the cloud point temperature;  $CP - 5^{\circ}\text{C} < T < CP$ .
- Foaming is greatly reduced above the cloud point.
- Low-foaming surfactants are often selected based on their cloud point.
- Use of anionic surfactants with nonionics will significantly impact the cloud point.



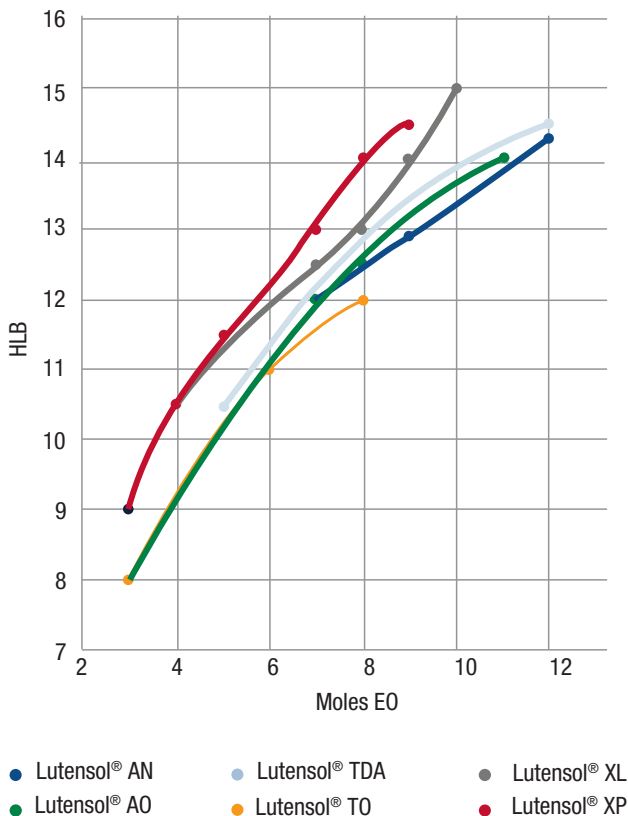


# HLB

The **Hydrophilic-lipophilic balance** of a surfactant is a measure of the degree to which it is hydrophilic or lipophilic, determined by calculating values for the different regions of the molecule, as described by Griffin.



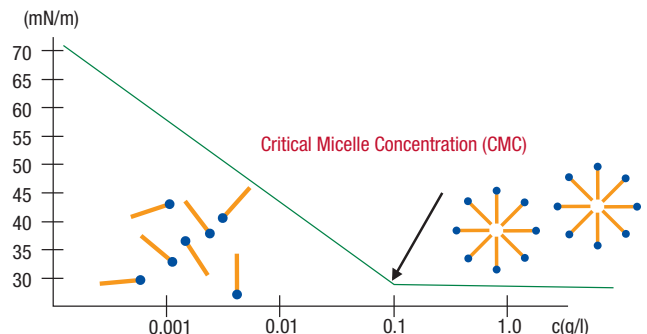
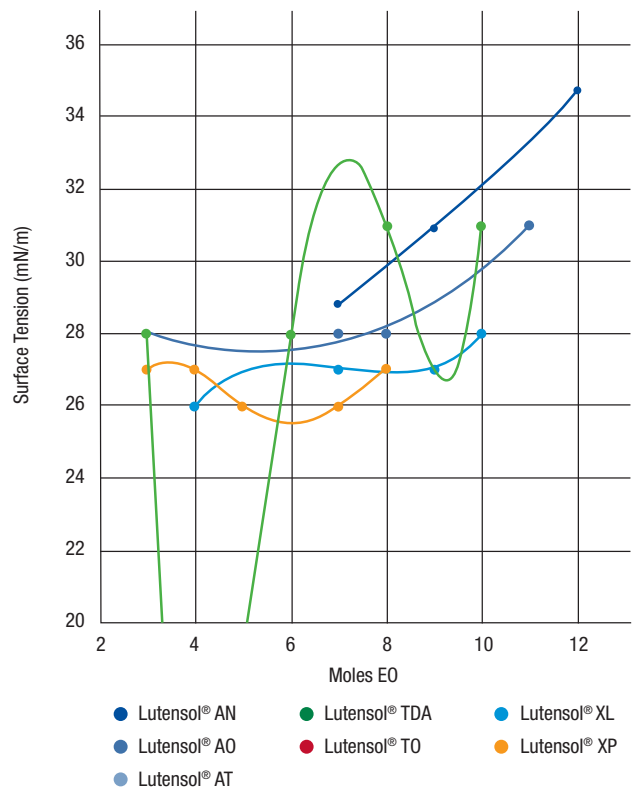
HLB by EO content



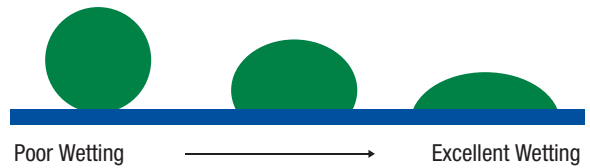
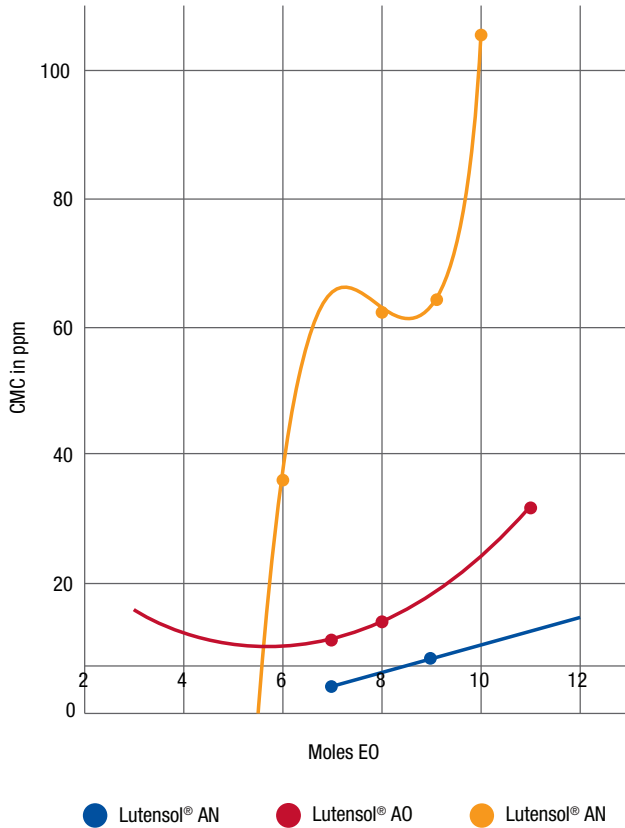
# SURFACE TENSION

Surface tension is a phenomenon in which the surface of a liquid, where the liquid is in contact with gas, acts like a thin elastic sheet. This term is typically used only when the liquid surface is in contact with gas (such as the air). If the surface is between two liquids (such as water and oil), it is called "interface tension."

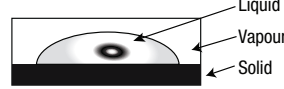
Surface Tension by EO content



CMC by EO content



Principle:

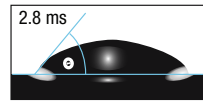


Young's Law

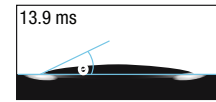
$$\sigma_{SV} = \sigma_{SL} + \sigma_{LV} \cdot \cos \theta$$

$\sigma_{SV}$  = interfacial tension solid/vapour (constant)  
 $\sigma_{SL}$  = interfacial tension solid/liquid (influenced by surfactant)  
 $\sigma_{LV}$  = surface tension (influenced by surfactant)

Example:

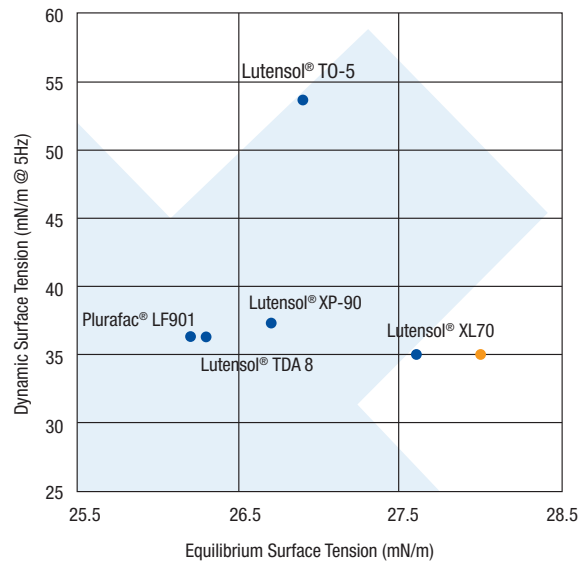


After 2.8 ms:  $\theta = 60$  degrees



After 13.9 ms:  $\theta = 24$  degrees

Lower dynamic (faster) and equilibrium surface tension give super wetting

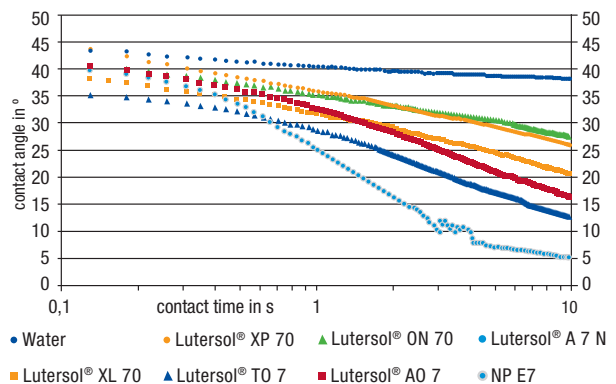


● BASF Products  
 ● Reference Organic Superwetter  
 C.J. Reader, J.M. Snyder, R. Reinartz, Y. Dai Proceedings of the Brazilian Coatings Manufacturers Association, 2017

## WETTING

Wetting is closely related to surface tension, and describes how well a liquid spreads on a surface. Poor wetting behavior is exhibited by the liquid forming a droplet on the surface, while excellent wetting the liquid will instead form a single layer "sheet" on the surface. Wetting is quantified by measuring the contact angle of the liquid-vapor interface on the solid surface. Surfactants typically lower the contact angle leading to more effective wetting. Some dynamic surfactants can facilitate wetting of a surface very quickly.

Contact angle on glass-various AE7 types (0,2 g/l, 40°C)



# FOAMING

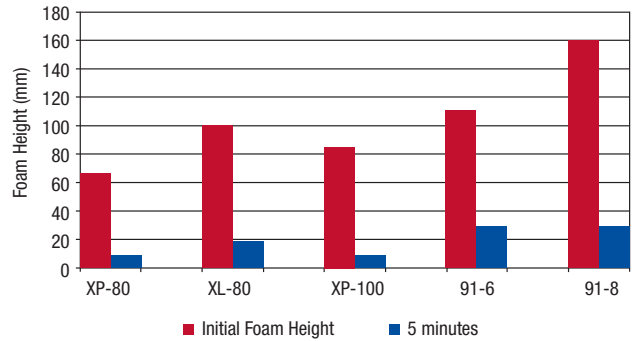
Foam can be defined as a dispersion of gas bubbles in a liquid and is therefore a colloiddally dispersed system.

Foam profiles for XP and XL surfactants are lower than linear alcohol ethoxylates.

The foam for XP and XL surfactants breaks faster than ethoxylates based on natural alcohols including C<sub>9-11</sub> ethoxylates.

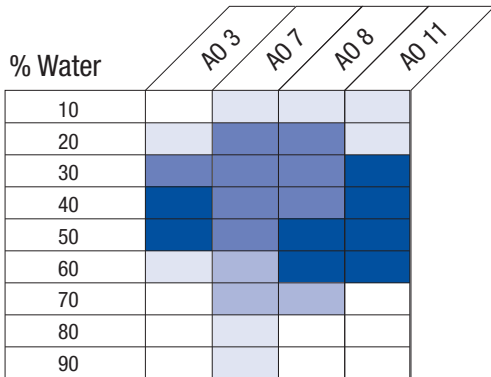
Foam profiles for XP and XL surfactants are lower than NPE's if the cloud point is matched (NP-9 and above).

Ross Miles Foam Heights (0.1 wt % @ 122 deg F)

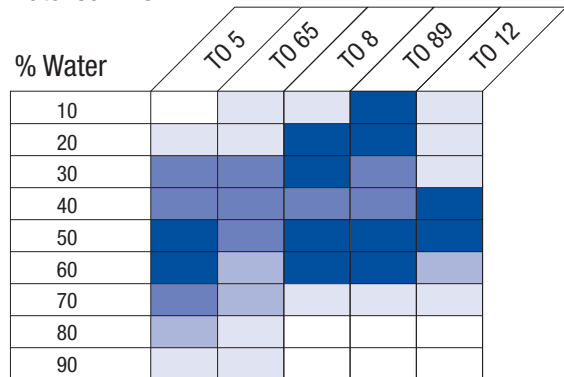


# GELLING BEHAVIOR

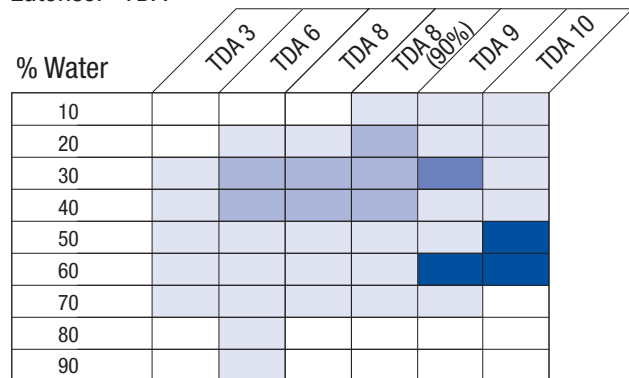
Lutensol® A0



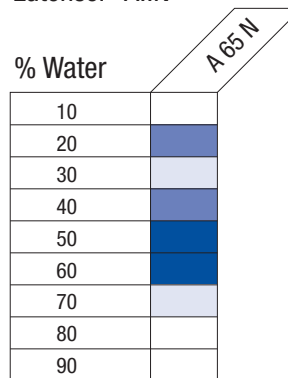
Lutensol® T0



Lutensol® TDA



Lutensol® A..N



Lutensol® XL

% Water	XL 40	XL 50	XL 60	XL 70	XL 80	XL 90	XL 100
10							
20							
30							
40							
50							
60							
70							
80							
90							

Lutensol® XP

% Water	XP 30	XP 40	XP 50	XP 60	XP 70	XP 80	XP 90	XP 100
10								
20								
30								
40								
50								
60								
70								
80								
90								

Viscosity	
10-100	
100-1000	
1000-10000	
10000-100000	
>100000	



# SOLUBILITY

Product Name	Distilled Water	Potable water (ca 2.7 mmol Ca <sup>2+</sup> ions/l)	Caustic soda (5% w/w)	Hydrochloric acid (5% w/w)	Salt solution	Mineral oils	Alcohols	Aromatic hydrocarbons
Lutensol® AO 3	-	-	-	-	-	+	+	+
Lutensol® AO 7	+/-	+/-	±	+	±	+/-	+	+/-
Lutensol® AO 8	+	+	-	+	+	±	+	+/-
Lutensol® AO 11	+	+	-	+	+	+/-	+	+/-
Lutensol® AT 25 Pwd.	+	+	-	+	+	-	+	+
Lutensol® AT 80 Flake	+	+	-	+	+	-	+	+
Lutensol® CS 6250	+	+	+	+	+	+	+	+
Lutensol® TDA 3	-	-	-	-	-	+	+	+
Lutensol® TDA 6	+/-	+/-	•	+/-	+/-	+/-	+	+
Lutensol® TDA 8	+	+	-	+	+	-	+	+
Lutensol® TDA 9	+	+	+	+	+	-	+	+
Lutensol® TDA 10	+	+	+	+	+	-	+	+
Lutensol® TO 12	+	+	+	+	+	-	+	-
Lutensol® TO 5	-	-	-	-	-	+	+	+
Lutensol® TO 6	-	-	-	-	-	+	+	+
Lutensol® TO 65	-	-	-	-	-	+	+	+
Lutensol® TO 8	+	+	-	+	+	±	+	-

+ Clear solution

± Sparingly soluble

- Insoluble (Phase separation)

• Forms an opaque soluble, homogeneous emulsion

Product Name	Distilled Water	Potable water (ca 2.7 mmol Ca <sup>2+</sup> ions/l)	Caustic soda (5% w/w)	Hydrochloric acid (5% w/w)	Salt solution (5%)	Solvent naphtha	Ethanol Isopropanol	Aromatic hydrocarbons
Lutensol® XL 40	-	-	-	-	-	+	+	+
Lutensol® XL 50	•	•	-	-	•	+	+	+
Lutensol® XL 70	+	+	•	+	-	+	+	+
Lutensol® XL 80	+	+	-	+	+	±	+	+
Lutensol® XL 90	+	+	+	+	+	±	+	+
Lutensol® XL 100	+	+	+	+	+	-	+	+
Lutensol® XP 30	-	-	-	-	-	±	+	+
Lutensol® XP 40	-	-	-	•	-	±	+	+
Lutensol® XP 50	•	•	-	•	•	±	+	+
Lutensol® XP 70	+	+	•	+	-	±	+	+
Lutensol® XP 80	+	+	-	+	+	±	+	+
Lutensol® XP 90	+	+	•	+	+	±	+	+

+ Clear solution

± Sparingly soluble

- Insoluble (Phase separation)

• Forms an opaque soluble, homogeneous emulsion

# Sustainability


---


We believe that a world with more efficient and safer chemicals is a better world for all. Our commitment to the industry, to society and to the environment has been translated into initiatives like developing Safer Choice, biodegradable, and biobased product portfolio. We are constantly adding sustainable ingredients to the Lutensol portfolio. So consider this list as a starting guide!

## DEFINITIONS



**Safer Choice** – Ingredients that meet requirements created by the United States Environmental Protection Agency (EPA) based on performance, packaging, pH, and VOCs. All chemicals that pass this investigation are listed on CleanGredients.

 **Biobased** – Ingredients are considered biobased if they have biologically-based carbon molecules. Percentages of biobased carbon are approximate.

 **Biodegradable** – Ingredients are considered biodegradable if they can naturally decay at a certain ratio. There are five categories of biodegradability.

- RB: Readily Biodegradable by OECD criteria ( $\geq 60\%$  in 10-day window)
- UB: Readily Biodegradable ( $\geq 60\%$  in 28 days)
- MB: Moderately Biodegradable ( $> 20\text{--}60\%$  in 28 days)
- PB: Poorly Biodegradable ( $\leq 20\%$  in 28 days)

## EPA Inert Ingredients permitted for use:




† Nonfood use – Nonfood use ingredients are solely for use in pesticide products applied to nonfood use sites, such as nonfood handling establishments, nonfood industrial applications, bathroom cleaning, etc. Food use is not permitted.

‡ Food and Nonfood use – The only inert ingredients approved for use in pesticide products applied to food are those that have either tolerances or tolerance exemptions in the Code of Federal Regulations (CFR), 40 CFR part 180 (the majority are found in sections 180.910–960), or where no residues are found in food. Food use sites may include food contact surfaces in public eating places, dairy-process equipment, and food-processing equipment and utensils. Restrictions and limitations may vary. Please consult your BASF representative for further information on suitable BASF inert ingredients for your pesticide products.




Determination of BASF product EPA Inert status is either provided directly from EPA Inerts or by BASF self-assessment.

# Physical and Property Table





## Lutensol® AN

Product Name	Physical form (23° C)	Molecular weight (g/mol)	Active content, %w	Water, %w	Degree of ethoxylation (approx.)	PH, ("EN 1262, solution B, ""5% in water	Color, Pt-Co (APHA)	Foam Height [mm] Ross Miles (0.1% wt)	Density g/cm <sup>3</sup> (DIN 51757, 23° C)	Viscosity (EN 12092, 23° C, Brook field,6	Hydroxyl No., (DIN 53240) mg KOH/g	Surface tension, mN/m (EN 14370, 1g/l)	Cloud pt, °C (EN 1890, Method E)	HLB NO.	CMC (ppm)
Lutensol® A 65 N <sup>†</sup> 	Liquid	500	100	0	7	6 to 7	50 max	118 113	0.98	150	117	28.8	48-52	12	3.989
Lutensol® A 9 N <sup>†</sup> 	Waxy Solid	554	100	0	9	5-8.0	50 max	108 108	0.98	35.9 (37.8°C)	99	30.9	72-82	12.9	8.100
Lutensol® A 12 N <sup>†</sup> 	Waxy Solid	698	100	0	12	5.5-6.5			1.007 (37.8°C)	49 (37.8°C)	79.7	34.7	65-71	14.3	

## Lutensol® AO







Product Name	Physical form (23° C)	Molecular weight (g/mol)	Active content, %w	Water, %w	Degree of ethoxylation (approx.)	PH, ("EN 1262, solution B, ""5% in water	Foam Height [mm] Ross Miles (0.1% wt)	Density g/cm <sup>3</sup> (DIN 51757, 23° C)	Viscosity (EN 12092, 23° C, Brookfield,6	Hydroxyl No., (DIN 53240) mg KOH/g	Surface tension, mN/m (EN 14370, 1g/l)	Cloud pt, °C (EN 1890, Method E)	HLB NO.	CMC (ppm)
Lutensol® AO 3 <sup>†</sup> 	Liquid	340	100	0	3	7	13.5 13.5	0.92	60	165	28	45	8	
Lutensol® AO 7 <sup>†</sup> 	Liquid	520	100	0	7	7	101 101	0.98	800	110	28	75	12	11.292
Lutensol® AO 8	Solid	560	100	0	8	7	102 98	0.99	30 (60°C)	100	28	79	12.5	14.048
Lutensol® AO 11 <sup>†</sup> 	Solid	690	100	0	11	7	115.00 106.50	1.02	30 (60°C)	80	31	87	14	31.585

## Lutensol® AT, CS 6250, LA






Product Name	Physical form (23° C)	Molecular weight (g/mol)	Active content, %w	Water, %w	Degree of ethoxylation (approx.)	PH, ("EN 1262, solution B, ""5% in water	Foam Height [mm] Ross Miles (0.1% wt)	Density g/cm <sup>3</sup> (DIN 51757, 23° C)	Viscosity (EN 12092, 23° C, Brookfield,6	Hydroxyl No., (DIN 53240) mg KOH/g	Surface tension, mN/m (EN 14370, 1g/l)	Cloud pt, °C (EN 1890, Method E)	HLB NO.	CMC (ppm)
Lutensol® AT 25 Fl. <sup>†</sup> 	Solid	1360	100	0	25	7	83 63	1.02 (60°C)	70 (60°C)	40	45	95	16	49.019
Lutensol® AT 25 Pwd. <sup>†</sup> 	Solid	1360	100	0	25	7	83 63	1.02 (60°C)	70 (60°C)	40	45	95	16	49.019
Lutensol® AT 80 Pwd.	Solid	3780	100	0	80	7	62.5 40	1.04 (60°C)	300 (60°C)	14	50	>100	18.5	281.606
Lutensol® CS 6250 <sup>†</sup> 	Liquid		100	0		7	11.00 0.00	1.00	20		48	82		16183.13
Lutensol® LA 60 <sup>†</sup> 	Liquid		100	0	6	6-7.5	117 116	0.98	150	104-112	29.2	58-62		27.623

















## Lutensol® TDA

Product Name	Physical form (23° C)	Molecular weight (g/mol)	Active content, %w	Water, %w	Degree of ethoxylation (approx.)	PH,(“EN 1262, solution B, ““5% in water	Color, Pt-Co (APHA)	Sp.Gravity @ 25° C	Foam Height [mm] Ross Miles (0.1% wt)	Viscosity (EN 12092, 23° C, Brookfield,6	Hydroxyl No., (DIN 53240) mg KOH/g	Surface tension, mN/m (EN 14370,1g/l)	Cloud pt, °C (EN 1890, Method E)	HLB NO.	CMC (ppm)
Lutensol® TDA 3 <sup>+</sup> 	Liquid	325	100	0	3	6-7.5	70 max	0.95	11.5 0	90		28	<0°	8	
Lutensol® TDA 6 <sup>+</sup> 	Liquid	505	100	0	6	6-7.5	70 max	0.98	54 48	150		28	38-43	11	36.512
Lutensol® TDA 8 <sup>+</sup> 	Paste	550	100	0	8	6-7.5	70 max		115.5 73.8	18 (60°C)	102	31	43	12	62.821
Lutensol® TDA 8 <sup>+</sup> 90% 	Liquid	550	90	10	8	6-7.5	70 max	1		120 (25°C)	102	31	43	12	
Lutensol® TDA 9 <sup>+</sup> 	Liquid	590	100	0	9	6-7.5	70 max	1	123 85	140		27	58	13	64.540
Lutensol® TDA 10 <sup>+</sup> 	Paste	640	100	1.0 max	10	6-7.5	70 max	1.03	1.03 112.3			31	73-82	14	106.085

## Lutensol® TO

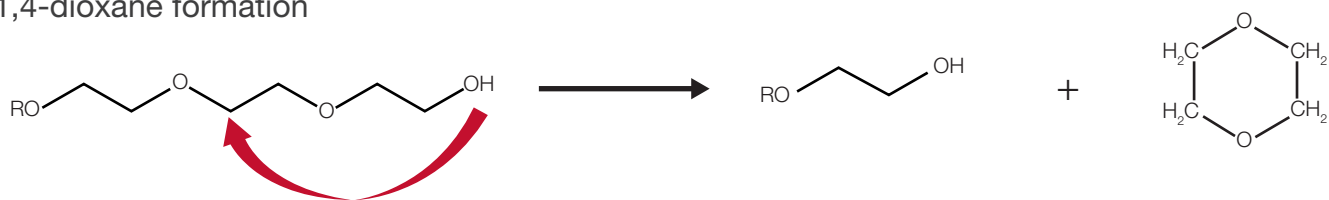
Product Name	Physical form (23° C)	Molecular weight (g/mol)	Active content, %w	Water, %w	Degree of ethoxylation (approx.)	PH,(“EN 1262, solution B, ““5% in water	Foam Height [mm] Ross Miles (0.1% wt)	Viscosity (EN 12092, 23° C, Brookfield,6	Hydroxyl No., (DIN 53240) mg KOH/g	Surface tension, mN/m (EN 14370,1g/l)	Cloud pt, °C (EN 1890, Method E)	HLB NO.	CMC (ppm)
Lutensol® TO 5 <sup>+</sup> 	Liquid	430	100	0	5	7**	18 18	50	130	27	62	10.5	
Lutensol® TO 65 <sup>+</sup> 	Liquid	485	100	0	6.5	7**		100	115	27	67	11.5	
Lutensol® TO 8 <sup>+</sup> 	Liquid	600	100	0	8	7**	115 74	150	95	28	80	13	42.718
Lutensol® TO 89 <sup>+</sup> 	Liquid	600	90	10	8	7**		120	95	28	80	13	
Lutensol® TO 12 <sup>+</sup> 	Paste	750	100	0	12	7**	125 68	40 (60°C)	75	31	88	14.5	101.700

## Lutensol® XP, XL

Product Name	Physical form (23° C)	Molecular weight (g/mol)	Active content, %w	Water, %w	Degree of ethoxylation (approx.)	Foam Height [mm] Ross Miles (0.1% wt)	Density g/cm3 (DIN 51757, 23° C)	Viscosity (EN 12092, 23° C, Brookfield,6	Hydroxyl No., (DIN 53240) mg KOH/g	Surface tension, mN/m (EN 14370,1g/l)	Flash pt. ° C (ISO 2592)	Cloud pt, °C (EN 1890, Method E)	HLB NO.	CMC (ppm)
Lutensol® XL 40 <sup>+</sup> 	Liquid		100	0	4	20 5	0.95	40	150	26	>140	46	10.5	
Lutensol® XL 70 <sup>+</sup> 	Liquid		100	0	7	105 15	0.99	70	100	27	>180	71	12.5	274.816
Lutensol® XL 79 <sup>+</sup> 	Liquid		85	15	7	105 15	1.01	120	100	27	>180	71	12.5	
Lutensol® XL 80 <sup>+</sup> 	Liquid		100	0	8	105 15	1.00	120	95	27	>180	74	13	359.878
Lutensol® XL 90 <sup>+</sup> 	Liquid		100	0	9	111 20	1.02	400	90	27	>180	77	14	307.975
Lutensol® XL 100 <sup>+</sup> 	Liquid/ Paste		100	0	10	120 35	0.99 (60°C)	30 (60°C)	75	28	>190	80	15	412.501
Lutensol® XP 30 <sup>+</sup> 	Liquid		100	0	3	0 0	0.95	25	195	27	>110	31	9	
Lutensol® XP 40 <sup>+</sup> 	Liquid		100	0	4	10 0	0.96	90	170	27	>120	44	10.5	
Lutensol® XP 50 <sup>+</sup> 	Liquid		100	0	5	20 0	0.97	90	150	26	>130	56	11.5	
Lutensol® XP 70 <sup>+</sup> 	Liquid		100	0	7	80 5	0.99	290	125	26	>140	68	13	565.845
Lutensol® XP 79 <sup>+</sup> 	Liquid		85	15	7	80 5	1.01	90	125	26	>140	68	13	
Lutensol® XP 80 <sup>+</sup> 	Liquid		100	0	8	60 5	0.98	290	110	27	>140	74	14	1081.856
Lutensol® XP 89 <sup>+</sup> 	Liquid		85	15	8	60 5	1.02	90	110	27	>140	74	14	
Lutensol® XP 90 <sup>+</sup> 	Liquid		100	0	9	95 10	0.99 (60°C)	1200	110	28	>150	76	14.5	1345.321

# Low 1,4, Dioxane Solution – Flex

## 1,4-dioxane formation



Ethoxylated product, 3 moles of EO

Ethoxylated product, 1 moles of EO

1,4- Dioxane

- Unintended side reaction, known as “intramolecular chain transfer” or “backbiting”.
- Two moles of EO are eliminated to form 1,4-Dioxane
- More moles of EO result in greater amounts of 1,4-Dioxane (backbiting can happen more than once!)

## BASF launches first of many *Flex* products formulation *Flexibility*

New alternatives to existing products offer guaranteed low 1,4-Dioxane levels, certified at batch level on every COA

Market	Product Name	1,4-Dioxane current specification limit (ppm)	1,4-Dioxane FLEX specification limit (ppm)
Home Care I&I	Pluriol® E 8000 E FLEX	Not listed on CoA	1
	Pluriol® E 600 LS FLEX	Not listed on CoA	1
	Pluriol® E 400 LS FLEX	Not listed on CoA	1
	Lutensol® TDA3 FLEX	< 25 ppm per Prop 65 Statement	3
	Lutensol® TDA9 FLEX	< 10 ppm per Prop 65 Statement	2
Standard Surfactants	Lutensol® XL 90 FLEX	< 20 ppm per Prop 65 Statement	2
	Dehypon® LS 54 FLEX	< 20 ppm per Prop 65 Statement	1
	Plurafac® SLF 180 FLEX	Not listed on CoA	1
	Texapon® N 70 FlexGold	N/A	5
	Texapon® N 70 FlexSilver	N/A	10

## More *Flex* products to be launched soon

Please contact representative for the updated list of FLEX products.

Or view our [sustainability product guide](#) for full range of bio-based, bio-degradable, safer choice certified ingredients list.

**BASF**  
We create chemistry

**Flex**  
Formulation flexibility for low  
1,4 - Dioxane requirements



# What's Next?

Reach out to your account manager for more details

Email [detergents-cleaners-na@basf.com](mailto:detergents-cleaners-na@basf.com)

Go to [hcii.basf.us](http://hcii.basf.us) for our latest innovation and insights



## Disclaimer

This document, or any answers or information provided herein by BASF, does not constitute a legally binding obligation of BASF. While the descriptions, designs, data and information contained herein are presented in good faith and believed to be accurate, it is provided for your guidance only. Because many factors may affect processing or application/use we recommend that you make tests to determine the suitability of a product for your particular purpose prior to use. It does not relieve our customers from the obligation to perform a full inspection of the products upon delivery or any other obligation.

No warranties of any kind, either express or implied, including warranties of merchantability or fitness for a particular purpose, are made regarding products described or designs, data or information set forth, or that the products, designs, data or information may be used without infringing the intellectual property rights of others. In no case shall the descriptions, information, data or designs provided be considered a part of our terms and conditions of sale.

## Safety

We know of no ill effects that could have resulted from using our products for the purpose for which they are intended and from processing them in accordance with current practice. According to the experience we have gained up to now and other information at our disposal, our products do not exert any harmful effects on health, provided that they are used properly, due attention is given to the precautions necessary for handling chemicals, and the information and advice given in our safety data sheet are observed.

## Labeling

Details about the classification and labeling of our products and further advice on safe handling are contained in the current safety data sheets.

® = Registered Trademark of BASF in many countries

TM = Trademark of BASF

### **BASF CORPORATION**

07932 Florham Park, NJ

USA

Phone : 1 973 245 6000

Fax : 1 973 245 6002