

Technical Information

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Page 1 of 16

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® = Registered trademark of
BASF Aktiengesellschaft

Lutensol® TO types

Lutensol® TO 2
Lutensol® TO 3
Lutensol® TO 5
Lutensol® TO 6
Lutensol® TO 65
Lutensol® TO 7
Lutensol® TO 79
Lutensol® TO 8

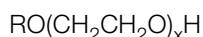
Lutensol® TO 89
Lutensol® TO 10
Lutensol® TO 109
Lutensol® TO 11
Lutensol® TO 12
Lutensol® TO 129
Lutensol® TO 15
Lutensol® TO 20
Lutensol® TO 389

Nonionic surfactants for use in detergents and cleaners and for the chemical and allied industries

Chemical nature

The Lutensol® TO types are nonionic surfactants. They are based on a saturated iso-C₁₃ alcohol.

They conform to the following structural formula.



where

R = iso-C₁₃H₂₇

x = 2, 3, 5, 6, 6,5, 7, 8, 10, 11, 12, 15, 20

The numeric code in the product name indicates the degree of ethoxylation.

Lutensol® TO 79 consists of approx. 90 % Lutensol® TO 7 and approx. 10 % water.

Lutensol® TO 89 consists of approx. 90 % Lutensol® TO 8 and approx. 10 % water.

Lutensol® TO 109 consists of approx. 85 % Lutensol® TO 10 and approx. 15 % water.

Lutensol® TO 129 consists of approx. 85 % Lutensol® TO 12 and approx. 15 % water.

Lutensol® TO 389 is a special mixture of Lutensol® TO 3 and Lutensol® TO 8 with an active content of approx. 90 % and a water content of approx. 10 %.

The Lutensol® TO types are manufactured by causing the iso-C₁₃ oxo alcohol to react with ethylene oxide in stoichiometric proportions. The ethoxylation temperature is kept as low as possible. This, combined with the high purity of the feedstocks, ensures that high-performance products with low toxicity are obtained.

Properties

Lutensol® TO 2, TO 3, TO 5, TO 6, TO 64, TO 65, TO 7 and TO 8 are cloudy liquids at 23 °C which tend to form a sediment. They are clear at 50 °C.

Lutensol® TO 79, TO 89, TO 109, TO 129 and TO 389 are clear liquids at 23 °C.

Lutensol® TO 10, TO 12, TO 15 and TO 20 are soft, slightly yellowish pastes.

Lutensol®		TO 2	TO 3	TO 5	TO 6	TO 65	TO 7
Physical form (23°C)		Liquid	Liquid	Liquid	Liquid	Liquid	Liquid
Degree of ethoxylation		approx. 2	approx. 3	approx. 5	approx. 6	approx. 6.5	approx. 7
Concentration	%	approx. 100	approx. 100	approx. 100	approx. 100	approx. 100	approx. 100
Cloud point (EN 1890)*							
Method A	°C	—	—	—	—	—	—
Method B	°C	—	—	—	—	—	—
Method C	°C	—	—	—	—	—	—
Method D	°C	approx. 37	approx. 50	approx. 66	approx. 70	approx. 71	approx. 72
Method E	°C	—	approx. 40	approx. 62	approx. 67	approx. 68	approx. 70
Molar mass (calculated from hydroxyl number)	g/mol	approx. 295	approx. 340	approx. 430	approx. 470	approx. 485	approx. 500
pH (5 % in water)**		approx. 7	approx. 7	approx. 7	approx. 7	approx. 7	approx. 7
Density (DIN 51757, 23 °C)	g/cm ³	approx. 0.90	approx. 0.93	approx. 0.96	approx. 0.97	approx. 0.98	approx. 0.98
Dropping point (DIN 51801)	°C	< 5	< 5	approx. 14	approx. 18	approx. 18	approx. 18
Congearing point (ISO 2207)	°C	< 5	< 5	< 5	< 5	< 5	approx. 5
Melting point	°C						
Viscosity (EN 12092, 23 °C, Brookfield, 60 rpm)	mPa · s	approx. 30	approx. 50	approx. 85	approx. 150	approx. 100	approx. 100
Hydroxyl number (DIN 53240)	mgKOH/g	approx. 190	approx. 165	approx. 130	approx. 120	approx. 115	approx. 110
Hydrophilic-lipophilic balance		approx. 7	approx. 9	approx. 10.5	approx. 11	approx. 11.5	approx. 12
Flash point (DIN 51376)	°C	> 100	> 100	> 100	> 100	> 100	> 100
Wetting power (EN 1772, in distilled water with 2 g/l soda ash at 23 °C)							
0.5 g/l	s	> 300	> 300	approx. 80	approx. 60	approx. 60	approx. 60
1 g/l	s	> 300	> 300	approx. 50	approx. 25	approx. 20	approx. 20
2 g/l	s	approx. 150	approx. 230	approx. 20	approx. 10	approx. 10	approx. 10
Foam formation (EN 12728, 40 °C, 2 g/l in water with 1.8 mmol Ca ²⁺ -ions/l, after 30 sec)	cm ³	approx. 10	approx. 10	approx. 50	approx. 70	approx. 90	approx. 120
Surface tension*** (EN 14370, 1 g/l in distilled water at 23 °C)	mN/m	approx. 27	approx. 27	approx. 27	approx. 27	approx. 27	approx. 27

* Cloud point according to EN 1890:

Method A : 1 g of surfactant + 100 g of distilled water

Method B : 1 g of surfactant + 100 g of NaCl solution (c = 50 g/l)

Method C : 1 g of surfactant + 100 g of NaCl solution (c = 100 g/l)

Method D : 5 g of surfactant + 45 g of diethylene glycol monobutyl ether solution (c = 250 g/l)

Method E : 5 g of surfactant + 25 g of diethylene glycol monobutyl ether solution (c = 250 g/l)

** The pH of the Lutensol® TO types can decrease during storage, but this does not have any effect on their performance.

*** Applying Harkins-Jordan correction.

Lutensol®		TO 79	TO 8	TO 89	TO 10	TO 109	TO 11
Physical form (23 °C)		Liquid	Liquid	Liquid	Liquid	Liquid	Paste
Degree of ethoxylation		approx. 7	approx. 8	approx. 8	approx. 10	approx. 10	approx. 11
Concentration	%	approx. 90	approx. 100	approx. 90	approx. 100	approx. 85	approx. 100
Cloud point (EN 1890)*							
Method A	°C	—	approx. 60	approx. 60	approx. 70	approx. 70	approx. 89
Method B	°C	—	approx. 46	approx. 46	approx. 54	approx. 54	approx. 70
Method C	°C	—	approx. 35	approx. 35	approx. 43	approx. 43	approx. 58
Method D	°C	approx. 72	approx. 80	approx. 80	approx. 81	approx. 81	approx. 85
Method E	°C	approx. 70	approx. 80	approx. 80	approx. 82	approx. 82	approx. 86
Molar mass (calculated from hydroxyl number)	g/mol	approx. 500	approx. 600	approx. 600	approx. 630	approx. 630	approx. 700
pH (5 % in water)**		approx. 7	approx. 7	approx. 7	approx. 7	approx. 7	approx. 7
Density (DIN 51757, 23 °C)	g/cm ³	approx. 0.99	approx. 1.01	approx. 1.02	approx. 0.97 (60 °C)	approx. 1.02	approx. 0.98 (60 °C)
Dropping point (DIN 51801)	°C	< 5	approx. 22	< 5	approx. 25	approx. 5	approx. 28
Congeaing point (ISO 2207)	°C	< 5	approx. 10	< 5	approx. 14	< 5	approx. 17
Melting point	°C				approx. 21		approx. 25
Viscosity (EN 12092, 23 °C, Brookfield, 60 rpm)	mPa · s	approx. 110	approx. 300	approx. 120	approx. 30 (60 °C)	approx. 150	approx. 40 (60 °C)
Hydroxyl number (DIN 53240)	mgKOH/g	approx. 110	approx. 95	approx. 95	approx. 90	approx. 90	approx. 80
Hydrophilic-lipophilic balance		approx. 12	approx. 13	approx. 13	approx. 13.5	approx. 13.5	approx. 14
Flash point (DIN 51376)	°C	> 100	> 100	> 100	> 100	> 100	> 100
Wetting power (EN 1772, in distilled water with 2 g/l soda ash at 23 °C)							
0.5 g/l	s	approx. 60	approx. 70	approx. 90	approx. 80	approx. 80	approx. 100
1 g/l	s	approx. 20	approx. 25	approx. 30	approx. 30	approx. 35	approx. 40
2 g/l	s	approx. 5	approx. 10	approx. 10	approx. 10	approx. 10	approx. 20
Foam formation (EN 12728, 40 °C, 2 g/l in water 1,8 mmol Ca ²⁺ -ions/l, after 30 sec)	cm ³	approx. 50	approx. 550	approx. 550	approx. 600	approx. 600	approx. 600
Surface tension*** (EN 14370, 1 g/l in distilled water at 23 °C)	mN/m	approx. 27	approx. 28	approx. 28	approx. 28	approx. 29	approx. 30

* Cloud point according to EN 1890:

Method A : 1 g of surfactant + 100 g of distilled water

Method B : 1 g of surfactant + 100 g of NaCl solution (c = 50 g/l)

Method C : 1 g of surfactant + 100 g of NaCl solution (c = 100 g/l)

Method D : 5 g of surfactant + 45 g of diethylene glycol monobutyl ether solution (c = 250 g/l)

Method E : 5 g of surfactant + 25 g of diethylene glycol monobutyl ether solution (c = 250 g/l)

** The pH of the Lutensol® TO types can decrease during storage, but this does not have any effect on their performance.

*** Applying Harkins-Jordan correction.

Lutensol®		TO 12	TO 129	TO 15	TO 20	TO 389
Physical form (23 °C)		Paste	Liquid	Paste	Paste	Liquid
Degree of ethoxylation		approx. 12	approx. 12	approx. 15	approx. 20	approx. 7
Concentration	%	approx. 100	approx. 85	approx. 100	approx. 100	approx. 90
Cloud point (EN 1890)*						
Method A	°C	approx. 93	approx. 93	> 100	> 100	—
Method B	°C	approx. 75	approx. 75	approx. 80	approx. 86	—
Method C	°C	approx. 62	approx. 62	approx. 66	approx. 73	—
Method D	°C	approx. 87	approx. 87	approx. 88	approx. 90	approx. 72
Method E	°C	approx. 88	approx. 88	approx. 89	approx. 92	approx. 70
Molar mass (calculated from hydroxyl number)	g/mol	approx. 750	approx. 750	approx. 850	approx. 1000	approx. 500
pH (5 % in water)**		approx. 7	approx. 7	approx. 7	approx. 7	approx. 7
Density (DIN 51757, 23 °C)	g/cm ³	approx. 0.99 (60 °C)	approx. 1.04	approx. 1.00 (60 °C)	approx. 1.02 (60 °C)	approx. 0.99
Dropping point (DIN 51801)	°C	approx. 30	approx. 8	approx. 33	approx. 38	approx. 5
Congeaing point (ISO 2207)	°C	approx. 20	< 5	approx. 22	approx. 26	< 5
Melting point	°C	approx. 29		approx. 31	approx. 36	
Viscosity (EN 12092, 23 °C, 23 °C, Brookfield, 60 rpm)	mPa · s	approx. 40 (60 °C)	approx. 200	approx. 50 (60 °C)	approx. 60 (60 °C)	approx. 100
Hydroxyl number (DIN 53240)	mgKOH/g	approx. 75	approx. 75	approx. 65	approx. 55	approx. 110
Hydrophilic-lipophilic balance		approx. 14.5	approx. 14.5	approx. 15.5	approx. 16.5	approx. 12
Flash point (DIN 51376)	°C	> 100	> 100	> 100	> 100	> 100
Wetting power (EN 1772, in distilled water with 2 g/l soda ash at 23 °C)						
0.5 g/l	s	approx. 120	approx. 120	approx. 160	> 300	approx. 70
1 g/l	s	approx. 50	approx. 55	approx. 90	> 300	approx. 30
2 g/l	s	approx. 20	approx. 20	approx. 40	approx. 200	approx. 10
Foam formation (EN 12728, 40 °C, 2 g/l in water with 1,8 mmol Ca ²⁺ -ions/l, after 30 sec)	cm ³	approx. 600	approx. 600	approx. 600	approx. 600	approx. 90
Surface tension*** (EN 14370, 1 g/l in distilled water at 23 °C)	mN/m	approx. 31	approx. 31	approx. 32	approx. 36	approx. 27

* Cloud point according to EN 1890:

Method A : 1 g of surfactant + 100 g of distilled water

Method B : 1 g of surfactant + 100 g of NaCl solution (c = 50 g/l)

Method C : 1 g of surfactant + 100 g of NaCl solution (c = 100 g/l)

Method D : 5 g of surfactant + 45 g of diethylene glycol monobutyl ether solution (c = 250 g/l)

Method E : 5 g of surfactant + 25 g of diethylene glycol monobutyl ether solution (c = 250 g/l)

** The pH of the Lutensol® TO types can decrease during storage, but this does not have any effect on their performance.

*** Applying Harkins-Jordan correction.

The above information is correct at the time of going to press. It does not necessarily form part of the product specification.

A detailed product specification is available from your local BASF representative.

Solubility

Details on the solubility of the Lutensol® TO types in various solvents are given in the table below.

Solubility of the Lutensol® TO types (10 % solutions at 23 °C)

	Distilled water	Potable water (approx. 2.7 mmol Ca ²⁺ -ions/l)	Caustic soda (5 %)	Hydro-chloric acid (5 %)	Salt solution (5 %)	Mineral oils	Alcohols	Aromatic hydro-carbons
Lutensol® TO 2	–	–	–	–	–	+	+	+
Lutensol® TO 3	–	–	–	–	–	+	+	+
Lutensol® TO 5	–	–	–	–	–	+	+	+
Lutensol® TO 6	–	–	–	–	–	+	+	+
Lutensol® TO 65	–	–	–	–	–	+	+	+
Lutensol® TO 7	–	–	–	–	–	+	+	+
Lutensol® TO 79	–	–	–	–	–	+	+	+
Lutensol® TO 8	+	+	–	+	+	(+)	+	–
Lutensol® TO 89	+	+	+	+	+	+	+	–
Lutensol® TO 10	+	+	+	+	+	–	+	–
Lutensol® TO 109	+	+	+	+	+	(+)	+	–
Lutensol® TO 11	+	+	+	+	+	–	+	–
Lutensol® TO 12	+	+	+	+	+	–	+	–
Lutensol® TO 129	+	+	+	+	+	(+)	+	–
Lutensol® TO 15	+	+	+	+	+	–	+	–
Lutensol® TO 20	+	+	+	+	+	–	+	–
Lutensol® TO 389	–	–	–	–	–	(+)	+	+

+ = Clear solution

(+) = Sparingly soluble

– = Insoluble

Viscosity

The relationship between viscosity and temperature is always an important point to consider as far as storage and shipping are concerned. This is shown in the following diagram (mPa · s, Brookfield LVT).

Viscosity at °C	0	10	20	23	30	40	50	60
Lutensol® TO 2	250	120	60	30	20	10	< 10	< 10
Lutensol® TO 3	350	150	70	50	35	25	15	10
Lutensol® TO 5	> 10 ⁵	2600	110	85	50	30	20	10
Lutensol® TO 6	> 10 ⁵	4500	180	150	60	30	20	15
Lutensol® TO 65	16500	1700	600	100	70	30	25	20
Lutensol® TO 7	> 10 ⁵	75000	500	100	60	40	30	20
Lutensol® TO 79	550	250	130	110	75	50	30	20
Lutensol® TO 8	> 10 ⁵	> 10 ⁵	> 10 ⁵	300	75	50	40	25
Lutensol® TO 89	1200	250	160	120	70	40	25	20
Lutensol® TO 10	> 10 ⁵	> 10 ⁵	2000	1000	450	150	50	30
Lutensol® TO 109	1200	600	220	150	100	70	35	25
Lutensol® TO 11	> 10 ⁵	> 10 ⁵	3000	1500	700	200	70	40
Lutensol® TO 12	> 10 ⁵	> 10 ⁵	4500	2000	800	200	80	40
Lutensol® TO 129	1200	650	280	200	150	80	50	35
Lutensol® TO 15	> 10 ⁵	> 10 ⁵	> 10 ⁵	10000	1500	250	100	50
Lutensol® TO 20	> 10 ⁵	> 10 ⁵	> 10 ⁵	> 10 ⁵	2000	300	120	60
Lutensol® TO 389	700	350	130	100	70	35	30	20

We would recommend preparing stock solutions with a concentration of 10–25 % if the Lutensol® TO types are to be used in the form of very dilute solutions or if they are to be mixed with other solutions. This makes it very much easier to dilute them later on.

The rate at which the Lutensol® TO types dissolve can be increased by adding alcohols, glycols and other solubilizers.

The Lutensol® TO types can form fairly stiff gels at certain concentrations when water is added. The figures below were measured with a Brookfield viscometer at 23 °C and 60 rpm.

The viscosity of selected Lutensol® TO types as a function of concentration (in mPa · s)

Water content (%)	Lutensol® TO 2	Lutensol® TO 3	Lutensol® TO 5	Lutensol® TO 6	Lutensol® TO 65	Lutensol® TO 7	Lutensol® TO 8	Lutensol® TO 89
10	50	70	80	110	120	150	130	130
20	100	80	140	4000	150	250	14000	45000
30	130	160	30000	33000	35000	20000	30000	35000
40	120	200	30000	6000	40000	35000	6400	26000
50	100	200	> 10 ⁵	2000	28000	10000	17600	10000
60	70	200	> 10 ⁵	1000	8000	5000	> 10 ⁵	3200
70	20	200	30000	300	2500	1500	350	1000
80	10	30	1000	200	700	400	25	400
90	10	20	280	70	150	250	10	100
Water content (%)	Lutensol® TO 10	Lutensol® TO 109	Lutensol® TO 11	Lutensol® TO 12	Lutensol® TO 129	Lutensol® TO 15	Lutensol® TO 20	Lutensol® TO 389
10	135	175	150	150	200	160	200	120
20	150	> 10 ⁵	200	220	300	200	250	10000
30	4800	2000	1000	800	> 10 ⁵	600	1200	12000
40	1500	3500	> 10 ⁵	> 10 ⁵	> 10 ⁵	> 10 ⁵	> 10 ⁵	10000
50	> 10 ⁵	> 10 ⁵	> 10 ⁵	> 10 ⁵	> 10 ⁵	> 10 ⁵	> 10 ⁵	1000
60	> 10 ⁵	> 10 ⁵	> 10 ⁵	1700	300	600	> 10 ⁵	500
70	450	135	800	300	70	100	400	200
80	120	65	200	150	50	40	50	150
90	20	15	30	20	30	20	20	20

Storage

- The Lutensol® TO types should be stored indoors in a dry place. Storerooms must not be overheated.
- They are hygroscopic and readily soluble in water, with the result that they absorb moisture very quickly. Drums must be resealed each time they are opened.
- The storage temperature should not be allowed to fall substantially below 20 °C. The setting points of these products also need to be taken into account.
- Lutensol® TO 2, TO 3, TO 5, TO 6, TO 65, TO 7, TO 79 and TO 8, are cloudy liquids at room temperature, and they tend to form a sediment. This cloudiness can be dissipated by heating them to approx. 50 °C.
- Liquid that has solidified or that shows signs of sedimentation should be heated to 50–60 °C and homogenized before it is processed.

- f) Drums that have solidified or that have begun to precipitate should be reconstituted by gentle heating, preferably in a heating cabinet. The temperature must not be allowed to exceed 70 °C. This also applies if drums are heated by external electrical elements.

Internal electrical elements should not be used because of the localized anomalies in temperature that they cause.

- g) The Lutensol® TO types must be blanketed with nitrogen if they are stored in heated tanks (at 50 - 70 °C) to prevent them from coming into contact with air. Constant, gentle stirring helps to prevent them being discoloured as a result of prolonged contact with electrical elements or external heating coils.

Materials

The following materials can be used for tanks and drums.

- a) AISI 321 stainless steel (X6 CrNiTi 1810)
- b) AISI 316 Ti stainless steel (X10 CrNiMoTi 1810)

Shelf life

The Lutensol® TO types have a shelf life of at least two years in their original packaging, provided they are stored properly and drums are kept tightly sealed.

Applications

The Lutensol® TO types belong to a group of nonionic surfactants that have established themselves in detergents and cleaners, and in other branches of the chemical industry, by virtue of the high levels of surface activity that they display. Their main area of application is in detergents and cleaners for household, industrial and institutional use.

Because they are nonionic, the Lutensol® TO types can be combined very effectively with anionic, cationic and nonionic surfactants and auxiliaries. They are fully compatible with alkylaryl sulphonates (Lutensit® A-LB types), ether sulphates (Lutensit® AS 2230) and other sulphated and sulphonated products. This enables synergistic effects and very high levels of performance to be obtained. They are also compatible with the Lutensit® KLC types (cationic products based on dimethyl fatty alkylbenzeneammonium chloride) and with other nonionic surfactants such as our Lutensol® A N, AO, AP, AT, F, GD, ON, XL and XP types, and with the low-foaming surfactants in our Plurafac® LF and our Pluronic® PE and RPE ranges. Their compatibility with dyes, pigments, protective colloids, thickeners and other substances with a molar mass in the upper range is also very good.

The versatility of the Lutensol® TO types is such that they can be used to formulate acid, alkaline and neutral cleaners that satisfy the most varied demands. They are very effective emulsifiers in combination with Emulan® and other products from the Lutensol® range.

Laundry detergents

The Lutensol® TO types and other similar nonionic surfactants have been gaining in importance in recent years, for the following reasons.

1. Detergent manufacturers have been working steadily for years to reduce the amount of pentasodium triphosphate (STP) in their products, or to eliminate it completely, for ecological reasons. The proportion of nonionic surfactants in detergent formulations, in terms of their total surfactant content, has had to be increased to compensate for the drop in performance caused by replacing STP with other builders. Fatty alcohol ethoxylates, especially those with a medium-length alkyl chain, have been shown to provide substantial increases in detergency in extensive trials.

2. Laundry detergents that contain predominately anionic surfactants are only really effective on cotton fabrics at high temperatures and at high concentrations. Detergents, especially all-temperature detergents, have to contain a large proportion of nonionic surfactants if they are to provide acceptable results on cotton, synthetic fibres and blended fabrics. The detergency of medium-chain fatty alcohol ethoxylates is substantially better than that of anionic surfactants, especially in the low-to-medium temperature range and at reduced concentrations.
3. Medium-chain fatty alcohol ethoxylates can be used to control foaming in household detergents. Their degree of ethoxylation can be in the lower or upper range, depending on the temperatures for which detergents are designed. Detergents are often expected to produce different amounts of foam at different temperatures, and this is normally achieved simply by adjusting the proportions of linear alkylbenzenesulphonate, fatty alcohol sulphate, soap and nonionic surfactants, but special antifoams can be added if required.
4. Nonionic surfactants with ca. 7 mol of EO are the best choice for liquid laundry detergents, because they are the most effective in the 60 °C temperature range. The popularity of Lutensol® TO 7 and Lutensol® TO 79 has been increasing in line with the increasing demand for household liquid detergents.

High-temperature powders

We would recommend Lutensol® TO 8, Lutensol® TO 10, Lutensol® TO 11 and Lutensol® TO 12 for use at temperatures of up to 95 °C, either alone or in combination with Lutensol® AO types.

Machine-washing detergents for use at 60°C

The Lutensol® TO types with a medium degree of ethoxylation perform best at 60 °C, and they perform well in low-phosphate and phosphate-free formulations. We would therefore recommend using Lutensol® TO 7, Lutensol® TO 79, Lutensol® TO 8 and Lutensol® TO 89 here, either alone or in combination with Lutensol® AO types.

Lutensol® TO 389 has been shown to perform very well in low-foaming, low-phosphate and phosphate-free detergents and in institutional laundry detergents, either alone or in combination with Lutensol® AO 3109.

Lutensol® TO 389, TO 5, TO 6 and TO 65 have been shown to remove fatty soil very effectively in combination with Lutensol® TO 8.

Combinations of Lutensol® TO 5 or TO 6 and Plurafac® LF 403 can be employed in low-foaming institutional laundry detergents for use at 60–70 °C.

Light-duty liquids and powders, detergents for wool, hand-washing detergents

Lutensol® TO 7, TO 79, TO 8, TO 89 and TO 389 perform very well in detergents of this type in combination with Lutensol® AO 3109 and Plurafac® LF 400 or Plurafac® LF 401.

Cleaners

The Lutensol® TO types have high detergency and high soil-dispersing capacity, and they are very effective emulsifiers and wetting agents. It is for this reason that they are frequently employed in detergents and cleaners and in other industrial processes that require this type of performance. The Lutensol® TO types with a low degree of ethoxylation perform very well as emulsifiers for mineral oils, which is particularly useful in cleaners that are applied cold.

The Lutensol® TO types with a degree of ethoxylation in the middle of the range perform particularly well in all-purpose cleaners and in cleaners for industrial, household and institutional use that are applied at higher temperatures.

Large amounts of acids, alkalis, salts and organic solvents may have to be added to some formulations in order to fulfil special requirements. High concentrations of inorganic salts, bases and acids can impair the solubility of the Lutensol® TO types. Electrolytes of this type do not cause the Lutensol® TO types to decompose, but they can cause surfactant solutions to become cloudy or to separate out. Nevertheless, the performance of solutions of Lutensol® TO types is not affected by turbidity provided they are still homogeneous.

Neutral cleaners

The water-soluble products in the range - Lutensol® TO 8, TO 10, TO 12, TO 89, TO 109 and TO 129 - perform particularly well in neutral cleaners in combination with anionic surfactants from our Lutensit range (especially Lutensit® A-LB types), dispersing agents (Sokalan® CP and PA types) and chelating agents (Trilon®). It can be advisable to add a solubilizer such as cumene sulphonate to highly concentrated formulations.

Neutral metal cleaners

Neutral cleaners and degreasers with a corrosion-inhibiting action for metal pretreatment can be formulated from products such as Korantin® MAT, Korantin® PAT, Korantin® PM and Korantin® PP. The water-soluble surfactants in the range, especially Lutensol® TO 8 or TO 89 and Lutensol® TO 10 or TO 109, are very effective wetting agents for use in this type of formulation.

Alkaline cleaners

Cleaners of this type are based on caustic alkalis and carbonates, silicates and phosphates. They are mainly used to clean metal before it is plated, coated, phosphatized or anodized. Lutensol® TO 8, TO 10, TO 11 and TO 12 perform best, in combination with anionic surfactants such as Lutensit® TC-APS 35 and Lutensit® A-LB types, chelating agents (Trilon®) and dispersing agents (Tamol® N types).

Lutensol® TO 89, TO 109 and TO 129 can also be employed in liquid alkaline cleaners.

Acid cleaners

Lutensol® TO 8, TO 10, TO 11, TO 12, TO 89, TO 109 and TO 129 can be used in pickling solutions, degreasers, descalers and derusters based on hydrochloric, sulphuric, phosphoric or sulphamic acid. Formulations can also contain Lutensol® FA 12, Lutensit® TC-KLC 50 and corrosion inhibitors such as our Korantin® BH types, Korantin® PM and Korantin® PP.

Household cleaners

Household cleaners are mostly neutral, but they can be slightly alkaline or slightly acidic. They can be formulated with Lutensol® TO 5, TO 6, TO 65, TO 7, TO 79, TO 8, TO 10, TO 11, TO 89 and TO 109 together with other anionic and nonionic surfactants, chelating agents (Trilon®) and dispersing agents (Sokalan®).

Lutensol® TO 12, TO 15 and TO 20 can be used alongside our Pluriol® E types as binders for solid cleaners.

Solvent-based cleaners

Lutensol® TO 3 and Lutensol® TO 5 can be used alongside Emulan® P to emulsify hydrocarbons such as kerosene and white mineral spirits in emulsion-type cleaners and solvent-based cleaners that are applied cold.

Emulsification

The Lutensol® TO types generally perform well as emulsifiers, although some perform better than others. Their practical performance as emulsifiers can be assessed according to their hydrophilic-lipophilic balance, which correlates with their degree of ethoxylation.

The Lutensol® TO types can be combined with other emulsifiers from our nonionic Emulan® and anionic Emulphor® ranges, and with alkali soaps, amine soaps and sulphonated oils. Graduated tests are the most effective means of determining the best emulsifiers or combinations of emulsifiers and the amounts required. Tests are indispensable if emulsions are subjected to severe demands due to the presence of electrolytes, finely divided suspended solids or water-soluble, organic solvents. Special emulsifier combinations often have to be employed to cope with exceptional thermal or mechanical stress.

Lutensol® TO 5, TO 6, TO 65, TO 7, TO 8, TO 10, TO 11, TO 12, TO 15, TO 20 and TO 389 can be used to emulsify aromatic solvents such as benzene, toluene, xylene and solvent naphtha.

Lutensol® TO 7, TO 8, TO 10, TO 11, TO 12, TO 15 and TO 20 can be used in emulsion polymerization process to emulsify monomers such as styrene, acrylic and vinyl compounds, either alone or in combination with anionic emulsifiers such as Emulphor® OPS 25.

Dispersing

The dispersing capacity of surfactants, which plays an important part in cleaning and emulsification processes, can be their single most important attribute in situations in which sparingly soluble solids have to be dispersed in water, polar solvents or mixtures of water and solvents. The Lutensol® TO types are effective dispersing agents in grinding and milling processes, and they can be used to disperse the solids generated by precipitation, coagulation and other chemical reactions. They can be used alone or in combination with protective colloids, depending on the particular application.

Wetting

The Lutensol® TO types are very effective wetting agents. They can be employed in many branches of industry in a variety of refining, mixing, impregnating and surface-treatment processes in aqueous media. No specific recommendations can be made on account of the diversity of these processes. Again, graduated tests under practical conditions are the most effective means of determining the best products for specific applications.

Other applications

There are many other applications for the Lutensol® TO types in the manufacture of leather, paper, paints and building products.

Lutensol® TO 3 and Lutensol® TO 3 can be employed as feedstocks in the production of ether sulphates.

Substitutes for alkylphenol ethoxylates (APEO)

In July 2003, the European Parliament published Directive 2003/53/EC “....relating to restrictions on the marketing and use of certain dangerous substances and preparations (nonylphenol, nonylphenol ethoxylates....” in the Official Journal. This legislation was introduced in response to demands to minimise the risks posed by nonylphenol that were identified in the EU Risk Assessment.

This legislation has been in force since January 2005.

The directive covers all applications that result in discharges, emissions or losses to the environment and has the aim of minimising discharges of nonylphenol and nonylphenol ethoxylates into receiving waters. Nonylphenol and nonylphenol ethoxylates may only be brought into circulation at concentrations of less than 0.1 % w/w as substances or as ingredients of preparations in applications in which they are discharged.

The applications that are affected by this directive include commercial cleaning, household cleaning and textile and leather processing.

These requirements also apply to products that are imported from outside Europe.

BASF supplies a variety of surfactants with comparable performance such as the Lutensol® TO types which, along with the Lutensol® XL and XP types, can be used as environmentally friendly alternatives.

Formulations

Suggested formulations are contained in the following publications.

Cleaners and shampoos
Liquid detergents
Powder detergents
Technical cleaners
Specialty chemicals for metal pretreatment

Safety

We know of no ill effects that could have resulted from using the Lutensol® TO types for the purpose for which they are intended and from processing them in accordance with current practice.

According to the experience we have gained over many years and other information at our disposal, the Lutensol® TO types 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 sheets are observed.

Labelling

Please refer to the latest safety data sheets for detailed, up-to-date information on classification, labelling and product safety.

Note

The data contained in this publication are based on our current knowledge and experience. In view of the many factors that may affect processing and application of our product, these data do not relieve processors from carrying out their own investigations and tests; neither do these data imply any guarantee of certain properties, nor the suitability of the product for a specific purpose. Any descriptions, drawings, photographs, data, proportions, weights etc. given herein may change without prior information and do not constitute the agreed contractual quality of the product. It is the responsibility of the recipient of our products to ensure that any proprietary rights and existing laws and legislation are observed.

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