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Lutensol® ON types

Lutensol® ON 30
Lutensol® ON 50
Lutensol® ON 60
Lutensol® ON 66
Lutensol® ON 70
Lutensol® ON 80
Lutensol® ON 110

Nonionic surfactants for detergents and cleaners, and for the chemical and allied industries

Chemical nature

The Lutensol® ON types are nonionic surfactants. They are alkyl polyethylene glycol ethers made from a saturated synthetic, short-chain fatty alcohol.

They conform to the following formula.

$RO(CH_2CH_2O)_xH$

R = saturated, synthetic, short-chain fatty alcohol

x = 3, 5, 6, 6.5, 7, 8 or 11

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

The Lutensol® ON types are manufactured by causing the fatty 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® ON 30, ON 50, ON 60, ON 66, ON 70 and ON 80 are clear or cloudy, virtually colourless liquids. Lutensol® ON 110 is a soft, colourless paste.

The most important properties of the Lutensol® ON types are shown in the table below. The figures quoted are averages from representative batches of product.

Lutensol®		ON 30	ON 50	ON 60	ON 66
Physical form (23 °C)		liquid	liquid	liquid	liquid
Degree of ethoxylation		ca. 3	ca. 5	ca. 6	ca. 6.5
Concentration	%	ca. 100	ca. 100	ca. 100	ca. 100
Cloud point (EN 1890) *					
Method A	°C	–	–	ca. 36	ca. 53
Method B	°C	–	–	–	ca. 39
Method C	°C	–	–	–	ca. 29
Method D	°C	ca. 60	ca. 70	ca. 71	ca. 76
Method E	°C	ca. 53	ca. 67	ca. 68	ca. 75
Molar mass (calc. from OH)	g/mol	ca. 290	ca. 380	ca. 430	ca. 450
pH (EN 1262, Solution B) **		ca. 7	ca. 7	ca. 7	ca. 7
Density (DIN 51757, 23 °C)	g/cm^3	ca. 0.95	ca. 0.98	ca. 0.99	ca. 1.00
Dropping point (DIN 51801)	°C	ca. 5	ca. 10	ca. 12	ca. 13
Solidification point (ISO 2207)	°C	< 5	< 5	< 5	< 5
Viscosity (EN 12092, 23 °C, Brookfield, 60 rpm)	mPa·s	ca. 40	ca. 160	ca. 180	ca. 180
Hydroxyl number (DIN 53240)	mg KOH/g	ca. 190	ca. 150	ca. 130	ca. 125
HLB value		ca. 9	ca. 11.5	ca. 12	ca. 12.5
Wetting (EN 1772, in dist. water, 23 °C, 2 g Soda ash/l)					
0.5 g/l	s	ca. 60	ca. 70	ca. 70	ca. 120
1 g/l	s	ca. 40	ca. 20	ca. 20	ca. 30
2 g/l	s	ca. 10	ca. 5	ca. 5	ca. 10
Foam formation (EN 12728, 40 °C, 2 g/l in water with a hardness of 1.8 mmol Ca^{2+}-Ions/l, after 30 s)	cm^3	ca. 70	ca. 500	ca. 500	ca. 650
Surface Tension *** (DIN 53914, 1 g/l, 23 °C, dist. water)	mN/m	ca. 26	ca. 27	ca. 27	ca. 27

Lutensol®		ON 70	ON 80	ON 110
Physical form (23°C)		liquid	liquid	paste
Degree of ethoxylation		ca. 7	ca. 8	ca. 11
Concentration	%	ca. 100	ca. 100	ca. 100
Cloud point (EN 1890) *				
Method A	°C	ca. 60	ca. 80	ca. 98
Method B	°C	ca. 47	ca. 62	ca. 78
Method C	°C	ca. 36	ca. 51	ca. 66
Method D	°C	ca. 78	ca. 82	ca. 88
Method E	°C	ca. 76	ca. 81	ca. 88
Molar mass (calc. from OH)	g/mol	ca. 470	ca. 510	ca. 640
pH (EN 1262, Solution B)**		ca. 7	ca. 7	ca. 7
Density (DIN 51757, 23 °C)	g/cm^3	ca. 1.00	ca. 1.02	ca. 1.00 (60 °C)
Dropping point (DIN 51801)	°C	ca. 15	ca. 20	ca. 26
Solidification point (ISO 2207)	°C	< 5	ca. 7	ca. 15
Viscosity (EN 12092, 23 °C Brookfield, 60 rpm)	mPa·s	ca. 200	ca. 800	ca. 30 (60 °C)
Hydroxyl number (DIN 53240)	mg KOH/g	ca. 120	ca. 110	ca. 85
HLB value		ca. 13	ca. 14	ca. 15
Wetting (EN 1772, in dist. water, 23 °C, 2 g Soda ash/l)				
0.5 g/l	s	ca. 110	ca. 140	> 300
1 g/l	s	ca. 25	ca. 40	ca. 120
2 g/l	s	ca. 5	ca. 10	ca. 20
Foam formation (EN 12728, 40 °C, 2 g/l in water with a hardness of 1.8 mmol Ca^{2+}-Ions/l, after 30 s)	cm^3	ca. 600	ca. 650	ca. 650
Surface Tension *** (DIN 53914, 1 g/l, 23 °C, dist. water)	mN/m	ca. 27	ca. 30	ca. 34

* *Cloud point EN 1890 :*
Method A : 1 g surfactant + 100 g distilled water
Method B : 1 g surfactant + 100 g NaCl solution (c = 50 g/l)
Method C : 1 g surfactant + 100 g NaCl solution (c = 100 g/l)
Method D : 5 g surfactant + 45 g of diethylene glycol monobutyl ether solution (c = 250 g/l)
Method E : 5 g surfactant + 25 g of diethylene glycol monobutyl ether solution (c = 250 g/l)

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

*** *Applying Harkins-Jordan correction*

The stability of 10 % solutions of Lutensol® ON at 23 °C

	Distilled water	Potable water (ca. 2.7 mmol Ca^{2+}-ions/l)	Caustic soda (5 %)	Hydro-chloric acid (5 %)	Mineral oil	Ethanol	Aromatic Hydro-carbons
Lutensol® ON 30	–	–	–	○	+	+	+
Lutensol® ON 50	+	+	○	+	○	+	+
Lutensol® ON 60	+	+	○	+	○	+	+
Lutensol® ON 66	+	+	–	+	○	+	+
Lutensol® ON 70	+	+	–	+	○	+	+
Lutensol® ON 80	+	+	+	+	–	+	+
Lutensol® ON 110	+	+	+	+	–	+	+

\+ = clear solution
○ = cloudy solution
– = insoluble

We recommend preparing 10 – 25 % stock solutions of Lutensol® ON types if they are to be used in the form of very dilute solutions, or if they are to be added to other solutions. This makes it very much easier to dilute them later.

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

Viscosity

The relationship between viscosity and temperature is always an important point to consider when Lutensol® ON types are being stored or transported. This is shown in the following table.

Viscosity at (°C)	0	10	20	23	30	40	50	60
Lutensol® ON 30	500	200	70	40	30	20	15	10
Lutensol® ON 50	60000	1000	200	160	60	30	20	10
Lutensol® ON 60	$> 10^5$	2000	250	180	60	30	20	10
Lutensol® ON 66	$> 10^5$	3000	250	180	60	30	20	10
Lutensol® ON 70	$> 10^5$	$> 10^5$	300	200	80	40	30	20
Lutensol® ON 80	$> 10^5$	$> 10^5$	30000	800	200	40	30	20
Lutensol® ON 110	$> 10^5$	$> 10^5$	$> 10^5$	$> 10^5$	500	80	50	30

The Lutensol® ON 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 Lutensol® ON types (mPa·s) as a function of concentration

Water content (%)	Lutensol® ON 30	Lutensol® ON 50	Lutensol® ON 60	Lutensol® ON 66	Lutensol® ON 70	Lutensol® ON 80	Lutensol® ON 110
0	40	160	180	180	200	800	–
10	50	60	60	60	80	110	150
20	60	160	80	80	90	130	160
30	100	5000	900	500	140	140	180
40	10000	4000	2000	800	140	170	230
50	3000	400	110	110	170	160	180
60	10000	70	60	60	110	100	100
70	6000	40	40	40	50	30	40
80	1000	20	30	30	20	10	20
90	300	10	10	10	10	10	10

Storage

a) The Lutensol® ON types should be stored indoors in their original packaging, which should be kept tightly sealed.

b) 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.

c) The storage temperature should not be allowed to fall substantially below 20 °C, and storerooms must not be overheated.

d) The Lutensol® ON types can become slightly cloudy if they are stored at low temperatures, but this has no effect on their performance.

This cloudiness can be dissipated by heating them to 20 – 30 °C, or 50 °C in the case of Lutensol® ON 110.

e) Liquid that has solidified or that shows signs of precipitation should be heated to around 30 °C (Lutensol® ON 110: 50 °C) and rehomogenized 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 60 °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® ON types must be blanketed with nitrogen if they are stored in heated tanks (at 50 – 60 °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 304 stainless steel (X6CrNiTi1810)
b) AISI 316 stainless steel (X10CrNiMoTi1810)
c) Iron lined with a phenolic resin

Shelf life

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

Applications

The Lutensol® ON types belong to a group of nonionic surfactants that have established themselves in the detergents and cleaners industry, and in other branches of industry by virtue of the high levels of surface activity they display. Their detergency and soil-dispersing capacity are also very pronounced, with the result that they perform particularly well in household, industrial and institutional laundry detergents.

Their high surface activity makes them particularly effective wetting agents for use in water and other polar liquids.

The Lutensol® ON types perform particularly well in products that contain only small or moderate amounts of neutral salts or bases such as caustic alkalis, soluble carbonates, silicates and phosphates. They also perform well in formulations that contain no inorganic substances.

Compatibility

Because they are nonionic, the Lutensol® ON types can be combined with anionic, cationic and nonionic surfactants and auxiliaries. They are fully compatible with alkylaryl sulfonates (Lutensit® A-LB types), ether sulfates and other sulfated and sulfonated products. This enables synergistic effects and very high levels of performance to be obtained. They are also compatible with Lutensit® TC-KLC 50 (cationic biocides based on dimethyl fatty alkylbenzylammonium chloride) and with other nonionic surfactants such as our Lutensol® A, AO, AT, TO, XP, XL and F types, and the low-foaming surfactants in our Plurafac® LF and 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® ON types is such that they can be used to formulate acid, alkaline and neutral cleaners that satisfy the most varied requirements. They are very effective emulsifiers in combination with Emulan® and other products from the Lutensol® range.

The Lutensol® ON types with a low degree of ethoxylation have a spontaneous emulsifying effect, which is very useful in emulsion-type cleaners and cleaners that are applied cold.

Cleaners

We recommend the following Lutensol® types for the products listed below.

Household cleaners

Dishwashing detergents and cleaners for floors, sanitary ware, tiles and enamel can be formulated with Lutensol® ON 50, ON 60, ON 66, ON 70, ON 80 and ON 110 together with other Lutensol® types, Lutensit® A types, dispersing agents (Sokalan®) and chelating agents (Trilon®).

Neutral water-based cleaners

The water-soluble products in the range – all except Lutensol® ON 30 – perform particularly well in neutral cleaners in combination with anionic surfactants from our Lutensit range (especially Lutensit® A-LB types), dispersing agents (Sokalan®) and chelating agents (Trilon®).

Alkaline water- based cleaners	Cleaners of this type are used to clean metal before it is plated, coated, phosphatized or anodized. Lutensol® ON 60, ON 66, ON 70, ON 80 and ON 110 perform best, in combination with Lutensit® A-PS, other Lutensol® types, dispersing agents (Sokalan®) and chelating agents (Trilon®).
Acid water- based cleaners	Lutensol® ON 50, ON 60, ON 66, ON 70, ON 80 and ON 110 are used in pickling solutions, degreasers, descalers and derusters based on hydrochloric, sulfuric, phosphoric or amidosulfonic acid. Formulations also contain Lutensol® FA 12, Lutensit® TC-KLC 50 or Lutensit® A-PS, and corrosion inhibitors such as Korantin® BH.
Contract cleaning, disinfectants	Disinfectants and cleaners for offices, etc., can be formulated with Lutensol® ON 50, ON 60, ON 66, ON 70, ON 80 and ON 110, Lutensol® A 8, FSA 10, FA 12, Lutensit® TC-KLC 50 or Lutensit® A-LB types, dispersing agents (Sokalan®) and chelating agents (Trilon®).
Solvent-based cleaners	Lutensol® ON 30 can be used alongside Emulan® A, P and PO to emulsify hydrocarbons such as mineral spirits, kerosene and diesel oil in solvent-based cleaners that are applied cold. Cleaners of this type are used to clean motor vehicles, engines, machine parts, road and rail tankers, etc., and to degrease metal.
Toilet cones	Solid blocks and cones can be formulated with Lutensol® ON types, Lutensit® AT types, Pluriol® E 9000, dyes and fragrance. Combinations of Lutensol® ON types such as ON 30 and ON 110 can also be used.

Emulsification

The Lutensol® ON types with a low degree of ethoxylation are effective emulsifiers for some oils and solvents.

They can be combined with other emulsifiers from our Emulan range, and with alkali soaps, amine soaps and sulfonated oils.

Graduated tests are the most effective means of determining the best combination of emulsifiers and the amount required. Tests are indispensable if emulsions are subjected to severe demands due to the presence of electrolytes, finely divided solids or water-soluble solvents. Special emulsifier combinations often have to be employed to cope with exceptional thermal or mechanical stress.

Lutensol® ON 30 is especially recommended for emulsifying spindle oil, machine oil, mineral spirits and kerosene in cleaners, drilling oils, rolling oils, drawing oils and mould-release agents. It may be used alone or in combination with other nonionic emulsifiers such as Emulan® A, P and PO, anionic emulsifiers such as Korantin® SH, and sulfonated oils and amine soaps.

Dispersing

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

Wetting

The Lutensol® ON types are very effective wetting agents. They can be employed in a variety of refining, mixing, impregnating and surface-treatment processes.

Again, graduated tests under practical conditions are the most effective means of determining the best products for specific applications.

Other applications

There are applications for the Lutensol® ON types in the leather, paper, paints and building products industries.

Replacement products for alkylphenol ethoxylates (APEO)

In June 2003, the European Parliament published Directive 2003/53/EC which places restrictions on the marketing and use of certain dangerous substances and preparations (nonylphenol, noylphenol ethoxylates) in the Official Journal of the European Union. This legislation entered into force on 17 January 2005 in response to demands to reduce the risks identified in the EU risk assesment of nonylphenol. It applies to all applications in which these products are discharged as effluent, and its aim is to minimising the release of NP and NPEO into surface waters. If effectively amounts to ban on these substances.

Safety

We know of no ill effects that could have resulted from using Lutensol® ON types for the purpose for which it is intended and from processing it in accordance with current practices.

According to the experience that we have gained over many years and other information at our disposal, Lutensol® ON types do not exert harmful effects on health, provided 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.

Handling

Protect the eyes and avoid prolonged contact with the skin. Safety glasses should be worn when handling these products in their undiluted form.

Biological Degradability

These products fulfil the requirements of Regulation (EC) No 648/2004 on detergents, tested according to the methods listed in Annex III. Further information on their ecological and toxicological properties can be found un the safety data sheets.

Labelling

Please refer to the latest Safety Data sheet for detailed information on 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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