

Technical Information

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Last change WF-No. 3881

® = Registered trademark of BASF

Lutensol® AO types

Lutensol® AO 3
Lutensol® AO 5
Lutensol® AO 7
Lutensol® AO 79

Lutensol® AO 8
Lutensol® AO 11
Lutensol® AO 3109

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

Chemical nature

The Lutensol® AO types are nonionic surfactants. They are based on C₁₃C₁₅ oxo alcohol that consists of ca. 67% C₁₃ and ca. 33% C₁₅.

The Lutensol® AO types conform to the following structural formula:



R = C₁₃C₁₅ oxo alcohol

x = 3, 5, 7, 8, 11

The degree of ethoxylation is denoted by the numeric product designation.

Lutensol® AO 79 consist of ca. 10% water and ca. 90% Lutensol® AO 7 and Lutensol® AO 8 respectively. These products are supplied in the form of mobile liquids, and they are easier to process than 100% active products supplied in paste form.

Lutensol® AO 3109 is a mixture of Lutensol® AO 3 and Lutensol® AO 10 with an active content of ca. 90% w/w and a water content of ca. 10% w/w.

The Lutensol® AO types are manufactured by causing the C₁₃C₁₅ 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 surfactants with low toxicity are formed

PRD-Nos.*

30043958	Lutensol® AO 3
30043962	Lutensol® AO 5
30044948	Lutensol® AO 7
30043959	Lutensol® AO 79
30043942	Lutensol® AO 8
30043957	Lutensol® AO 11
30043964	Lutensol® AO 3109

* BASF's commercial product numbers.

Properties

Lutensol® AO 3, AO 5 and AO 7 are cloudy, colourless liquids at 23 °C. They have a tendency to form a sediment, but they form clear solutions at 50 °C.

Lutensol® AO 79 and AO 3109 are clear liquids at 23 °C.

Lutensol® AO 8 and AO 11 are soft, colourless pastes.

Lutensol®		AO 3	AO 5	AO 7	AO 79
Physical form (23 °C)		Liquid	Liquid	Liquid	Liquid
Degree of ethoxylation		approx. 3	approx. 5	approx. 7	approx. 7
Concentration	%	approx. 100	approx. 100	approx. 100	approx. 90
Water content (EN 13267)	%	–	–	–	approx. 10
Cloud point (EN 1890)*					
Method A	°C	–	–	approx. 43	approx. 43
Method B	°C	–	–	–	–
Method C	°C	–	–	–	–
Method D	°C	approx. 54	approx. 66	approx. 77	approx. 79
Method E	°C	approx. 45	approx. 62	approx. 75	approx. 75
Molar mass (calculated from OH number)	g/mol	approx. 340	approx. 430	approx. 520	approx. 520
pH value (EN 1262, solution B)**		approx. 7	approx. 7	approx. 7	approx. 7
Density (DIN 51757)					
23 °C	g/cm ³	approx. 0.92	approx. 0.95	approx. 0.98	approx. 0.99
60 °C	g/cm ³	approx. 0.89	approx. 0.92	approx. 0.95	–
Dropping point (DIN 51801)	°C	<5	approx. 12	approx. 21	<5
Solidification point (ISO 2207)	°C	<5	<5	approx. 15	<5
Viscosity (EN 12092, Brookfield, 60 rpm)					
23 °C	mPa·s	approx. 60	approx. 80	approx. 800	approx. 150
Hydroxyl number (DIN 53240)	mg KOH/g	approx. 165	approx. 130	approx. 110	approx. 110
HLB value		approx. 8	approx. 10	approx. 12	approx. 12
Flash point (DIN 51376)	°C	approx. 130	approx. 150	approx. 190	approx. 220
Wetting power (EN 1772, in distilled water at 23 °C, 2 g/l soda ash)					
0.5 g/l	s	>300	approx. 200	approx. 90	approx. 90
1.0 g/l	s	>300	approx. 100	approx. 30	approx. 30
2.0 g/l	s	>300	approx. 40	approx. 10	approx. 10
Foam formation (EN 12728, 40 °C, 2 g/l in water contain- ing 1.8 mmol/l Ca ions, after 30 s)	cm ³	approx. 20	approx. 30	approx. 250	approx. 250
Surface tension (EN 14370, 20 °C, 1 g/l in distilled water)***	mN/m	approx. 28	approx. 28	approx. 28	approx. 28

* 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® AO types can decrease during storage, but this does not have any effect on their performance.

***Applying Harkins-Jordan correction.

Lutensol®		AO 8	AO 11	AO 3109
Physical form (23 °C)		Solid	Solid	Liquid
Degree of ethoxylation		approx. 8	approx. 11	approx. 8
Concentration	%	approx. 100	approx. 100	approx. 90
Water content (EN 13267)	%	–	–	approx. 10
Cloud point (EN 1890)*				
Method A	°C	approx. 52	approx. 86	–
Method B	°C	approx. 38	approx. 72	–
Method C	°C	approx. 31	approx. 59	–
Method D	°C	approx. 79	approx. 86	approx. 74
Method E	°C	approx. 79	approx. 87	approx. 73
Molar mass (calculated from OH number)	g/mol	approx. 560	approx. 690	approx. 550
pH value (EN 1262, solution B)**		approx. 7	approx. 7	approx. 7
Density (DIN 51757)				
23 °C	g/cm ³	approx. 0.99	approx. 1.02	approx. 0.98
60 °C	g/cm ³	approx. 0.96	approx. 0.99	–
Dropping point (DIN 51801)	°C	approx. 25	approx. 30	approx. 10
Solidification point (ISO 2207)	°C	approx. 18	approx. 20	approx. 5
Viscosity (EN 12092, Brookfield, 60 rpm)				
23 °C	mPa·s	–	–	approx. 150
60 °C	mPa·s	approx. 30	approx. 30	–
Hydroxyl number (DIN 53240)	mg KOH/g	approx. 100	approx. 80	approx. 110
HLB value		approx. 12.5	approx. 14	approx. 11.5
Flash point (DIN 51376)	°C	approx. 200	approx. 220	approx. 190
Wetting power (EN 1772, in distilled water at 23 °C, 2 g/l soda ash)				
0.5 g/l	s	approx. 90	approx. 130	approx. 140
1.0 g/l	s	approx. 30	approx. 60	approx. 50
2.0 g/l	s	approx. 10	approx. 30	approx. 20
Foam formation (EN 12728, 40 °C, 2 g/l in water contain- ing 1.8 mmol/l Ca ions, after 30 s)	cm ³	approx. 350	approx. 400	approx. 70
Surface tension (EN 14370, 20 °C, 1 g/l in distilled water)***	mN/m	approx. 28	approx. 31	approx. 28

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

The solubility of the Lutensol® AO types in selected solvents is shown overleaf.

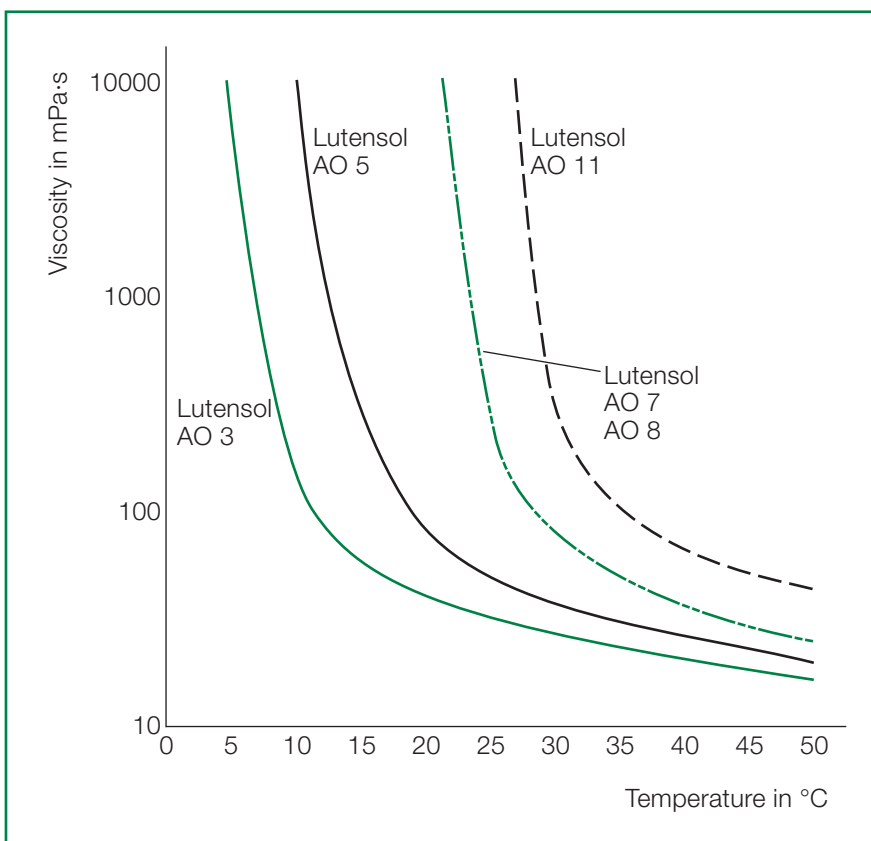
Solubility of 10% solutions of Lutensol® AO types at 25 °C

	Distilled water	Potable water (ca 2.7 mmol Ca ²⁺ ions/l)	Caustic soda (5% w/w)	Hydro-chloric acid (5% w/w)	Salt solution	Mineral oils	Alcohols	Aromatic hydro-carbons
Lutensol® AO 3	–	–	–	–	–	+	+	+
Lutensol® AO 5	•	•	–	•	•	+/•	+	+/•
Lutensol® AO 7	+/•	+/•	•	+	•	+/•	+	+/•
Lutensol® AO 79	+/•	+/•	•	+	•	+/•	+	+/•
Lutensol® AO 8	+	+	–	+	+	•	+	+/•
Lutensol® AO 11	+	+	–	+	+	+/•	+	+/•
Lutensol® AO 3109	•	•	•	•	–	+	+	+

+ = Clear solution
 • = Sparingly soluble
 – = Insoluble

Viscosity

The relationship between viscosity and temperature is always an important point to consider when Lutensol® AO types are to be delivered or put into storage. The following curves show the viscosity of the Lutensol® AO types as a function of temperature.



The viscosity of the Lutensol® AO types as a function of temperature.

It is advisable to prepare stock solutions with a concentration of 10 – 0% for mixing with other solutions or for preparing very dilute solutions. These solutions are then easy to dilute down to their final concentration.

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

The Lutensol® AO types tend to form a gel in water at certain concentrations, as can be seen from the table below. The viscosity was measured with a Brookfield viscometer at 23 °C and 60 rpm.

The viscosity of the Lutensol® types as a function of their water content (in mPa·s)

Water content %	AO 3	AO 5	AO 7	AO 79	AO 8	AO 11	AO 3109
0	40	80	300	150	–	–	150
10	60	90	150	70000	150	200	25000
20	150	6000	70000	50000	30000	400	90000
30	15000	40000	50000	12000	20000	>10 ⁵	60000
40	>10 ⁵	>10 ⁵	12000	30000	25000	>10 ⁵	30000
50	>10 ⁵	>10 ⁵	30000	7000	>10 ⁵	>10 ⁵	45000
60	100	90000	7000	1400	>10 ⁵	>10 ⁵	10000
70	80	20000	1400	800	1700	70	3000
80	50	2000	800	200	70	30	450
90	10	50	200	60	20	20	20

Storage

- The Lutensol® AO types should be stored in a dry place. Storerooms must not be overheated.
- The Lutensol® AO types are hygroscopic and soluble in water, with the result that they absorb moisture very quickly. Drums should be tightly resealed each time material is taken from them.
- The Lutensol® AO types should not be stored at temperatures substantially below 20 °C. Attention also needs to be paid to their setting points.
- Lutensol® AO 3, AO 5, and AO 7 are supplied in the form of cloudy liquids, and they have a tendency to form a sediment. They become clear at ca. 50 °C.
- Liquid that has solidified or that shows signs of precipitation should be heated to 50 – 60 °C and homogenized before use.
- 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.
- The Lutensol® AO types must be blanketed with nitrogen if they are stored in heated tanks at 50 – 60 °C (Lutensol® AO 30: 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 (X6 CrNiMoTi 17122)

Shelf life

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

Safety

We know of no ill effects that could have resulted from using the Lutensol® AO 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® AO 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 Sheet for detailed information on product safety.

Note

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