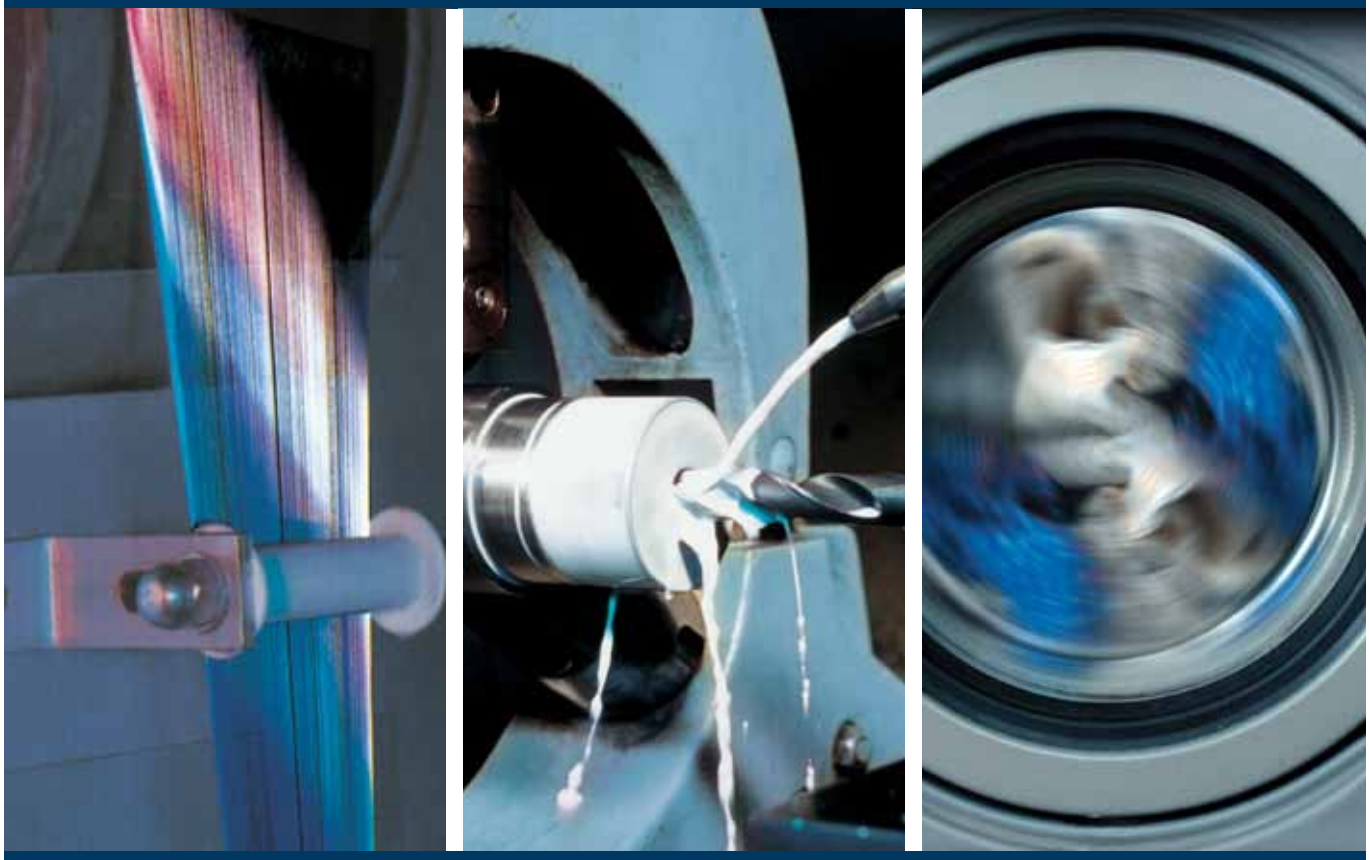
MARLIPAL O13 Isotridecanol ethoxylates

EMEA

Sasol Performance Chemicals



Contents

About us

Sasol's Performance Chemicals business unit markets a broad portfolio of organic and inorganic commodity and speciality chemicals. Our business consists of four key business divisions: Organics, Inorganics, Wax and PCASG (Phenolics, Carbon, Ammonia and Speciality Gases). About 6300 people including employees from our Regional Operating Hubs in offices in 18 countries serve customers around the world with a multi-faceted portfolio of state-of-the-art chemical products and solutions for a wide range of applications and industries.

Our key products include surfactants, surfactant intermediates, fatty alcohols, linear alkylbenzene (LAB), short-chain linear alpha olefins, ethylene, petrolatum, paraffin waxes, synthetic waxes, cresylic acids, high-quality carbon solutions as well as high-purity and ultra-high-purity alumina. Our speciality gases subdivision supplies its customers with high-quality ammonia, hydrogen and CO_2 as well as liquid nitrogen, liquid argon, krypton and xenon gases.

Our products are as individual as the industrial applications they serve, with tailor-made solutions creating real business value for customers. Ongoing research activities result in a continuous stream of innovative product concepts that help our customers position themselves successfully in future markets.

Our products are used in countless applications in our daily lives to add value, security and comfort. Typical examples include detergents, cleaning agents, personal care, construction, paints and coatings, leather and metal processing, hot-melt adhesives, bitumen modification, and catalyst support for automotive catalysts and a wide range of other specialty applications, including oil and gas recovery, aroma production, plastic stabilisation, and polymer production. Every day, our researchers explore ways to improve our products and develop innovations that improve the quality of people's lives.

1. General remarks

The products of the MARLIPAL O13 series are alkylpolyethylene glycol ethers and belong to the class of nonionic surfactants. Isotridecanol, a C13-oxo alcohol, is the synthetic alcohol on which these products are based.

The individual grades of the MARLIPAL O13 series differ in the number n of added mol ethylene oxide per mol alcohol and cover a broad spectrum of properties, useful in a wide range of applications. In general, the product group is characterized by the following properties:

- High detergency and surface activity
- Good hard water stability
- Synergistic effects with other surfactants
- Favourable environmental characteristics
- Favourable emulsifying power
- Chemical stability over a wide pH range
- User-friendly viscosity and storage behaviour

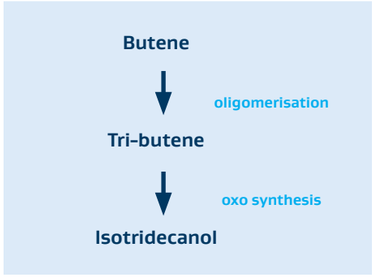
These properties have opened up numerous fields of applications for MARLIPAL O13 products. They are used as surfactant raw materials in detergents and cleaning products, as auxiliaries in textile production, metalworking, emulsifier technology and also in chemical-industrial applications.

2. Product description

2.1 Oxo alcohol base

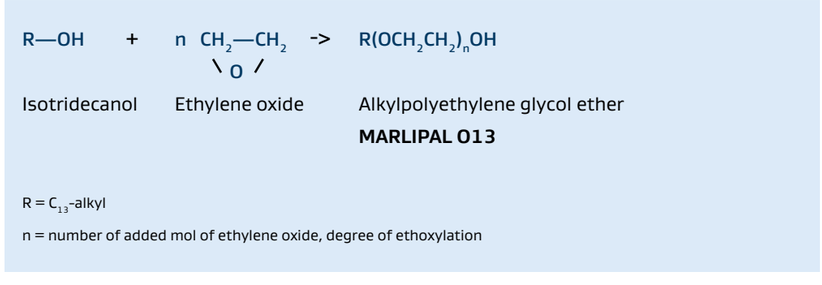
The MARLIPAL O13 ethoxylates are based on isotridecanol, a branched C_{13}-oxo alcohol.

The isotridecanol is made via a C_{12}-olefin, which is prepared by trimerisation of butene monomer. The hydroformylation (oxo synthesis) of the olefin with carbon monoxide and hydrogen produces an isomeric mixture of primary isotridecyl alcohols with a branched alkyl chain.



2.2 Preparation of the ethoxylates

The alkylpolyglycol ethers of the MARLIPAL O13 series are formed by reaction of isotridecanol with varying amounts of ethylene oxide according to the following equation:

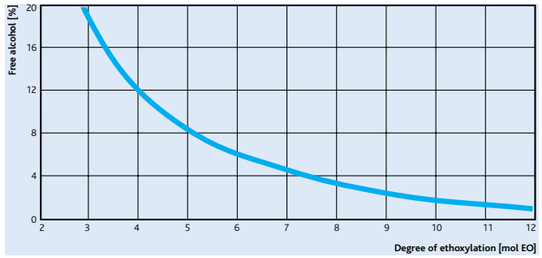


The individual grades differ in the number n of added mol of ethylene oxide and, accordingly, in the length of the polyethylene glycol ether chain. The letter n denotes the average degree of ethoxylation, since a whole range of ethoxylation stages is produced during the preparation. Thus the MARLIPAL O13 grades are, like all alcohol ethoxylates, mixtures of homologous alkylpolyethylene glycol ethers.

2.3 Purity

The MARLIPAL O13 products have a high active content of alkylpolyglycol ethers. Depending on the degree of ethoxylation, the products also contain varying amounts of the starting material isotridecanol. The free alcohol, the proportion of which decreases with increasing degree of ethoxylation (as shown in Figure 1) supports the cleaning action of the ethoxylates and contributes to foam regulation.

Figure 1:
Content of free alcohol in MARLIPAL O13 products



During the ethoxylation, secondary reactions yield polyethylene glycols having the structure $H(OCH_2CH_2)_nOH$. The proportion of polyethylene glycols having varying chain lengths is below 2 %. Polyethylene glycols are water-soluble products which do not impair the properties of the nonionic surfactants.

To neutralize the alkaline catalyst required for the ethoxylation reaction, MARLIPAL O13 grades are treated with shortchain organic acids (usually acetic acid or lactic acid) and adjusted to a pH of 5–7 (2 % in water). Accordingly, they contain a small amount of organic salt and small amounts (less than 0.5 %) of water. The water content, however, may increase on exposure to air since ethoxylates are hygroscopic.

2.4 Nomenclature

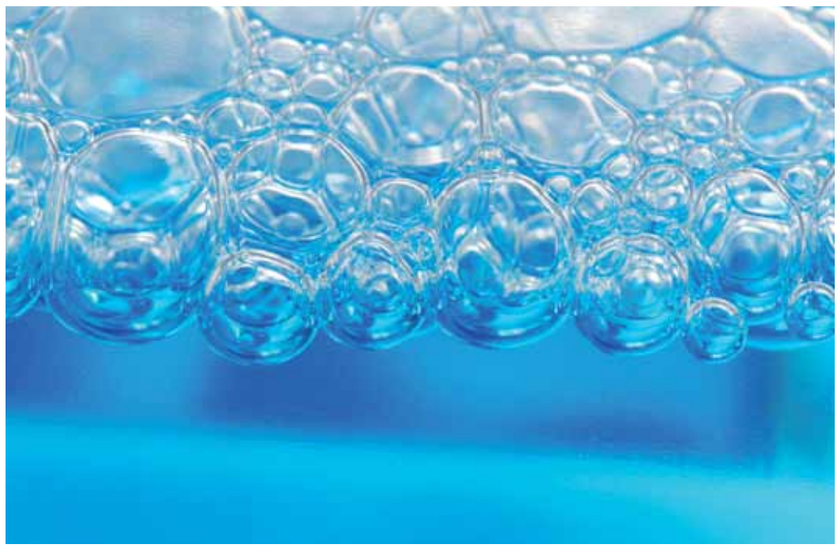
The MARLIPAL range is classified by a code system which is descriptive of the composition of the surfactant. Accordingly, the extension O13 denotes the C13-oxo alcohol (isotridecanol). Numbers after the oblique denote the degree of ethoxylation n, 100 % MARLIPAL O13 grades additionally have a zero as the last digit. If, on the other hand, the last digit is a 9, the product contains 90 % of alkylpolyglycol ethers and 10 % of water. This addition of water produces liquid and homogeneous products with improved cold storage behaviour.

3. Product range

The standard product range includes the following MARLIPAL O13 grades:

Product	Chemical characterization
MARLIPAL O13/30	Isotridecanol + 3 mol EO/mol
MARLIPAL O13/40	Isotridecanol + 4 mol EO/mol
MARLIPAL O13/50	Isotridecanol + 5 mol EO/mol
MARLIPAL O13/60	Isotridecanol + 6 mol EO/mol
MARLIPAL O13/69*	Isotridecanol + 6 mol EO/mol
MARLIPAL O13/70	Isotridecanol + 7 mol EO/mol
MARLIPAL O13/79*	Isotridecanol + 7 mol EO/mol
MARLIPAL O13/80	Isotridecanol + 8 mol EO/mol
MARLIPAL O13/89*	Isotridecanol + 8 mol EO/mol
MARLIPAL O13/90	Isotridecanol + 9 mol EO/mol
MARLIPAL O13/99*	Isotridecanol + 9 mol EO/mol
MARLIPAL O13/100	Isotridecanol + 10 mol EO/mol
MARLIPAL O13/109*	Isotridecanol + 10 mol EO/mol
MARLIPAL O13/120	Isotridecanol + 12 mol EO/mol
MARLIPAL O13/129*	Isotridecanol + 12 mol EO/mol

* 90 % supply form

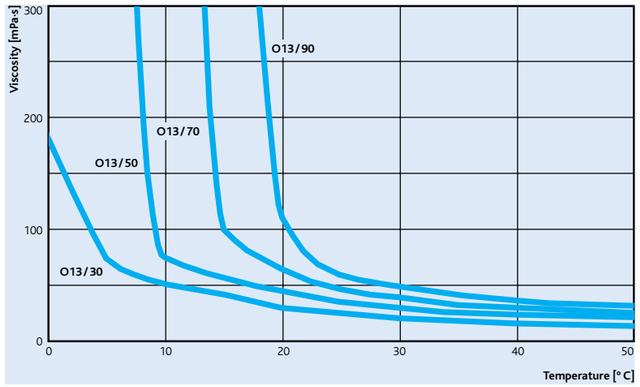


4. Technical data

4.1 Viscosities

At room temperature, the ethoxylates of the MARLIPAL O13 series with a short EO chain are low-viscous liquids. The viscosity increases with increasing degree of ethoxylation within the product series. Viscosities at 20 °C and 50 °C are listed on page 12 and 13. Figure 2 shows the viscosities of MARLIPAL O13 ethoxylates as a function of temperature.

Figure 2: Viscosity as a function of temperature at a shear rate of D = 10 1/s.



4.2 Solubility, gel formation with water

Since the polyethylene glycol ether chain is the watersoluble constituent of MARLIPAL O13 surfactants, the solubility in water increases with increasing degree of ethoxylation. The lower ethoxylates (3–6 mol EO), in which the alkyl group predominates as the hydrophobic component, are accordingly only sparingly soluble in water. They do, however, dissolve in nonpolar organic solvents and are used for example as w/o-emulsifiers. In contrast, the higher ethoxylates are readily soluble in water. Table 1 shows the solubility behaviour of the MARLIPAL O13 surfactants in dilute aqueous solution.

Product	Appearance at 20 °C	Product	Appearance at 20 °C
MARLIPAL O13/30	cloudy, non-homogeneous	MARLIPAL O13/80	cloudy, homogeneous
MARLIPAL O13/40	cloudy, homogeneous	MARLIPAL O13/90	clear, dissolved
MARLIPAL O13/50	cloudy, homogeneous	MARLIPAL O13/100	clear, dissolved
MARLIPAL O13/60	cloudy, homogeneous	MARLIPAL O13/120	clear, dissolved
MARLIPAL O13/70	cloudy, homogeneous		

Table 1 Appearance of aqueous solutions of MARLIPAL O13 grades (0.5 % in demineralized water)

Like all alkylpolyethylene glycol ethers, the MARLIPAL O13 ethoxylates form free-flowing or solid gels when water is added in certain concentration ranges. During the preparation of cleaning formulations, this tendency to gel can have an adverse effect on processing. To prevent lumping and gelling, it is thus advisable to add the nonionic surfactant to the water, use warm water and stir well. Additional solvents, for example alcohols, but also salts and electrolytes that have been dissolved in water, can also suppress gel formation.

Table 2 shows the physical states of aqueous mixtures of MARLIPAL O13 grades. At very high surfactant concentrations (10 % water) and at relatively low concentrations below approximately 30 % surfactant (70 % water), the mixtures of the higher ethoxylates are homogeneous and clear. In the medium concentration range, on the other hand, the MARLIPAL O13 products form pastes or gels which may be clear or cloudy.

	Water in %									
MARLIPAL	**0**	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**
O13/30	●	■	■	●	●	●	●	●	●	●
O13/40	●	■	■	■	■	■	■	■	●	●
O13/50	●	■	■	■	■	■	■	■	■	●
O13/60	●	■	■	■	■	■	■	■	■	●
O13/70	●	■	■	■	■	■	●	●	●	●
O13/80	●	■	■	■	■	■	■	■	■	■
O13/90	●	■	■	■	■	■	■	■	■	■
O13/100	◆	■	■	■	■	■	■	■	■	■
O13/120	◆	■	■	■	■	■	■	■	■	■

■ = clear liquid ■ = gel or paste ● = cloudy liquid ● = cloudy, non-homogeneous ◆ = solid

Table 2: Physical states of aqueous MARLIPAL O13 solutions at 20 °C, homogeneity and gel formation

The table 2, which is only intended as a guide to possible physical states on mixing with water, shows that the addition of 10 % of water to the ethoxylates always gives a clear solution. This applies to MARLIPAL grades in the 90 % supply form.

4.3 Cloud point

The cloud point is an important parameter for characterizing nonionic surfactants and is determined by a simple test method. The phenomenon of the cloud point can be explained as follows: the solubility of ethoxylates in water is based on the hydration of the oxygen group via hydrogen bonds. Since this hydration decreases with increasing temperature, the solubility of the surfactants in water decreases accordingly.

At a certain temperature the initially clear solution of an ethoxylate immediately becomes cloudy because a water-immiscible surfactant phase is formed. This process is reversible; i.e. upon cooling the solution clarifies at the same temperature. The temperature, at which this clouding occurs, is specific for each ethoxylate and is referred to as the cloud point of the surfactant.

The cloud point is a function of concentration and is usually determined in 1 % or 2 % aqueous surfactant solutions. If the ethoxylate is insoluble or only sparingly soluble in water, the cloud point can also be determined in aqueous butyldiglycol solution. For ethoxylates, whose aqueous solutions do not turn cloudy even at the boiling point of water, a cloud point can be determined by adding sodium chloride. The cloud point of the ethoxylates is lowered by adding electrolytes.

The cloud points of MARLIPAL O13 products are listed in Table 3.

Table 3: Cloud point in °C according to DIN EN 1890

MARLIPAL	10 % in 25 % butyldiglycol solution	2 % in demineralized water	2 % in 10 % NaCl solution	16.7 % in 25 % butyldiglycol solution	1 % in demineralized water	1 % in 5 % NaCl solution
O13/30	ca. 50	—	—	ca. 37	—	—
O13/40	ca. 60	—	—	ca. 51	—	—
O13/50	ca. 66	—	—	ca. 60	—	—
O13/60 O13/69	ca. 71	—	—	ca. 66	—	—
O13/70 O13/79	ca. 74	—	—	ca. 70	—	—
O13/80 O13/89	ca. 77	ca. 51	—	ca. 76	ca. 50	—
O13/90 O13/99	—	ca. 58	—	ca. 79	ca. 57	ca. 43
O13/100 O13/109	—	ca. 76	ca. 46	ca. 82	ca. 75	ca. 59
O13/120 O13/129	—	ca. 87	ca. 56	—	ca. 86	ca. 70

4.4 Surface activity

One of the universally recognized performance characteristic of a surfactant is its ability to reduce the surface tension of water. Table 4 illustrates the surface tension of MARLIPAL O13 products in aqueous solutions. Even at low concentrations, they lower the surface tension of water from 72 mN/m to values below 30 mN/m.

The critical micelle concentrations (CMCs) of the MARLIPAL O13 surfactants range from ca. 25 to 100 mg/l. Since the lower and medium ethoxylates bring about a larger reduction in the surface tension, or the CMC, these product grades are particularly suitable for emulsifying and cleaning processes.

Table 4:
Surface tension (in mN/m, at 25 °C in demin. water)

	Surfactant concentration (at 25 °C in demin. water) Surfactant concentration			Critical micelle concentration (CMC)
MARLIPAL	**0.01 g/l**	**0.1 g/l**	**1.0 g/l**	**[mg/l]**
O13/30	34.5	27.0	27.0	26
O13/40	35.5	27.5	27.5	26
O13/50	37.5	27.5	27.5	32
O13/60	38.5	27.5	27.5	37
O13/70	39.0	27.5	27.5	41
O13/80	40.5	27.5	27.5	47
O13/90	42.5	28.0	28.0	56
O13/100	43.5	28.5	28.5	74
O13/120	46.0	29.0	29.0	94

Ring method: DIN 53914/ISO 304

4.5 HLB values

The hydrophilic-lipophilic balance (HLB) value of a surfactant is a figure, which describes the ratio of the hydrophilic EO chain to the lipophilic alkyl chain of the alcohol in the surfactant molecule and simplifies the choice of emulsifiers for a given product series.
The MARLIPAL O13 product series provides ethoxylates with HLB values in a broad range from 8.0 (MARLIPAL O13/30) to 14.5 (MARLIPAL O13/120). The HLB values of the ethoxylates are given in the table on pages 12 and 13.

4.6 Solidification points

The solidification temperatures of MARLIPAL O13 surfactants increase with increasing degree of ethoxylation. The 90 % supply forms have lower solidification points compared to the neat surfactant.

The solidification points measured under laboratory conditions are given in the table on pages 12 and 13. The ethoxylates were slowly cooled with gentle stirring until solidification occurred. If, however, the products are stored for an extended period, for example in tank containers, the solidification temperatures may be higher due to crystallization processes.

The table overleaf, summarizes the technical characteristics of the MARLIPAL O13 surfactants. The product specifications can be found in the current product data sheets.

4.7 Technical data of MARLIPAL O13 products

Product name **MARLIPAL**			**O13/30**	**O13/40**	**O13/50**	**O13/60**	**O13/69**	**O13/70**
Chemical composition		C_{13}-Oxo alcohol + n mol EO/mol	n = 3	n = 4	n = 5	n = 6	n = 6	n = 7
Technical data								
Appearance at 20 °C			liquid, clear-cloudy	liquid, clear-cloudy	liquid, clear-cloudy	liquid, clear-cloudy	liquid, clear	liquid, clear-cloudy
Iodine colour number		mg I/100 ml	max. 2	max. 2	max. 2	max. 2	max. 2	max. 2
Cloud point	10 % in 25 % BDG solution	°C	48–51	58–61	64–67	69–72	69–72	72–75
	2 % in demin. water	°C	—	—	—	—	—	—
	2 % in 10 % NaCl solution	°C	—	—	—	—	—	—
pH Value	2 % in demin. water		5–7	5–7	5–7	5–7	5–7	5–7
Density	at 20 °C	g/ml	—	—	—	—	ca. 0.99	—
	at 50 °C	g/ml	ca. 0.91	ca. 0.92	ca. 0.94	ca. 0.95	—	ca. 0.96
Refractive index n 20/D			—	—	—	—	ca. 1.450	—
Refractive index n 50/D			ca. 1.445	ca. 1.446	ca. 1.447	ca. 1.448	—	ca. 1.449
Solidification point [1]		°C	< -20	< -10	ca. -5	ca. +3	< -20	ca. +7
Flash point	ISO 2592	°C	> 130	> 150	> 150	> 150	n.a.	> 150
Ignition temperature	DIN 51794	°C	ca. 320	ca. 340	ca. 345	ca. 355	ca. 355	ca. 355
Viscosity	at 50 °C	mPa·s	ca. 15	ca. 18	ca. 20	ca. 20	—	ca. 25
(Brookfield)	at 20 °C	mPa·s	—	—	—	—	ca. 110	—
Water		% by weight	max. 0.5	max. 0.5	max. 0.5	max. 0.5	ca.10	max. 0.5
Polyethylene glycol		% by weight	max. 2	max. 2	max. 2	max. 2	max. 2	max. 2
EO content (calculated)		% by weight	39.8	46.8	52.4	56.9	56.9	60.6
HLB value (calculated)		$\frac{20 \times MW\ hydrophilic}{MW\ total}$	8.0	9.4	10.5	11.4	11.4	12.1
Hydroxyl number		mg KOH/g	ca. 165	ca. 150	ca. 135	ca. 120	—	ca. 110

Specifications of MARLIPAL O13 products are given in the current product data sheets.

O13/79	**O13/80**	**O13/89**	**O13/90**	**O13/99**	**O13/100**	**O13/109**	**O13/120**	**O13/129**
n = 7	n = 8	n = 8	n = 9	n = 9	n = 10	n = 10	n = 12	n = 12
liquid, clear	liquid, clear-cloudy	liquid, clear	liquid, clear-cloudy	liquid, clear	liquid, clear-cloudy	liquid, clear	liquid, pasty	liquid, clear
max. 2	max. 2	max. 2	max. 2	max. 2	max. 2	max. 2	max. 2	max. 2
72–75	76–78	76–78	—	—	—	—	—	—
—	—	—	56–59	56–59	74–77	74–77	—	—
—	—	—	—	—	—	—	54–57	54–57
5–7	5–7	5–7	5–7	5–7	5–7	5–7	5–7	5–7
ca. 0.99	—	ca. 1.01	—	ca. 1.02	—	ca. 1.03	—	ca. 1.03
—	ca. 0.97	—	ca. 0.98	—	ca. 0.99	—	ca. 1.00	—
ca. 1.453	—	ca. 1.453	—	ca. 1.453	—	ca. 1.453	—	ca. 1.454
—	ca. 1.450	—	ca. 1.451	—	ca. 1.452	—	ca. 1.453	—
< -10	ca. +11	< -10	ca. +13	< -10	ca. +17	ca. -6	ca. +20	ca. -3
n.a.	> 150	n.a.	> 180	n.a.	> 180	n.a.	> 180	n.a.
ca. 355	ca. 360	ca. 360	ca. 360	ca. 360	ca. 360	ca. 360	ca. 360	ca. 360
—	ca. 30	—	ca. 30	—	ca. 35	—	ca. 40	—
ca. 120	—	ca. 130	—	ca. 150	—	ca. 160	—	ca. 170
ca. 10	max. 0.5	ca. 10	max. 0.5	ca. 10	max. 0.5	ca. 10	max. 0.5	ca. 10
max. 2	max. 2	max. 2	max. 2	max. 2	max. 2	max. 2	max. 2	max. 2
60.6	63.8	63.8	66.4	66.4	68.7	68.7	72.5	72.5
12.1	12.8	12.8	13.3	13.3	13.7	13.7	14.5	14.5
—	ca. 100	—	ca. 95	—	ca. 90	—	ca. 75	—

1) Determination under laboratory conditions (see Section 4.6)

n.a. = not applicable

5. Technical properties

5.1 Wetting efficiency on textiles

In detergents, the surfactants are the active force which removes grease, soiling and pigment particles from the fibres. The wetting efficiency on textiles is therefore an important criterion for assessing the performance of a surfactant. The products of the MARLIPAL O13 series have high wetting efficiency on textiles, the best values being observed for MARLIPAL O13/60 to MARLIPAL O13/100. The wetting effect, which, in accordance with DIN EN 1772, corresponds to the time taken for a cotton disc to sink, is shown in Figure 3 as a function of the degree of ethoxylation. The shorter the sinking time, the better the wetting efficiency.

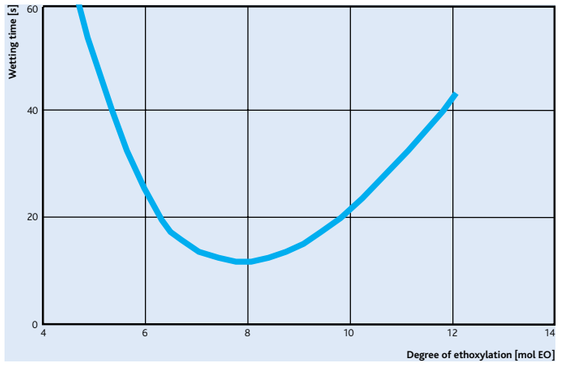


Figure 3:
Wetting efficiency on cotton as a function of degree of ethoxylation
(1 g/l in demin. water, 20 °C)

5.2 Wetting efficiency on hard surfaces

The wetting behaviour of surfactant solutions on hard surfaces, such as glass, ceramics, steel and plastics, can be assessed by wetting angle investigations. Good wetting on hard surfaces can be recognized from how much the shape of the droplet of a surfactant-containing aqueous droplet, traced onto the surface of the material, deviates from the shape of a droplet of pure water. The parameter measured is the wetting angle of the droplet. A high reduction of the wetting angle corresponds to good wetting properties on a given substrate which is shown in Figure 4. Polypropylene and steel are wetted very well, the optimum range being from 6–8 mol of ethylene oxide per mol alcohol.

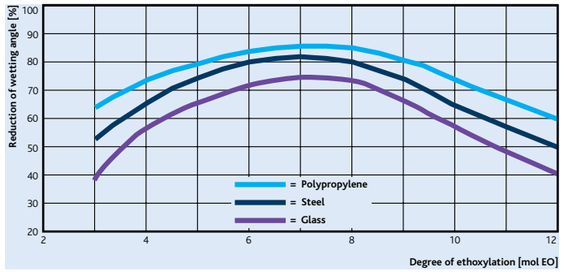


Figure 4:
Wetting efficiency on hard surfaces as a function of degree of ethoxylation
(1 g/l in demin. water, 25 °C)

5.3 Foaming profile

Like all nonionic surfactants, the MARLIPAL O13 ethoxylates produce less foam than anionic products. The foaming profile of the MARLIPAL O13 surfactants is described in Figure 5 and has been determined by the Schlag foam method (DIN EN 12728).

The MARLIPAL O13 products containing 8–12 mol of EO/mol produce foam volumes of 100–250 ml in the test, whereas the short chain product grades with lower solubility in water produce significantly less foam. The foaming profile is well within the typical range of alcohol ethoxylates. In comparison, an anionic surfactant such as linear alkylbenzene sulphonate (LAS) produces a foam volume of ca. 600 ml.

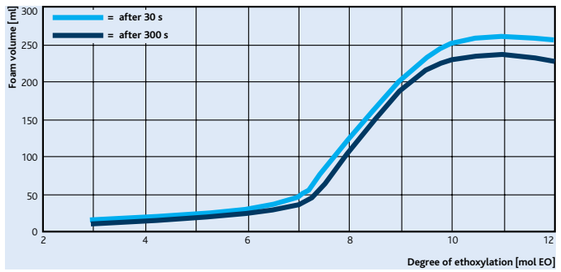


Figure 5:
Foaming profile in accordance with DIN EN 12728 (1 g/l in demin. water, 20 °C)

5.4 Detergency on textiles

The MARLIPAL O13 surfactants have excellent detergency performance both on synthetic and on natural fabrics. The performance on polyester, cotton/polyester blend and cotton (Figures 6, 7, 8 and 9) was investigated. There are optima in the detergency in the range from 6–10 mol EO, which shift to higher degrees of ethoxylation at a higher washing temperature.

Washing Conditions

Linitest laboratory washing machine	
Surfactant concentration	1 g/l
Water hardness	13 °dH (German hardness)
Washing liquor	250 ml
Liquor ratio	1:80
Washing cycles	3
Test soiling	Pigment/sebum

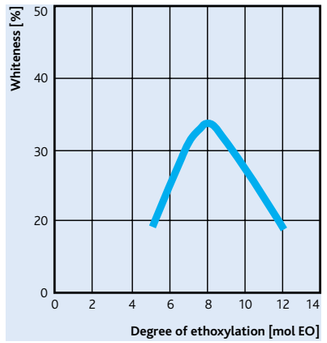


Figure 6:
Detergency on polyester at 30 °C

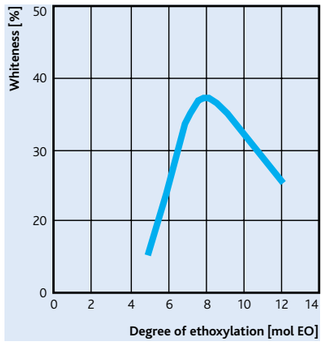


Figure 7:
Detergency on cotton/polyester blend at 60 °C

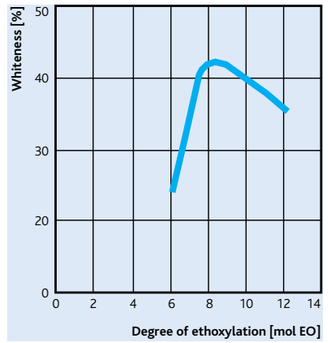


Figure 8:
Detergency on cotton at 60 °C

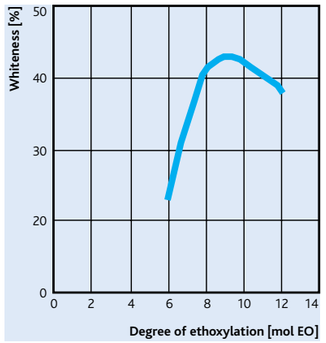


Figure 9:
Detergency on cotton at 90 °C

6. Applications

The favourable properties of the MARLIPAL O13 products result in advantageous end-use features in many fields of applications. In particular the favourable wetting and excellent washing and cleaning efficiency opens the way for universal use.

6.1 Fabric care

- Washing powders
- Liquid detergents
- Detergent tablets
- Detergency boosters (I & I washing)

6.2 Home care

- All-purpose cleaners
- Floor cleaners
- Bathroom cleaners
- Dishwashing detergents

6.3 I & I cleaners

- Vehicle cleaners
- Ultrasonic cleaners
- Janitorial cleaners
- High pressure cleaners

6.4 Chemical-industrial applications

- Auxiliaries for textile and leather processing
- Emulsifier in metalworking auxiliaries
- Silicone emulsions for technical applications
- Water based defoamer emulsions
- Spreader for pesticides

The MARLIPAL O13 ethoxylates are important elements of cleaner formulations and important raw materials for process auxiliaries. By combining them with other products, e.g. anionic or cationic surfactants, it is possible to achieve synergistic and performance enhancing effects.

MARLIPAL O13 products are versatile raw materials for the textile industry. They are used to formulate scouring, wetting, degreasing or dying auxiliaries as well as lubricants or bleaches. In the leather industry they are used in soaking and defatting agents.

The MARLIPAL O13 grades have good emulsifying properties for various oils and solvents. In applications where e.g. polydimethyl siloxanes shall be used, MARLIPAL O13 yields fine dispersion water-based emulsions.

The good hard water stability and their stability over a wide range both in acidic and in alkaline media results in a broad variety of applications. Some examples of guideline formulations are given below to illustrate some of the many possible applications of MARLIPAL O13 grades in detergents and technical applications.

6.5 Guideline formulations

Heavy duty detergent, powder	
MARLIPAL O13/60	7.0 %
MARLON ARL (LAS powder, Sasol Germany GmbH)	10.0 %
Soap	3.0 %
Zeolite A	30.0 %
Polycarboxylate	5.0 %
Sodium disilicate	5.0 %
Sodium perborate monohydrate	11.0 %
TAED	4.0 %
Sodium carbonate	14.0 %
Phosphonate	1.0 %
Enzymes, optical brightener, perfume	add to 100 %

Prepared by the spray mixing process.

Laundry liquid	
MARLIPAL O13/79	15.0 %
MARLON AS3 (LAS, Sasol Germany GmbH)	10.0 %
Coconut fatty acid	12.0 %
Potassium hydroxide solution (50%) to pH 9.5	ca. 10.0 %
Sodium citrate dihydrate	3.0 %
Phosphonate	2.0 %
Ethanol, propylene glycol	8.0 %
Water, preservative, enzymes, perfume, dye	add to 100 %

Detergent for 30 °C and 60 °C washes.

All-purpose cleaner, concentrate	
MARLIPAL O13/70	12.0 %
MARLON A 350	3.0 %
(LAS-Na, Sasol Germany GmbH)	
Soft soap, 40 %	1.0 %
Sodium citrate dihydrate	1.0 %
Na cumene sulphonate 40	5.0 %
(hydrotrope, Sasol Germany GmbH)	
Butyldiglycol	1.0 %
Water, preservative, enzymes, perfume, dye	add to 100 %

Recommended dosage: 5 g/l of water
For heavy soiling, use as is.

Sanitary cleaner, viscous	
MARLIPAL O13/99	3.3 %
MARLAZIN OL 2	3.5 %
(fatty amine ethoxylate, Sasol Germany GmbH)	
Citric acid	10.0 %
Na cumene sulphonate 40	3.5 %
(hydrotrope, Sasol Germany GmbH)	
Water, preservative, perfume, dye	add to 100 %

Acid cleaner with limescale removing properties.

Ultrasonic cleaner	
MARLIPAL O13/70	7.0 %
MARLIPAL O13/120	3.0 %
Nitrilotriacetate, powder	8.0 %
Sodium metasilicate pentahydrate	3.0 %
KNa cumene sulphonate 40	15.0 %
(hydrotrope, Sasol Germany GmbH)	
Water, preservative	add to 100 %

Recommended dosage: 1–3 % in water.

Cleaner for car washes, high foaming	
MARLIPAL O13/129	7.5 %
Cocobetaine, 30 %	7.5 %
DACAMID DC	1.0 %
(coconut oil diethanolamide, Sasol Italy S.p.A.)	
Nitrilotriacetate, 40 %	12.0 %
Phosphonate, 60 % (HEDP type)	3.0 %
Water, preservative	add to 100 %

For use in automatic brush-type car washes.

Silicone oil emulsion for technical applications	
MARLIPAL O13/79	11.1 %
Water	8.9 %
Dimethyl polysiloxane (e. g. 400 – 8000 mm^2/s)	40.0 %
Water	add to 100 %

Mix MARLIPAL O13/79 with a portion of hot water. Add silicone oil (ca. 60 °C) to the warm mixture and homogenized under intensive stirring for ca. 1 h. Add warm water (60 °C) in portions while reducing step by step the stirring action.

7. Product safety and environmental impact

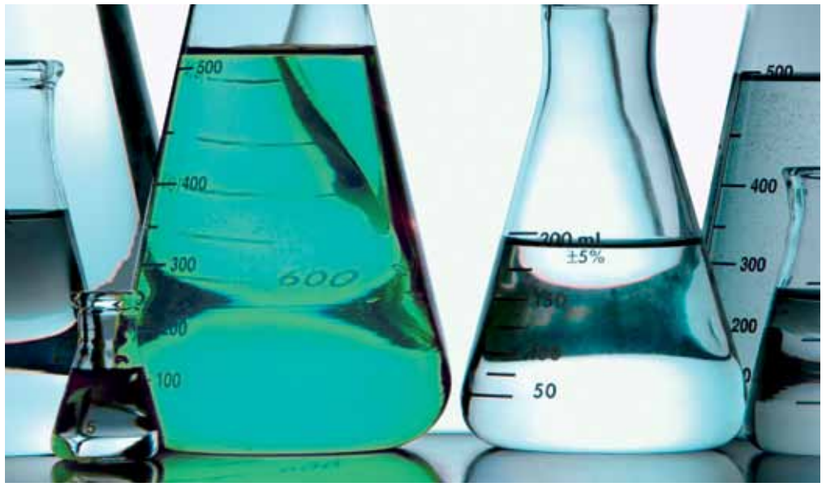
As other ethoxylates of the current market the MARLIPAL O13 products have low to moderate oral toxicity. Some MARLIPAL O13 grade exert eye irritating or damaging properties, hence safety precautions, such as eye protection, have to be observed when handling alcohol ethoxylates.

The impact of MARLIPAL O13 grades on the aquatic environment has been investigated in various tests. While in principle they are of low acute aquatic toxicity and readily biodegradable, some of them are classified for aquatic effects. The majority of MARLIPAL O13 products can be considered biodegradable under anaerobic conditions, and hence the products are suitable for use in environmentally labelled formulations (e.g. Ecolabel, Nordic Swan, Blue Angel).

No long term effects have been reported after many years of experience in various applications.

For specific product information please refer to the safety data sheet.

Precise information on handling, toxicological data and environmental characterization of the individual grades is given in the safety data sheets that are available on request.



8. Storage and handling

MARLIPAL O13 products can be stored in stainless steel tanks (steel grade 1.4541 or 1.4571), which must be heatable for the medium and higher range ethoxylates.

If the MARLIPAL O13 products are stored at a low temperature they may turn cloudy, solidify or form layers. It is therefore advisable to heat and thoroughly mix the contents of drums or containers before partially draining some of the contents, in order to obtain a homogeneous product.

Overheating is a key variable that could have an adverse effect on product quality, e.g. on colour quality. Care should be taken, therefore, to store the product at the proper temperature and to use a heating medium that does not produce excessive localized temperatures. It is generally recommended that MARLIPAL O13 products should not be stored at temperatures above 50 °C for extended periods. It is best to store the individual products at the lowest temperature necessary to keep them fluid enough to pump and process.

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