LIAL
ALCHEM
ISALCHEM

C_9 – C_{15} alcohols

Sasol Chemicals

About us

We at Sasol Chemicals innovate for a better world and deliver long-term value to our customers, communities and society.

Our broad portfolio of high-value products plays an integral role in the creation of numerous solutions that benefit the lives of millions of people.

Thousands of companies around the world leverage our technology, world-class facilities, expertise and collaborative approach to tackle their challenges.

Contents

Sasol oxo alcohol portfolio

Sasol is a global market leader in linear and branched alcohols, their mixtures and derivatives.

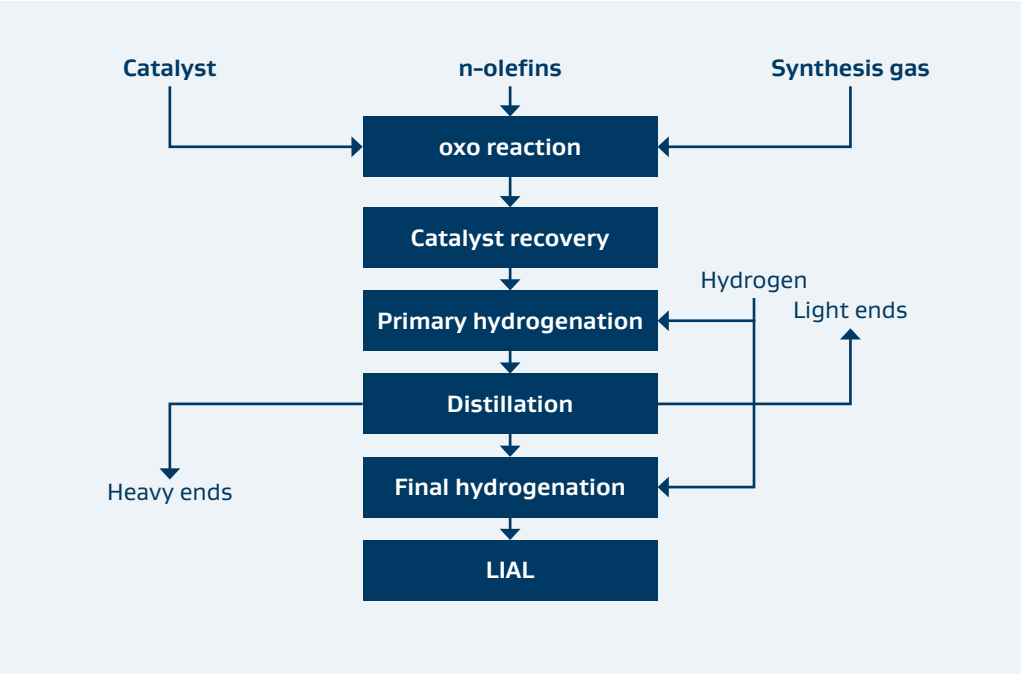
The alcohols produced by Sasol Italy at its Augusta (SR, Italy) plant are made via hydroformylation and hydrogenation (the oxo process) of n-olefins.

Our alcohols are inherently deforestation-free built into the process.

With a production base in Europe, we offer reliable, consistent lead times for regional deliveries.

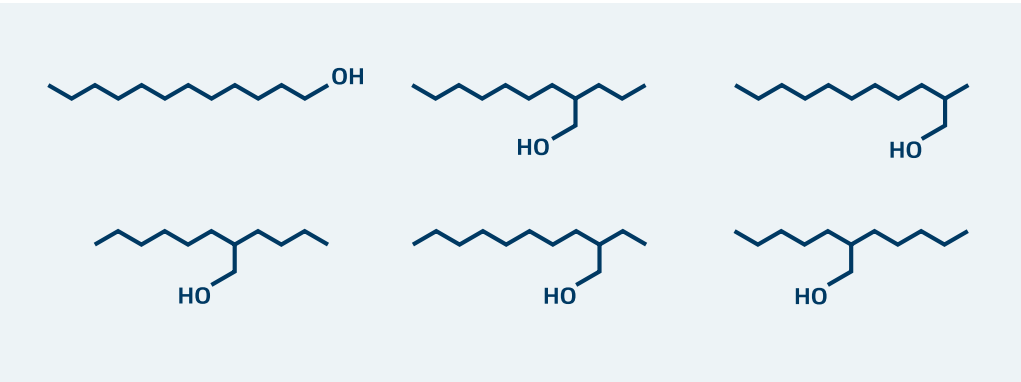
A block diagram of the entire manufacturing process is shown in Figure 1.

Figure 1:
Production flow chart of **LIAL** alcohols

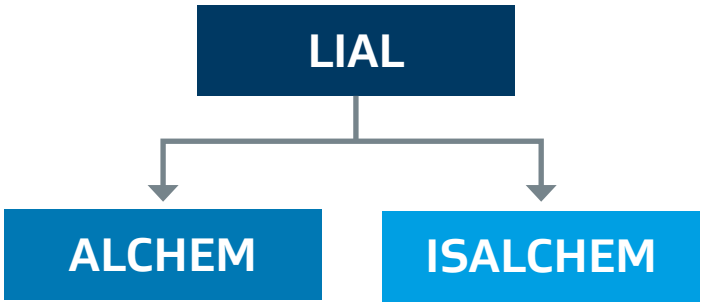


The resulting product is a mixture of linear and primary C2-monobranched alcohols with well-defined chemical structures. Figure 3 illustrates the chemical structures of the C12 isomers present in **LIAL** alcohols.

Figure 2:
Chemical structure of C_{12} isomers in **LIAL** alcohols.

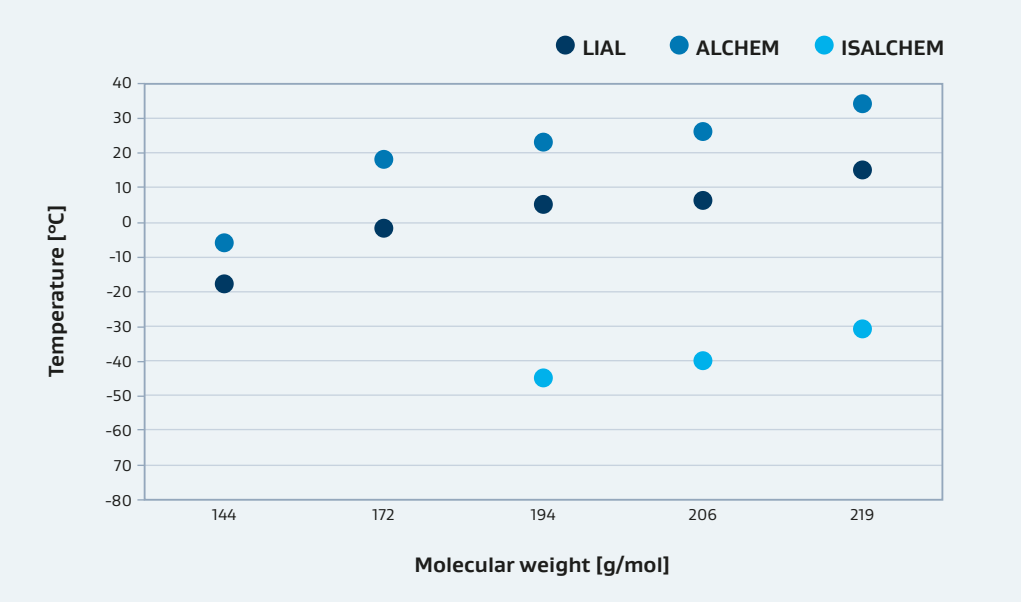


LIAL alcohols can be further processed to obtain **ISALCHEM** (monobranched) and **ALCHEM** (linear) fractions. Although some lighter **ISALCHEM** grades, such as **ISALCHEM 11**, are not included in our standard production range, we can make them available to support market needs and meet specific requirements. In addition, custom blends can be prepared to accommodate individual customer needs.



The differing chemical structures of **LIAL** (a mixture of linear and branched alcohols), **ALCHEM** (linear alcohols) and **ISALCHEM** (branched alcohols) lead to significant differences in physico-chemical properties – both for the alcohols themselves (e.g., pour point; see Figure 3) and for their corresponding derivatives – enabling us to provide products that best fit our customers' requirements.

Figure 3:
Pour point of **LIAL**, **ALCHEM**, and **ISALCHEM** alcohols as a function of molecular weight.



Applications

Owing to their diverse structures and properties, **LIAL**, **ALCHEM** and **ISALCHEM** alcohols can be used directly or converted into derivatives, enabling effective performance across a broad range of applications.

Our oxo alcohols are fully saturated, offering excellent stability against oxidation. This makes them an ideal choice for a wide range of end uses where product longevity and performance consistency are essential.

Detergents and cleaners

- Washing powders
- Liquid detergents
- Detergent tablets
- All-purpose cleaners

Cosmetics and personal care

- Shampoos
- Bath foams
- Toothpastes
- Hair conditioners
- Creams and lotions
- Make-up products

Plastic additives

- Plasticizers
- Lubricants
- Stabilizers
- Polymerization auxiliaries

Textile and leather

- Scouring agents
- Wetting agents
- Softeners
- Emulsifiers

Metal processing

- Metalworking fluids
- Aluminium rolling oils
- Industrial lubricants
- Automotive lubricants

Pulp and paper

- Deinking
- Floatation agents
- Foam depressants

Agro solutions

- Adjuvants
- Emulsifiers
- Wetting Agents
- Dispersants

Flavourings and fragrance

- Aroma chemicals

Oil and gas

- Enhanced oil recovery
- Cleaning agents

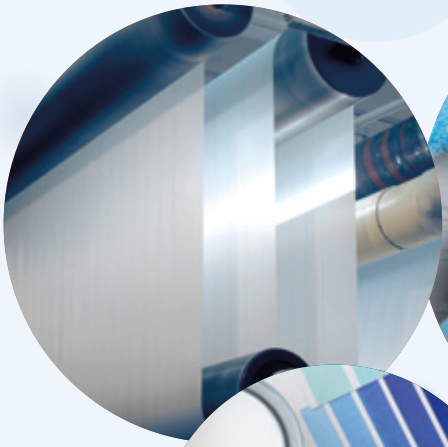
Inks, paints and coatings

- Wetting agents
- Dispersants
- Emulsifiers
- Foam control





Applications





Our products are used across a wide range of everyday applications, enhancing safety, convenience and value.

Customized branching to meet specific requirements

The range of branching levels, from 5 % to 95 % – spanning **ALCHEM**, **LIAL**, and **ISALCHEM** – enables to select the grade that best suits your end-users' requirements. In addition, a choice of different molecular weights allows for precise fine-tuning of product properties.

The variation in basic physico-chemical properties due to linearity and molecular weight, such as viscosity and pour point, is reflected in the different performance of oxo alcohols in various application tests.

Surface wetting

It is well established that branching effectively enhances wetting. **ISALCHEM** and **LIAL** remain the preferred choices for applications where solid surfaces need to be wetted, with **ISALCHEM** being particularly effective for aluminium.

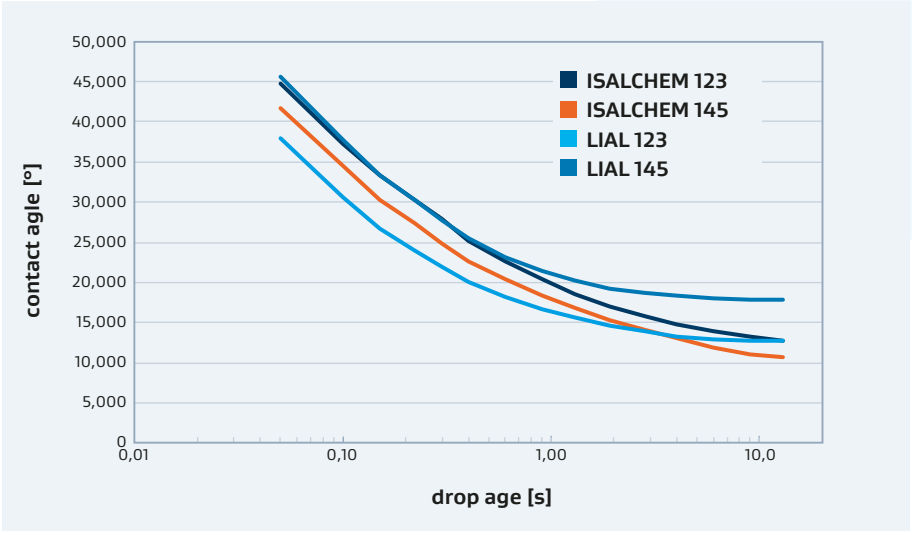


Figure 4:
Contact angles of pure alcohols on stainless steel at 25 °C

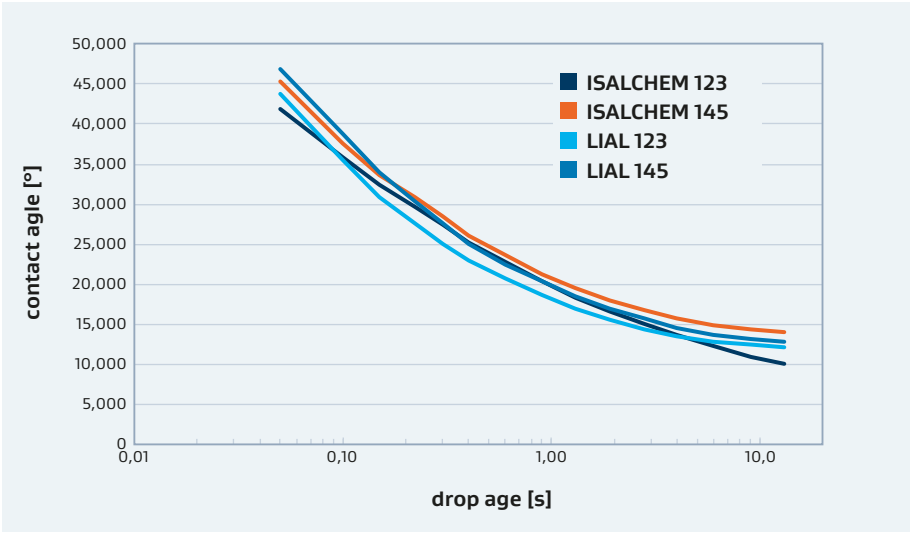


Figure 5:
Contact angles of pure alcohols on aluminium at 25 °C

Solubility in mineral oils and effectiveness as co-emulsifiers

The presence of some branching in the molecular structure can also improve solubility in media, notably enhancing stability at lower temperatures. Oxo alcohols are highly miscible with oils representative of Group II, Group III, Group IV, and Group V.

The following table shows the appearance of mixtures composed of 75 % base oil and 25 % alcohol. The base oils were selected to represent various classes and all have the same viscosity (ISO VG 22).

	4 °C				25 °C			
Alcohol	Group II	Group III	Group IV	Group V	Group II	Group III	Group IV	Group V
LIAL 123	●	●	●	●	●	●	●	●
LIAL 145	●	●	●	●	●	●	●	●
ISALCHEM 123	●	●	●	●	●	●	●	●
ISALCHEM 145	●	●	●	●	●	●	●	●
Linear C_{14} alcohol	●	●	●	●	●	●	●	●
Linear C_{16} alcohol	●	●	●	●	●	●	●	●

● Liquid
● Biphasic
● Solid

Figure 6: Appearance of 75 % base oil and 25 % alcohol mixtures

Oxo alcohols can also support the solubilisation of additive packages in base oils; the quantity required varies depending on the additive package and base oil, but all grades have demonstrated their effectiveness.

Owing to their polarity, alcohols serve as highly effective co-emulsifiers. While mid- to long-chain alcohols are traditionally employed as co-emulsifiers and consistency enhancers in cosmetic formulations, branching in mid-cut alcohols makes them particularly suitable for stabilising water-based liquid formulations, such as those used in metal forming and cutting.

The following example illustrates the efficacy of medium to highly branched alcohols in stabilising a semi-synthetic metalworking fluid formulation. Alcohol is added incrementally until the concentrate achieves clarity.

All concentrates produced stable emulsions upon dilution with water down to 5 %.

Component	Weight %
Napthenic base oil 22 cSt	30.0
Oleic acid	1.0
Sodium petroleum sulphonate	4.0
SLOVACID O3	2.0
MARLOX RT 64	5.0
MARLOX RT 42	2.0
MARLOWET 4562	2.0
Oxo alcohol	**Up to clarity**
ISOCARB 12	4.0
Lactic acid	1.0
MIPA	7.0
TEA	5.0
Benzotriazole	0.4
Biocide	q.s.
Water	34

Products offered by Sasol are shown in **bold**.

Component	Weight %
LIAL 123	**1.7**
LIAL 145	**1.8**
ISALCHEM 123	**1.7**
ISALCHEM 145	**1.7**

Figure 7: Example of metalworking formulation stabilized with alcohol

Raw material for high-performance plasticizers

The availability of grades with varying linear alcohol content makes the oxo alcohol range particularly suitable for the production of plasticizer esters for PVC. Medium branching enables a balanced combination of desirable properties derived from both linear and branched structures, allowing for fine-tuning of end-product characteristics.

Phthalate esters have been prepared to evaluate the performance of oxo alcohols with different degrees of branching, in comparison with tris(2-ethylhexyl) trimellitate (TEHTM), for the manufacture of PVC sheets.

As anticipated, results demonstrate that linear plasticizers provide superior low-temperature flexibility, while the incorporation of some branching enhances mechanical properties.

PVC test sheets are prepared under standard conditions using the test formulation specified below:

100 phr	S PVC K70
50 phr	Plasticizer
1.5 phr	BaZn stabilizer
0.3 phr	Lubricant

Alcohol component		Unit	LIAL 111	LIAL 111L	ALCHEM 11-99	2-ETHYL HEXYL
Linearity		%	50	70	99	100
Acid component		—	Phthalic anhydride			Trimellitic anhydride
Before ageing						
100 % Modulus		[N/mm²]	12.3	12.1	11.4	13.9
Tensile strength		[N/mm²]	22.0	22.0	21.2	24.5
Elongation @ break		[%]	293	310	316	304
Cold flexibility (Clash & Berg)	334.5 N/mm²	[°C]	-34	-34.7	-35	-15
	669 N/mm²	[°C]	-48	-47.9	-50	-29
After ageing (7 d/90°C)						
Volatile loss after (168 h/90 °C)		[%]	0.7	0.4	0.4	0.7
100 % Modulus		[N/mm²]	13.9	13.0	10.5	10.4
Tensile strength		[N/mm²]	24.5	21.9	21.6	21.3
Elongation @ break		[%]	304	278	308	300
Cold flexibility (Clash & Berg)	334.5 N/mm²	[°C]	-15	-34	-36	-33
	669 N/mm²	[°C]	-29	-48	-51	-46

Trademarks of oxo alcohol derivatives

Sasol offers a comprehensive portfolio of derivatives of its oxo alcohols, engineered to meet specific requirements across detergent, industrial, paints and coatings, enhanced oil recovery, and personal care applications.

LIALET	ethoxylates are effective ingredients for detergent formulations, delivering excellent detergency and a favourable solubility profile.
MARLOX	within the this alkoxylates portfolio, derivatives based on short-chain oxo alcohols deliver superior wetting, with a selection of low-foam and anti-foam performance options. This makes them suitable for a wide range of end-use formulations in both detergent and industrial applications.
NONIDAC	high-mole ethoxylates are tailored to the needs of the Paints and Coatings industry, serving as high-performance non-ionic emulsifiers and effective dispersants for reliable stability and processing.
DACLOR	low-mole ethoxysulphates are an ideal choice in the detergent field when high degreasing is required.
ANIODAC	high-mole ethoxysulphates, by contrast, are ideal emulsifiers for emulsion polymerization with a wide variety of monomers.
ALFOTERRA	alkoxysulphates have been successfully developed for enhanced oil recovery in low to medium temperatures reservoirs across a wide range of salinities.
COSMACOL Esters	are emollients based on oxo alcohols and acids, selected to enhance specific product properties such as keratolytic and moisturising effects.

LIAL product range

	Sales specification					
	Composition	**Average molar mass**	**Hydroxyl number**	**Colour**	**Acid number**	**Carbonyl number**
Unit	[wt. %]	[g/mol]	[mg KOH/g]	[APHA]	[mg KOH/g]	[mg KOH/g]
LIAL – Mixture of linear and monobranched alcohols (single cuts and blends)						
LIAL 99	**C_8 and lighter:** max. 1.0 **C_9:** min. 95.0 **C_{10} and heavier:** max. 4.0	142 – 148	389*	max. 10	max. 0.50	max. 0.30
LIAL 111	**C_{10} and lighter:** max. 2.0 **C_{11}:** min. 94.0 **C_{12} and heavier:** max. 5.0	170 – 175	320 – 330	max. 10	max. 0.05	max. 0.20
LIAL 111 L	**C_{11} and lighter:** max. 2.0 **C_{11}:** min. 94.0 **C_{12} and heavier:** max. 5.0	170 – 175	320 – 330	max. 10	max. 0.05	max. 0.20
LIAL 123	**C_{11} and lighter:** max. 1.0 **C_{12}:** 38 – 48 **C_{13}:** 52–62 **C_{14} and heavier:** max. 3.0	192–196	286 – 292	max. 10	max. 0.10	max. 0.15
LIAL 125	**C_{11} and lighter:** max. 0.5 **C_{12}:** 19 – 25 **C_{13}:** 28 – 34 **C_{14}:** 27 – 33 **C_{15}:** 15 – 21 **C_{16} and heavier:** max. 1.5	204 – 209	270 – 276	max. 10	max. 0.10	max. 0.25
LIAL 125 L	**C_{11} and lighter:** max. 1.0 **C_{12}:** 18 – 25 **C_{13}:** 25 – 32 **C_{14}:** 28 – 34 **C_{15}:** 16 – 22 **C_{16} and heavier:** max. 2.0	204 – 210	267 – 275	max. 10	max. 0.10	max. 0.20
LIAL 145	**C_{11} and lighter:** max. 1.0 **C_{14}:** 55 – 65 **C_{15}:** 35 – 45 **C_{16} and heavier:** max. 3.0	217 – 222	252 – 258	max. 10	max. 0.08	max. 0.30

* Typical value

						Additional properties (typical values)				
	Bromine index	**Water**	**Hydro-carbons**	**Diols**	**Flash point**	**Branching degree**	**Density @20 °C**	**Viscosity @40 °C**	**Pour point**	**Distillation**
	[mg Br/100 g]	[wt. %]	[wt. %]	ppm	[°C]	[wt. %]	[kg/l]	[cSt]	[°C]	[°C]
	max. 50	max. 0.50	max. 0.20	—	98*	35	0.829	7	-18	—
	max. 50	max. 0.10	max. 0.10	—	min. 110	50	0.835	10	-2	i. b. p. 236 f. b. p. 243
	max. 50	max. 0.10	max. 0.10	—	min. 110	32 – 38	0.835	10	4	236 – 245
	max. 50	max. 0.10	max. 0.10	max. 1,000	min. 125	54	0.836	13	5	i. b. p. 253 f. b. p. 277
	max. 50	max. 0.10	max. 0.15	max. 1,000	min. 125	57	0.836	14	6	i. b. p. 261 f. b. p. 298
	max. 100	max. 0.10	max. 0.15	max. 1,000	min. 136*	27	0.820 at 50 °C	14	15	265 – 290
	max. 50	max. 0.10	max. 0.15	max. 1,000	min. 125	60	0.837	16	15	i. b. p. 274 f. b. p. 296

ISALCHEM and ALCHEM product range

	Sales specification					
	Composition	**Total linear alcohol**	**Average molar mass**	**Hydroxyl number**	**Colour**	**Acid number**
Unit	[wt. %]	[wt. %]	[g/mol]	[mg KOH/g]	[APHA]	[mg KOH/g]
ISALCHEM – Monobranched alcohols						
ISALCHEM 123	**C_8 and lighter:** max. 1.0 **C_{12}:** 37 – 48 **C_{13}:** 52 – 63 **C_{14} and heavier:** max. 4.0	—	192 – 196	286 – 293	max. 10	max. 0.10
ISALCHEM 125	**C_{11} and lighter:** max. 1.0 **C_{12}:** 18 – 25 **C_{13}:** 26 – 34 **C_{14}:** 27 – 36 **C_{15}:** 16 – 22 **C_{16} and heavier:** max. 2.0	—	203 – 209	268 – 276	max. 10	max. 0.10
ISALCHEM 145	**C_{13} and lighter:** max. 5.0 **C_{14}:** 54 – 68 **C_{15}:** 32 – 45 **C_{16} and heavier:** max. 3.0	—	215 – 221	253 – 261	max. 10	max. 0.08
ALCHEM – Linear alcohols (single cuts and blends)						
ALCHEM 9–99	**C_9 monobranched and lighter:** max. 0.50 **C_9 linear:** min. 99.0 **C_{10} and heavier:** max. 1.0	min. 99	142 – 145	389*	5*	max. 0.10
ALCHEM 11–99	**C_{11} monobranched and lighter:** max. 0.50 **C_{11} linear:** min. 99.0 **C_{12} and heavier:** max. 1.0	min. 99	172	326*	max. 10	max. 0.20
ALCHEM 123	**C_{11} and lighter:** max. 1.0 **C_{12}:** 37 – 48 **C_{13}:** 26 – 34 **C_{13}:** 52 – 63 **C_{14} and heavier:** max. 4.0	min. 92	194*	287 – 293	max. 10	max. 0.06
ALCHEM 125	**C_{11} and lighter:** max. 0.5 **C_{12}:** 18 – 25 **C_{13}:** 26 – 34 **C_{14}:** 26 – 35 **C_{15}:** 15 – 21 **C_{16} and heavier:** max. 1.5	min. 93	203 – 209	268 – 276	max. 10	max. 0.10
ALCHEM 145	**C_{13} and lighter:** max. 4.0 **C_{14}:** 57 – 68 **C_{15}:** 31 – 42 **C_{16} and heavier:** max. 3.0	min. 93	218*	203 – 209	max. 10	max. 0.60

* Typical value

						Additional properties (typical values)				
	Carbonyl number	**Bromine index**	**Water**	**Hydro-carbons**	**Flash point**	**Branching degree**	**Density @20 °C**	**Viscosity @40 °C**	**Pour point**	**Distillation**
	[mg KOH/g]	[mg Br/100 g]	[wt. %]	[wt. %]	[°C]	[wt. %]	[kg/l]	[cSt]	[°C]	[°C]
	max. 0.25	max. 80	max. 0.10	max. 0.20	137*	min. 92	0.835	12	-45	i. b. p. 257 f. b. p. 287
	max. 0.30	max. 90	max. 0.10	max. 0.25	min. 125	94	0.836	14	-40	i. b. p. 268 f. b. p. 305
	max. 0.25	max. 100	max. 0.10	max. 0.25	min. 125	95	0.837	15	-31	i. b. p. 283 f. b. p. 308
	max. 0.20	max. 20	max. 0.10	max. 0.15	102*	—	0,830	9	-6	i. b. p. 212 f. b. p. 229
	max. 0.35	max. 50	max. 0.10	max. 0.10	120*	—	0,832	10	18	i. b. p. 240 f. b. p. 245
	max. 0.10	max. 50	max. 0.10	max. 0.10	120*	—	0,827 @ 30 °C	13	23	i. b. p. 267 f. b. p. 291
	max. 0.10	max. 50	max. 0.10	max. 0.10	124*	—	0,821 @ 40 °C	14	26	i. b. p. 275 f. b. p. 308
	max. 0.10	max. 50	max. 0.10	max. 0.15	142*	—	0,836 @ 50 °C	17	34	i. b. p. 291 f. b. p. 311

Viscosity, density and gas chromatogram

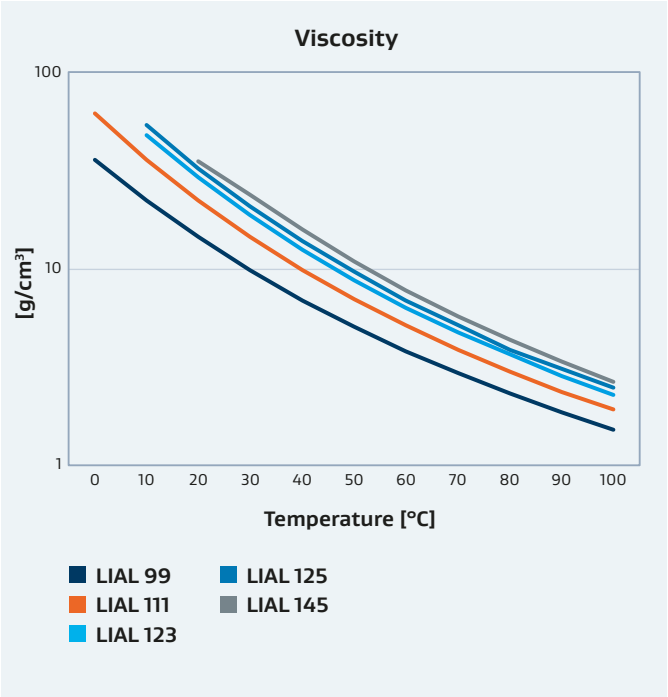


Figure 8: Viscosity of **LIAL** alcohols as a function of temperature

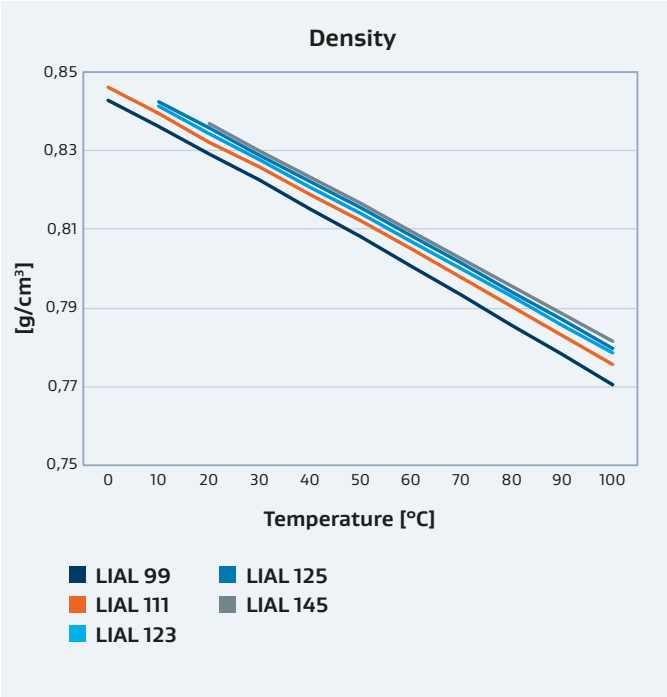


Figure 9: Density of **LIAL** alcohols as a function of temperature

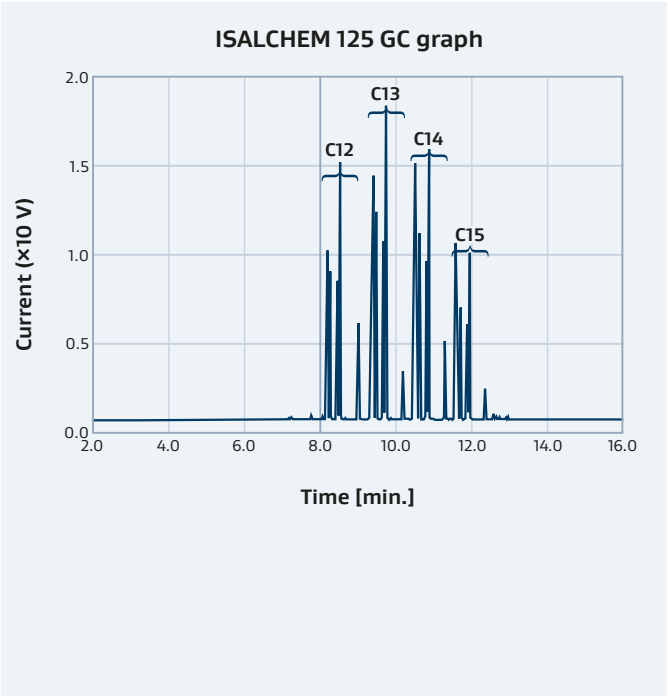


Figure 10: Gas chromatogram of **ISALCHEM 125**

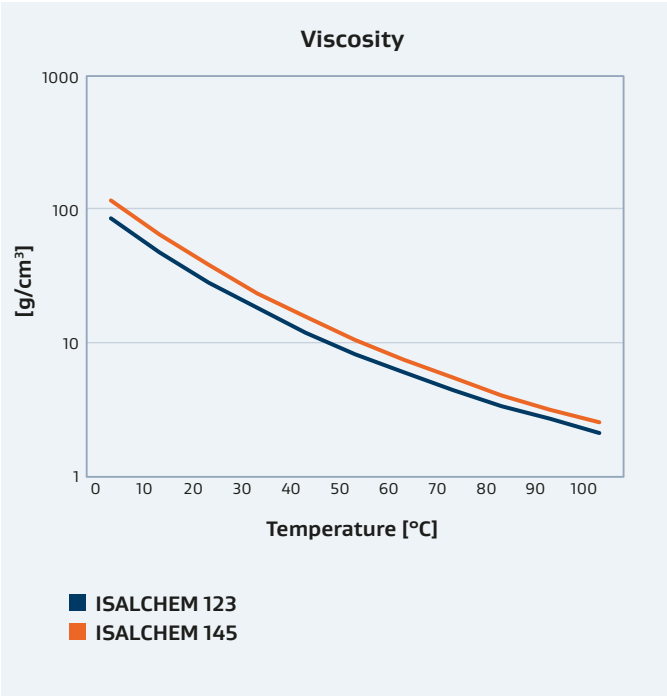


Figure 11: Viscosity of **ISALCHEM 123** and **ISALCHEM 145** as a function of temperature

Analytical methods

Parameter	With reference to
Composition	RCM 1101
Av. molar mass	RCM 1101
Hydroxyl number	RCM 1101[a)]
Colour	ASTM D5386
Acid number	ASTM D664
Carbonyl number	ISO 1279
Bromine index	ASTM D1492
Water	ISO 12937
Hydrocarbons	RCM 1101
Flash point	ASTM D93
Diols	RCM 1402
Branched / linear alcohol content	RCM 1101
Density @ 20 °C	ASTM D4052 / ASTM D7042
Viscosity @ 40 °C	ASTM D 446
Pour point	ASTM D5950
Distillation	ASTM D86

RCM refers to analytical methods developed internally by Sasol. Additional information is available upon request.
a) Calculated by GC results

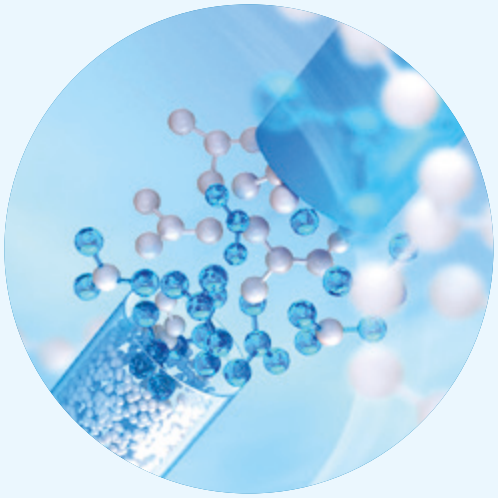
Why oxo alcohols are an ideal choice

Local manufacturing facilities in key import markets
Supporting local business with reliable supply chains and local assistance

Extensive portfolio of alcohols designed to meet market requirements for high-performance products and tailored solutions.

Products exempt from EUDR regulations

Committed to achieving our goal of reducing CO_2 emissions by 30 % by 2030.



SASOL CHEMICALS
Solutions for sustainability

Extending our customized high performance product lines through new sustainable feedstock options

- EcoVadis scorecards for all main production countries
- Product innovations reducing greenhouse gas emissions
- Following ISO norms and TfS guideline to calculate product carbon footprints
- ISCC PLUS certified solvents
- RSPO-MB certified fatty alcohols

Our global footprint

SASOL CHEMICALS

● Sasol Chemicals' business locations, e.g. offices, production sites, JVs, laboratories, etc.

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CONTACT US

Sasol Chemicals

www.chemicals.sasol.com

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