

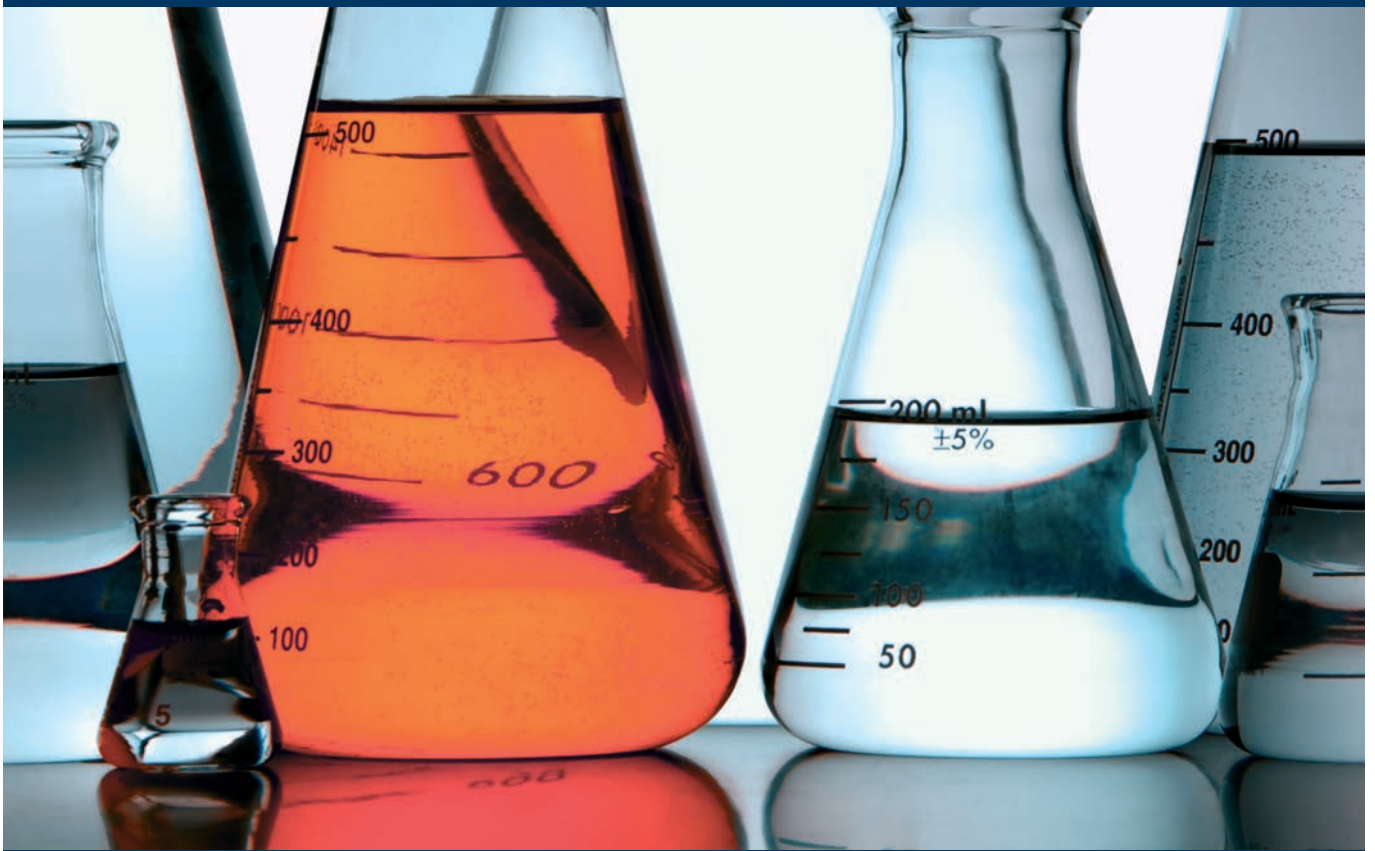


SASOL

LIAL ALCHEM ISALCHEM

$C_9 - C_{17}$ alcohols

Sasol Performance Chemicals



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About us

Sasol’s Performance Chemicals business unit markets a broad portfolio of organic and inorganic commodity and speciality chemicals. Our business consists four key business divisions: Organics, Inorganics, Wax and PCASG (Phenolics, Carbon, Ammonia and Speciality Gases). About 6300 people (incl. employees from 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 alkyl benzene (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 sub-division supplies its customers with high-quality ammonia, hydrogen and CO₂ 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 other diverse 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.

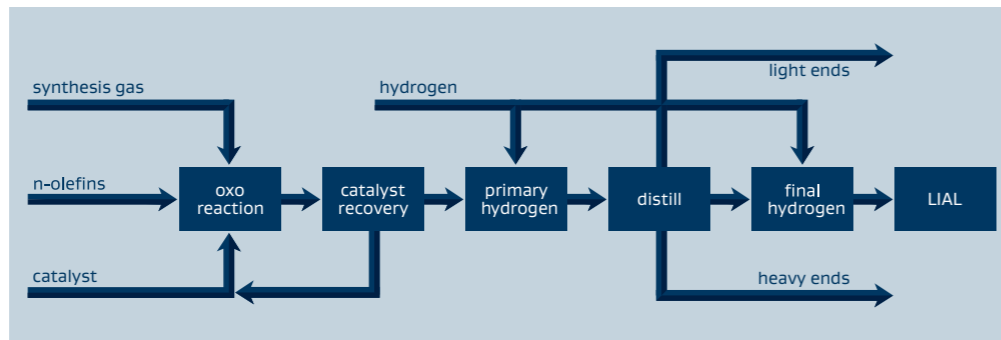


1. Sasol Italy alcohol portfolio

- LIAL** Mixture of linear and monobranched C₉–C₁₇ alcohols, single cuts and blends
- ALCHEM** Linear C₉–C₁₇ alcohols, single cuts and blends
- ISALCHEM** Monobranched C₉–C₁₇ alcohols, single cuts and blends

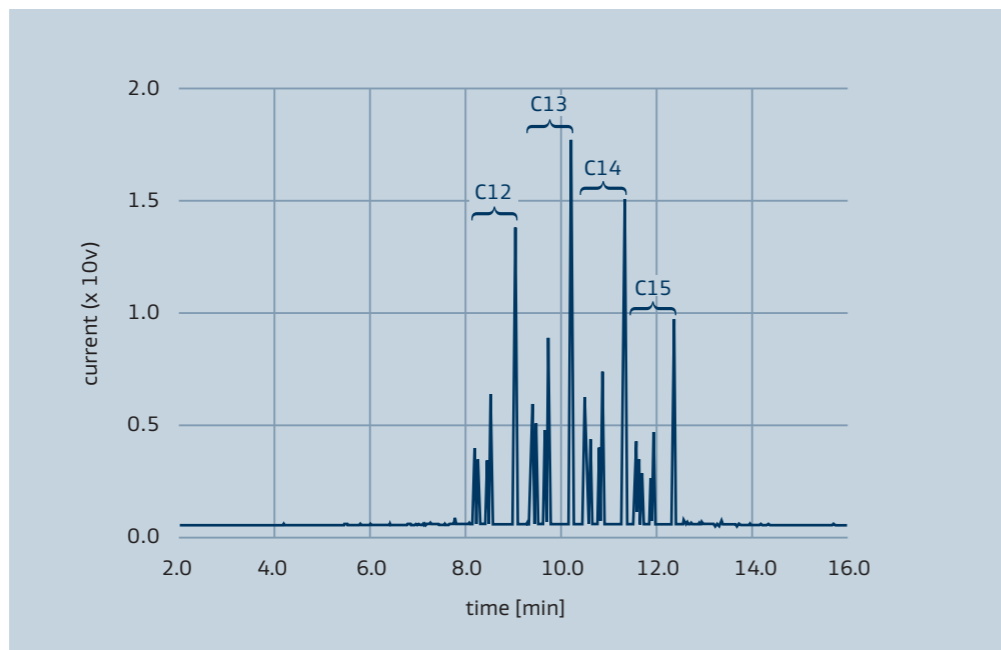
Sasol is a worldwide market leader of linear and branched alcohols, mixtures and derivatives. The alcohols produced by Sasol Italy in the plant sited in Augusta (SR), are obtained by hydroformylation and hydrogenation (OXO process) of petrochemical derived n-olefins. Figure 1 shows a block diagram of the entire manufacturing process.

Figure 1: Production flow chart of LIAL alcohols.

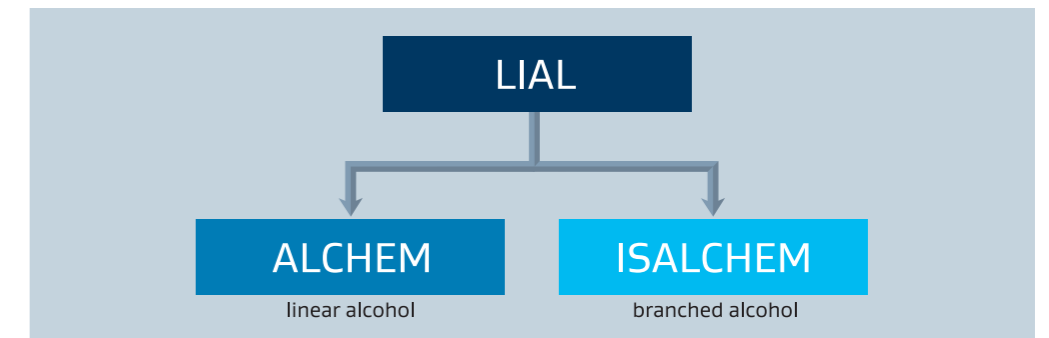


The product obtained is a mixture of linear and primary C₂-monobranched alcohols with a well defined chemical structure, as clearly noticeable from the alcohol chromatogram reported in Figure 2. In Figure 3 the chemical structure of the C₁₂ isomers contained in LIAL alcohols is represented.

Figure 2: Gas chromatogram of LIAL 125.



LIAL alcohols can be further processed in order to obtain ISALCHEM and ALCHEM alcohols that are the monobranched and linear fractions respectively. Moreover, additional blends can be prepared according to customer requests.



The different chemical structure of the LIAL (mixture of linear and branched alcohols), ALCHEM (linear alcohols) and ISALCHEM (branched alcohols) produces relevant differences in the physical-chemical properties both in the alcohols (as in the case of pour point, see Figure 4) and in the corresponding derivatives, giving us the possibility to offer the product that better fits our customer requirements.

Figure 3: Chemical structure of C₁₂ isomers in LIAL alcohols.

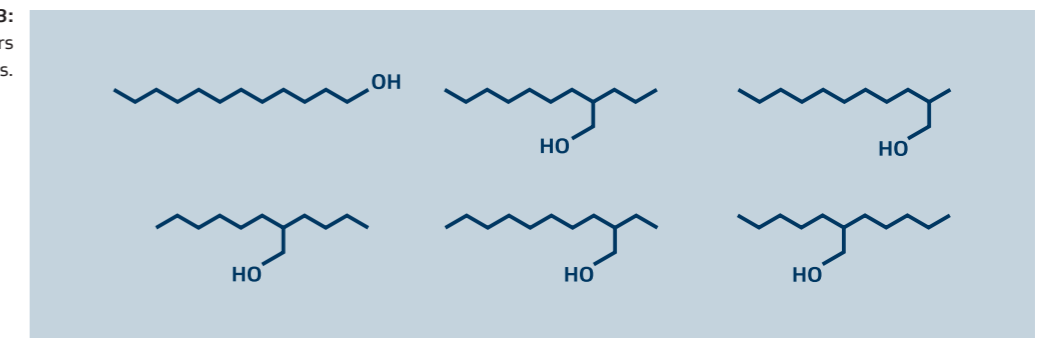
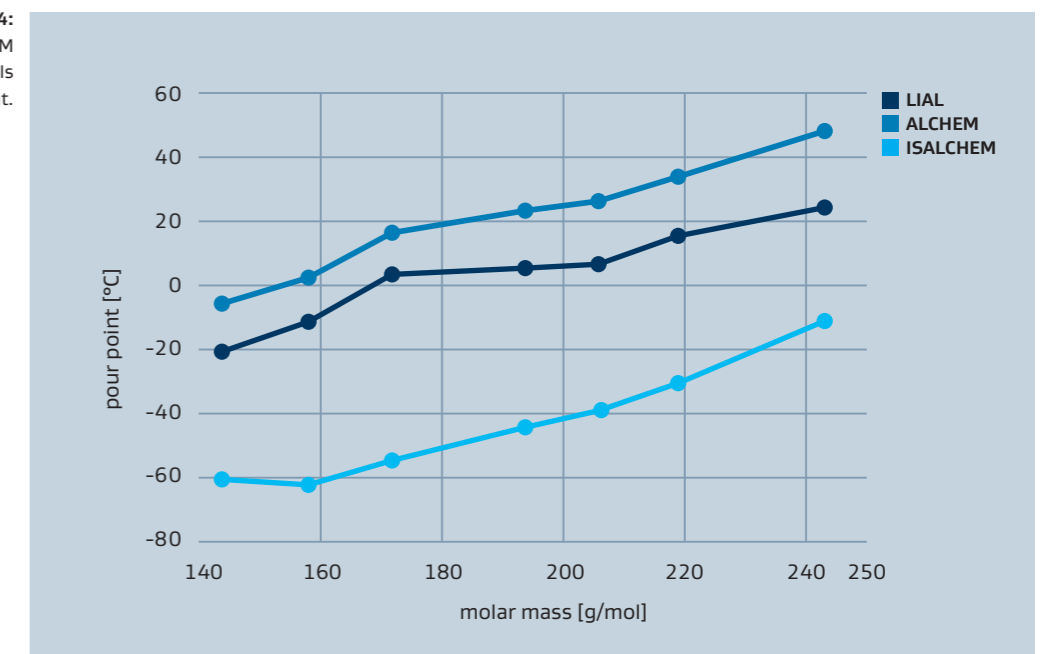


Figure 4: Pour point of LIAL, ALCHEM and ISALCHEM alcohols vs the molecular weight.



2. Applications

Due to the wide range of structure and properties, LIAL, ALCHEM and ISALCHEM alcohols can be used as is or derivatized to be successfully used in several application fields.

Detergents and I&I cleaners

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

Cosmetic and personal care

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

Plastic additives

- Plasticizers
- Lubricants
- Stabilizers
- Polymerization auxiliaries

Textile & leather

- Scouring agents
- Wetting agents
- Softeners
- Emulsifiers

Metal processing

- Coupling agents
- Aluminium rolling oils
- Metal working liquids

Pulp & paper

- Deinking
- Floatation agents
- Foam depressant

Agrochemicals

Flavour & fragrances

3. Other products and trademarks

Based on LIAL, ALCHEM and ISALCHEM, we produce the following derivatives:

LIALET	LIAl alcohol ethoxylates
BIODAC	Short chain alcohol ethoxylates
MARLOX	LIAl alkoxyates
NONIDAC	Alcohol ethoxylates
DACLOR	LIAl ethoxysulphates
DACPON	Alcohol sulfates
ANIODAC	Alcohol ethoxysulphates
COSMACOL	Esters



Our products are used in countless applications in our daily lives to add value, security and comfort.

4. LIAL

Mixture of linear and monobranched C₉–C₁₇ alcohols (single cuts and blends)

		LIAL 99	LIAL 100	LIAL 111
Sales specification		C ₉ -alcohols	C ₁₀ -alcohols	C ₁₁ -alcohols
Composition	[wt. %]	C ₈ & lighter: max. 1.0 C ₉ : min. 95.0 C ₁₀ & heavier: max. 4.0	C ₈ & lighter: max. 1.0 C ₉ : max. 5.0 C ₁₀ : min. 90.0 C ₁₁ : max. 5.0 C ₁₂ & heavier: max. 2.0	C ₁₀ & lighter: max. 2.0 C ₁₁ : min. 94.0 C ₁₂ & heavier: max. 5.0
Av. molar mass	[g/mol]	142–148	155–160	170–175
Hydroxyl number	[mg KOH/g]	389*	351–362	320–330
Colour	[APHA]	max. 10	max. 10	max. 10
Acid number	[mg KOH/g]	max. 0.50	max. 0.05	max. 0.05
Carbonyl number	[mg KOH/g]	max. 0.30	max. 0.20	max. 0.20
Bromine index	[mg Br ₂ /100 g]	max. 50	max. 50	max. 50
Water	[wt. %]	max. 0.50	max. 0.10	max. 0.10
Hydrocarbons	[wt. %]	max. 0.20	max. 0.20	max. 0.10
Diols	ppm	—	—	—
Flash point	[° C]	98*	min. 90	min. 110
Additional properties				
Branching degree	[wt. %]	40	45	50
Density @ 20° C	[kg/l]	0.832	0.833	0.833
Viscosity @ 40° C	[cSt]	7	8	10
Pour point	[° C]	-7	-8	0
Distillation	[° C]	—	i. b. p. 224 f. b. p. 246	i. b. p. 236 f. b. p. 243

*typical value

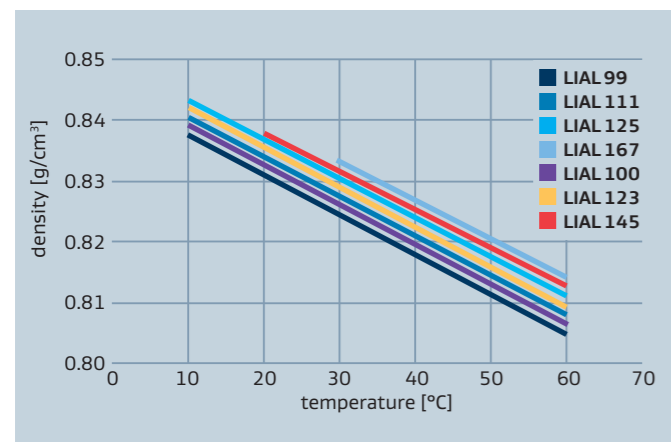


Figure 5: LIAL alcohols density vs temperature.

	LIAL 123	LIAL 125	LIAL 145	LIAL 167
	C ₁₂ –C ₁₃ -alcohols	C ₁₂ –C ₁₅ -alcohols	C ₁₄ –C ₁₅ -alcohols	C ₁₆ –C ₁₇ -alcohols
	C ₁₁ & lighter: max. 1.0 C ₁₂ : 38–48 C ₁₃ : 52–62 C ₁₄ & heavier: max. 3.0	C ₁₁ & lighter: max. 0.5 C ₁₂ : 19–25 C ₁₃ : 28–34 C ₁₄ : 27–33 C ₁₅ : 15–21 C ₁₆ & heavier: max. 1.5	C ₁₃ & lighter: max. 2.5 C ₁₄ : 55–65 C ₁₅ : 35–45 C ₁₆ & heavier: max. 3.0	C ₁₅ & lighter: max. 5.0 C ₁₆ : 55–70 C ₁₇ : 25–40 C ₁₈ & heavier: max. 2.0
	192–196	204–209	217–222	243–249
	286–293	270–276	252–258	223–231
	max. 10	max. 10	max. 10	max. 10
	max. 0.10	max. 0.10	max. 0.08	max. 0.10
	max. 0.15	max. 0.25	max. 0.30	max. 0.80
	max. 50	max. 50	max. 50	max. 50
	max. 0.10	max. 0.10	max. 0.10	max. 0.10
	max. 0.10	max. 0.15	max. 0.15	max. 0.25
	max. 1000	max. 1000	max. 1000	max. 1000
	min. 125	min. 125	min. 125	min. 160
Additional properties				
	54	57	60	65
	0.835	0.836	0.837	0.832 (30 °C)
	12	14	16	20
	5	6	15	24
	i. b. p. 253 i. b. p. 277	i. b. p. 261 i. b. p. 298	i. b. p. 274 i. b. p. 296	i. b. p. 278 i. b. p. 325

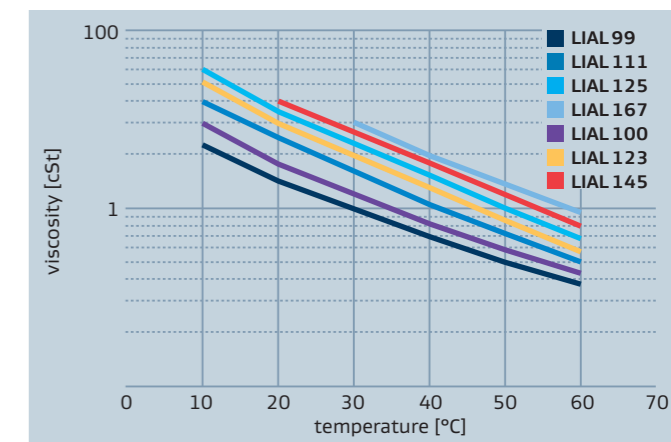


Figure 6: LIAL alcohols viscosity vs temperature.

5. ISALCHEM

Monobranched C₉–C₁₇ alcohols (single cuts and blends)

		ISALCHEM 9	ISALCHEM 10	ISALCHEM 11
Sales specification		C ₉ -alcohols	C ₁₀ -alcohols	C ₁₁ -alcohols
Composition	[wt. %]	C ₈ & lighter: max. 2.0 C ₉ monobranched: min. 90.0 C ₉ linear & heavier: max. 10.0	C ₈ & lighter: max. 0.1 C ₉ : min. 2 C ₁₀ monobranched: min. 85.0 C ₁₀ linear: max. 10 C ₁₁ & heavier: max. 0.1	C ₁₀ & lighter: max. 10.0 C ₁₁ monobranched: min. 90.0 C ₁₁ linear & heavier: max. 1.0
Branching degree	[wt. %]	92*	90*	92*
Av. molar mass	[g/mol]	142–153	155–160	172*
Hydroxyl number	[mg KOH/g]	389*	353*	326*
Colour	[APHA]	5*	max. 10	max. 10
Acid number	[mg KOH/g]	max. 0.20	max. 0.20	max. 0.10
Carbonyl number	[mg KOH/g]	max. 0.50	max. 0.50	—
Bromine index	[mg Br ₂ /100 g]	max. 50	max. 100	max. 50
Water	[wt. %]	max. 0.10	max. 0.10	max. 0.10
Hydrocarbons	[wt. %]	max. 0.50	max. 0.40	max. 0.20
Flash point	[° C]	95*	110*	120*
Additional properties				
Density @ 20° C	[kg/l]	0.830	0.831	0.833
Viscosity @ 40° C	[cSt]	7	8	10
Pour point	[° C]	-61	-63	-55
Distillation	[° C]	i. b. p. 199 f. b. p. 218	i. b. p. 220 f. b. p. 236	i. b. p. 227 f. b. p. 235

*typical value

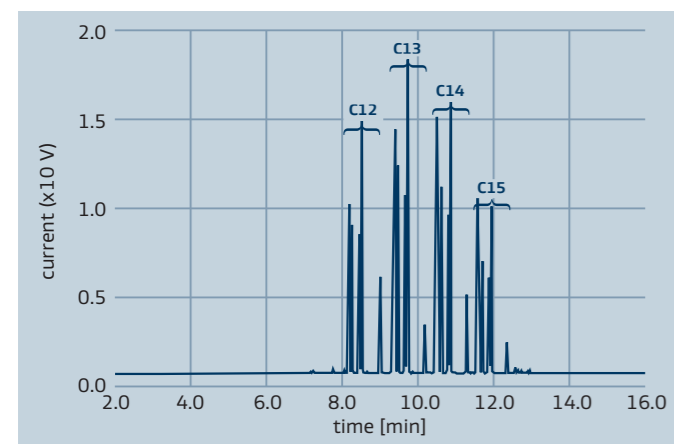


Figure 7: Gas chromatogram of ISALCHEM 125.

	ISALCHEM 123	ISALCHEM 125	ISALCHEM 145	ISALCHEM 167
	C ₁₂ –C ₁₃ -alcohols	C ₁₂ –C ₁₅ -alcohols	C ₁₄ –C ₁₅ -alcohols	C ₁₆ –C ₁₇ -alcohols
	C ₁₁ & lighter: max. 1.0 C ₁₂ : 37–48 C ₁₃ : 52–63 C ₁₄ & heavier: max. 4.0	C ₁₁ & lighter: max. 1.0 C ₁₂ : 18–25 C ₁₃ : 26–34 C ₁₄ : 27–36 C ₁₅ : 16–22 C ₁₆ & heavier: max. 2.0	C ₁₃ & lighter: max. 5.0 C ₁₄ : 54–68 C ₁₅ : 32–45 C ₁₆ & heavier: max. 3.0	C ₁₅ & lighter: max. 10 C ₁₆ : 55–70 C ₁₇ : 25–40 C ₁₈ & heavier: max. 2.0
	min. 92	94*	95*	min. 92
	192–196	203–209	215–221	238–248
	286–293	268–276	253–261	225–236
	max. 10	max. 10	max. 10	max. 10
	max. 0.10	max. 0.10	max. 0.05	max. 0.20
	max. 0.25	max. 0.30	max. 0.30	max. 1.0
	max. 80	max. 90	max. 100	max. 100
	max. 0.10	max. 0.10	max. 0.10	max. 0.10
	max. 0.20	max. 0.25	max. 0.25	max. 0.30
	137*	min. 125	min. 125	158*
Additional properties				
	0.835	0.836	0.837	0.839
	12	14	16	19
	-45	-40	-31	-12
	i. b. p. 257 i. b. p. 287	i. b. p. 268 i. b. p. 305	i. b. p. 283 i. b. p. 308	i. b. p. 288 i. b. p. 322

*typical value

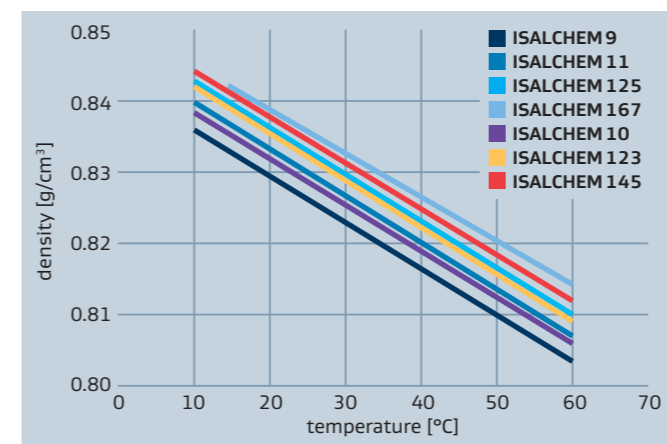


Figure 8: ISALCHEM alcohols density vs temperature.

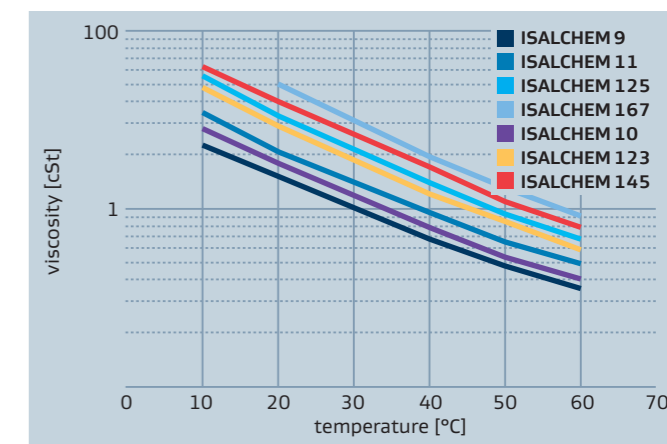


Figure 9: ISALCHEM alcohols viscosity vs temperature.

6. ALCHEM

Linear C₉–C₁₇ alcohols (single cuts and blends)

		ALCHEM 9–99	ALCHEM 10	ALCHEM 11–99
Sales specification		1-nonanol	1-decanol	1-undecanol
Composition	[wt. %]	C ₉ monobranched & lighter: max. 0.50 C ₉ linear: min. 99.0 C ₁₀ & heavier: max. 1.0	C ₁₀ monobranched & lighter: max. 5.0 C ₁₀ linear: min. 90 C ₁₁ & heavier: max. 5.0	C ₁₁ monobranched & lighter: max. 0.50 C ₁₁ linear: min. 99.0 C ₁₂ & heavier: max. 1.0
Total linear alcohol	[wt. %]	min. 99	min. 90	min. 99
Av. molar mass	[g/mol]	142–145	155–160	172*
Hydroxyl number	[mg KOH/g]	389*	353*	326*
Colour	[APHA]	5*	max. 10	max. 10
Acid number	[mg KOH/g]	max. 0.10	max. 0.10	max. 0.10
Carbonyl number	[mg KOH/g]	max. 0.20	max. 0.15	max. 0.35
Bromine index	[mg Br ₂ /100 g]	max. 20	max. 20	max. 50
Water	[wt. %]	max. 0.10	max. 0.10	max. 0.10
Hydrocarbons	[wt. %]	max. 0.15	max. 0.15	max. 0.10
Flash point	[° C]	102*	107*	120*
Additional properties				
Pour point	[° C]	-6	5	18
Distillation	[° C]	i. b. p. 212 f. b. p. 229	i. b. p. 218 f. b. p. 232	i. b. p. 240 f. b. p. 245

*typical value

	ALCHEM 123	ALCHEM 125	ALCHEM 145	ALCHEM 167
	C ₁₂ –C ₁₃ -alcohols	C ₁₂ –C ₁₅ -alcohols	C ₁₄ –C ₁₅ -alcohols	C ₁₆ –C ₁₇ -alcohols
	C ₁₁ & lighter: max. 1.0 C ₁₂ : 37–48 C ₁₃ : 52–63 C ₁₄ & heavier: max. 4.0	C ₁₁ & lighter: max. 0.5 C ₁₂ : 18–25 C ₁₃ : 26–34 C ₁₄ : 26–35 C ₁₅ : 15–21 C ₁₆ & heavier: max. 1.5	C ₁₃ & lighter: max. 4.0 C ₁₄ : 57–68 C ₁₅ : 31–42 C ₁₆ & heavier: max. 3.0	C ₁₅ & lighter: max. 15.0 C ₁₆ : 55–70 C ₁₇ : 25–40 C ₁₇ & heavier: max. 2
	min. 92	min. 93	min. 93	min. 92
	194*	203–209	218*	238–248
	287–293	268–276	252–258	225–236
	max. 10	max. 10	max. 10	max. 10
	max. 0.06	max. 0.10	max. 0.06	max. 0.10
	max. 0.10	max. 0.10	max. 0.10	max. 0.50
	max. 50	max. 50	max. 50	max. 50
	max. 0.10	max. 0.10	max. 0.10	max. 0.10
	max. 0.10	max. 0.10	max. 0.15	max. 0.15
	120*	124*	142*	—
Additional properties				
	23	26	34	—
	i. b. p. 267 i. b. p. 291	i. b. p. 275 i. b. p. 308	i. b. p. 291 i. b. p. 311	— —

*typical value

Analytical methods

Parameter	Sasol Italy Reference	Parameter	Sasol Italy Reference
Composition	RCM 1101	Hydrocarbons	RCM 1101
Av. molar mass	RCM 1101	Flash point	RCM 3628
Hydroxyl number	RCM 1101	Diols	RCM 1402
Colour	RCM 3607	Branching degree	RCM 1101
Acid number	RCM 3812	Density @ 20° C	ASTM D 4052
Carbonyl number	RCM 3814	Viscosity @ 40° C	ASTM D 446
Bromine index	RCM 3810	Pour point	ASTM D 97
Water	RCM 3804	Distillation	ASTM E 537

RCM are Sasol Italy analytical methods, internal or referred to international standard. Additional information are available upon request.

7. Sasol Performance Chemicals alcohol portfolio

LIAL Mixture of linear and monobranched alcohols from C ₉ to C ₁₇	Sasol Italy S.p.A. Augusta
ALCHEM Linear alcohol monocuts and blends from C ₉ to C ₁₇	Sasol Italy S.p.A. Augusta
ISALCHEM Monobranched alcohol monocuts and blends from C ₉ to C ₁₇	Sasol Italy S.p.A. Augusta
NACOL Pure cuts of linear alcohols C ₆ to C ₂₂	Sasol Germany GmbH Brunsbüttel
NAFOL Blends of linear alcohols C ₈ to C ₂₈	Sasol Germany GmbH Brunsbüttel
ISOFOL Defined branched Guerbet alcohols C ₁₂ to C ₃₂	Sasol Germany GmbH Brunsbüttel
SAFOL Mixture of linear and branched alcohols C ₁₂ to C ₁₃	Sasol Ltd Secunda
ALFOL Pure cuts and blends of linear Ziegler alcohols C ₆ to C ₂₂	Sasol Chemicals (USA) LLC Lake Charles

Our global footprint



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