ROKAnol IT Series

Ethoxylated iso-C13 fatty alcohols

Non-ionic surfactant series

Local. Global. Integrated.


Operating in 17 countries, in 39 different locations, PCC SE currently employs over 3 300 people.

About Us

PCC Exol SA is a major player in the European surfactants market. In the eastern and central-eastern part of the continent, it is the undisputed leader in its industry. Most of the production facilities and the company's headquarters are located in Brzeg Dolny, Poland. Here we develop, test and manufacture a wide range of anionic, non-ionic and amphoteric surfactants and speciality industrial formulations.

New products are continuously added to the portfolio in response to market trends and individual customer requirements. The surfactants produced at the plants have a very wide range of industrial applications. They are used as wetting agents, emulsifiers, auxiliaries in paper, metallurgy and many other industries, as well as in household chemicals, personal care products and textiles.

PCC EXOL pays special attention to the issue of sustainable development, which is one of the key elements of the company's strategy. In order to strengthen its competitive position in the surfactants market, the company is committed to promoting responsible production and consumption throughout the value chain. The concept of sustainable development is therefore a key aspect of all the company's management and operational processes.

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PCC PCG OXYALKYLATES
IRPC

Polyols

- Polyether polyols
- Polyester polyols
- Prepolymers
- Polyurethane Systems

PCC
ROKITA SA

Chlorine

- Chlorine
- MCAA
- Other Chlorine Downstream Product

PCC
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Phosphorus

- Phosphorus derivatives
- Naphthalene derivatives
- Polycarboxyethers (PCE)

PCC EXOL SA
PCC CHEMAX INC
PCC PCG OXYALKYLATES

Surfactants

- Anionic surfactants
- Cationic surfactants
- Nonionic surfactants
- Amphoteric surfactants (betaines)
- Chemical formulation

PCC
SYNTEZA

Alkylphenols

- Nonylphenol
- Dodecylphenol
- Tristyrylphenol

PCC CONSUMER PRODUCTS SA

Consumer Products

- Household & industrial Cleaners, Detergents and Personal Care Products

PCC
ROKITA SA

Energy

- Renewable Energy
- Conventional Energy

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INTERMODAL SA

Logistics

- Intermodal transport
- Road Haulage
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Silicon

- Microsillica
- Silicon Metal

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Holding & Projects

- Portfolio Management
- Project Development

ROKAnol IT Series

Chemical description

ROKAnol IT Series are nonionic surfactants of the polyethoxylated fatty alcohol type. The line of ROKAnols IT is based on fully branched, synthetic isotridecyl alcohol. Owing to the appropriate method of conducting the reaction with ethylene oxide, it is possible to obtain a range of products with various ethoxylation degrees. The chemical structure of the ROKAnol IT Series is represented by the following formula:

$$R(OCH_2CH_2)_nOH$$ where **n – 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 15, 20, 40, 100**

R – branched alkyl radical, with an average carbon chain length of 13

Application

Nonionic surfactants - ROKAnol IT Series find their use in many different applications. They are especially suitable for:

- Industrial and institutional cleaning
- Metalworking
- Textile industry
- Agrochemicals
- Cosmetic and detergents
- Emulsion polymerization
- Food industry
- Others

Basic physical and chemical properties

Depending on the ethoxylation degree, the appearance of the ROKAnol IT Series ranges from clear or turbid liquids to paste and solid. Basic information concerning their physical and chemical properties is summarised in a Table 1.

General characteristic

Basic physical and chemical properties	ROKAnol IT3	ROKAnol IT4	ROKAnol IT5	ROKAnol IT6	ROKAnol IT6R	ROKAnol IT7	ROKAnol IT7W	ROKAnol IT8	ROKAnol IT8W	ROKAnol IT9
Average molecular weight [g/mol]	330	370	420	460	460	510	510	550	550	600
Appearance at room temperature	clear or cloudy liquid with a tendency to separation in time	liquid	clear or cloudy liquid with a tendency to separation in time	clear liquid [a]	clear liquid [a]	clear or turbid liquid	liquid	turbid liquid or paste	clear liquid	liquid of oily consistence
Color	max. 100 (40°C) [a]	max. 60 (40-45°C) [a]	max. 100 (40°C) [a]	max. 100 (50°C) [a]	max. 100 (50°C), a	max. 100 (50°C) [a]	max. 50 [a]	max. 50 (40°C) [a]	max. 50 (40°C) [a]	max. 70 (50°C) [a]
Solution pH	5-7 [b]	5.0 - 7.5 [a]	5 - 7 [a]	5 - 7 [a]	5 - 7 [a]	5 - 7 [a]	5 - 7 [a]	5 - 7 [a]	5 - 7 [a]	5 - 7 [a]
Cloud point A [°C]	<10	<10	<10	<10	<10	<10	<10	44	44	56 - 60
Cloud point B [°C]	<10	<10	<10	<10	<10	<10	<10	<10	<10	approx. 42
Cloud point C [°C]	<10	<10	<10	<10	<10	<10	<10	<10	<10	approx. 32
Cloud point D [°C]	48 - 51	55 - 59	approx. 67	67 - 72	71 - 73	approx. 71	approx. 71	76 - 78	75 - 79	approx. 80
Cloud point E [°C]	approx. 41	approx. 48	60 - 62	approx. 66	approx. 69	65 - 70	65 - 70	approx. 76	approx. 76	approx. 78
Solidification point [°C]	approx. -20	below -20	approx. -5	approx.-3	approx. 3	approx. 2	bellow -18	approx. 8	below -20	approx. 10
Denisity [g/cm^3]	approx. 0.93 [c]	approx. 0.96 [c]	approx. 0.96 [c]	approx. 0.97 [c]	approx. 0.97 [c]	approx. 0.97 [c]	approx. 0.98 [c]	approx. 1.00 [c]	approx. 1.00 [c]	approx. 1.01 [c]
Water content [%]	max. 1	max. 0.5	max. 0.5	max. 0.5	max. 0.5	max. 1	approx. 10	max. 0.5	approx. 10	max. 1
Surfacetension [mN/m]	27	27	27	27	27	28	28	28	28	28
HLB	8.0	9.4	10.5	11.4	11.5	12.1	12.1	12.8	12.8	13.3

Appearance at room temperature:
a – at 50°C.

Color
a – Hazen, b – Gardner.

pH according to PN-EN 1262:2004 solution B at 20°C where:
a - pH of a 1% solution,
b - pH of a 2% solution,
c - pH of a 5% solution,
d - pH of a 10% solution.

Cloud points are measured according to PN-EN 1890:2000:
Cloud point A – aqueous solution,
Cloud point B – 50 g/l NaCl solution,
Cloud point C – 100 g/l NaCl solution,
Cloud point D – 45 g butyldiglycol/water solution,
Cloud point E – 25 g butyldiglycol/water solution.

ROKAnol IT9W	ROKAnol IT10	ROKAnol IT10R	ROKAnol IT12	ROKAnol IT13	ROKAnol IT15	ROKAnol IT20	ROKAnol IT20/80	ROKAnol IT40	ROKAnol IT40/70	ROKAnol IT100/35
600	640	620	730	770	860	1080	1080	1960	1960	4600
liquid	turbid liquid or paste	turbid liquid or paste	turbid liquid or paste	clear liquid (a)	soft white solid	white to yellowish solid	clear liquid	solid	viscous liquid	liquid
max. 70 [a]	max. 100 (50°C) [a]	max. 60 (50°C) [a]	max. 70 (40°C) [a]	max. 100 (50°C) [a]	max. 2 (50°C) [b]	approx. 20 (40°C) [a]	max. 100 [a]	approx. 20 (50°C) [a]	max. 150 (25°C) [a]	max. 150 [a]
5 - 7 [a]	5 - 7 [a]	5.0 - 7.5	5 - 7 [a]	5 - 7 [a]	5 - 8 [c]	5 - 7 [a]	5 - 7 [a]	5 - 7 [d]	5 - 7 [d]	6 - 8 [a]
58 - 62	74 - 77	70 - 75	79 - 85	>90	>90	>90	>90	>90	>90	>90
approx. 42	approx. 57	approx. 55	approx. 64	74 - 76	81	84 - 88	84 - 88	>90	>90	>90
approx. 32	approx. 45	approx. 43	approx. 52	approx. 63	64 - 68	approx. 72	approx. 72	72 - 77	72 - 77	>90
approx. 80	approx. 83	approx. 83	approx. 84	approx. 87	approx. 89	approx. 90	approx. 90	>90	>90	>90
approx. 78	approx. 82	approx. 82	approx. 83	approx. 87	approx. 89	approx. 90	approx. 90	>90	>90	>90
approx. -10	approx. 18	approx. 18	approx. 20	approx. 24	approx. 24	approx. 30	approx. -4	approx. 40	approx. 9	approx. -7
approx. 1.01 [c]	approx. 1.02 [b]	approx. 1.02 [b]	approx. 1.02 [c]	approx. 1.02 [d]	approx. 1.02 [d]	approx. 1.02 [e]	approx. 1.00 [b]	approx. 1.05 [a]	approx. 1.09 [b]	approx. 1.06 [a]
approx. 10	max. 0.5	max. 0.5	max. 0.5	max. 0.5	max. 1.5	max. 1	approx. 20	max. 1	approx. 30	approx. 70
28	28	29	29	31	32	34	34	42	42	48
13.3	13.8	13.7	14.5	14.8	15.3	16.3	16.3	18.0	18.0	19.1

Density measurements:
a – at 20°C,
b – at 25°C,
c – at 30°C,
d – at 50°C,

Water content was measured according to PN-ISO 760:2001, direct method, solvent – methanol.

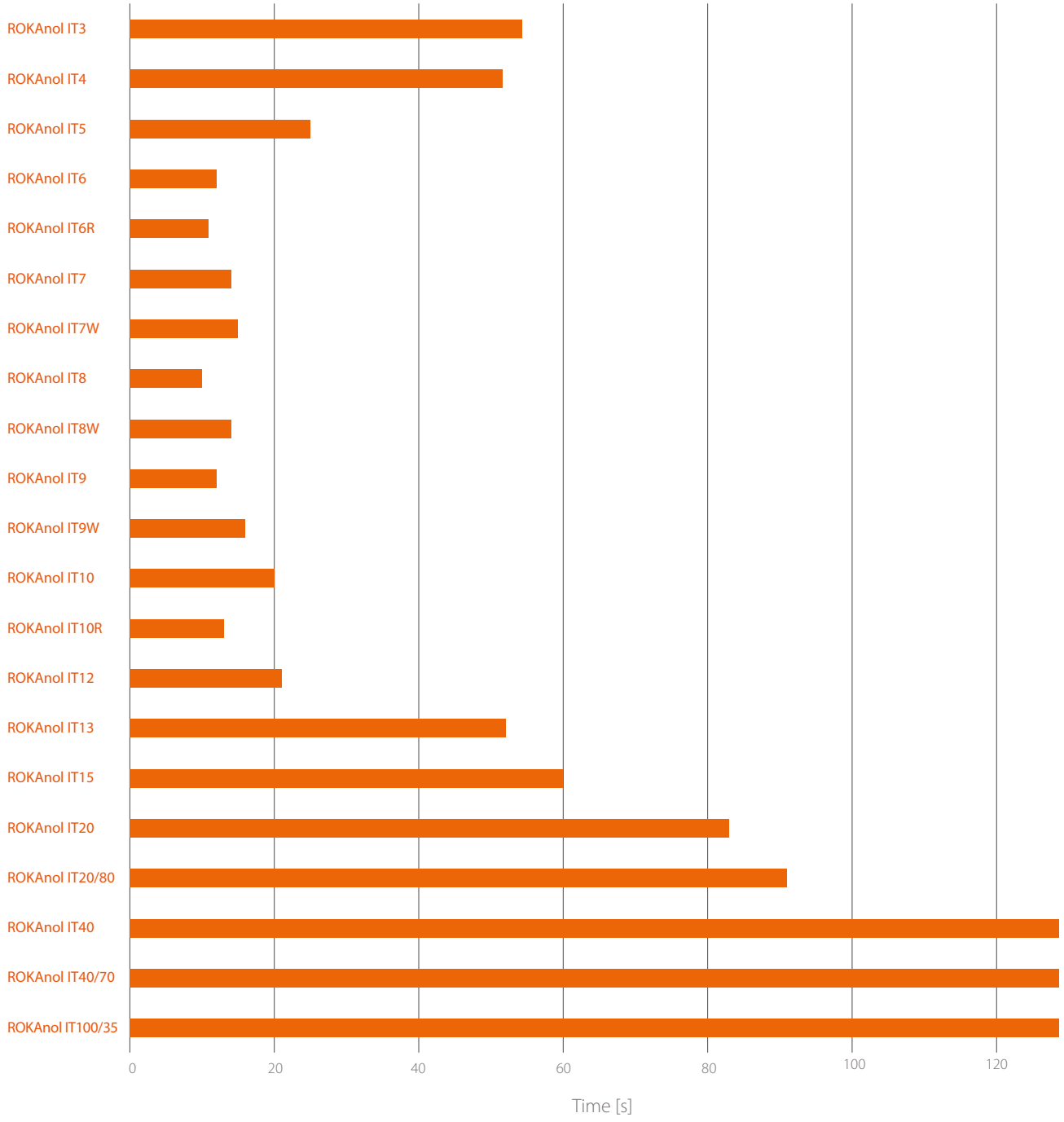
Surface tension according to PN-EN 14370:2004, determined using Wilhelmy plate method at a temperature of 25°C and concentration of 0.1%.

HLB was determined using calculation method.

Wetting capability

In a large number of applications the capability of effective wetting is desired property of surfactants. The wetting capability of cotton fabric was determined according to **EN 1772:2001** method. Wetting time (time in seconds necessary for wetting the textile material) was measured in ROKAnols solutions with a concentration of 1.0 g/L in demineralized water at a temperature of 20°C.

Wettability in solution concentration of 1.0 g/L in demineralised water at 20°C



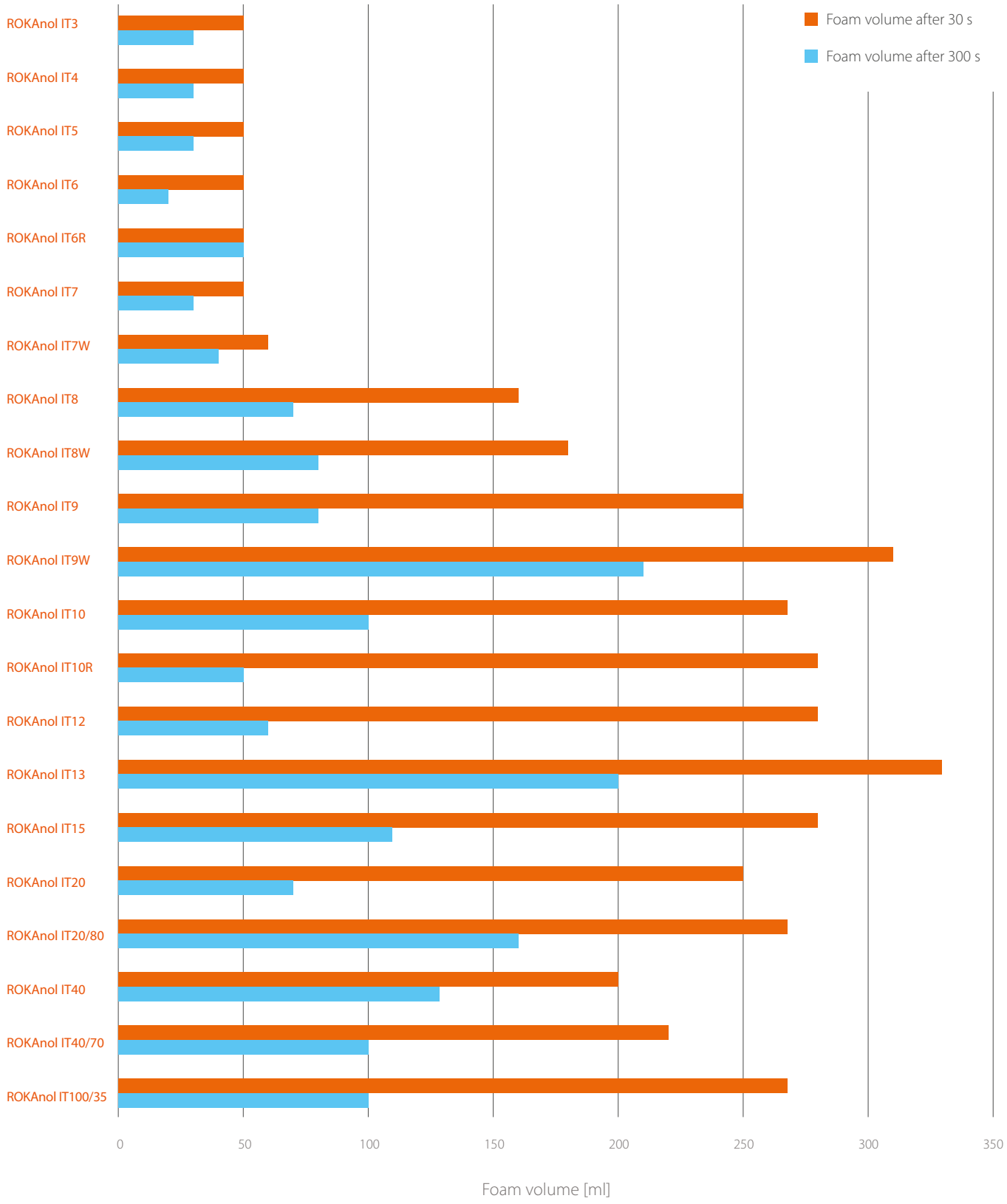
Wetting time is highly depended on ethoxylation degree and HLB. The lowest wetting time is observed for HLB in range of 11.0 - 13.0. The best wetting agents are ROKAnol IT6R, ROKAnol IT8 and ROKAnol IT9.

Effective wetting capability is particularly important in case of the textile industry processes

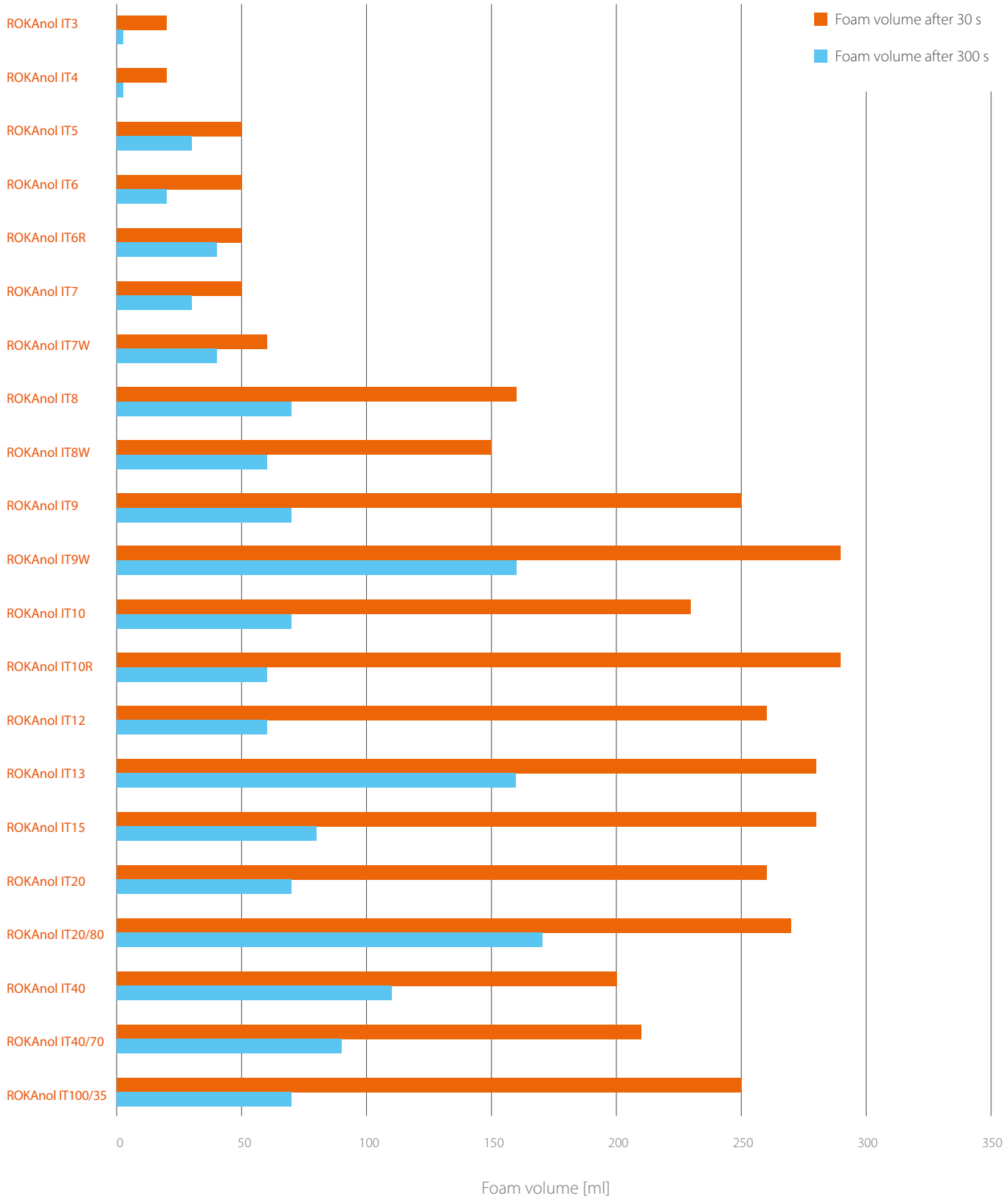
Foaming capability

Determination of the foaming capability was performed according to **PN-ISO 696:1994** (the modified Ross-Miles method) for the ROKAnol IT Series solutions with a concentration of 1.0 g/L in deionised water at a temperature of 25°C. The ROKAnol IT Series display lower foaming capability in comparison to anionic surfactants for which the average foam volume obtained after 5 minutes is approximately 430 ml (alkylethersulfates). The foaming properties change with increasing product ethoxylation degree.

Foaming capability in demineralized water



Foaming capability in hard water with calcium hardness of 3 Ca^{2+} mmol/L (17°d)



Alkali and acid resistance

Determination of capability to form stable solutions in the acid and alkaline environment was performed according to **PN-EN 14712:2005** at a temperature of 20°C. Stability in the alkaline environment is defined as the maximum concentration of sodium hydroxide (with minimum purity of 98%) in g/L in a stable surfactant solution with a concentration of 1% (as active substance). Stability in the acid environment is defined as the maximum concentration of sulphuric acid (with purity in the range between 95% and 98%) in ml/L in a stable surfactant solution with a concentration of 1% (as active substance).

Alkali resistance (Sodium Hydroxide); concentration of 1% active matter; temperature 20°C

Product	NaOH Concentration [g/L]								
	10	20	30	40	50	60	70	80	110
ROKAnol IT3	insoluble in water								
ROKAnol IT4	insoluble in water								
ROKAnol IT5	insoluble in water								
ROKAnol IT6	●	●	o						
ROKAnol IT6R	●	●	●	o					
ROKAnol IT7	●	●	●	o					
ROKAnol IT7W	●	●	o						
ROKAnol IT8	●	●	●	o					
ROKAnol IT8W	●	●	●	●	●	o			
ROKAnol IT9	●	●	●	●	●	o			
ROKAnol IT9W	●	●	●	●	o				
ROKAnol IT10	●	●	●	●	●	●	o		
ROKAnol IT10R	●	●	●	●	●	o			
ROKAnol IT12	●	●	●	●	o				
ROKAnol IT13	●	●	●	●	o				
ROKAnol IT15	●	●	●	●	●	●	o		
ROKAnol IT20	●	●	●	●	o				
ROKAnol IT20/80	●	●	●	●	●	o			
ROKAnol IT40	●	●	●	●	●	●	o		
ROKAnol IT40/70	●	●	●	●	●	●	●	●	o
ROKAnol IT100/35	●	●	●	o					

● clear, homogenous solution ● homogenous, opalescent solution ● homogenous, cloudy solution o macroscopic phase separation

Acid resistance (Sulphuric Acid); concentration of 1% active matter; temperature 20°C

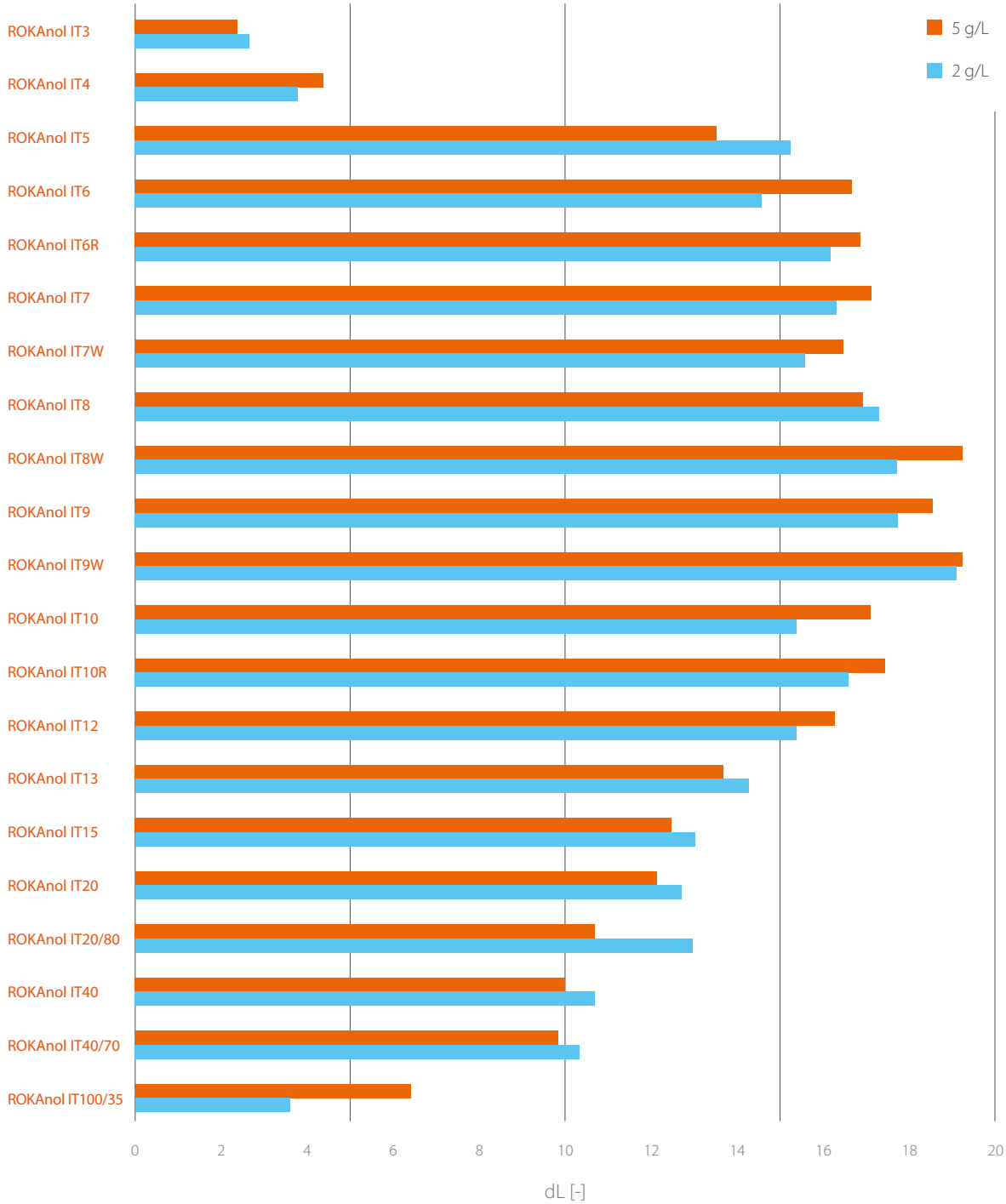
Product	H_2SO_4 Concentration [g/L]					
	1	5	20	40	140	225
ROKAnol IT3	insoluble in water					
ROKAnol IT4	insoluble in water					
ROKAnol IT5	insoluble in water					
ROKAnol IT6	•	•	•	•	•	•
ROKAnol IT6R	•	•	•	•	•	•
ROKAnol IT7	•	•	•	•	•	•
ROKAnol IT7W	•	•	•	•	•	•
ROKAnol IT8	•	•	•	•	•	•
ROKAnol IT8W	•	•	•	•	•	•
ROKAnol IT9	•	•	•	•	•	•
ROKAnol IT9W	•	•	•	•	•	•
ROKAnol IT10	•	•	•	•	•	•
ROKAnol IT10R	•	•	•	•	•	•
ROKAnol IT12	•	•	•	•	•	•
ROKAnol IT13	•	•	•	•	•	•
ROKAnol IT15	•	•	•	•	•	•
ROKAnol IT20	•	•	•	•	•	•
ROKAnol IT20/80	•	•	•	•	•	•
ROKAnol IT40	•	•	•	•	•	•
ROKAnol IT40/70	•	•	•	•	•	•
ROKAnol IT100/35	•	•	•	•	•	•

• clear, homogenous solution • homogenous, opalescent solution • homogenous, cloudy solution ° macroscopic phase separation

Detergency

Detergency is the ability of the surfactant to remove soils from the fabric surface during the laundering process. Detergency tests were performed using to own method, with an EMPA 125 fabric: soiled with a mixture of oils and carbon black. Cotton was washed at a temperature 40°C in ROKAnol IT Series solutions. After drying the fabrics and pressing them, the total color difference of the fabric before and after washing, was measured. The higher the difference is, the better detergency properties are for surfactant.

Detergency



The dL parameter is described by perceptually uniform, trichromatic colour models: CIE LAB and CIE LCH. The following is an interpretation of this parameter: L is defined as lightness (luminosity), while dL is determined by the equation: dL = LT - LS, where: T – tested sample (fabric after the detergency test), S – standard to which the tested sample is compared (fabric before the detergency test).

Solubility

Determination of the solubility of products is carried out by visual evaluation of 1%, 10% and 50% solutions of a given product in a specified solvent, 24 hours after their preparation. Visually, the appearance of the sample is evaluated according to the following scale:

Result	Appearance of the test sample
1	Homogeneous clear
2	Homogeneous opalescent
3	Homogeneous cloudy
4	Macroscopic phase separation

The results of the samples (1%, 10% and 50%) are added up and on this basis the solubility of the product is determined. The following table gives the solubility scales according to the sum of the appearance scale results:

Sum	Solubility
3 – 6	Soluble
7 – 9	Partially soluble
10 – 12	Insoluble

Product	Water	Methanol	Eter	Aceton
ROKAnol IT3	Insoluble	Soluble	Insoluble	Soluble
ROKAnol IT4	Insoluble	Soluble	Insoluble	Soluble
ROKAnol IT5	Insoluble	Soluble	Insoluble	Soluble
ROKAnol IT6	Insoluble	Soluble	Insoluble	Soluble
ROKAnol IT6R	Insoluble	Soluble	Partially soluble	Soluble
ROKAnol IT7	Insoluble	Soluble	Partially soluble	Soluble
ROKAnol IT7W	Insoluble	Soluble	Insoluble	Soluble
ROKAnol IT8	Soluble	Soluble	Insoluble	Soluble
ROKAnol IT8W	Soluble	Soluble	Soluble	Soluble
ROKAnol IT9	Soluble	Soluble	Partially soluble	Soluble
ROKAnol IT9W	Soluble	Soluble	Partially soluble	Soluble
ROKAnol IT10	Soluble	Soluble	Insoluble	Soluble
ROKAnol IT10R	Soluble	Soluble	Insoluble	Soluble
ROKAnol IT12	Soluble	Soluble	Insoluble	Soluble
ROKAnol IT13	Soluble	Soluble	Insoluble	Soluble
ROKAnol IT15	Soluble	Soluble	Insoluble	Soluble
ROKAnol IT20	Soluble	Soluble	Insoluble	Soluble
ROKAnol IT20/80	Soluble	Soluble	Insoluble	Soluble
ROKAnol IT40	Soluble	Soluble	Insoluble	Soluble
ROKAnol IT40/70	Soluble	Soluble	Insoluble	Soluble
ROKAnol IT100/35	Soluble	Soluble	Insoluble	Soluble

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