SULFOROKAnol IT370 and IT330 versus SULFOROKAnol L270/1

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.

PCC ROKITA SA
PCC PCG
OXYALKYLATES
IRPC

Polyols

- Polyether polyols
- Polyester polyols
- Prepolymers
- Polyurethane Systems

PCC
ROKITA SA

Chlorine

- Chlorine
- MCAA
- Other Chlorine Downstream Product

PCC
ROKITA SA

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

PCC
INTERMODAL SA

Logistics

- Intermodal transport
- Road Haulage
- Rail Transport

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Silicon

- Microsillica
- Silicon Metal

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Holding & Projects

- Portfolio Management
- Project Development

General characteristic for SULFOROKAnol L270/1, SULFOROKAnol IT370, SULFOROKAnol IT330

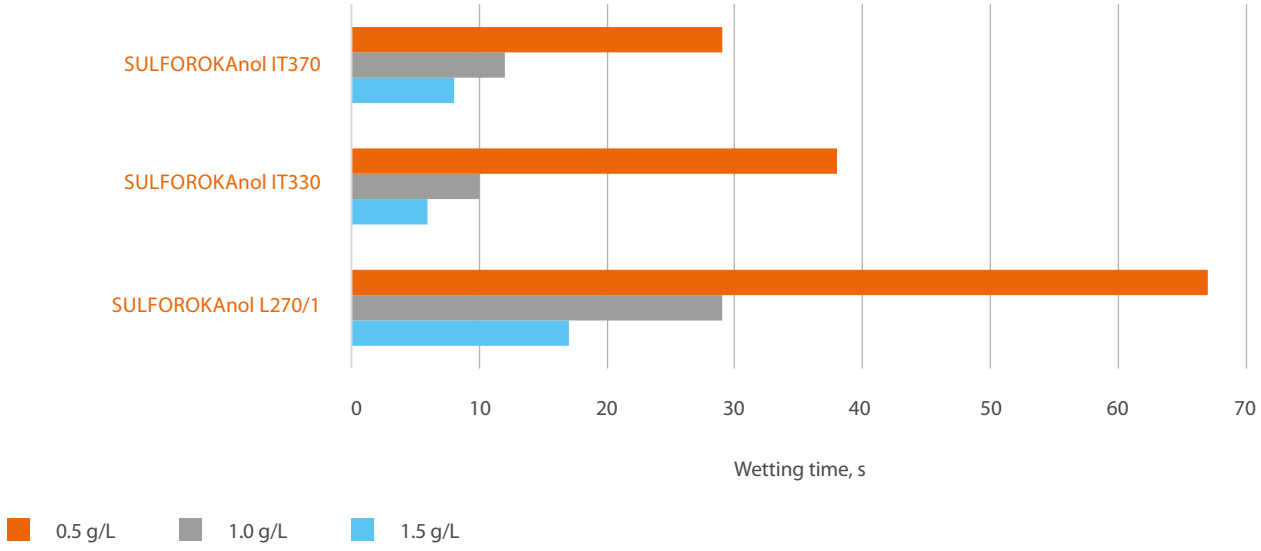
Basic physical and chemical properties are summarized in the table below.

	SULFOROKAnol L270/1	SULFOROKAnol IT370	SULFOROKAnol IT330
Chemical name	Alcohols C12-C14, ethoxylated (<2.5 EO), sulfates, sodium salts	Tridecyl alcohol, ethoxylated (>2.5 EO), sulfated, sodium salt	Tridecyl alcohol, ethoxylated (>2.5 EO), sulfated, sodium salt
CAS number	68891-38-3	150413-26-6	150413-26-6
INCI name	Sodium Laureth Sulfate	Sodium Trideceth Sulfate	Sodium Trideceth Sulfate
Function	Anionic surfactant, cleaning and foaming agent	Anionic surfactant, cleaning and foaming agent	Anionic surfactant, cleaning and foaming agent
Appearance at temperature 20÷25°C	**liquid paste**	**liquid paste**	**clear liquid**
Colour	**max 50 [Klett colour]**	**max 2 [Gardner scale]**	**max 4 [Gardner scale]**
pH, at 25°C	**7.0-10.0 [pH of 5% solution]**	**8.0-10.0 [pH of 4% solution]**	**9-11 [pH of 10% solution]**
Active substance, %(m/m)	**68-72**	**62-65**	**29-31**
Unsulphonated substances, %(m/m)	**max 3**	**max 2**	–
Sodium sulphate (VI), %(m/m)	**max 1**	**max 2**	**max 1**
Molecular weight, g/mol	approx. 384	approx. 434	approx. 434
Solidification point, °C	approx. 10	approx. -20	approx. -5
Density, g/ml	approx. 1.1 (at 20°C)	approx. 1.09 (at 25°C)	approx. 1.03 (at 20°C)

* Bolded parameters are guaranteed technical requirements

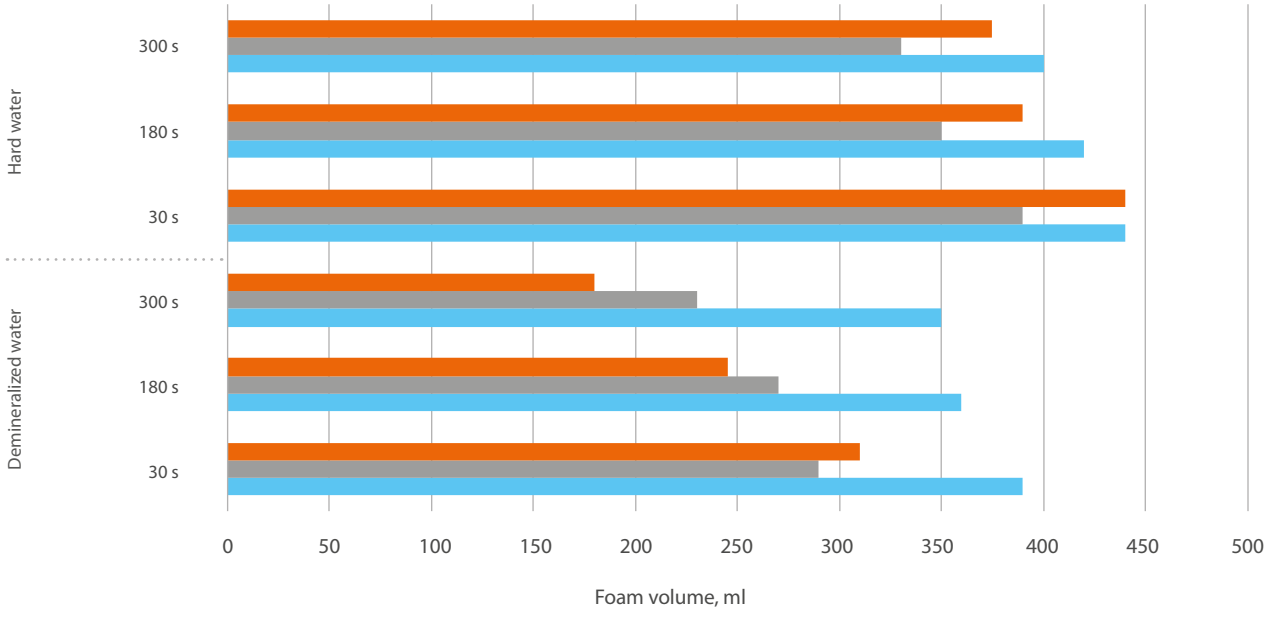
Wetting capability

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 was measured in solutions with a concentration of 0.5, 1.0 and 1.5 g/l for active content in demineralized water at a temperature of 20°C.



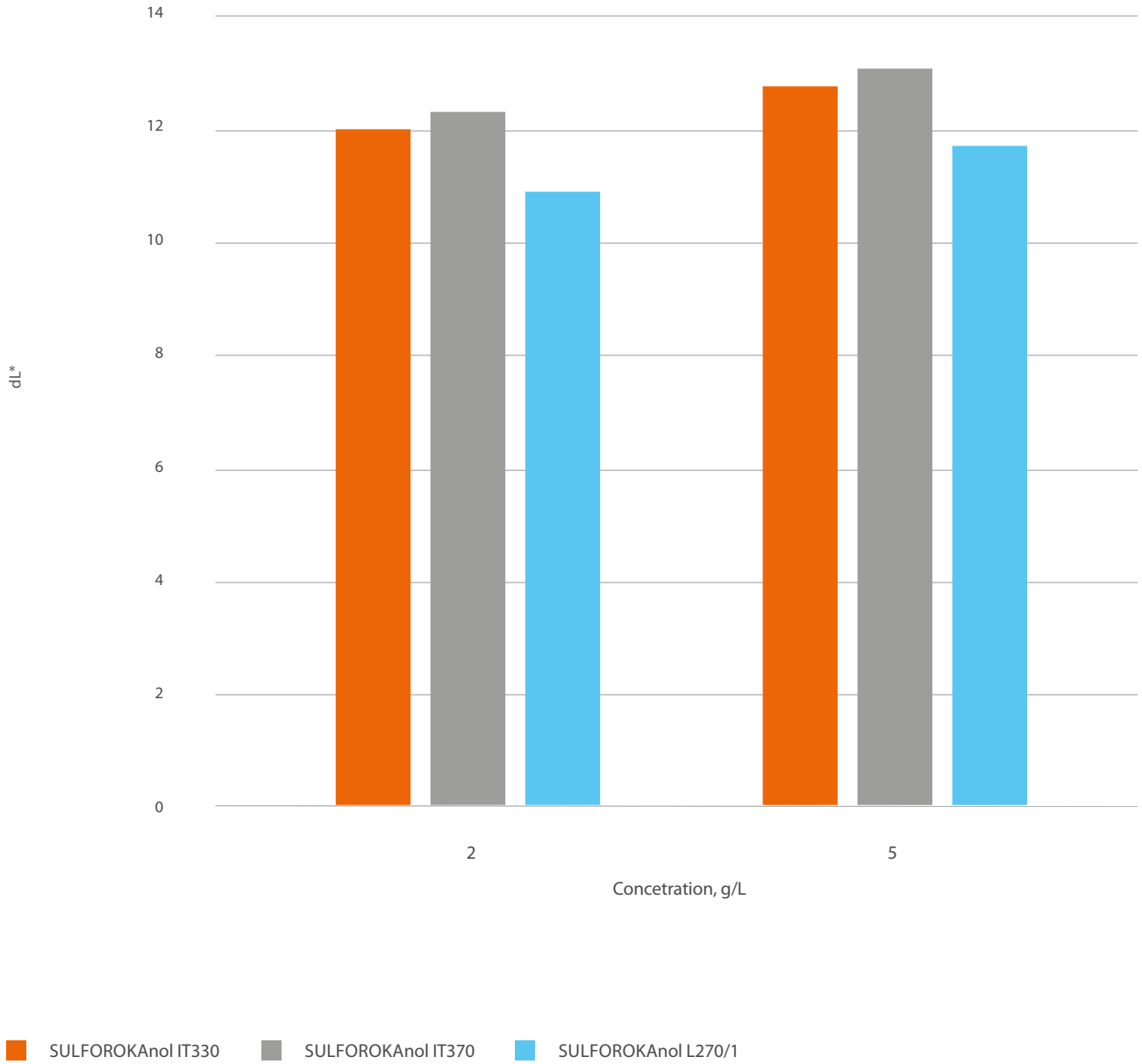
Foaming capability

Foaming capability was measured according to modified Ross-Miles' method (PN-ISO 696:1994). The foam volume was measured after 30, 180 and 300 seconds. The modified Ross-Miles method, 1.0 g/L for active content, 25°C.



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. 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.



The dL* parameter is described by perceptually uniform, trichromatic color 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:

$$dL^* = L^*T - L^*S$$

where: T – tested sample (fabric after the detergency test), S – standard to which the tested sample is compared (fabric before the detergency test). The higher the dL* value, the better the detergent effectiveness.

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:

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:

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

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

Product	Demineralized water	Methanol	Ethyl ether	Acetone
SULFOROKAnol L270/1	Soluble	Partially soluble	Insoluble	Insoluble
SULFOROKAnol IT370	Soluble	Partially soluble	Soluble	Insoluble
SULFOROKAnol IT330	Soluble	Partially soluble	Partially soluble	Insoluble

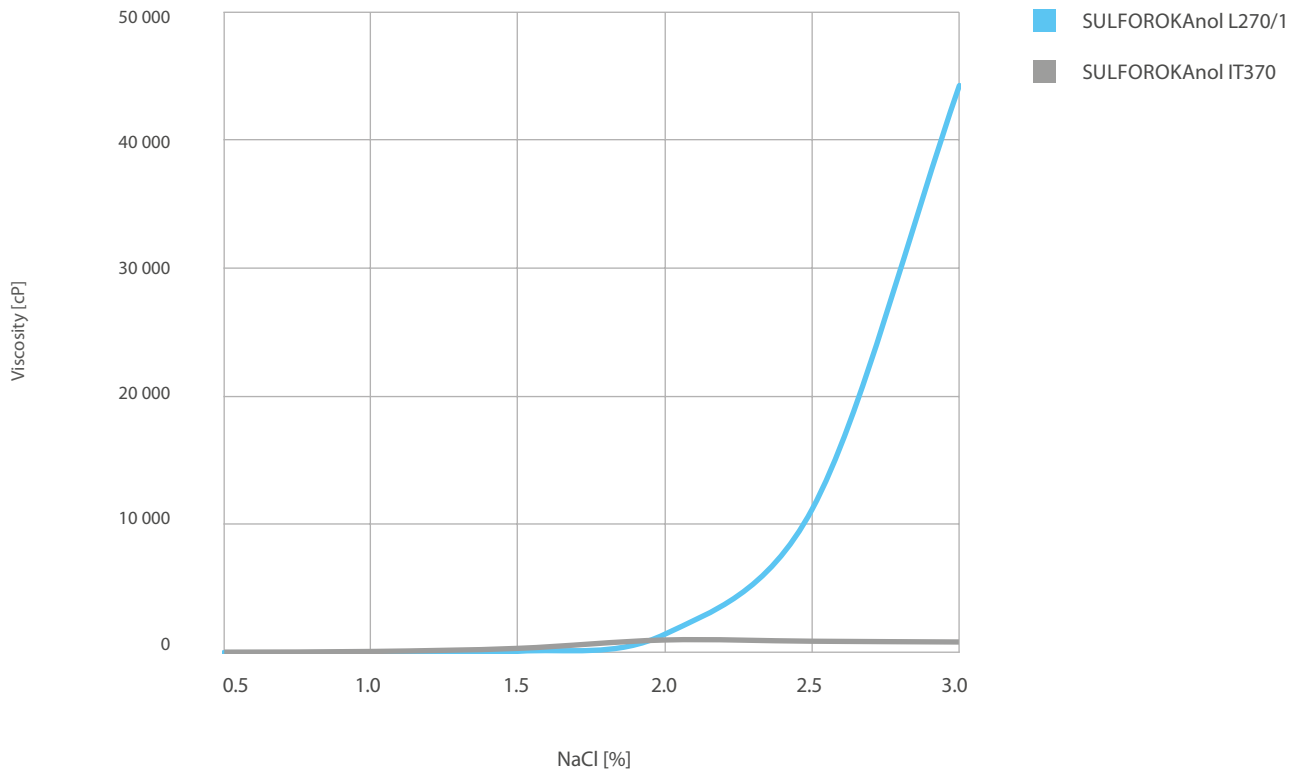
Viscosity

Viscosity comparison of the formulation with SULFOROKAnol L270/1 and SULFOROKAnol IT370 were presented below. Viscosity was measured at temperature at 20°C. Information about the formulation used for comparisons below.

Formulations:

	Formulation I	
	SULFOROKAnol L270/1	SULFOROKAnol IT370
Compound	**Concentration [%]**	
SULFOROKAnol L270/1	8.0 (active matter)	–
SULFOROKAnol IT370	–	8.0 (active matter)
Cocamidopropyl Betaine	7.0	
NaCl	0.5-3.0	
Water	up to 100.0	

SULFOROKAnol L270/1 vs SULFOROKAnol IT370 (8% active matter) - I



Irritant potential

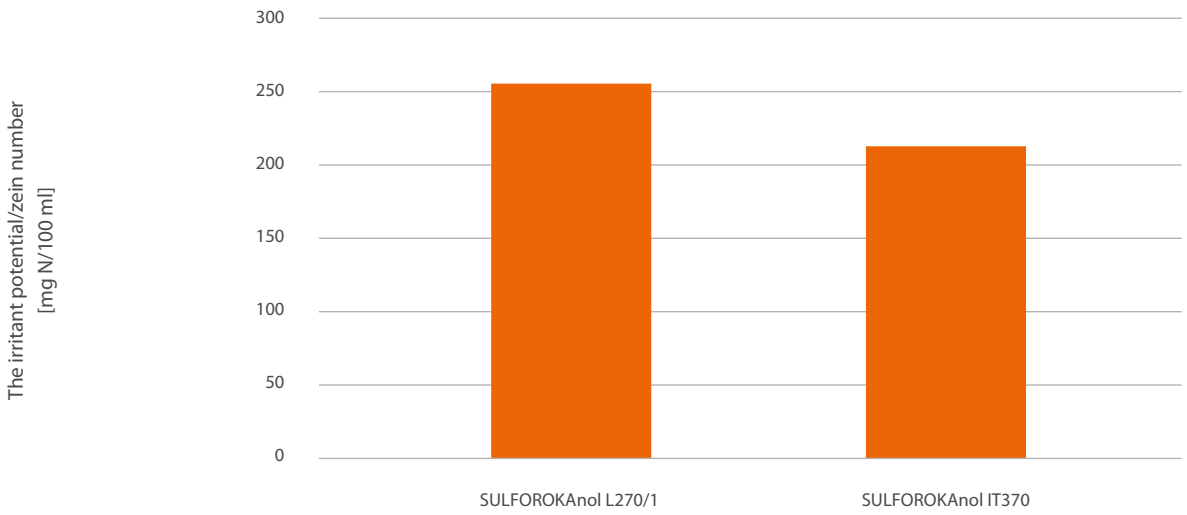
The irritant potential was determined for solution of SULFOROKAnol IT370 with a concentration of 1% active substance using the Zein test.

The Zein test provides a quick and convenient test of irritant potential, especially for compositions containing surfactants.

Methodology

The protein (zein) which is insoluable in water was immersed in the surfactant solution and afterwards the solution was separated from the protein. Subsequently the Kiejdahl method was used to determine the nitrogen content. Based on the outcomes the irritatnt potential was estimated. The more protein is solubilized by the surfactant solution, the higher the irritant potential.

Irritant potential of SULFOROKAnol IT370 compared to SULFOROKAnol L270/1. SULFOROKAnol IT370 is characterized by lower irritation potential.



Liquid Laundry Detergent (LLD)

INCI name	Brand name	Concentration [%]	Function
Sodium Trideceth Sulfate/ Sodium Laureth Sulfate	**SULFOROKAnol IT330/ SULFOROKAnol L227/1**	**10.0 (a.m.)**	**removes stains/ foaming agent**
Isotrideceth-9	**ROKAnol IT9**	**10.0**	**breaks down stains**
Trisodium Citrate	–	2.5	chelator
Tetrasodium Glutamate Diacetate	–	2.0	chelator
Enzymes	–	0.2	breaks down different types of stains
Fluorescent brightener	–	0.1	optical brightener
Citric Acid	–	for pH 7-8	pH regulator
Aqua	–	up to 100.0	solvent

Appearance	visual method	liquid
pH		7.5-8.5
Viscosity [cP]	Brookfield LV, T: 20°C	<100

Procedure:

1. Mix fluorescent brightener with water.
2. Add Trisodium Citrate and mix until a homogeneous solution is obtained.
3. Then add SULFOROKAnol IT330/ SULFOROKAnol L227/1 and mix.
4. Add ROKAnol IT9 and mix.
5. Add GLDA-Na_4, mix.
6. Add Citric Acid to obtained pH in the mass around 7-8.
7. Finally, add Enzymes and mix until a clear liquid is obtained.

Performance test of Liquid Laundry Detergent (LLD)

Effectiveness of the formulation was confirmed in a detergency test. Detergency is the ability of the detergent to remove soils from the fabric surface during the laundering process. Detergency tests were performed using to own method on fabric soiled with standard, different dirt: 1. Fluid make-up, 2. Curry, 3. Blood, aged, 4. Wine, aged, 5. Spaghetti sauce with beef, 6. Chocolate ice cream, aged, 7. Grass/mud, with thickening agent, 8. Highly discriminative tea, 9. Grass, pure, 10. Baby food carrot/potato, 11. Standard clay, 12. Betacarotene on cotton, circular stain, 13. Dirty Motor Oil (DMO), 14. Butterfat with colorant, 15. Beef fat, colored with Sudan Red.

Tested dirt divided into three categories:

Enzymatic
- Blood, aged
- Chocolate ice cream, aged

Bleachable
- Curry
- Wine, aged
- Grass/mud, with thickening agent
- Highly discriminative tea
- Grass, pure
- Standard clay
- Beta-carotene on cotton, circular stain
- Baby food carrot/potato

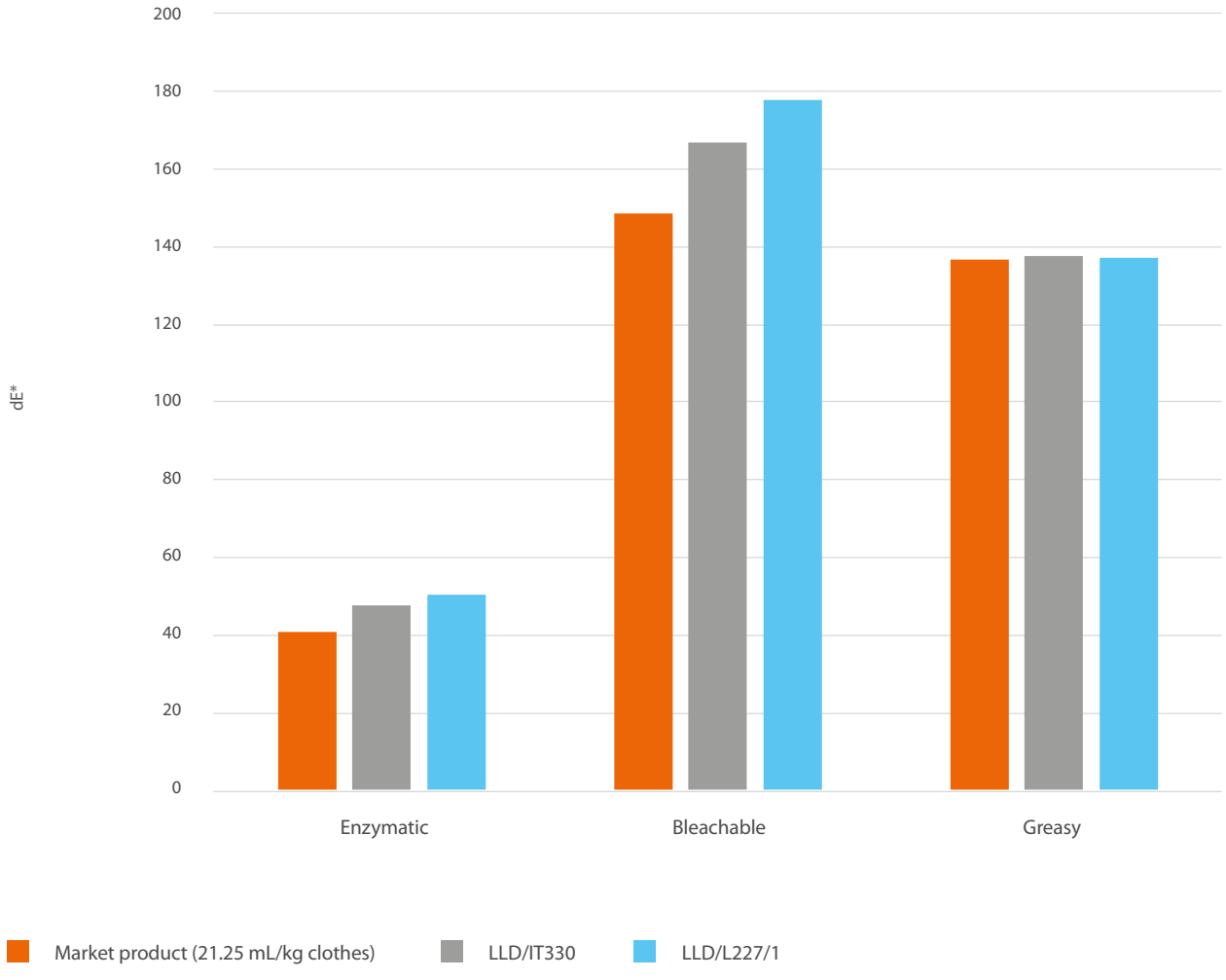
Greasy
- Fluid make-up
- Spaghetti sauce with beef
- Butter with colorant
- Beef fat, colored with Sudan Red
- Dirty Motor Oil (DMO)

Detergency test was performed under the following conditions:

- automatic washing machine
- water hardness (13 °dH)
- cotton program, 40°C
- load – 2 kg dry, white towels
- dose – 30 ml of formulation
- fabric soiled with standard dirt

After the washing process was performed, the standardly soiled fabric were dried and then the degree of washing was assessed by measuring parameter dE* from the CIELab scale, as the difference between the initially stain and the degree of its washing - higher dE*, better detergency.

Liquid Laundry Detergent (15 mL/kg clothes)



Daily Shampoo

INCI name	Brand name	Concentration [%]	Function
Sodium Benzoate, Potassium Sorbate	–	1.0	preservative
Betaine	–	2.0	Active
Glycerin	–	1.0	Humectant
Sodium Trideceth Sulfate/ Sodium Laureth Sulfate	**SULFOROKAnol IT330/ SULFOROKAnol L227/1**	**10.0 (a.m.)**	**surfactant**
Sodium Lauroyl Sarcosinate	**ROKAtend LS**	**2.0**	**surfactant**
Cocamidopropyl Betaine	**ROKAmina K30**	**15.0**	**surfactant**
Citric Acid	–	for pH 4.5-5.5	pH regulator
Aqua	–	up to 100.0	solvent

Appearance	visual method	clear gel
pH		4.5-5.5
Viscosity [cP]	Brookfield LV, T: 20°C	3500-4500 (SULFOROKAnol IT330) 15 000-16 000 (SULFOROKAnol L227/1)

Procedure:

1. Mix preservative and Betaine with water until a homogeneous solution is obtained.
2. Add Glycerin and mix.
3. Then add SULFOROKAnol IT330/SULFOROKAnol L227/1 mix.
4. Add ROKAtend LS and mix.
5. Then add ROKAmina K30, mix.
6. Add Citric Acid solution to obtained pH in the mass around 4.5-5.5.

Body Wash

INCI name	Brand name	Concentration [%]	Function
Sodium Benzoate	–	0.4	preservative
C10-30 Alky Acrylate Crosspolymer	–	1.0	rheology modifier
Sodium Hydroxide, 30% solution	–	0.5	pH regulator
Sodium Trideceth Sulfate	**SULFOROKAnol IT370**	**17.0**	**surfactant, emulsifier**
Trideceth-3	**ROKAnol IT3**	**1.5**	**co-surfactant**
Cocamidopropyl Betaine	**ROKAmina K30**	**7.0**	**surfactant**
Sodium Chloride	–	2.0	rheology modifier
Helianthus Annuus Seed Oil	–	4.0	emollient
Aqua	–	up to 100.0	solvent

Appearance	visual method	white emulsion
pH		4.5-5.5

Procedure:

1. Mix Sodium Benzoate with water, heat up to 40-45°C.
2. Add C10-30 Alky Acrylate Crosspolymer and wait until it swells.
3. Then add Sodium Hydroxide to increase pH and mix keeping the temperature approx. 40-45°C until a homogeneous, clear gel is obtained.
4. Lower the temperature to 35°C.
5. Add SULFOROKAnol IT370, mix.
6. Then add ROKAnol IT3 and mix.
7. Next add ROKAmina K30, mix.
8. Add Sodium Chloride and mix.
9. Add Helianthus Annuus Seed Oil, homogenize with approx. 12 000 RPM, 60 sec.

Universal Kitchen Degreaser (UKD)

INCI name	Brand name	Concentration [%]	Function
Isotrideceth-7	**ROKAnol IT7**	**2.5**	**degreaser/ wetting agent**
Sodium Trideceth Sulfate/ Sodium Laureth Sulfate	**SULFOROKAnol IT330/ SULFOROKAnol L227/1**	**1.0 (a.m.)**	**foaming agent**
Polyoxyalkylene glycol fatty alcohol	**ROKAnol LP3135**	**2.0**	**wetting agent**
Sodium Polyacrylate	**EXOlat C40**	**3.0**	**sequestrant**
Methoxydipropanol	–	3.0	formulation stabilizer/degreasing agent/ solvent and additives
Sodium Hydroxide	–	for pH 9-10	pH regulator
Aqua	–	up to 100.0	solvent

Appearance	visual method	clear liquid
pH		9-10
Viscosity [cP]	Brookfield LV, T: 20°C	<100

Procedure:

1. Mix ROKAnol IT7 with water.
2. Add SULFOROKAnol IT330/SULFOROKAnol L227/1 and mix until a homogeneous solution is obtained.
3. Then add ROKAnol LP3135 and EXOlat C40, mix.
4. Add Methoxydipropanol and mix.
5. Add Sodium Hydroxide solution to obtained pH in the mass around 9-10.

Performance test of Universal Kitchen Degreaser (UKD)

The detergency properties of Universal Kitchen Degreaser was measured as the ability of surfactant based formulation to remove greasy soil from the surface of the masonite tile during the cleaning process. Non-polar structural fragments of surfactants form a micelle which interact with a particle of dirt. Subsequently, an emulsion is formed, that can be removed mechanically with a sponge. The cleaning process was carried out on a BYK Gardner scrub abrasion tester according to our own method.

Water

UKD/IT330

UKD/L227/1

Summer Windshield Concentrate (1:100)

INCI name	Brand name	Concentration [%]	Function
Sodium Trideceth Sulfate/ Sodium Laureth Sulfate	**SULFOROKAnol IT370/ SULFOROKAnol L270/1**	**36.0**	**cleaning agent**
Ethanol	–	10.0	solvent, cleaning booster
Water	–	up to 100.0	solvent

Appearance	visual method	clear liquid
pH		10-12
Viscosity [cP]	Brookfield LV, T: 20°C	<100

Procedure:

1. Add Ethanol to the weighed amount of water.
2. Then SULFOROKAnol IT370/SULFOROKAnol L270/1 and mix thoroughly until uniform.

Winter Windshield Washer Fluid

INCI name	Brand name	Concentration [%]	Function
Sodium Trideceth Sulfate/ Sodium Laureth Sulfate	**SULFOROKAnol IT370/ SULFOROKAnol L270/1**	**5.0**	**cleaning agent**
Ethanol	–	25.0	solvent, cleaning booster
Propylene glycol	–	5.0	anti-freeze agent
Water	–	up to 100.0	solvent

Appearance	visual method	clear liquid
pH		10-11
Viscosity [cP]	Brookfield LV, T: 20°C	<100

Procedure:

1. Add Ethanol to the weighed amount of water.
2. Then SULFOROKAnol IT330/SULFOROKAnol L227/1 and mix thoroughly until uniform.
3. Add Propylene Glycol, mix.

Bug Remover

INCI name	Brand name	Concentration [%]	Function
Sodium Trideceth Sulfate/ Sodium Laureth Sulfate	**SULFOROKAnol IT370/ SULFOROKAnol L270/1**	**18.0**	**cleaning agent**
Alkyl Polyglucoside	–	2.0	wetting agent, hydrotrope
2-Butoxyethanol	–	4.0	solvent
PEG-17 Rapeseedamide	**ROKAmid MRZ17**	**3.0**	**cleaning booster**
Glycerin	–	10.0	stabiliser, humectant
Methoxydipropanol	–	5.0	solubiliser
Sodium Polyacrylate	**EXOlat C40**	**2.5**	**sequestrant**
Sodium Hydroxide 30% solution	–	1.0	emollient
Water	–	up to 100.0	solvent

Appearance	visual method	clear, yellow liquid
pH		11-12
Viscosity [cP]	Brookfield LV, T: 20°C	<100

Procedure:

1. Add SULFOROKAnol L227/1 or SULFOROKAnol IT330 to a weighed amount of water and mix until a homogeneous liquid is formed.
2. Then add Alkyl Polyglucoside and 2-Butoxyethanol (BG), and mix.
3. Next, add ROKAmid MRZ17, Glycerine, Methoxydipropanol and EXOlat C40, mixing the sample each time. Mix until uniform.
4. Slowly add Sodium Hydroxide and mix thoroughly.

Car Shampoo

INCI name	Brand name	Concentration [%]	Function
Sodium Trideceth Sulfate/ Sodium Laureth Sulfate	**SULFOROKAnol IT370/ SULFOROKAnol L270/1**	**10.0**	**foaming agent**
Sodium Dodecylbenzenesulfonate	**ABSNa 30**	**27.0**	**cleaning agent**
Cocamidopropyl Betaine	**ROKAmina K40HC**	**2.0**	**foam stabiliser**
Sodium Carbonate	–	2.0	cleaning booster
Sodium Metasilicate 30% solution	–	10.0	cleaning booster
Aqueous solution of acrylic-maleic copolymer sodium salt	**EXOlat MC60**	**2.0**	**sequestrant**
Water	–	up to 100.0	solvent

Appearance	visual method	milky liquid
pH		10.5-11.5
Viscosity [cP]	Brookfield LV, T: 20°C	<100

Procedure:

1. Mix SULFOROKAnol IT330/SULFOROKAnol L227/1 with half the required amount of water until dissolved.
2. Then add ABSNa 30 to the solution and mix.
3. Add ROKAmina K40HC and mix until a homogeneous solution is obtained.
4. Prepare a second solution in a separate vessel. Mix sodium carbonate and sodium metasilicate with the remaining water. While mixing, add EXOlat MC60 and mix until a homogeneous solution is obtained.
5. Finally, pour solution 2 in portions into the still mixed solution 1.

Performance test of Car Shampoo

The detergency properties of Car Shampoo was measured as the ability of surfactant based formulation to remove greasy soil from the metal surface during the cleaning process. The surface to be tested was prepared by placing dirt on a metal plate. The soiled plate was then baked at 60°C for 24 hours and then at 80°C for 2 hours. The cleaning process was carried out on a BYK Gardner scrub abrasion tester according to our own method.

Soiled plate before cleaning process

Car Shampoo with SULFOROKAnol IT330

Car Shampoo with SULFOROKAnol L227/1

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