# SULFOROKAnol L370 and L327 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.

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- Polyether polyols
- Polyester polyols
- Prepolymers
- Polyurethane Systems

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- Chlorine
- MCAA
- Other Chlorine Downstream Product

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## Phosphorus

- Phosphorus derivatives
- Naphthalene derivatives
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- Cationic surfactants
- Nonionic surfactants
- Amphoteric surfactants (betaines)
- Chemical formulation

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- Project Development

# General characteristic for SULFOROKAnol L270/1, SULFOROKAnol L370, SULFOROKAnol L327

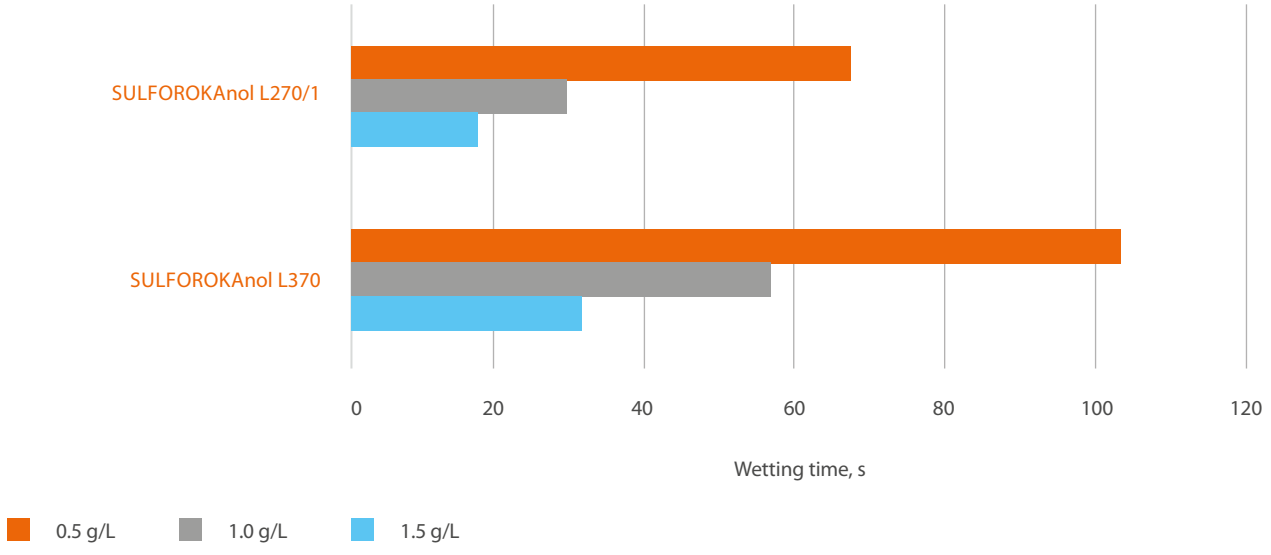
Basic physical and chemical properties are summarized in the table below.

| | SULFOROKAnol L270/1 | SULFOROKAnol L370 | SULFOROKAnol L327 |
|---|---|---|---|
| Chemical name | Alcohols C12-C14, ethoxylated (<2,5 EO), sulfates, sodium salts | Alcohols C12-C15, ethoxylated (>2.5 EO), sulfates, sodium salts | Alcohols C12-C15, ethoxylated (>2,5 EO), sulfates, sodium salts |
| CAS number | 68891-38-3 | 125301-92-0 | 125301-92-0 |
| INCI name | Sodium Laureth Sulfate | Sodium C12-C15 Pareth Sulfate | Sodium C12-C15 Pareth 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** | **liquid with a gelation tendency** |
| Klett colour, Klett value | **max 30** | **max 50** | **max 50** |
| pH of 5% solution of active substance, at 25°C | **7.0-10.0** | **7.5-10.5** | **10.0-11.4 (10% solution of active substance)** |
| Active substance, %(m/m) | **68-72** | **68-72** | **26-28** |
| Unsulphonated substances, %(m/m) | **max 3** | **max 4.5 (as active substance)** | **max 4.5 (as active substance)** |
| Sodium sulphate (VI), %(m/m) | **max 1** | **max 2.0 (as active substance)** | **max 2.0 (as active substance)** |
| Molecular weight, g/mol | approx. 384 | approx. 445 | approx. 445 |
| Density at 20°C, g/ml | approx. 1.1 | approx. 1.1 | approx. 1.04 |

* Bolded parameters are guaranteed technical requirements

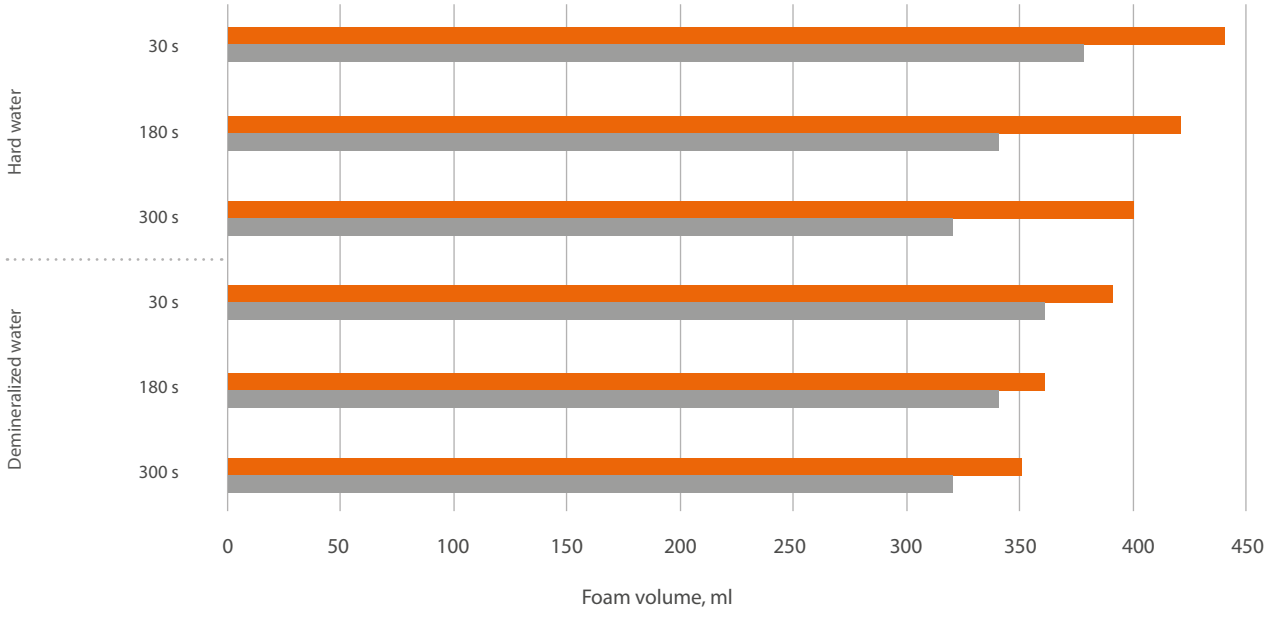
## Wetting capability

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 in demineralized water at a temperature of 20°C



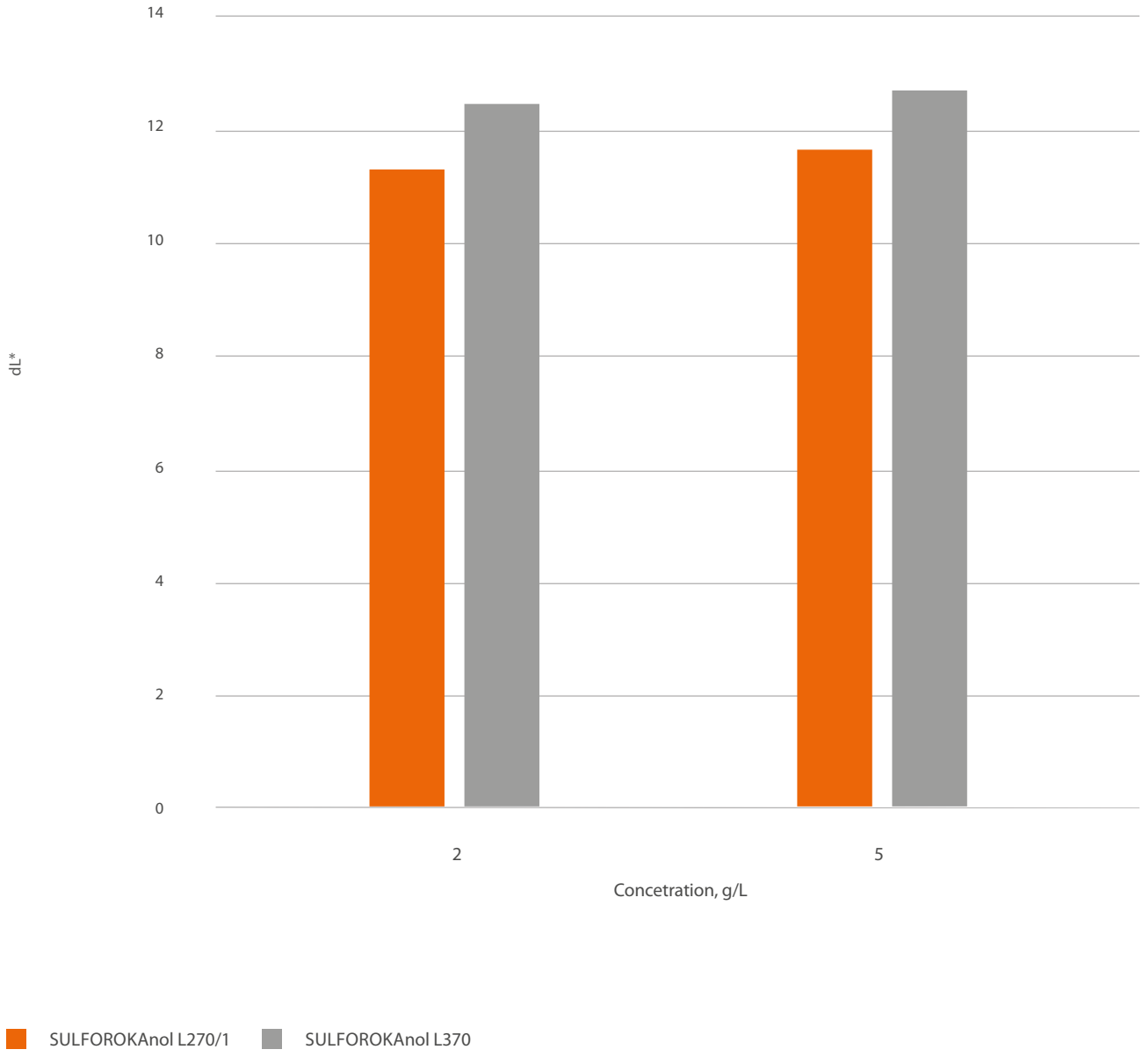

## Foaming capability

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



## 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:

| 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 | Demineralized water | Methanol | Ethyl ether | Acetone |
|---|---|---|---|---|
| SULFOROKAnol L270/1 | Soluble | Partially soluble | Insoluble | Insoluble |
| SULFOROKAnol L370 | Soluble | Partially soluble | Partially soluble | Insoluble |

## Viscosity

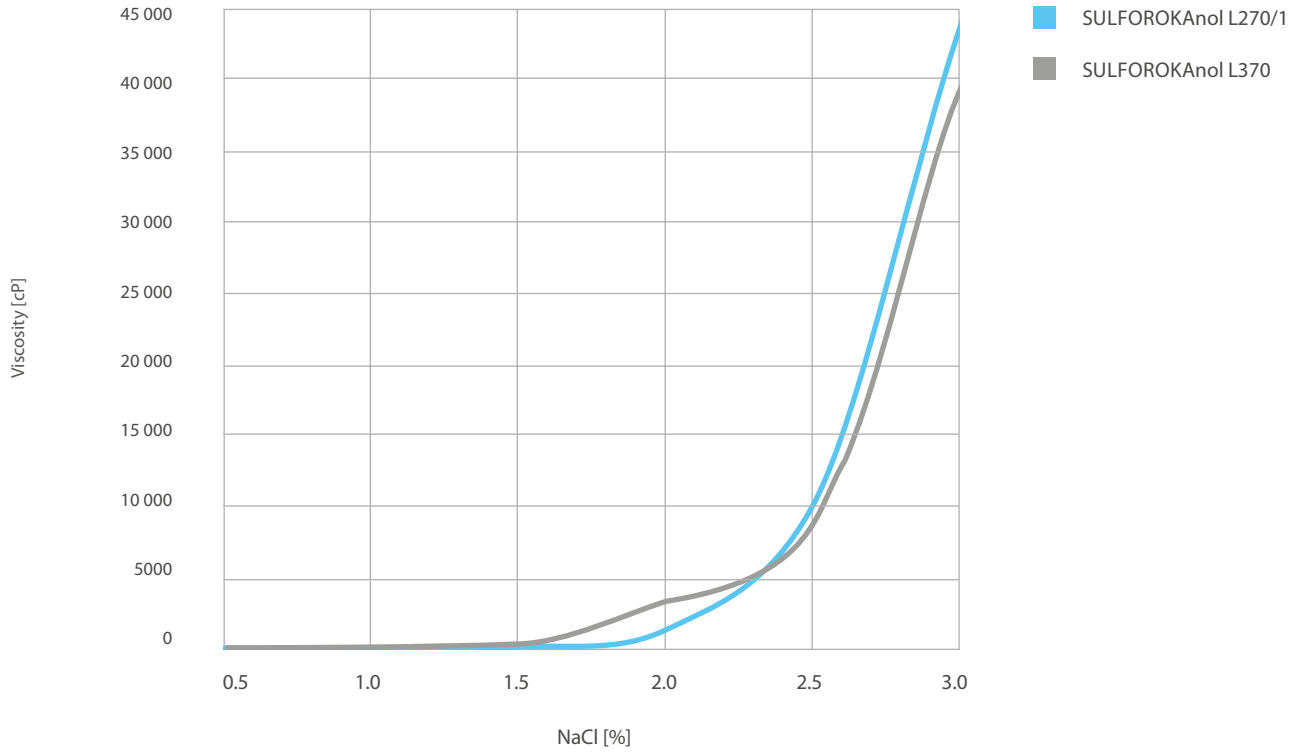
Viscosity comparison of the formulation with SULFOROKAnol L270/1 and SULFOROKAnol L370 were presented below. Viscosity was measured at temperature at 20°C. Information about the formulation used for comparisons below.

## Formulations:

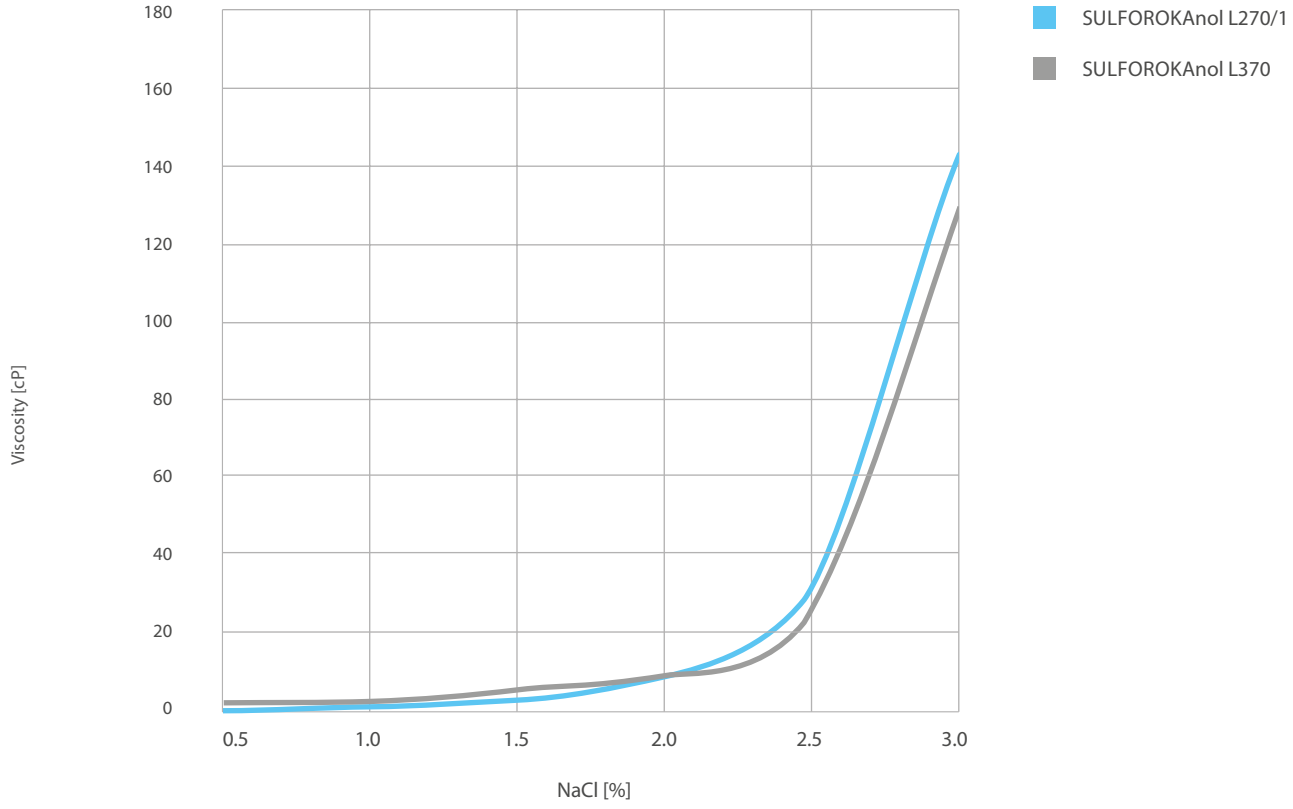
| | Formulation I | |
|---|---|---|
| | SULFOROKAnol L270/1 | SULFOROKAnol L370 |
| **Compound** | **Concentration [%]** | |
| SULFOROKAnol L270/1 | 8.0 (active matter) | – |
| SULFOROKAnol L370 | – | 8.0 (active matter) |
| Cocamidopropyl Betaine | 7.0 | |
| NaCl | 0.5-3.0 | |
| Water | up to 100.0 | |

| | Formulation II | |
|---|---|---|
| | SULFOROKAnol L270/1 | SULFOROKAnol L370 |
| **Compound** | **Concentration [%]** | |
| SULFOROKAnol L270/1 | 4.0 (active matter) | – |
| SULFOROKAnol L370 | – | 4.0 (active matter) |
| Cocamidopropyl Betaine | 3.4 | |
| NaCl | 0.5-3.0 | |
| Water | up to 100.0 | |

## SULFOROKAnol L270/1 vs SULFOROKAnol L370 (8% active matter) - I




## SULFOROKAnol L270/1 vs SULFOROKAnol L370 (4% active matter) - II



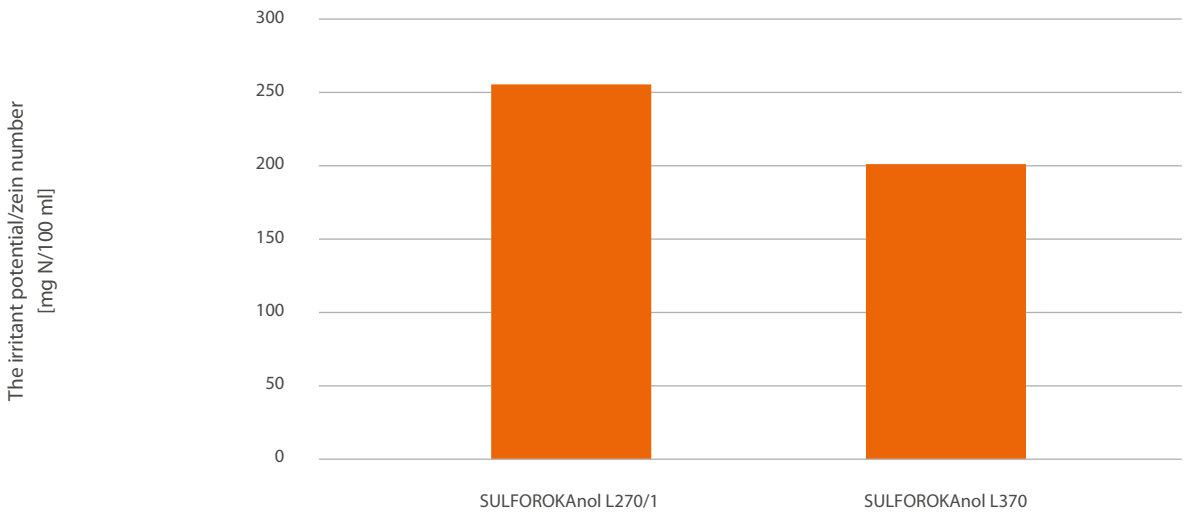
# Irritant potential

The irritant potential was determined for solution of SULFOROKAnol L370 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 insoluble 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 irritant potential was estimated. The more protein is solubilized by the surfactant solution, the higher the irritant potential.




# Home Care formulation

Examples of household formulations are presented below. The table contains the percentage compositions of the formulations, below is the preparation method.

## Gel for cleaning tiles

| INCI name | Brand name | Concentration [%] | Function |
|---|---|---|---|
| **Sodium Laureth Sulfate / Sodium C12-15 Pareth Sulfate** | **SULFOROKAnol L270/1 or SULFOROKAnol L370** | **5.0** | **cleaning agent / foaming agent** |
| **Alcohols, C13-15-ethoxylated** | **ROKAnol TMP7** | **7.0** | **cleaning agent** |
| Sodium Carbonate | Sodium Carbonate | 2.0 | pH regulator |
| Aqua and additives* | Water | up to 100.0 | solvent |

* Additives: preservatives, dyes, fragrances and others

| | | |
|---|---|---|
| **Appearance** | visual method | clear liquid |
| **pH** | | 10–11 |
| **Viscosity [cP]** | Brookfield LV, T: 20°C | 200-800 |

### Procedure:

**1.** Mix SULFOROKAnol L270/1 or SULFOROKAnol L370 with water until dissolved.
**2.** Add ROKAnol TMP7 and mix.
**3.** Then add Sodium Carbonate and mix.
**4.** Check the pH in the mass.

# Concentrated Dishwashing Liquid

| INCI name | Brand name | Concentration [%] | Function |
|---|---|---|---|
| **Sodium Laureth Sulfate/ Sodium C12-15 Pareth Sulfate** | **SULFOROKAnol L270/1 or SULFOROKAnol L370** | **15.0** | **cleaning agent / foaming agent** |
| **Cocamidopropyl Betaine** | **ROKAmina K30** | **15.0** | **cleaning agent / foaming agent** |
| Glycerin | Glycerin | 7.0 | humectant |
| Panthenol | D-Panthenol | 1.0 | active substance |
| Sodium Chloride | Sodium Chloride | 0.5 | rheology modifier |
| Aqua and additives* | Water | up to 100.0 | solvent |

* Additives: preservatives, dyes, fragrances and others

| | | |
|---|---|---|
| **Appearance** | visual method | liquid gel |
| **pH** | | 7.0–8.0 |
| **Viscosity [cP]** | Brookfield LV, T: 20°C | 2000-5000 |

## Procedure:

**1.** Mix SULFOROKAnol L270/1 or SULFOROKAnol L370 with water until dissolved.
**2.** Add ROKAmina K30 and mix.
**3.** Then add Glycerin, D-Panthenol and mix.
**4.** Then add Sodium Chloride and mix
**5.** Check the pH in the mass.

# Low-Temp Liquid Detergent, LTLD

| INCI name | Brand name | Concentration [%] | Function |
|---|---|---|---|
| **Sodium Laureth Sulfate/ Sodium C12-15 Pareth Sulfate** | **SULFOROKAnol L270/1 or SULFOROKAnol L370** | **14.6** | **removes stains/ foaming agent** |
| **Alcohols, C12-18 ethoxylated** | **ROKAnol C7** | **9.0** | **breaks down stains** |
| **Potassium Cocoate** | **EXOsoft PC35** | **7.0** | **breaks down stains** |
| Tetrasodium Glutamate Diacetate | Glutamic acid, N,N-diacetic acid, tetra sodium salt (GLDA) | 3.0 | chelator |
| Sodium Citrate | Sodium citrate | 2.5 | chelator |
| Enzymes | Multi-enzyme blend, liquid | 0.5 | breaks down different types of stains |
| Fluorescent Brightener | Fluorescent brightener | 0.1 | optical brightener |
| Citric Acid | Citric acid, monohydrate, 50% | for pH ~ 7.5 | pH regulator |
| Aqua and additives* | Water | up to 100.0 | solvent |

* Additives: preservatives, dyes, fragrances and others

| | | |
|---|---|---|
| **Appearance** | visual method | liquid |
| **pH** | | 7.0–8.0 |
| **Viscosity [cP]** | Brookfield LV, T: 20°C | 200-600 |

## Procedure:

**1.** Mix Fluorescent Brightener with water until dissolved.
**2.** Add Sodium Citrate and mix until a homogeneous solution is obtained.
**3.** Then add SULFOROKAnol L270/1 or SULFOROKAnol L370 and mix.
**4.** Add ROKAnol C7 and mix.
**5.** Then add EXOsoft PC35 and mix a homogeneous solution is obtained.
**6.** Add GLDA, mix.
**7.** Add Citric Acid to obtained pH in the mass around 7.5.
**8.** Finally, add Enzymes and mix until a clear liquid is obtained.

# Liquid for Washing Delicate And Woollen Fabrics- ECO-Friendly

| INCI name | Brand name | Concentration [%] | Function |
|---|---|---|---|
| **Sodium Laureth Sulfate/ Sodium C12-15 Pareth Sulfate** | **SULFOROKAnol L270/1 or SULFOROKAnol L370** | **11.4** | **removes stains/ foaming agent** |
| **Alcohols, C9-11 + EO/PO** | **ROKAnol LP3135** | **5.0** | **removes stains/ foaming agent** |
| **Potassium Oleate** | **EXOsoft PO30** | **15.0** | **removes stains/ foaming agent** |
| **Sodium polyacrylates** | **EXOlat C40** | **3.0** | **sequestring/dispersing agents** |
| Cellulase | Cellulase | 1.0 | active substance |
| Aqua and additives* | Water | up to 100.0 | solvent |

* Additives: preservatives, dyes, fragrances and others

| | | |
|---|---|---|
| **Appearance** | visual method | clear liquid |
| **pH** | | 8.0–10.0 |
| **Viscosity [cP]** | Brookfield LV, T: 20°C | <200 |

## Procedure:

**1.** Mix SULFOROKAnol L270/1 or SULFOROKAnol L370 with water until dissolved.
**2.** Add ROKAnol LP3135 and mix.
**3.** Then add EXOsoft PO30, EXOlat C40 and mix.
**4.** Then add Cellulase and mix
**5.** Check the pH in the mass.

# Detergency of laundry formulations

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. Beta-carotene 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

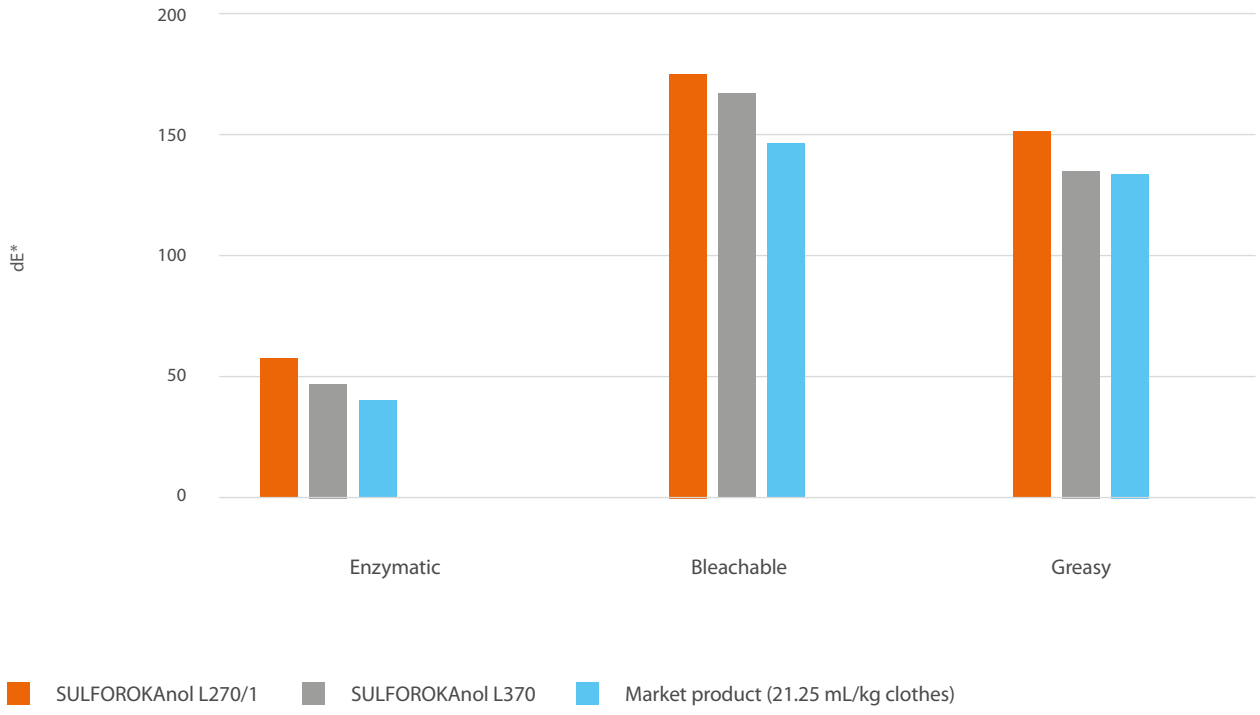
**Greasy**
- Fluid make-up
- Spaghetti sauce with beef
- Butter with colorant
- Beef fat, colored with Sudan Red
- Dirty Motor Oil (DMO)

## Detergency test was performed under the following conditions:

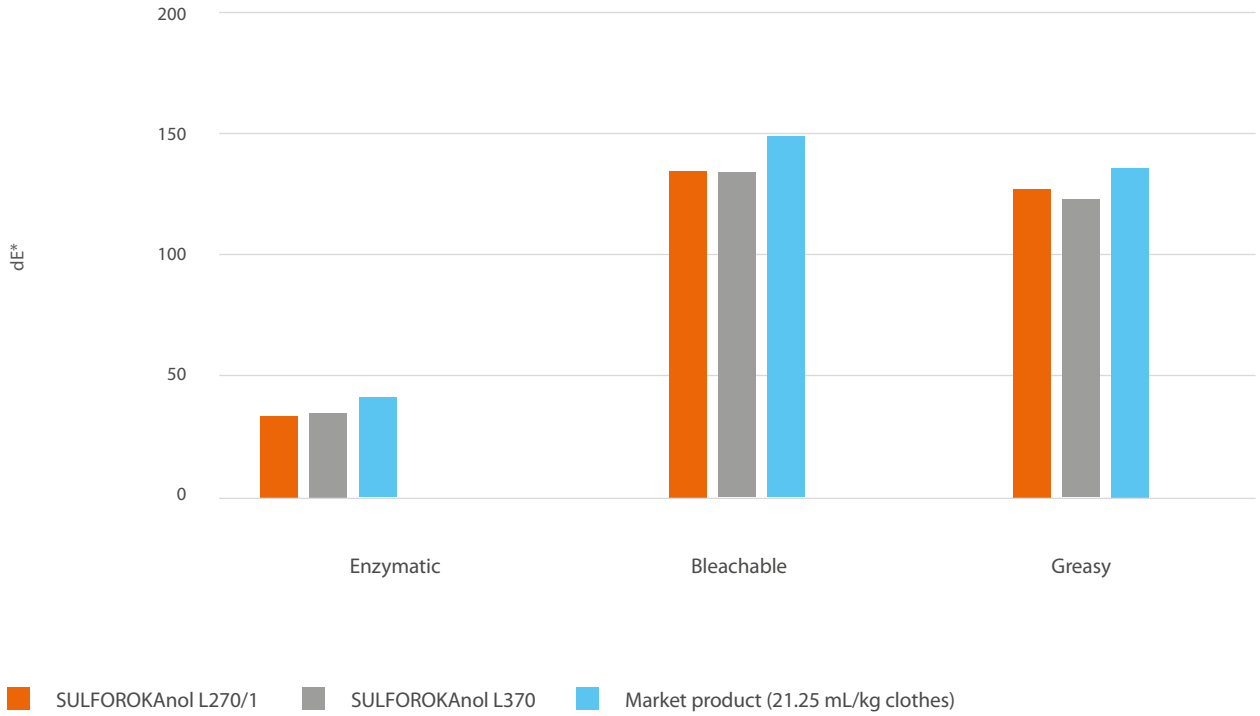
- automatic washing machine
- water hardness (13 °dH)
- cotton program, 40°C
- load – 2 kg dry, white towels
- dose – 30 ml of formulation
- fabric soiled with standard dirt

After the washing process was performed, the standardly soiled fabrics 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.

## Low-Temp Liquid Detergent (15ml/kg clothes)




## Liquid For Washing Delicate And Woollen Fabric (15ml/kg clothes)



# Personal Care formulation

## 2 in 1 Shampoo and Conditioner

| Phase | INCI name | Brand name | Concentration [%] | Function |
|---|---|---|---|---|
| A1 | Xanthan Gum | – | 0.50 | rheology modifier |
| A1 | Glycerin | – | 1.00 | solvent |
| **B** | **Sodium C12-15 Pareth Sulfate** | **SULFOROKAnol L370** | **15.00** | **surfactant** |
| **B** | **Cocamidopropyl Betaine** | **ROKAmina K30** | **10.00** | **surfactant** |
| **C** | **Glycol Distearate , Laureth-4, Cocoamidopropyl Betaine** | **EXOpearl SF** | **1.00** | **surfactant** |
| D | Panthenol | – | 1.00 | active |
| **D** | **PPG-15 Stearyl Ether** | **ROKAnol SP15L** | **1.50** | **emollient** |
| D | Parfum | – | 0.50 | fragrance |
| E | Sodium Benzoate | – | 0.40 | preservative |
| F | Lactic Acid | – | 0.30 | pH adjuster |
| A | Aqua | – | 68.80 | solvent |

| | | |
|---|---|---|
| **Appearance** | visual method | white with pearl effect |
| **pH** | | 4.7–5.5 |
| **Viscosity [cP]** | Brookfield LV, spindle 34, speed 3.0 RPM, T: 25°C | 5000-8000 |
| **Stability** | 1 month in 5°C, 20°C, 40°C | confirmed |

### Procedure:

**1.** Mix ingredients from phase A1 and next add to warm water (40-45°C). Mix until homogenous solution is obtained.
**2.** Cool the batch down to at least 35°C.
**3.** Add phase B during mixing. Mix until homogenous solution is obtained.
**4.** Add phase C-E ingredients while mixing- mix until uniform.
**5.** Adjust pH by Lactic Acid to 5.0-5.4

# Moisturizing Face Wash Gel

| Phase | INCI name | Brand name | Concentration [%] | Function |
|---|---|---|---|---|
| A | **Sodium C12-15 Pareth Sulfate** | **SULFOROKAnol L370** | **8.00** | **surfactant** |
| A | **PEG-6 Caprylic/Capric Glycerides** | **ROKAcet CC6** | **4.00** | **surfactant** |
| A | **Polysorbate 20** | **ROKwinol 20** | **0.20** | **solubilizer** |
| A | **Poloxamer 184** | **EXOmer L64** | **0.70** | **surfactant** |
| B | Glycerin | – | 1.00 | active |
| B | Betaine | – | 1.20 | active |
| C | Parfum | – | 0.30 | fragrance |
| C | Sodium Benzoate | – | 0.40 | preservative |
| D | Citric Acid | – | 0.10 | pH adjuster |
| E | Sodium Chloride | – | 0.50 | rheology modifier |
| A | Aqua | – | 83.60 | solvent |

| | | |
|---|---|---|
| **Appearance** | visual method | clear transparent gel |
| **pH** | | 4.8–5.2 |
| **Viscosity [cP]** | Brookfield LV, spindle 34, speed 3.0 RPM, T: 25°C | 1000-2000 |
| **Stability** | 1 month in 5°C, 20°C, 40°C | confirmed |

## Procedure:

**1.** Add ingredients from phase A to warm water (40-45°C). Mix until homogenous solution is obtained.
**2.** Cool the batch down to at least 35°C.
**3.** Mix phase B and add during mixing. Mix until homogenous solution is obtained.
**4.** Add phase C while mixing- mix until uniform.
**5.** Adjust pH by Citric Acid to 4.8-5.2
**6.** Add Sodium Chloride and check viscosity.

# Cleansing Mousse

| Phase | INCI name | Brand name | Concentration [%] | Function |
|---|---|---|---|---|
| A | Aqua | – | 86.55 | solvent |
| **A** | **Disodium Laureth Sulfosuccinate** | **EXOsoft L3/40** | **1.50** | **surfactant** |
| **A** | **Sodium C12-15 Pareth Sulfate** | **SULFOROKAnol L370** | **5.00** | **surfactant** |
| **A** | **Cocamidopropyl Betaine** | **ROKAmina K30** | **2.00** | **surfactant** |
| B | Glycerin | – | 3.00 | humectant |
| B | Alantoina | – | 0.50 | active |
| B | Panthenol | – | 0.50 | active |
| B | Parfum | – | 0.25 | fragrance |
| C | Sodium Benzoate | – | 0.40 | preservative |
| D | Lactic Acid | – | 0.30 | pH adjuster |

| | | |
|---|---|---|
| **Appearance** | visual method | clear liquid |
| **pH** | | 4.3–4.9 |
| **Stability** | 1 month in 5°C, 20°C, 40°C | confirmed |

## Procedure:

**1.** Add ingredients from phase A to warm water (40-45°C). Mix until homogenous solution is obtained.
**2.** Cool the batch down to at least 35°C.
**3.** Add phase B during mixing. Mix until homogenous solution is obtained.
**4.** Add Sodium Benzoate and mix.
**5.** Adjust pH by Lactic Acid to 4.4-4.8

**PCC Exol SA**
Sienkiewicza 4
56-120 Brzeg Dolny, Poland
products@pcc.eu

Please visit our capital group business platform:
**www.products.pcc.eu**

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