

Liquid laundry detergents for household use



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The main task of detergents, designed for home laundry, is to remove stains and dirt from clothes using the lowest possible washing temperature and avoiding the need for prior soaking.

The choice of detergent and its amount depend on the size of the load, the hardness of the water, the colour and type of laundered fabrics. The effectiveness of the detergent depends primarily on the amount used for washing. An insufficient amount as well as an excess of it can result in worse washing results.

PCC Exol products can be used for both liquid and capsule detergents. Detergents in the form of laundry capsules are as effective as liquid detergents, with the added advantage of less water in the product itself, which is in line with the current zero waste trend. In addition, the concentrated form of the capsules allows for the transport of larger quantities compared to liquid detergents.

The developed formulation is shown below:

- Heavy Duty Liquid Detergent, HDLD
- Universal Liquid Detergent, ULD
- Low-Temp Liquid Detergent, LTLD
- Baby Laundry Detergent, BLD
- Laundry Capsules, LC



Detergency

Detergency - 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 colourant, 15. Beef fat, coloured 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 colourant
- Beef fat, coloured with Sudan Red
- Dirty Motor Oil (DMO)

Test conditions:

- automatic washing machine
- 40°C
- water hardness (13 °dH)
- cotton program
- load – 2 kg of dry, white towels
- the dosing of the market product was verified with the information on the label
- 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.



Figure 1. Soiled fabric before washing

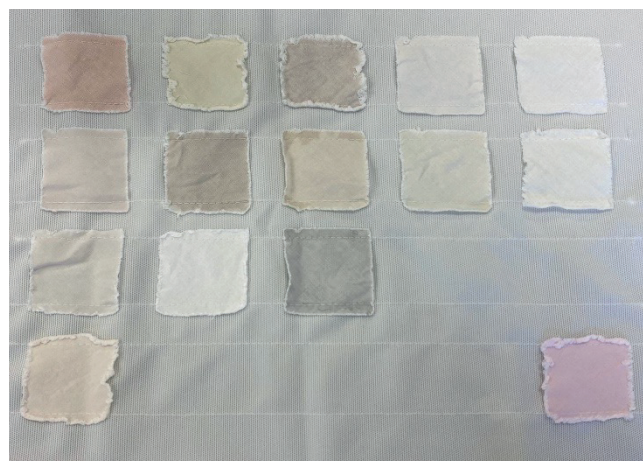


Figure 2. Fabric after washing

Heavy duty liquid detergent, HDLD

Compound	Brand name	Concentration [%]	Function
Sodium Laureth Sulfate	SULFOROKAnol L227/1	30.0	Removes stains/ foaming agent
PEG-6 Glyceryl Cocoate/ Laureth-7/ Alcohols, C8-18-ethoxylated/ PEG 11-Rapeseedamide	ROKAcet KO400G/ ROKAnol L7/ ROKAnol MT7E/ ROKAmid MRZ11	10.0	Breaks down stains
Potassium Cocoate	EXOsoft PC35	3.0	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

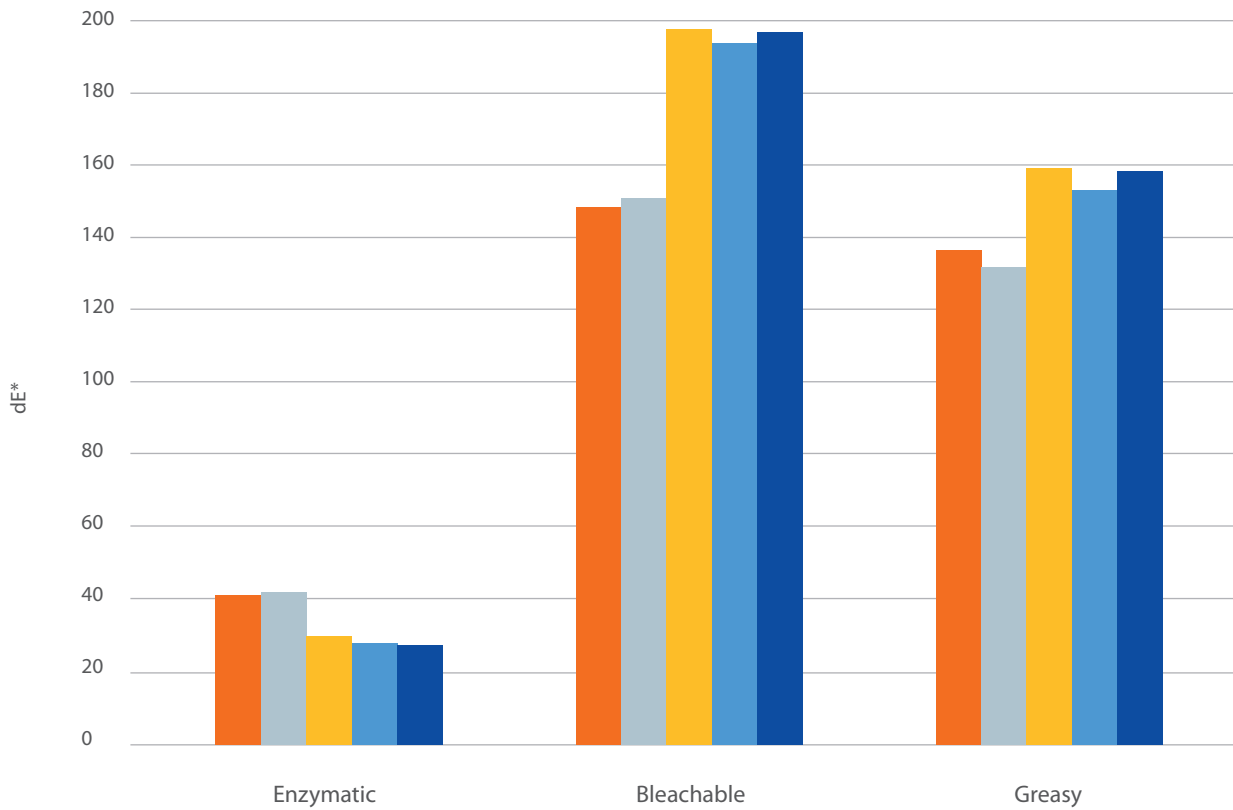
APPEARANCE	visual method	liquid
pH		7.5-8.5
VISCOSITY [cP]	Brookfield LV, T: 20°C	<100



PROCEDURE

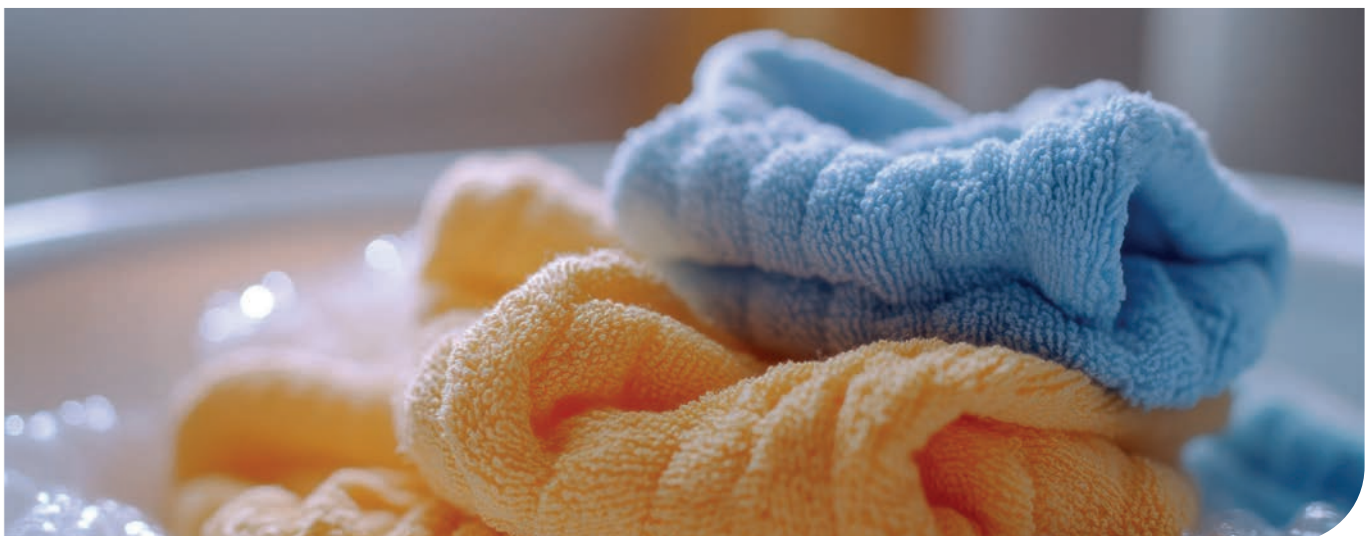
1. Mix Fluorescent brightener with water.
2. Add Trisodium Citrate and mix until a homogeneous solution is obtained.
3. Then add SULFOROKAnol L227/1 and mix.
4. Add ROKAcet KO400G/ROKAnol L7/ROKAnol MT7E/ROKAmid MRZ11 and mix.
5. Then add EXOsoft PC35 and mix.
6. Add GLDA-Na₄ mix.
7. Add Citric Acid to obtained pH in the mass around 7-8.
8. Finally, add Enzymes and mix until a clear liquid is obtained.

Heavy duty liquid detergents (15 mL/kg clothes)



- Market product (21.25 mL/kg clothes)
- HDLD with ROKAcet KO400G
- HDLD with ROKAnol L7
- HDLD with ROKAnol MT7E
- HDLD with ROKAmid MRZ11

Parameter dE* is the difference between the initial stain and the degree of its washing, higher dE*, better detergency.



Universal liquid detergent, ULD

Compound	Brand name	Concentration [%]	Function
Sodium Laureth Sulfate	SULFOROKAnol L227/1	40.0	Removes stains/ foaming agent
PEG-6 Glyceryl Cocoate/ Laureth-7/ Alcohols, C8-18-ethoxylated/ PEG 11-Rapeseedamide	ROKAcet KO400G/ ROKAnol L7/ ROKAnol MT7E/ ROKAmid MRZ11	10.0	Breaks down stains
Potassium Oleate	EXOsoft PO30	5.0	Breaks down stains
Magnesium Laureth Sulfate	–	5.0	Removes stains/ foaming agent
Glycerin	–	6.0	Humectant
Tetrasodium Glutamate Diacetate	–	2.5	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

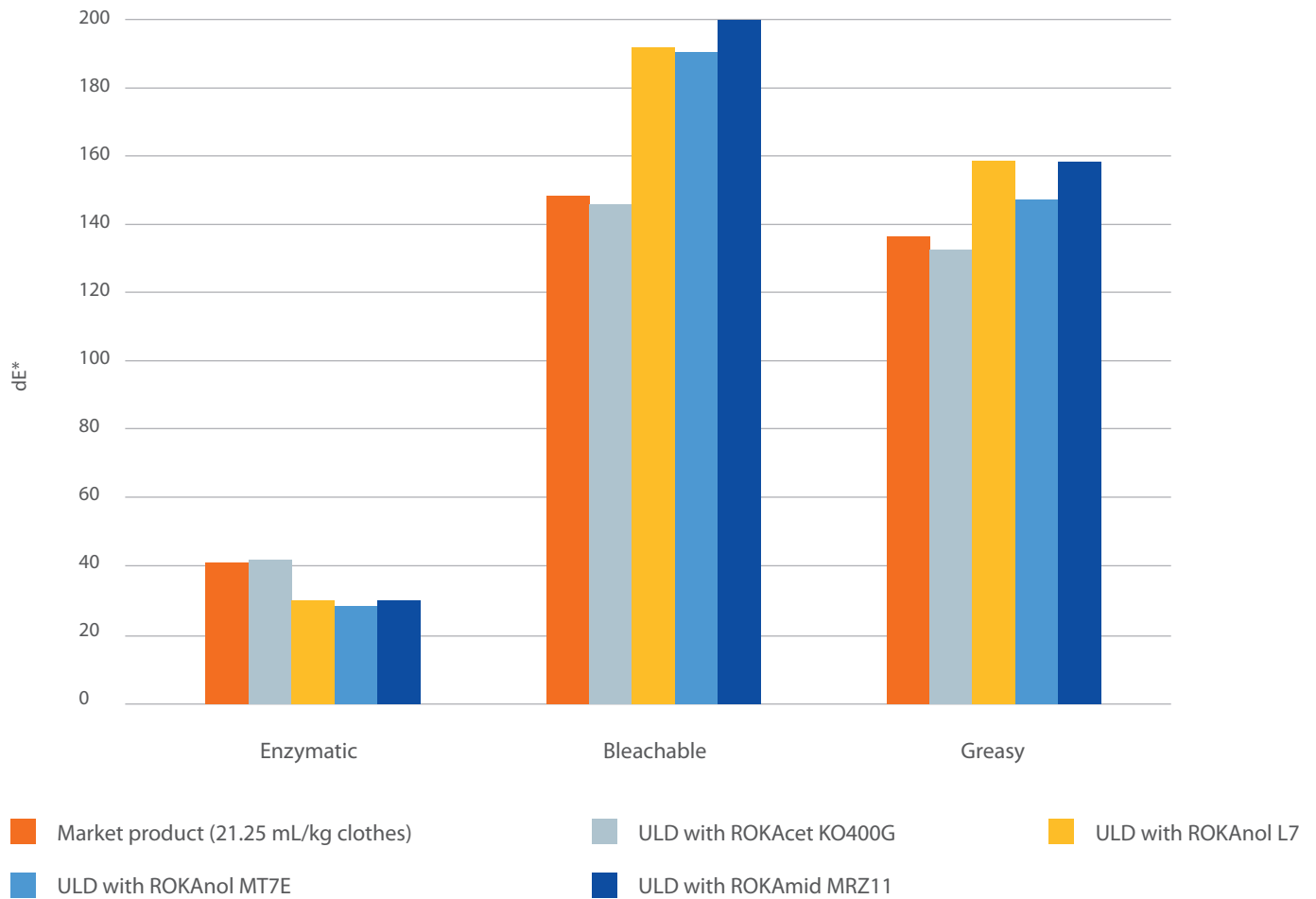
APPEARANCE	visual method	liquid
pH		7.5-8.5
VISCOSITY [cP]	Brookfield LV, T: 20°C	<100



PROCEDURE

1. Mix Fluorescent brightener with water until dissolved.
2. Add SULFOROKAnol L227/1 and Magnesium Laureth Sulfate and mix until a homogeneous solution is obtained.
3. Then add ROKAcet KO400G/ROKAnol L7/ROKAnol MT7E/ROKAmid MRZ11 and mix.
4. Then add EXOsoft PO30 and mix a homogeneous solution is obtained.
5. Add Glycerin and mix.
6. Add GLDA-Na₄ mix.
7. Add Citric Acid to obtained pH in the mass around 7-8.
8. Finally, add Enzymes and mix until a clear liquid is obtained.

Universal liquid detergents (15 mL/kg clothes)



Parameter dE* is the difference between the initial stain and the degree of its washing, higher dE*, better detergency.



Low-temp liquid detergent, LTLD

Compound	Brand name	Concentration [%]	Function
Sodium Laureth Sulfate	SULFOROKAnol L227/1	38.0	Removes stains/ foaming agent
PEG-6 Glyceryl Cocoate/ Laureth-7/ Alcohols, C8-18-ethoxylated/ PEG 11-Rapeseedamide	ROKAcet KO400G/ ROKAnol L7/ ROKAnol MT7E/ ROKAmid MRZ11	9.0	Breaks down stains
Potassium Cocoate	EXOsoft PC35	7.0	Breaks down stains
Tetrasodium Glutamate Diacetate	–	3.0	Chelator
Trisodium Citrate	–	2.5	Chelator
Enzymes	–	0.5	Breaks down different types of stains
Fluorescent brightener	–	0.1	Optical brightener
Citric Acid	–	for pH ~ 7.5	pH regulator
Aqua	–	up to 100.0	Solvent

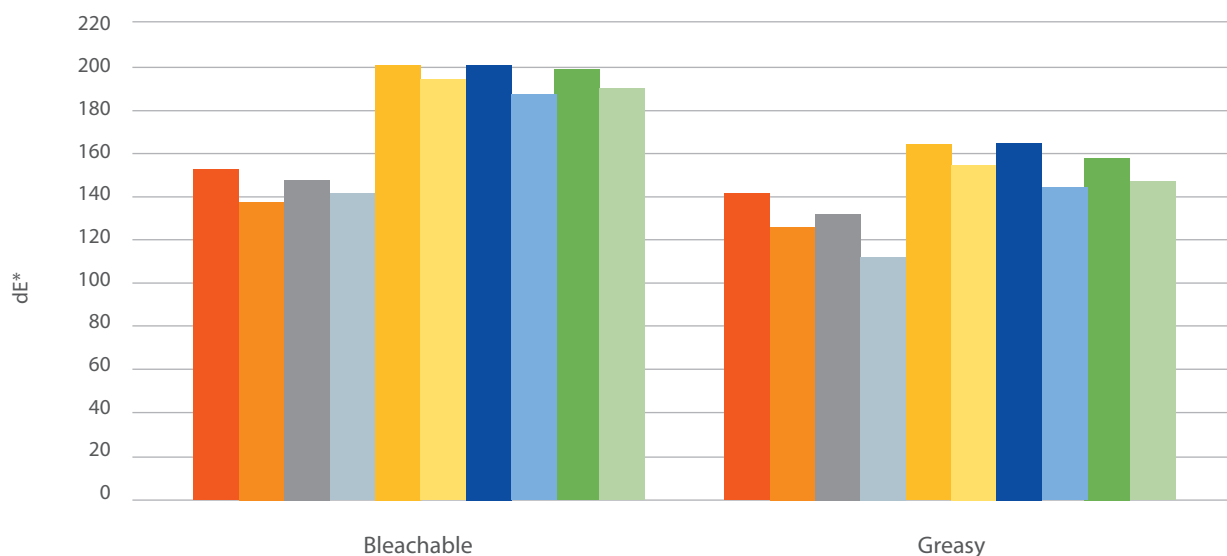
APPEARANCE	visual method	liquid
pH		8.0-8.5
VISCOSITY [cP]	Brookfield LV, T: 20°C	up to 100



PROCEDURE

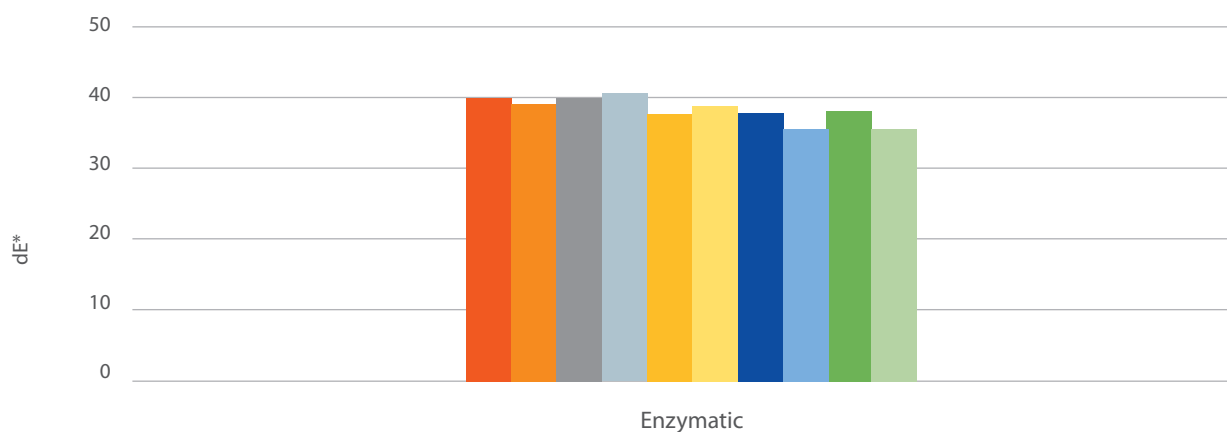
1. Mix Fluorescent brightener with water until dissolved.
2. Add Trisodium Citrate and mix until a homogeneous solution is obtained.
3. Then add SULFOROKAnol L227/1 and mix.
4. Add ROKAcet KO400G/ROKAnol L7/ROKAnol MT7E/ROKAmid MRZ11 and mix.
5. Then add EXOsoft PC35 and mix a homogeneous solution is obtained.
6. Add GLDA-Na₄ 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.

Low-temp liquid detergents (15 mL/kg clothes)



- Market product 40°C (13.75 mL/kg clothes)
- Market product cold tap water (13.75 mL/kg clothes)
- LTLD with ROKAcet KO400G 40°C
- LTLD with ROKAcet KO400G cold tap water
- LTLD with ROKAnol L7 40°C
- LTLD with ROKAnol L7 cold tap water
- LTLD with ROKAnol MT7E 40°C
- LTLD with ROKAnol MT7E cold tap water
- LTLD with ROKAmid MRZ11 40°C
- LTLD with ROKAmid MRZ11 cold tap water

Low-temp liquid detergents (15 mL/kg clothes)



- Market product 40°C (13.75 mL/kg clothes)
- Market product cold tap water (13.75 mL/kg clothes)
- LTLD with ROKAcet KO400G 40°C
- LTLD with ROKAcet KO400G cold tap water
- LTLD with ROKAnol L7 40°C
- LTLD with ROKAnol L7 cold tap water
- LTLD with ROKAnol MT7E 40°C
- LTLD with ROKAnol MT7E cold tap water
- LTLD with ROKAmid MRZ11 40°C
- LTLD with ROKAmid MRZ11 cold tap water

Parameter dE* is the difference between the initial stain and the degree of its washing, higher dE*, better detergency.

Baby laundry detergent, BLD

Compound	Brand name	Concentration [%]	Function
Sodium Laureth Sulfate	SULFOROKAnol L227/1	35.0	Removes stains/ foaming agent
Potassium Oleate	EXOsoft PO30	5.0	Breaks down stains
Magnesium Laureth Sulfate	-	5.0	Removes stains/ foaming agent
PEG-6 Glyceryl Cocoate/ Laureth-7/ Alcohols, C8-18-ethoxylated/ PEG 11-Rapeseedamide	ROKAcet KO400G/ ROKAnol L7/ ROKAnol MT7E/ ROKAmid MRZ11	3.0	Breaks down stains
Glycerin	-	6.0	Humectant
Tetrasodium Glutamate Diacetate	-	2.5	Chelator
Styrene/Acrylic Copolymer	-	0.5	Opacifier
Citric Acid	-	for pH ~ 9	pH regulator
Aqua	-	up to 100.0	Solvent

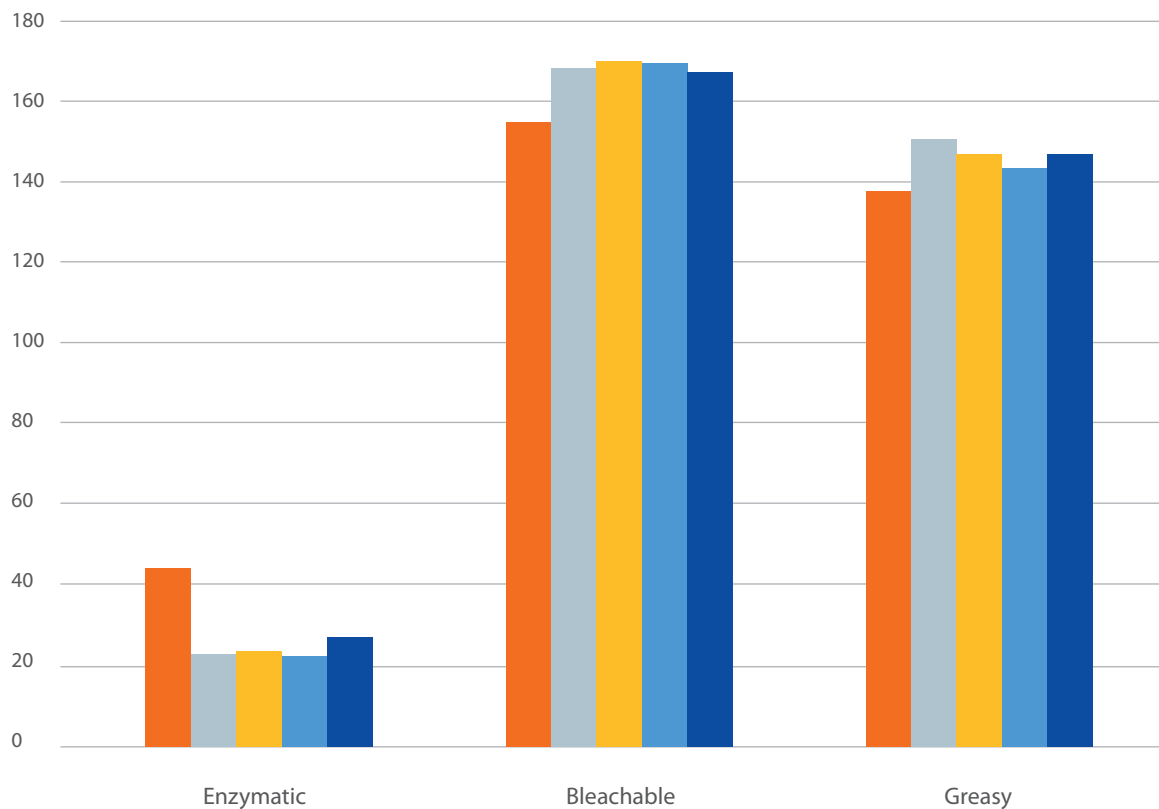
APPEARANCE	visual method	milky emulsion
pH		9
VISCOSITY [cP]	Brookfield LV,T: 20°C	<100



PROCEDURE

1. Mix SULFOROKAnol L227/1 with water until dissolved.
2. Add ROKAcet KO400G/ROKAnol L7/ROKAnol MT7E/ROKAmid MRZ11 and mix.
3. Then add Magnesium Laureth Sulfate and mix.
4. Add EXOsoft PO30 and mix.
5. Then add Styrene/Acrylic Copolymer and mix.
6. Add Glycerin, mix.
7. Add GLDA-Na₄, mix.
8. Finally, add Citric Acid to obtained pH in the mass around 9.

Baby laundry detergent (15 mL/kg clothes)



Market product (25 mL/kg clothes)

BLD with ROKAcet KO400G

BLD with ROKAnol L7

BLD with ROKAnol MT7E

BLD with ROKAmid MRZ11

Parameter dE* is the difference between the initial stain and the degree of its washing, higher dE*, better detergency.



Laundry capsules, LC/1

Compound	Brand name	Concentration [%]	Function
MIPA Laureth Sulfate (and) Propylene Glycol	SULFOROKAnol L290/1M/ SULFOROKAnol L390/1M	40.00	Removes stains/ wetting agent
PEG-6 Glyceryl Cocoate/ Laureth-7/ PEG 11-Rapeseedamide	ROKAcet KO400G/ ROKAnol L7/ ROKAmid MRZ11	32.00	Removes stains
Glycerin	–	17.95	Humectant
Tetrasodium Glutamate Diacetate	–	4.00	Chelator
Enzymes	–	1.00	Breaks down different types of stains
Fluorescent brightener	–	0.05	Optical brightener
Sodium Hydroxide	–	for pH 8.0-8.5	pH regulator
Aqua	–	5.00	Solvent

APPEARANCE	visual method	gel
pH		7.5-8.5
VISCOSITY [cP]	Brookfield LV, T: 20°C	600-1300
WATER CONTENT [%]	Karl Fischer method	<10



PROCEDURE

1. Mix Fluorescent brightener with water until dissolved.
2. Add Glycerin and GLDA-Na₄ mix.
3. Add ROKAcet KO400G/ROKAnol L7/ROKAmid MRZ11 and mix.
4. Then add SULFOROKAnol L290/1M/SULFOROKAnol L390/1M, mix.
5. Add Sodium Hydroxide to obtained pH in the mass around 8.0-8.5
6. Finally, add Enzymes and mix.

Laundry capsules, LC/2

Compound	Brand name	Concentration [%]	Function
MIPA Laureth Sulfate (and) Propylene Glycol	SULFOROKAnol L290/1M/ SULFOROKAnol L390/1M	40.00	Removes stains/ wetting agent
PEG-6 Glyceryl Cocoate	ROKAcet KO400G	17.00	Removes stains
Laureth-7	ROKAnol L7	15.00	Removes stains
Glycerin	–	17.95	Humectant
Tetrasodium Glutamate Diacetate	–	4.00	Chelator
Enzymes	–	1.00	Breaks down different types of stains
Fluorescent brightener	–	0.05	Optical brightener
Sodium Hydroxide	–	for pH ~ 8	pH regulator
Aqua	–	5.00	Solvent

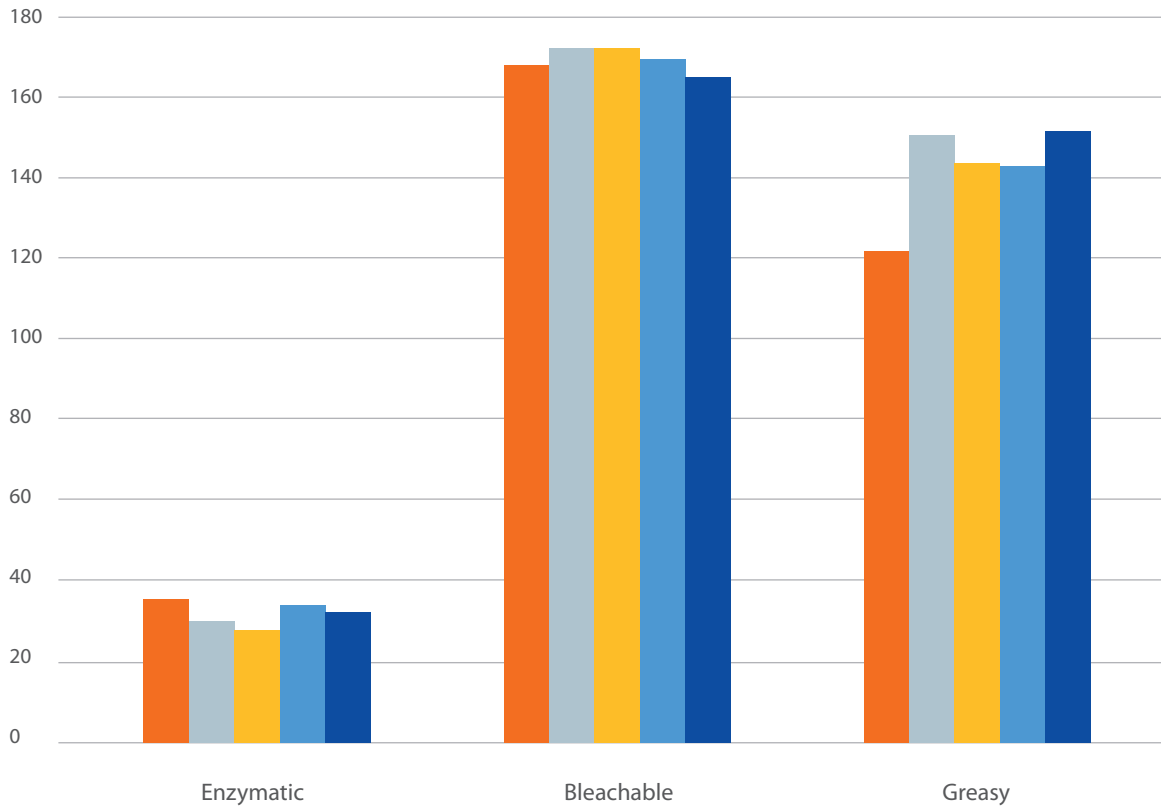
APPEARANCE	visual method	gel
pH		7.5-8.0
VISCOSITY [cP]	Brookfield LV, T: 20°C	600-900
WATER CONTENT [%]	Karl Fischer method	<10



PROCEDURE

1. Mix Fluorescent brightener with water until dissolved.
2. Add Glycerin and GLDA-Na₄ mix.
3. Add ROKAcet KO400G and mix.
4. Then add ROKAnol L7, mix.
5. Then add SULFOROKAnol L290/1M/SULFOROKAnol L390/1M and mix.
6. Add Sodium Hydroxide to obtained pH in the mass around 8.
7. Finally, add Enzymes and mix.

Laundry capsules
(8 g/kg clothes)



- Market product (9.5 g/kg clothes)
- LC/1 with ROKAcet KO400G
- LC/1 with ROKAnol L7
- LC/1 with ROKAmid MRZ1
- LC/2

Parameter dE* is the difference between the initial stain and the degree of its washing, higher dE*, better detergency.





PCC EXOL SA

Sustainable technologies for new generations



PCC EXOL SA is a company that combines cutting-edge technologies with rich experience in production of surfactants (surface active agents). The company is located in Brzeg Dolny (Poland), where anionic, nonionic and amphoteric surfactant production plants have been launched. Due to the flexible production processes, the company offers a wide spectrum of surfactants and industrial formulations, which are often suited for the individual customers operating in plenty of various industry sectors. As one of the leading surfactant manufacturers, PCC EXOL SA carries out new investment projects and implements innovative technologies based on the global sustainability trends.

PCC EXOL SA portfolio includes surfactants with a broad range of applications. Besides of the mass production for personal care and detergents industry, the substances produced by PCC EXOL SA also include specialized products used in various branches, such as textile, agrochemical, metal cleaning, oil drilling, building & construction, paints & coatings, paper industry, extraction & drilling, and many others. The company comprehensive portfolio is continuously enriched with new innovative products, which meet even the strictest market requirements and adapt to the individual needs of customers. This is possible due to the dynamic development of the research facili-

The background of the central section is a light blue gradient with a pattern of overlapping, semi-transparent hexagons. On the left side, there are faint, glowing blue lines and dots, resembling a molecular or network structure.

PCC EXOL SA combines innovative technologies with experience in designing, producing and selling surfactants and chemical formulations

ties, flexible production, knowledge as well as experienced personnel.

PCC EXOL SA has the key competence necessary for a worldwide production of surfactants. The ongoing projects will soon bring the new opportunities for the company's further development and expansion into new markets. The company offers not only a wide portfolio and professional servicing but most of all flexible production and comprehensive system solutions that meet individual customer demands. The strategic PCC EXOL SA investor is PCC SE, operating on international markets of the chemical raw materials, transport, energy, coal,

coke, petrol, plastics and metallurgy. PCC SE includes 80 companies operating in 39 different locations in 17 countries.



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October 2024

Please visit our capital group business platform:
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