HOME CARE FORMULATIONS:

LOW AND HIGH FOAMING SOLUTIONS FOR HOME CARE

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In these fast-paced times that we are living in, the Home Care sector needs to innovate and move towards more sustainable solutions, personalised to meet the needs of consumers with different lifestyles and in different places.

A wide range of applications for different needs are to be covered in the Home Care field. In all cases the objective is an effective, sustainable cleaning, but the requirements for the detergents used are diverse: from acid to alkaline products, from low foam to very high and sticky foam, hard or soft water, presence of hypochlorite or biocides… all should be considered.

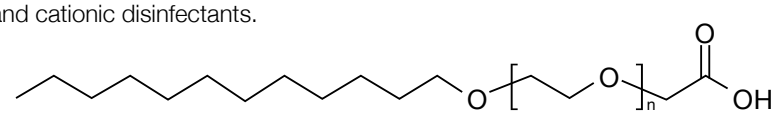
Kao Chemicals Europe, as a specialised surfactant manufacturer, has a wide range of ingredients that can provide an added value to Home Care formulations, covering different fields and applications for different needs.

This article focuses on two product ranges that show a high versatility regarding the foaming needs we may face.

AKYPO® and LEVENOL® product ranges

On the one hand, we have the AKYPO® product range. AKYPO® are plant-based ether carboxylic acids and salts thereof, with different alkyl chain lengths and different ethoxylation degrees. In this way, we can obtain low (AKYPO® LF types) to high foaming surfactants (AKYPO® RLM types as well as AKYPO® LM-40 for a durable sticky foam), all of them suitable for alkaline and acidic pH formulations, effective both in hard or soft water and compatible with the presence of electrolytes, hypochlorite and cationic disinfectants.

Table 1:

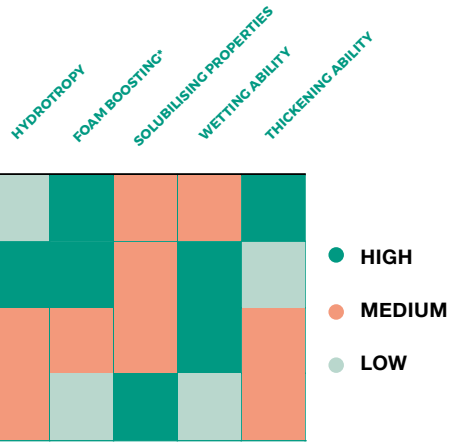


PRODUCT	CHAIN	EO MOL	MAIN BENEFITS
AKYPO® LF 1	C8	5	Hydrotropy Dispersing Low foaming
AKYPO® LF 2	C8	8	
AKYPO® LF 4	C6/C8	3+8	
AKYPO® LF 6	C4/C8	1+8	
AKYPO® RLM 25	C12/C14	2.5	Medium/ High foaming
AKYPO® RLM 45 CA	C12/C14	4.5	
AKYPO® RLM 100	C12/C14	10	
AKYPO® LM-40	C12/C14	>3	Special sticky foam
AKYPO® GENE KTS	Blend with a Polymer		Special for Carpet/Upholstery

On the other hand, LEVENOL® contains Polyoxyethylene Glycerol Esters of vegetable origin, with different properties. All of them are 100% concentrated products, with no solvents and no preservatives, liquid at room temperature, and colour- and odour-less. Glycereth-2 Cocoate is an effective foam booster and thickener. Glycereth-6 Cocoate, however, stands out for its hydrotropic and wetting ability, while also being a foam booster, which makes it a multifunctional ingredient for home care. Glycereth-7 Cocoate balances the properties of both Glycereth-2 Cocoate and Glycereth-6 Cocoate with a mixture of their properties, while Glycereth-17 Cocoate is a very good low foaming solubiliser.

Table 2:

	CHEMICAL DESCRIPTION	HLB
LEVENOL® C-421	Glycereth-2 Cocoate	11 approx.
LEVENOL® F-200	Glycereth-6 Cocoate	15 approx.
LEVENOL® C-301	Glycereth-7 Cocoate	14 approx.
LEVENOL® C-201	Glycereth-17 Cocoate	13 approx.



*Foam ability in the presence of anionic surfactants such as Sodium Laureth Sulfate (SLES) or Linear Alkylbenzene Sulfonic Acid (LABSA).

All LEVENOL® products have an excellent ecotoxicological profile, suitable for natural ECOCERT detergents and sustainable EU Ecolabel formulations. They are also available under the RSPO MB system on request. They also allow us to have unlabelled products according to the CLP regulation.

HOME CARE APPLICATIONS

Formulators find a wide range of possibilities for home care, since different requirements and types of formulations are to be covered. There is a wide pH range based on the type of surface to be cleaned: alkali for helping with the saponification of fats in kitchen cleaners and degreasers, acidic to help remove lime scale in bathroom cleaners or neutral to protect some home surfaces, such as wood or others.

Acid Bathroom Cleaners

To help remove lime scale, our proposal is the addition of AKYPO® LM-40 as anionic surfactant, combining it with standard Sodium Laureth Sulfate. Lauryl / Myristyl Ether Carboxylic Acid forms a creamy, dense, sticky foam that lasts longer even on vertical surfaces and has an impact for the consumer.

Figure 1:

BATHROOM CLEANER	%
AKYPO® LM-40 Lauryl / Myristyl Ether Carboxylic Acid	1.1
OXIDET® DMCLD Cocamine oxide	10.8
EMAL® 227 Sodium Laureth Sulfate	2.8
Citric Acid *	3.0
Propylene glycol n-butylether *	10.0
Deionised Water	Up to 100%

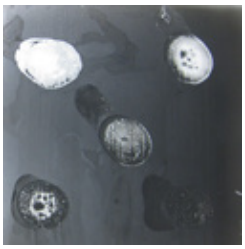
* (as active ingredient)

In order to measure lime scale removal, the IKW method “Recommendation for the Quality Assessment of Bathroom Cleaners” (SÖFW-Journal 129, 11-2003, pages 42-48) was used for bathroom cleaners. As shown in Figure 1, lime scale removal is much greater when formulating with SLES and AKYPO® LM-40 than when formulating only with SLES.

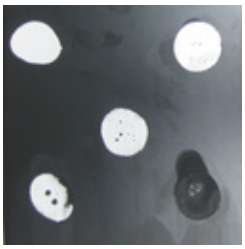
CLEANING PERFORMANCE
Lime soap removal (IKW method)

Calcium stearate and carbon black soil. 500 ml drops of formula on the surface. Different contact times.

SLES



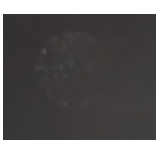
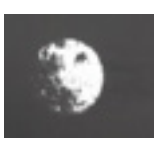
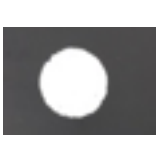
AKYPO® LM-40



However, when not so much foam is needed, short chain carboxylic acids still help improve lime soap removal. Figure 2 shows how soap removal is improved when using a mixture of SLES/AKYPO® LF2 1/1 instead of SLES alone. Replacing ethoxylated fatty alcohol with Glycereth-6 Cocoate or Glycereth-7 Caprylate/Caprate (EMANON® XLF) in the presence of SLES also shows a performance improvement according to this test (with the latter two, it is important to keep pH between 4 and 9).

Figure 2:

COMPOSITION 1.0% Surfactant - 4.0% Citric Acid | pH 3.5 | 12.5min

SURFACTANT BASE	SLES	SLES / AKYPO LF-2 1 : 1	SLES / EO FATTY ALCOHOL (C1315-7O) 1 : 1	SLES / LEVENOL F-200 1 : 1	SLES / EMANON XLF 1 : 1
LIME SOAP REMOVAL AFTER 12.5 MINUTES CONTACT TIME					
VISUAL ASSESSMENT	50 %	85 %	20 %	70 %	98 %

Neutral Floor and All-Purpose Cleaners

For the protection of surfaces where an extreme pH is not needed, we always recommend our LEVENOL® product range of non-ionic surfactants.

Due to their above properties, we recommend them in formulations such as the following (Figure 3), whose performance we have compared to the performance of the same formulations based on ethoxylated fatty alcohols and to a market product.

Figure 3:

NEUTRAL ALL-PURPOSE CLEANER (D-240)

Component	D-240 % Product	with POE-FA % Product
LEVENOL® F-200	3.0	-
POE-Fatty alcohol	-	3.0
Deionised water	q.s.	q.s.
Propylene Glycol	5.0	3.0
Ethanol	4.0	6.0
Sodium Citrate	2.0	2.0
NaOH	to pH=7	to pH=7
Dilution	(1-3)% or ready to use	(1-3)% or ready to use

NEUTRAL APC (D-240)

Non-ionic surfactant	LEVENOL®	POE-FA
LEVENOL® F-CLP Labelling 200	NL	

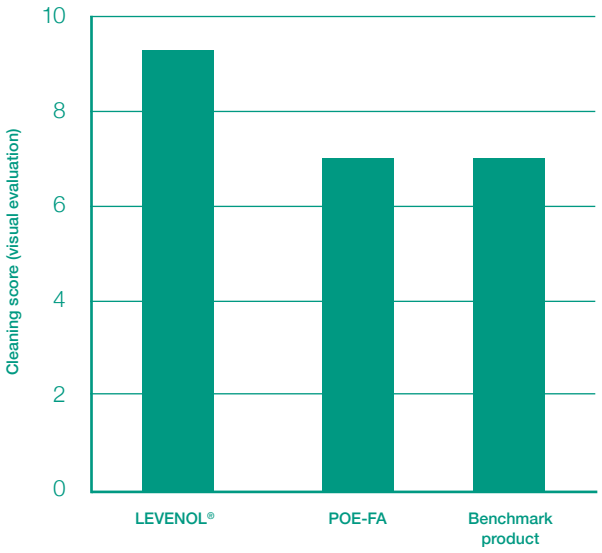
Thanks to these properties (better cleaning, fewer residues left, better CLP labelling), we can also formulate glass cleaners with Glycereth-6 Cocoate as proposed in Figure 4:

Figure 4:

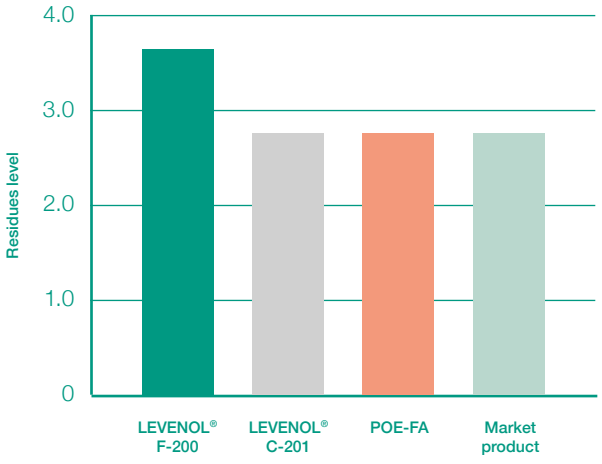
WINDOW CLEANER (D-226) Spray	%
LEVENOL® F-200 Glycereth-6 Cocoate	0.6
Ethanol	10.0
Propylene glycol	10.0
Perfume	q.s.
Preservative	q.s.
Water	Up to 100%

As we can see, measuring the cleaning ability according to “Recommendation for the Quality Assessment of the Product Performance of All-Purpose Cleaners 2014” (SÖFW-Journal 141, 04-2015, pages 47 - 56), cleaning performance is better with our D-240 formulation than with the same formulation based on an ethoxylated fatty alcohol and better than with a market product. Furthermore, fewer residues are left after the cleaning process (streak formation). And all of this is achieved with a formulation that is also unlabelled following CLP rules.

CLEANING ABILITY IKW test for All-Purpose Cleaner



CLEAR DRYING AND STREAK FORMATION IKW test for All-Purpose Cleaner



Alkaline Kitchen and Oven Cleaners

We may prefer not to get a lot of foam in the kitchen, while a high pH will enhance degreasing performance as mentioned above, so that formulations based on short chain carboxylic acids such as that shown in Figure 5 may be the best solution.

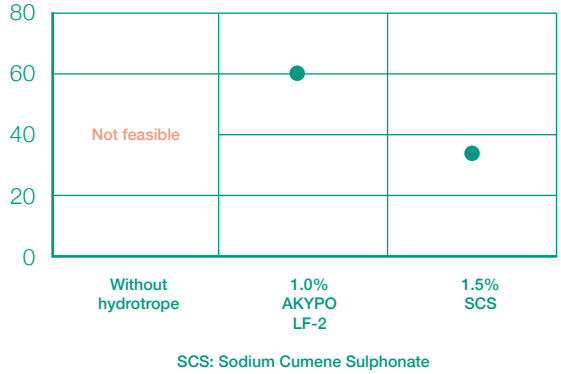
Figure 5:

KITCHEN CLEANER (D-186)	%
AKYPO® LF-2 Capryleth-9 Carboxylic Acid	1.0
FINDET® 10/18 Deceth-6	2.5
Trisodium Citrate	5.0
MEA	1.0
PnB	5.0
Potassium Hydroxide	q.s. (adjust pH=11.5)
Deionised Water	Up to 100%

Moreover, in this formulation Capryleth-9 Carboxylic Acid acts as a hydrotrope, providing a clear, transparent formulation. This formulation would not be feasible without hydrotrope, and at least 1.5% of Sodium Cumene Sulfonate would be needed in order for it to be transparent. When using Capryleth-9 Carboxylic Acid instead, with only 1% of product the solution is already clear (Figure 6), while the cleaning ability of our formulation is better compared with a market product and with the test reference from "Recommendation for the Quality Assessment of the Product Performance of All-Purpose Cleaners 2014" (SÖFW-Journal 141, 04-2015, pages 47 - 56) (Figure 7).

Figure 6:

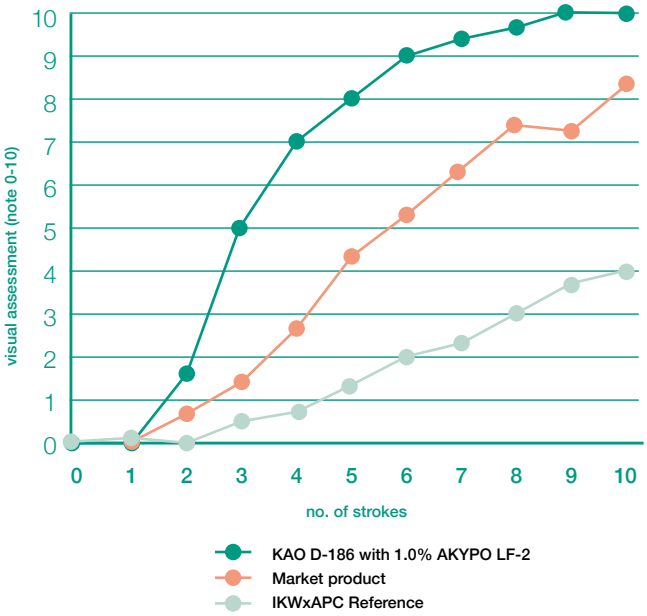
FORMULA STABILITY
Cloud Point (°C) for each product
Comparison hydrotrope effect



SCS: Sodium Cumene Sulphonate

Figure 7:

FORMULA STABILITY
Cloud Point (°C) for each product
Comparison hydrotrope effect



On the other hand, we may also want to have a high foaming oven cleaner. In this case, our recommendation would be again to use AKYPO® LM-40, due to its high foam retention. In this case, without a very extreme pH, we can obtain a very good foam retention combining Lauryl / Myristyl Ether Carboxylic Acid with SLES and amine oxide at a pH of 9.2, as shown in Figure 8.

Figure 8:

(%) Product*	Reference	Kao 1	Kao 2
AKYPO® LM-40	-	2.3	2.3
EMAL® 227E	7.0	1.7	1.7
OXIDET® DMCLD	2.1	1.5	1.5
NaOH 50%	0.4	2.0	-
MEA	-	-	0.8
Deionised water	e.q. 100	e.q. 100	e.q. 100
pH	11.5	11.5	9.2

*. as it is:
AKYPO® LM-40 : Ether Carboxylate, approx. 92 % a.m.
EMAL® 227E: SLES, approx. 27% a.m.
OXIDET® DMCLD: Amine Oxide, approx. 30% a.m.

	0 MIN	2 MIN	5 MIN
REFERENCE SLES/AO PH 11.5			
KAO 1 SLES/AK.LM40/AO PH 11.5			
KAO 2 SLES/AK.LM40/AO PH 9.2			

Hand Dishwashing Liquids

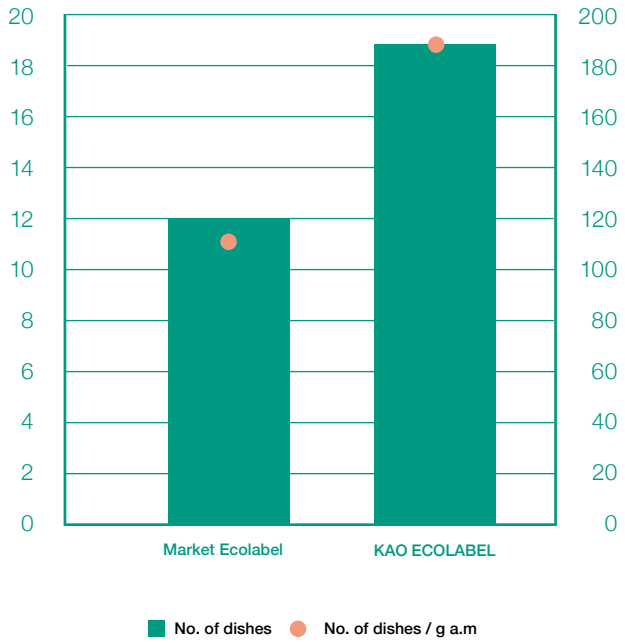
Hand Dishwashing Liquids are the foaming products par excellence. Now, our proposal is the following formulation, whose surfactants and their content would be suitable for an EU ECOLABEL formulation (as the rest of ingredients and requirements are fulfilled).

Figure 9:

WASHING-UP LIQUID (D-168)	%
OXIDET® L-75 Cocamidopropylamine Oxide	21.8
EMAL® 270D Sodium Laureth Sulfate	20.6
LEVENOL® F-200 Glycereth-6 Cocoate	2.4
Ethanol	2.6
Citric Acid (50%)	0.5
Fragrance	q.s.
Dye(s)	q.s.
Preservative	q.s.
Deionised Water	Up to 100%

As shown in Figure 10, following the “Recommendation for the Quality Assessment of the Cleaning Performance of Hand Dishwashing Detergents” (SÖFW-Journal 128, 5-2002, pages 11-15), both the number of dishes cleaned and the number of dishes cleaned with an active ingredient are higher when comparing this formulation to a market product with EU Ecolabel certification, which means we can have an effective, sustainable formulation.

Figure 10:



In summary, the different ingredients should be always aimed at a sustainable cleaning and fulfil specific requirements, from acid bathroom cleaners to alkaline kitchen degreasers, showing different advantages like lime-soap removal in acid bathroom cleaners or very good dispersing and degreasing properties in alkaline kitchen cleaners and other applications. Low and high foaming ingredients are available depending on the application, while ingredients that make unlabelled formulations effective according to the CLP regulation are also available.

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