

Plurafac® LF types

Plurafac LF 031	Plurafac LF 403
Plurafac LF 120	Plurafac LF 404
Plurafac LF 131	Plurafac LF 405
Plurafac LF 132	Plurafac LF 431
Plurafac LF 220	Plurafac LF 500
Plurafac LF 221	Plurafac LF 600
Plurafac LF 223	Plurafac LF 700
Plurafac LF 224	Plurafac LF 711
Plurafac LF 231	Plurafac LF 1300
Plurafac LF 400	Plurafac LF 1430
Plurafac LF 401	

Low-foaming nonionic surfactants

Plurafac LF types

Chemical nature

The Plurafac LF types are low-foaming nonionic surfactants.

They consist of alkoxyated, predominantly unbranched fatty alcohols, and they contain higher alkene oxides alongside ethylene oxide.

The fatty alcohol chains of Plurafac LF 031, LF 131, LF 132, LF 231 and LF 431 terminate in an alkyl group.

Plurafac LF 1430 is a special alkoxyate.

Properties

The Plurafac LF types are clear or slightly cloudy liquids. Their most important properties are shown in the table overleaf.

The figures quoted in the table are averages from a representative sample of batches.

The properties of the Plurafac LF types

Plurafac		LF 031	LF 120	LF 131	LF 132	LF 220	LF 221	LF 223	LF 224
Physical form		Liquid	Liquid	Liquid	Liquid	Liquid	Liquid	Liquid	Liquid
Concentration	%	ca. 95	ca. 100	ca. 100	ca. 100	ca. 95	ca. 95	ca. 98	ca. 100
Water content	%	ca. 5				ca. 5	ca. 5	ca. 2	
Cloud point (DIN 53917)									
in BDG	°C	ca. 60	ca. 43	ca. 35	ca. 30	ca. 48	ca. 43	ca. 33	ca. 27
in water	°C	ca. 40	ca. 28			ca. 42	ca. 33	ca. 15	
Cloud point index (DIN 53989)		>100	ca. 25	ca. 22	ca. 15	ca. 24	ca. 21	ca. 17	ca. 15
pH* (5% in water)		ca. 7	ca. 7	ca. 7	ca. 7	ca. 7	ca. 7	ca. 7	ca. 7
Density (23 °C)	g/cm ³	ca. 0.96	ca. 0.99	ca. 0.98	ca. 0.93	ca. 1.01	ca. 1.00	ca. 0.97	ca. 0.96
Setting point	°C	ca. 6	ca. 5	ca. 3	ca. 0	ca. 10	ca. 5	ca. -2	ca. -2
Viscosity (Brookfield, 60 rpm)									
at 25 °C	mPa·s	ca. 30	ca. 45	ca. 30	ca. 20	ca. 90	ca. 80	ca. 60	ca. 45
at 10 °C	mPa·s	ca. 36000	ca. 100	ca. 90	ca. 50	ca. 200	ca. 180	ca. 110	ca. 90
at 0 °C	mPa·s	>10 ⁵	>10 ⁵	ca. 450	ca. 300	>10 ⁵	>10 ⁵	ca. 4000	ca. 2800
Wetting (DIN 53901, in distilled water containing 2 g soda ash/l)									
23 °C: 0.5 g surfactant/l solution	s	ca. 100	ca. 80	ca. 65	ca. 160	ca. 75	ca. 75	> 300	> 300
1.0 g surfactant/l solution	s	ca. 40	ca. 25	ca. 30	ca. 75	ca. 30	ca. 30	> 300	> 300
2.0 g surfactant/l solution	s	ca. 20	ca. 5	ca. 10	ca. 30	ca. 15	ca. 15	ca. 160	ca. 210
70 °C: 0.5 g surfactant/l solution	s	ca. 150	> 300	> 300	> 300	> 300	> 300	> 300	> 300
1.0 g surfactant/l solution	s	ca. 100	ca. 80	> 300	> 300	> 300	> 300	> 300	> 300
2.0 g surfactant/l solution	s	ca. 60	ca. 30	ca. 70	> 300	ca. 75	ca. 100	> 300	> 300
Surface tension** (DIN 53914, 1 g/l in distilled water at 20 °C)	mN/m	ca. 28	ca. 29	ca. 29	ca. 29	ca. 31	ca. 30	ca. 30	ca. 30

* The Plurafac LF types can undergo a decrease in pH during storage, but this does not affect their performance.

** Applying Harkins-Jordan correction

The above information is correct at the time of going to press. It does not necessarily form part of the product specification.

A detailed product specification is available from your local BASF representative.

LF 231	LF 400	LF 401	LF 403	LF 404	LF 405	LF 431	LF 500	LF 600	LF 700	LF 711	LF 1300	LF 1430
Liquid	Liquid	Liquid	Liquid	Liquid	Liquid	Liquid	Liquid	Liquid	Liquid	Liquid	Liquid	Liquid
ca. 100	ca. 100	ca. 100	ca. 100	ca. 100	ca. 95	ca. 100	ca. 100	ca. 100	ca. 100	ca. 100	ca. 100	ca. 100
					ca. 5							
ca. 28	ca. 46 ca. 33	ca. 69 ca. 74	ca. 41	ca. 45	ca. 55	ca. 38	ca. 32	ca. 57 ca. 55	ca. 29	ca. 45 ca. 36	ca. 21	ca. 39 ca. 35
ca.16	ca. 25	>100	ca. 19	ca. 20	ca. 23	ca. 18	ca. 19	ca. 100	ca. 13	ca. 24	ca. 12	ca. 23
ca. 7	ca. 7	ca. 7	ca. 7	ca. 7	ca. 7	ca. 7	ca. 7	ca. 7	ca. 7	ca. 7	ca. 7	ca. 8
ca. 0.95	ca. 0.97	ca. 1.03	ca. 0.94	ca. 0.96	ca. 0.97	ca. 0.97	ca. 0.97	ca. 1.01	ca. 0.96	ca. 0.99	ca. 0.97	ca. 1.03
ca. -4	ca. 0	ca. 0	ca. -25	ca. -15	ca. -20	ca. -3	ca. -20	ca. -15	ca. 5	ca. -35	ca. -5	ca. -25
ca. 40 ca. 120 ca. 1700	ca. 60 ca. 130 >10 ⁵	ca. 135 ca. 275 8000-10 ⁵	ca. 45 ca. 70 ca. 130	ca. 45 ca. 90 ca. 220	ca. 70 ca. 150 ca. 340	ca. 40 ca. 55 ca. 230	ca. 60 ca. 130 ca. 260	ca. 90 ca. 220 ca. 380	ca. 70 ca. 170 ca. 90000	ca. 55 ca. 130 ca. 220	ca. 95 ca. 210 ca. 360	ca. 400 ca. 780 ca. 1600
ca. 120 ca. 50 ca. 20 > 300 > 300 > 300	ca. 90 ca. 25 ca. 10 > 300 ca. 180 ca. 75	ca. 200 ca. 115 ca. 65 ca. 90 ca. 40 ca. 25	> 300 > 300 > 300 > 300 > 300 > 300	ca. 160 ca. 70 ca. 35 > 300 > 300 > 300	ca. 200 ca. 100 ca. 55 > 300 > 300 > 300	ca. 85 ca. 30 ca. 15 > 300 > 300 ca. 80	ca. 150 ca. 60 ca. 20 > 300 > 300 ca. 210	ca. 140 ca. 65 ca. 35 > 300 ca. 100 ca. 50	> 300 ca. 170 ca. 80 > 300 > 300 > 300	ca. 70 ca. 25 ca. 10 > 300 ca. 90 ca. 45	> 300 > 300 ca. 200 > 300 > 300 > 300	> 300 > 300 > 300 > 300 > 300 > 300
ca. 30	ca. 29	ca. 33	ca. 30	ca. 30	ca. 30	ca. 30	ca. 30	ca. 33	ca. 32	ca. 30	ca. 32	ca. 41

Solubility

The solubility of the Plurafac LF types increases in line with their cloud point. Products with a cloud point below room temperature can be made to form clear solutions by adding solubilizers such as alcohols, glycols or sodium cumene sulfonate. The solubility of the Plurafac LF types in various solvents is shown below.

The solubility of the Plurafac LF types (10 % at 25 °C)

Plurafac	LF 031	LF 120	LF 131	LF 132	LF 220	LF 221	LF 223	LF 224	LF 231	LF 400	LF 401
Distilled water	+	+	+/-	+/-	+	+	○	-	+/-	+	+
Sodium hydroxide, 10%	-	-	-	-	-	-	-	-	-	-	-
Hydrochloric acid, 10%	+	+	+/-	+/-	+	+	○	-	+/-	+	+
Mineral spirits	+	+/-	-	+	+	+	+	+	+	+	+
Spindle oil	-	+/-	+	+	+	+	-	+	+/-	+	+
Ethanol	+	+	+	+	+	+	+	+	+	+	+
Isopropanol	+	+	+	+	+	+	+	+	+	+	+

Plurafac	LF 403	LF 404	LF 405	LF 431	LF 500	LF 600	LF 700	LF 711	LF 1300	LF 1430
Distilled water	-	-	-	-	-	+	-	+	-	+/-
Sodium hydroxide, 10%	-	-	-	-	-	-	-	-	-	-
Hydrochloric acid, 10%	-	+	-	+/-	+	+	○	+	-	○
Mineral spirits	+	+	+	+	+	+	+	+	+	+
Spindle oil	+	+/-	+	+	○	+	+	+	+	-
Ethanol	+	+	+	+	+	+	+	+	+	+
Isopropanol	+	+	+	+	+	+	+	+	+	+

- + = Clear solution
- = Insoluble
- +/- = Sparingly soluble
- = Opalescent solution

Viscosity

It is advisable to stir the surfactant into water when preparing aqueous solutions of Plurafac LF. The viscosity of solutions made up in the reverse order can be too high at certain concentrations. The relationship between the viscosity and water content of solutions of Plurafac LF is shown in the table below.

The viscosity of mixtures of Plurafac LF types and water (in mPa·s)

Water content (%)	LF 031	LF 120	LF 131	LF 132	LF 220	LF 221	LF 223	LF 224	LF 231	LF 400	LF 401
0	30	45	30	20	90	80	60	45	35	60	45
10	50	50	50	30	120	105	75	55	55	95	195
20	45000	55	45	40	150	115	80	60	60	110	265
30	> 10 ⁵	55	40	45	180	105	75	60	60	120	> 10 ⁵
40	> 10 ⁵	50	35	140	200	105	70	70	55	145	> 10 ⁵
50	1100	45	30	75	190	105	60	80	55	180	> 10 ⁵
60	400	40	25	25	100	70	55	50	55	210	> 10 ⁵
70	100	35	20	15	45	45	50	35	50	150	240
80	60	25	15	10	25	30	15	20	45	40	25
90	10	15	10	5	20	20	10	20	40	10	20

Water content (%)	LF 403	LF 404	LF 405	LF 431	LF 500	LF 600	LF 700	LF 711	LF 1300	LF 1430
0	45	45	70	40	60	90	70	55	95	400
10	70	65	110	60	80	120	90	70	135	300
20	125	85	180	65	85	175	100	80	155	220
30	190	145	210	65	90	205	85	80	130	140
40	230	6900	15000	70	80	300	55	80	40	85
50	275	21000	44000	80	60	320	40	80	25	45
60	215	19000	18000	55	50	195	30	65	15	25
70	65	11000	4000	20	25	45	25	45	15	15
80	15	1000	330	10	10	30	20	40	10	10
90	10	45	25	10	10	25	20	30	10	10

The figures above were measured with a Brookfield viscometer at 25 °C.

Storage

- The Plurafac LF types should be stored indoors in their original packaging, which should be kept tightly sealed.
- The Plurafac LF types are hygroscopic and soluble in water, with the result that they absorb moisture very quickly. Drums should be tightly resealed each time material is taken from them.
- The storage temperature should not be allowed to fall substantially below 20 °C, and storerooms must not be overheated.
- The Plurafac LF types can become cloudy if they are stored at low temperatures, but this has no effect on their performance.

The cloudiness can be dissipated by heating them to 40–50 °C.

- Liquid that has solidified or that shows signs of precipitation should be heated to ca. 40–50 °C before it is processed.
- Drums that have solidified or that have begun to form a sediment should be reconstituted by gentle heating, preferably in a heating cabinet. The temperature must not be allowed to exceed 50–60 °C. This also applies if drums are heated by external electrical elements.

Internal electrical elements should not be used because of the localized anomalies in temperature that they cause.

- The Plurafac LF types must be blanketed with nitrogen if they are stored in heated tanks (at ca. 50 °C) to prevent them from coming into contact with air. Gentle, constant stirring helps to prevent them being discoloured as a result of prolonged contact with electrical elements or external heating coils.

Materials

The following materials can be used for tanks and drums.

- AISI 316 Ti stainless steel
- AISI 321 stainless steel

Shelf life

Provided they are stored properly and drums are kept tightly sealed, the Plurafac LF types have a shelf life of at least two years in their original packaging.

Plurafac LF 1430 has a shelf life of one year.

Applications

The Plurafac LF types are compatible with other nonionic surfactants such as our Lutensol® A N, AO, AP, AT, EC, F, GD, ON and TO types and our Pluronic® PE and RPE types. They can also be used in combination with anionic (Lutensit® A types) and cationic surfactants (Protectol® KLC types). They do not react with calcium, magnesium or any of the other cations in hard water, nor with soluble alkali salts, anionic polymers such as carboxymethyl cellulose, or polycarboxylates such as our Sokalan® CP and PA types.

The products in the range that terminate in a hydroxyl group are resistant to formaldehyde, chlorine compounds, phosphates, silicates, soda ash, hydrochloric acid, phosphoric acid, citric acid and most other acids and alkalis. This also applies to Plurafac LF 1430. Those that terminate in an alkyl group are resistant to strong alkalis such as the alkalis used in detergents for bottle-washing machines.

The hydroxyl-terminated Plurafac LF types can gradually turn yellow over prolonged periods at elevated temperatures in moderately alkaline formulations, but this has no effect on their detergency or foaming characteristics. Yellowing can often be avoided in powder dishwasher detergents, etc., by spraying the surfactants onto the phosphates or carbonates before adding the other ingredients such as sodium metasilicate, sodium hydroxide and a soluble dichloroisocyanurate.

All of the hydroxyl-terminated Plurafac LF types are resistant to acids, but Plurafac LF 220, LF 221 and LF 711 are the most suitable products for use in strongly acidic solutions.

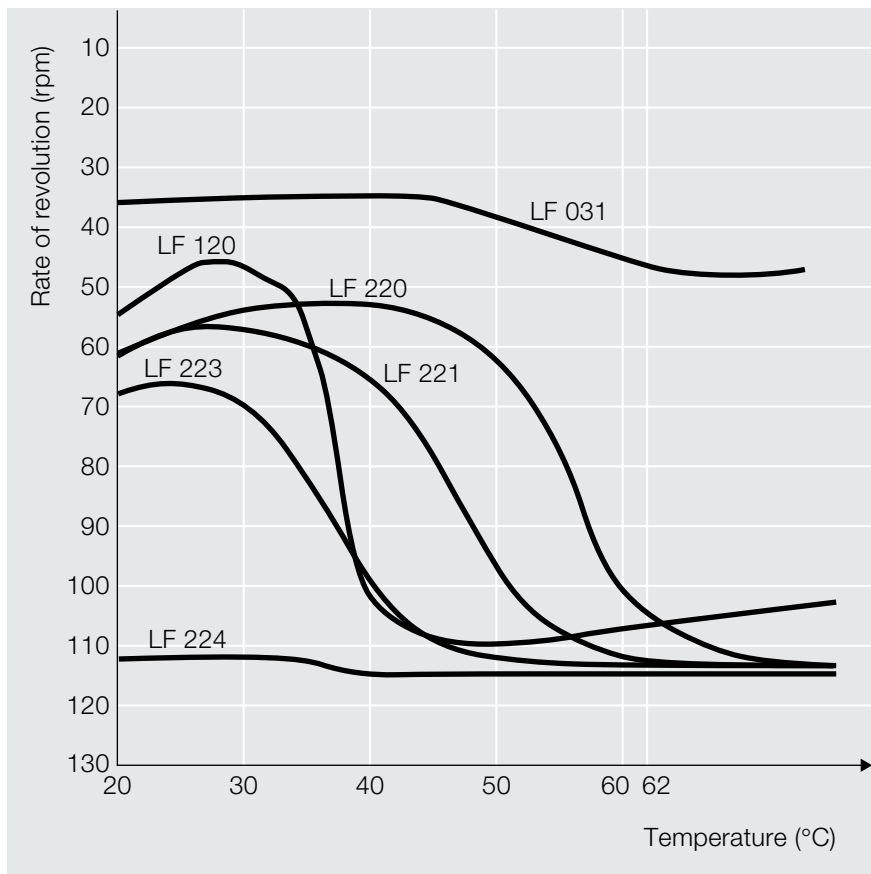
Foaming

Nonionic surfactants are renowned for their high detergency, wetting power and soil-dispersing capacity, but the distinguishing feature of the Plurafac LF types is that they form very little foam. Some of them can even be employed to inhibit foam formation.

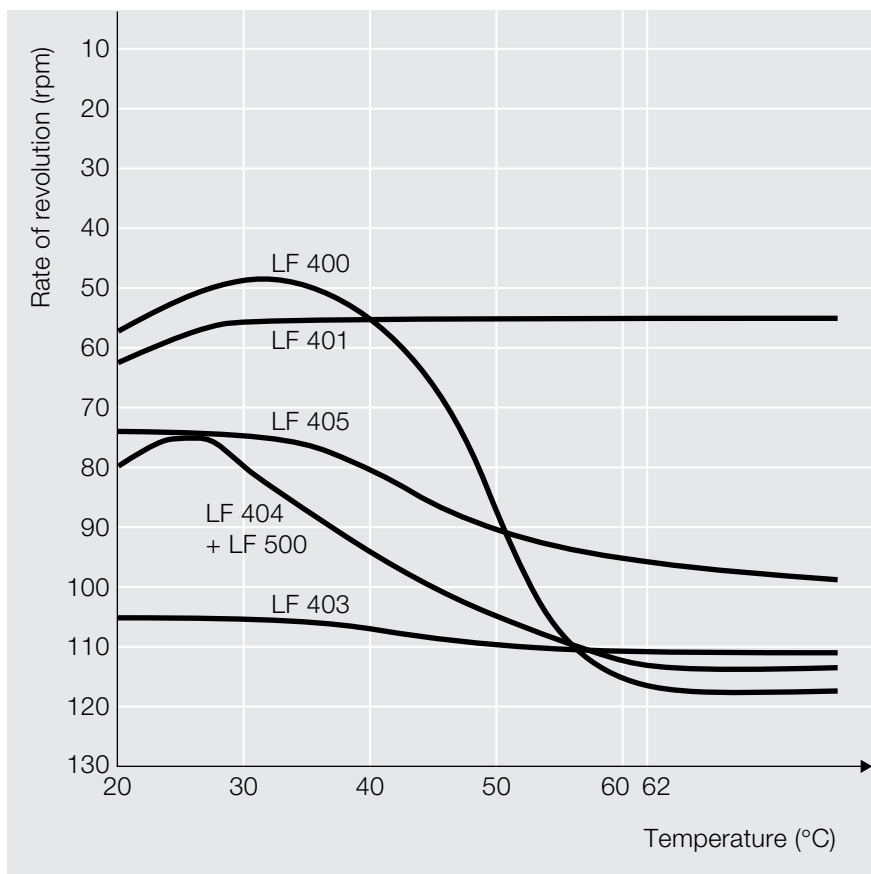
Foaming can often be a problem in cleaning processes that involve intensive mechanical action. It is difficult to predict the foaming behaviour of surfactants in advance with standard test methods because of the influence of the type of soil, the type of machinery, different temperature settings and the effects of the other ingredients in the formulation, etc. The results obtained by the beater method described in DIN 53902, Part 1, or the Ross-Miles method described in DIN 53902, Part 2, and ASTM D 1175-53, have to be substantiated with methods that correspond more closely to real conditions.

One method of testing foam formation which closely corresponds to the conditions encountered in practice is to measure the level of foam produced in a dishwasher. The rotating spray arm is slowed down by foam, and the higher the rate of revolution, the less foam is present. Mixtures of 5 parts of Plurafac LF and 95 parts of builder consisting of 50 % sodium metasilicate, 45 % pentasodium triphosphate and 5 % soda ash were tested at a concentration of 20 g/l. Foaming was encouraged by adding 10 cm³ of egg.

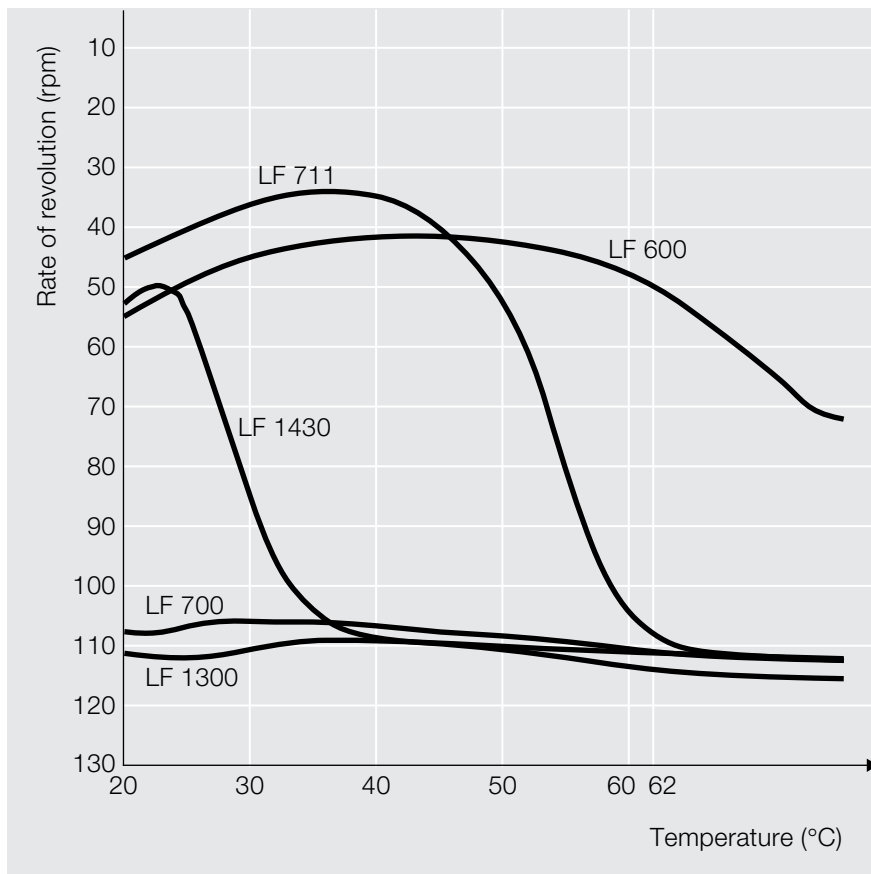
The results are shown in the diagrams overleaf. This method gives a reliable indication of the levels of foaming that can be expected in practice.



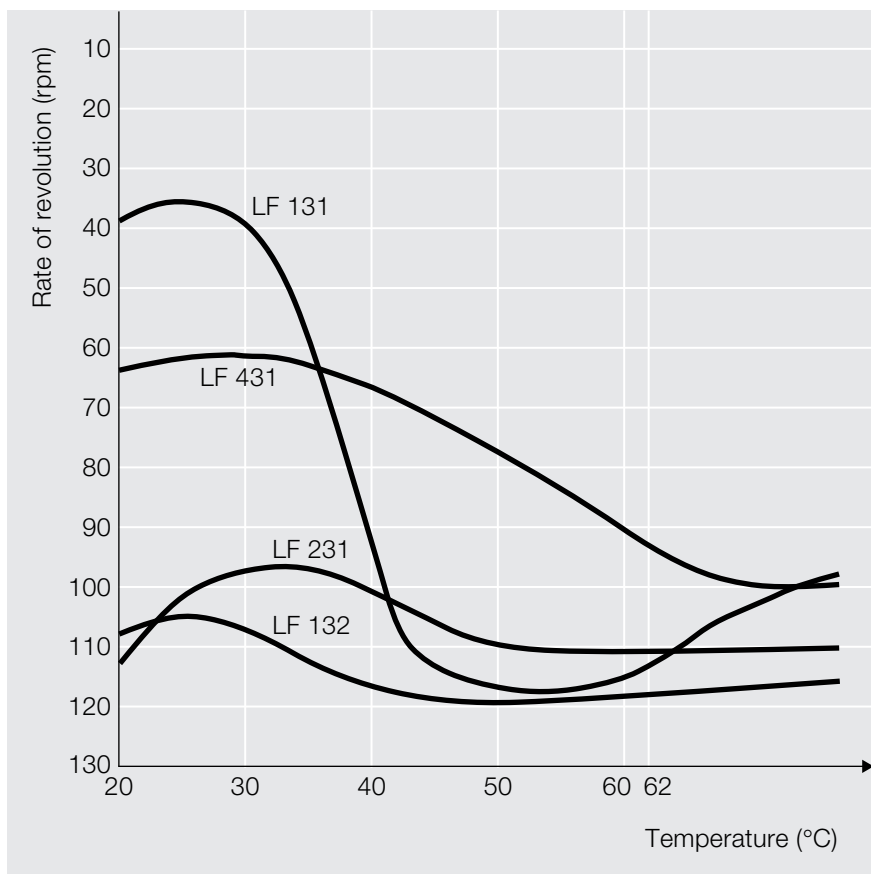
The foam formed by Plurafac LF types in alkaline solutions



The foam formed by Plurafac LF types in alkaline solutions

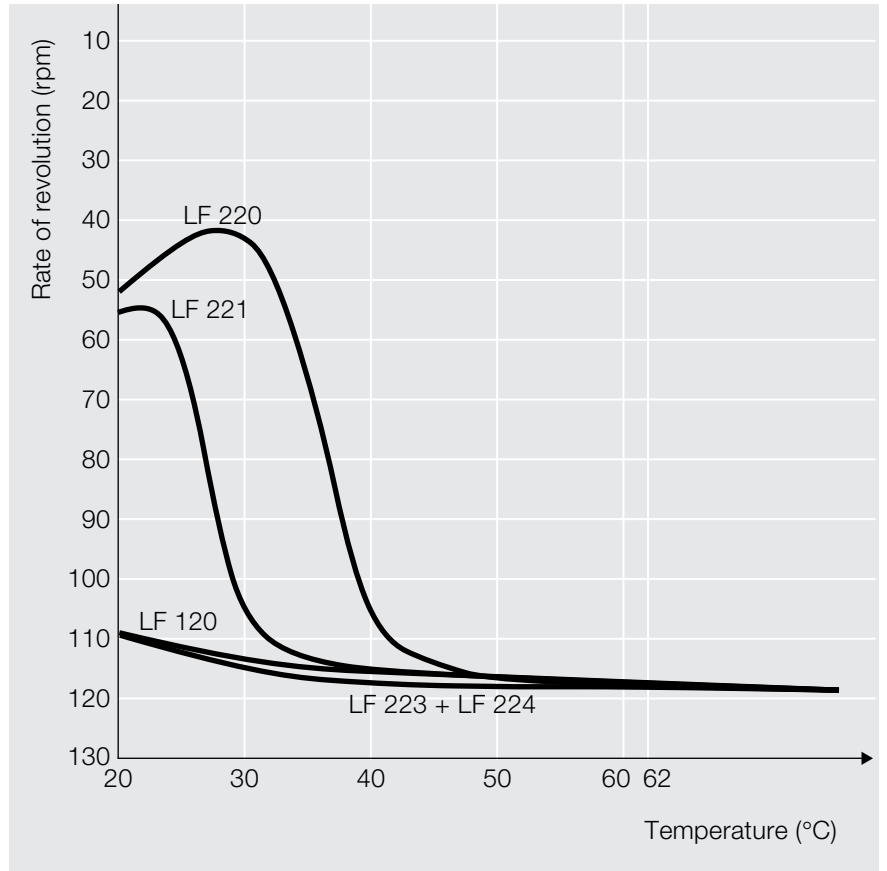


The foam formed by Plurafac LF types in alkaline solutions

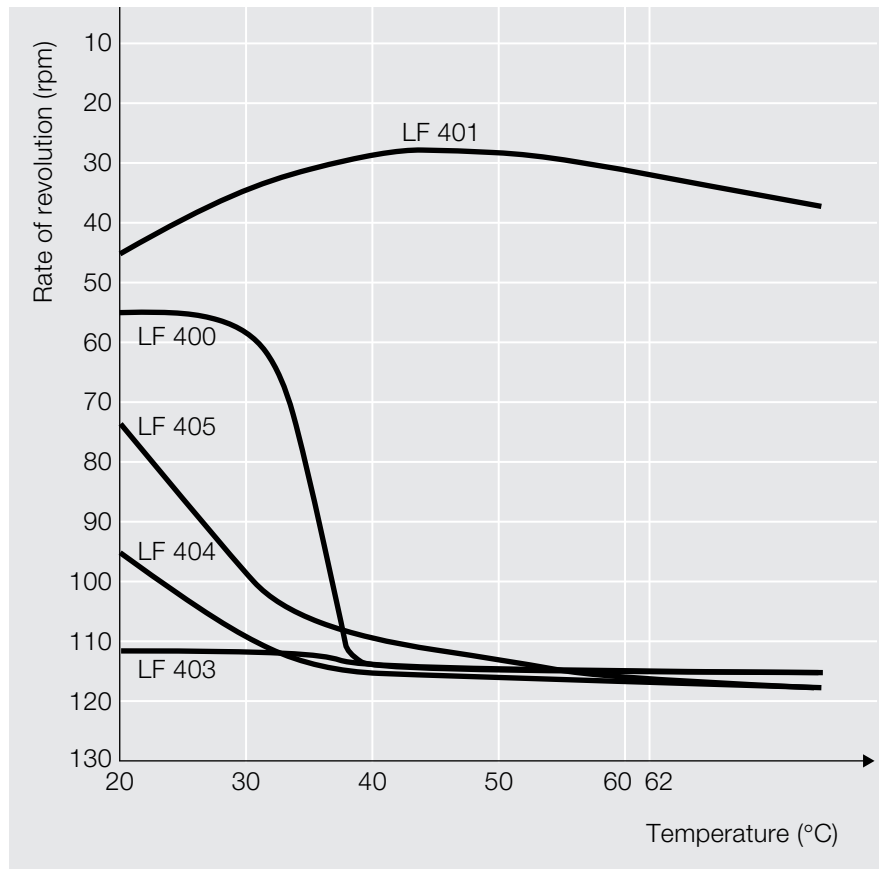


The foam formed by Plurafac LF types in alkaline solutions

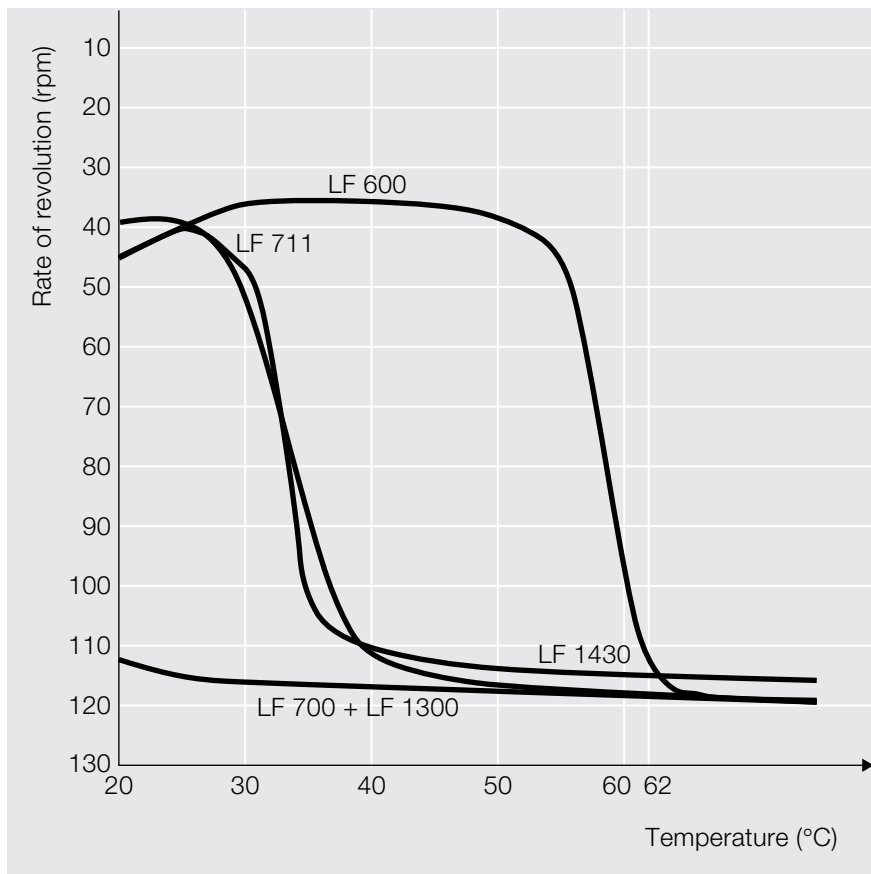
Much lower levels of foaming are observed if these tests are repeated in an acidic solution with no egg albumin. The curves below show the foam formed by surfactants at a concentration of 20% in an acidic rinse aid formulation employed at a rate of 0.3 cm³ per litre of water. This gives a reliable indication of the levels of foaming that can be expected in practice.



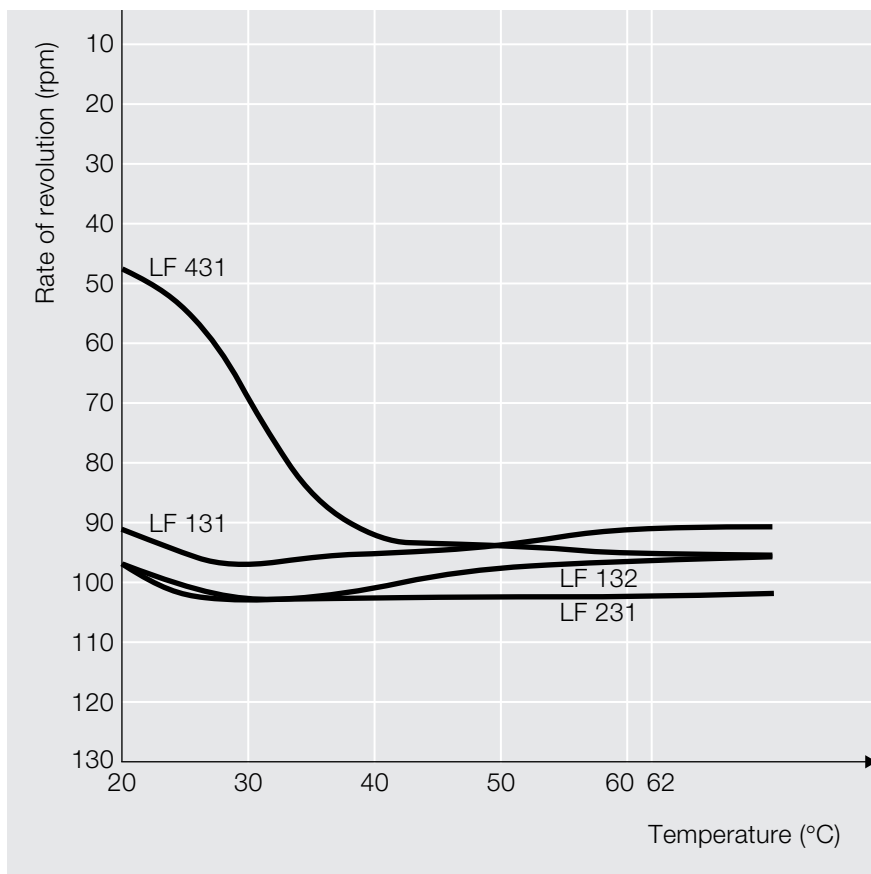
The foam formed by Plurafac LF types in acidic solutions



The foam formed by Plurafac LF types in acidic solutions



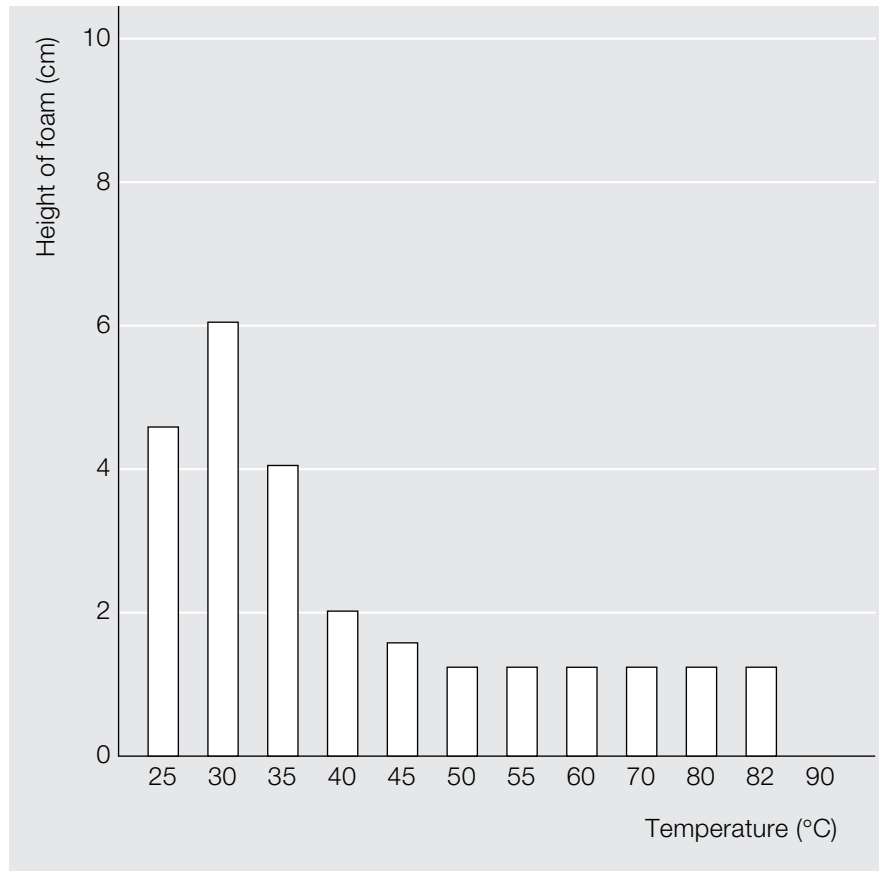
The foam formed by Plurafac LF types in acidic solutions



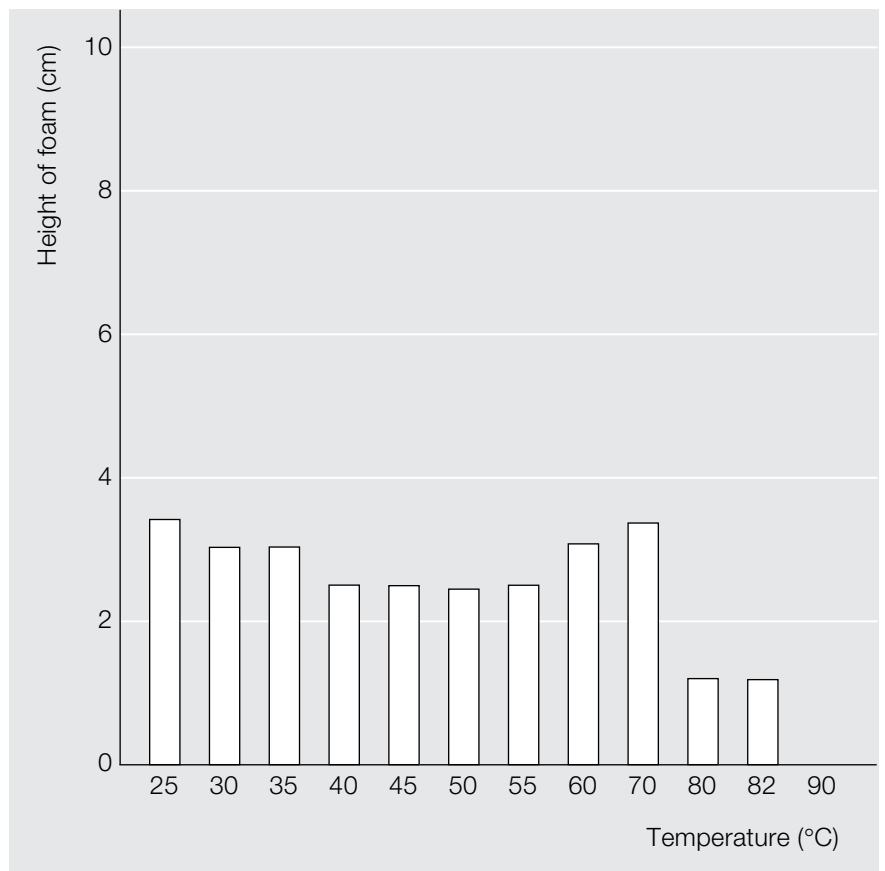
The foam formed by Plurafac LF types in acidic solutions

Alkali-resistant Plurafac LF types for washing bottles

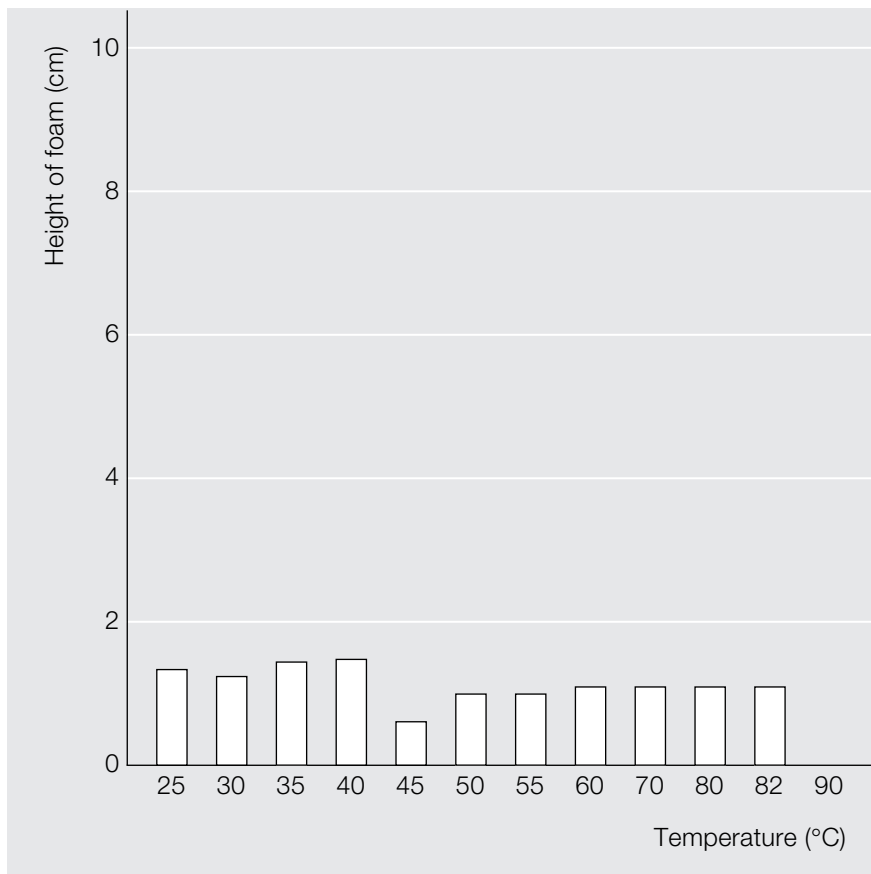
The level of foam formed is of prime importance in bottle-washing machines. We use a vessel fitted with a pump and jet nozzles to simulate the conditions found in bottle-washing machines in the laboratory. In the example below, a solution containing 0.2 g of surfactant, 20 g of sodium hydroxide and 20 g of a mixture of beer and animal glue was taken, and the height of foam that formed was measured at different temperatures.



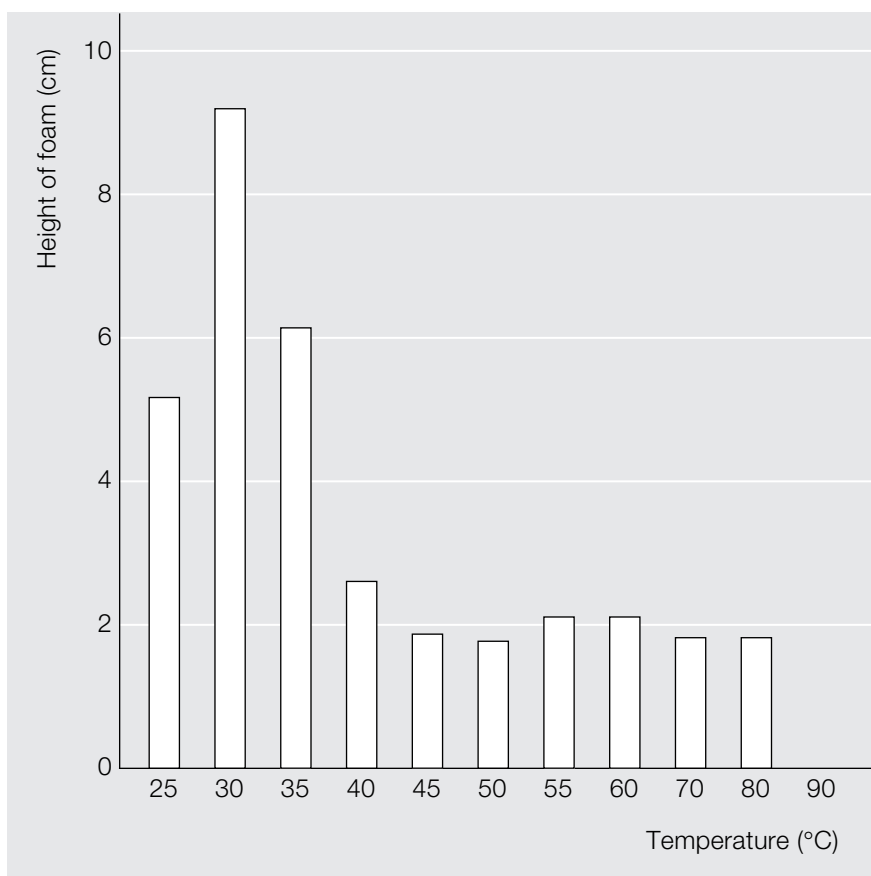
The foam formed by Plurafac LF 131 in the presence of beer and glue



The foam formed by Plurafac LF 132 in the presence of beer and glue

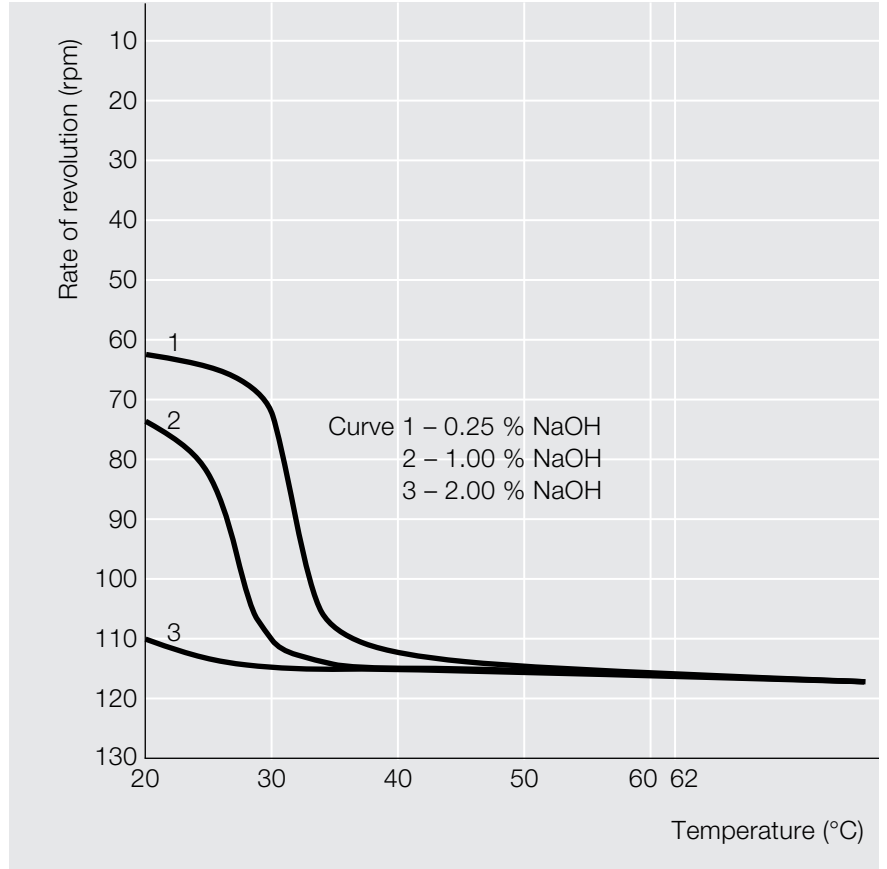


The foam formed by Plurafac LF 231 in the presence of beer and glue

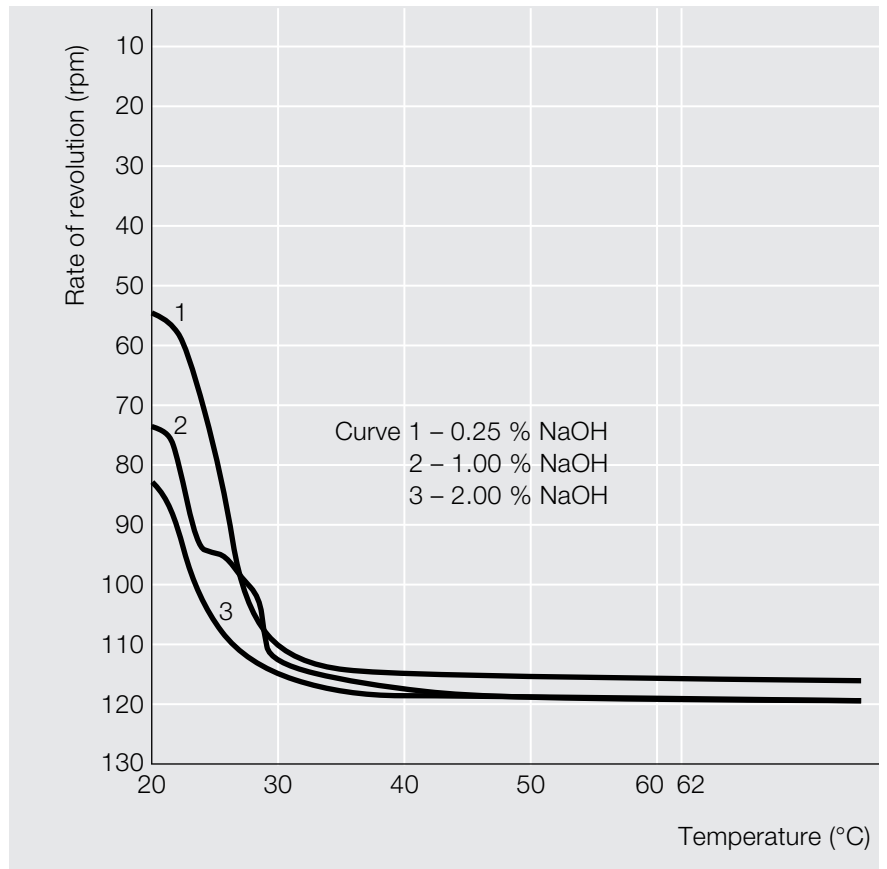


The foam formed by Plurafac LF 431 in the presence of beer and glue

The amount of alkali contained in alkaline cleaners plays an important part in determining their foaming behaviour. In the example below, Plurafac LF 431 and Plurafac LF 1430 were tested in a dishwasher at different alkali concentrations.



The foam formed by Plurafac LF 431 in caustic alkalis



The foam formed by Plurafac LF 1430 in caustic alkalis

The higher the alkali concentration, the less foam will be formed at low temperatures. This is important for when bottle-washing machines are started up at the beginning of a shift. The sodium hydroxide consumed during the cleaning process has to be replenished.

Areas of application

The Plurafac LF types are very low-foaming nonionic surfactants. They are used in detergents and cleaners in which foaming has to be kept to a minimum. They can be used in powder, paste and liquid products.

The most important products in this category are detergents and rinse aids for domestic and commercial dishwashers, detergents for bottle-washing machines, and cleaners for breweries and dairies. Some of the Plurafac LF types can also be used as antifoams and surfactants in laundry detergents.

The Plurafac LF types also have applications in cleaners and degreasers for the metal industry, in cosmetics, and in the oil industry.

The range of applications for the Plurafac LF types

Plurafac	Brewery and dairy cleaners	Emulsifiers for petroleum oils	Bottle-washing detergents	Powder dishwasher detergents	Household cleaners	Household rinse aids	Institutional rinse aids	Rinse aids for glass	Technical cleaners	Defoamers	Laundry detergents
LF 031									+		
LF 120	+			+	+	+	+	+	+		
LF 131			+								
LF 132			+								
LF 220	+				+	+	+	+	+		
LF 221	+				+	+	+	+	+		
LF 223	+			+	+	+	+		+		
LF 224	+			+	+	+	+		+	+	
LF 231			+								
LF 400	+				+	+	+	+	+		+
LF 401					+	(+)			+		+
LF 403	+	+	(+)	+	+	+	+		+	+	+
LF 404	+	+		+	+	+	+	+	+		+
LF 405	+	+		+	+	+	+	+	+		+
LF 431	+		+	+	+	+	+		+	+	
LF 500	+			+		+	+	+	+		
LF 600					+	(+)			+		
LF 700	+			+	+	+	+		+	+	(+)
LF 711	+			(+)	+	+	+	+	+		
LF 1300	+			+	+	+	+		+	+	(+)
LF 1430	+		+	+	+	+	+		+	+	

(+) Can be used in some special cases

Plurafac LF 031

Plurafac LF 031 is very resistant to alkalis, and it remains a very effective wetting agent at temperatures of up to 70 °C. Its main applications are in technical cleaners and textile auxiliaries.

Foaming can be controlled by adding Plurafac LF 224 or LF 403.

Plurafac LF 120

Plurafac LF 120 is a very effective wetting agent. Its main areas of application are in dishwasher detergents, rinse aids, industrial glass cleaners and in spray cleaners for metal. It is also employed in phosphatizing baths and in cleaners for food-processing machinery, etc.

It can be used in combination with Plurafac LF 403 in very low-foaming formulations.

Plurafac LF 120 is also recommended as a wetting agent for processing bulk solids.

Plurafac LF 220

Plurafac LF 220 is a hydrophilic surfactant which is mainly used in technical cleaners and in rinse aids for glass. It can also be used in combination with Plurafac LF 221 and LF 405 in order to improve their wetting power and their dispersibility in water, and to raise their cloud points.

Plurafac LF 221

Plurafac LF 221 is used in rinse aids for household and institutional dishwashers, either alone or in combination with other products from the Plurafac LF range. Its high wetting power, coupled with a low tendency to foam, is particularly effective in technical cleaners.

Plurafac LF 221 is resistant to strong acids.

Plurafac LF 223

Plurafac LF 223 is particularly effective in applications in which a very low-foaming surfactant with a high soil-dispersing capacity is required, such as cleaners for tanks and pipelines.

Because it is hydrophobic, it can be added to dishwasher detergents to improve their affinity for dishes and cutlery made from plastic.

Plurafac LF 224

Plurafac LF 224 is employed in low-temperatures applications and in cleaning operations in which turbulence can cause excessive foaming.

It can be used in dishwasher detergents together with the hydrophilic products in the Plurafac LF range to improve their wetting power for plastic dishes. It is more hydrophobic than Plurafac LF 223.

Plurafac LF 400

Plurafac LF 400 is a very effective wetting agent. It is employed in hard-surface cleaners for use in dairies and breweries, etc., technical cleaners, household cleaners and rinse aids. It can also be used in low-foaming laundry detergents.

Plurafac LF 401

Plurafac LF 401's high detergency is particularly useful in heavy-duty laundry detergents, all-purpose cleaners and some household cleaners for specific applications. It can also be used in acid pickling baths and alkaline cleaners for metal.

Plurafac LF 403

Plurafac LF 403 is a very low-foaming surfactant. It can be used in heavy-duty and light-duty laundry detergents to control foaming and to provide detergency.

Other applications include dishwasher detergents, rinse aids, floor cleaners, dairy cleaners, and other products in which the emphasis is on keeping foam formation to a minimum.

If Plurafac LF 403 is to be used in rinse aids, it should be borne in mind that this product has a very low cloud point, which means that solvents have to be added in large proportions in order to obtain a clear solution. It is also very hydrophobic, and its wetting power is not very high, as can be seen from the figures above. We would therefore recommend adding Plurafac LF 120, LF 221 or LF 400 to rinse-aid formulations that contain Plurafac LF 403.

Combinations of hydrophobic and hydrophilic surfactants in rinse aids give a very clear, spot-free finish on glass and plastics. They also perform well in detergents used for high-pressure spray cleaning.

Plurafac LF 403 can be used as a low-foaming emulsifier for petroleum oils.

Plurafac LF 404

Plurafac LF 404 is a very effective wetting agent. It is low-foaming and moderately hydrophobic. It has a high dispersing capacity for suspended solids, and it promotes the diffusion of soluble substances. It can be used as an antifoam for other surfactants.

Plurafac LF 404 can be used in household dishwasher detergents, institutional dishwasher detergents, low-foaming industrial cleaners, dairy and brewery cleaners, and floor cleaners for mechanical application. It is also a very effective emulsifier for petroleum oils.

Plurafac LF 404 can be combined with anionic surfactants in laundry detergents designed for use at temperatures of up to 60 °C. Its advantages are its low foam formation, high wetting power and its ability to emulsify fatty soil. It has a low cloud point in water, which ensures good results at low temperatures.

Plurafac LF 405

Plurafac LF 405 is one of the most versatile products in the range. It is an effective wetting, dispersing and levelling agent, it forms little foam, and it can be used as an antifoam for other surfactants. It can be used in the following applications.

- Dishwasher detergents
- Rinse aids for household dishwashers
- Rinse aids for institutional dishwashers
- Low-foaming industrial cleaners
- Dairy cleaners
- Brewery cleaners
- Heavy-duty laundry detergents
- Light-duty laundry detergents
- Floor cleaners for mechanical application
- Emulsifying petroleum oils

Plurafac LF 405 is hydrophilic, even though it has a low cloud point in water.

Plurafac LF 131 Plurafac LF 132 Plurafac LF 231 Plurafac LF 431

The alkyl-terminated Plurafac LF types are resistant to alkalis and acids. They can be used in alkaline cleaners and in additives that contain acids for use in bottle-washing machines.

Very high-quality detergents for bottle-washing machines can be formulated from these four surfactants. Formulations can incorporate silicates, phosphates, sodium carbonate, sodium hydroxide, Na₃NTA (Trilon® A), Na₄EDTA (Trilon B) and gluconates. Additives consisting of a surfactant and acids such as phosphoric acid, phosphonic acids or polycarboxylic acids (Sokalan PA and CP) are used in bottle-washing machines as dispersing agents.

The advantages of the alkyl-terminated Plurafac LF types are summarized below.

- Resistant to acids
- Stable in alkaline media at elevated temperatures
- Low-foaming
- Less foam is formed by glue from labels, soil and left-overs in bottles
- Insensitive to water hardness
- High wetting power: water drains off more quickly and labels can be removed more easily
- No taste
- Biodegradable

An important area of application for products of this type is in bottling plants for spring water. Washing bottles with Plurafac LF 131 or LF 132 helps to minimise the levels of carbon dioxide liberated from the highly carbonated mineral water, which enables bottling plants to be run at higher speeds. Plurafac LF 131 has the higher wetting power of these two surfactants.

Plurafac LF 231 is more effective for suppressing foam formation, but it is not such an efficient wetting agent at higher temperatures.

There is usually no need to add any other surfactants to bottle-washing detergents that contain alkyl-terminated Plurafac LF types, and adding other surfactants can cause foaming problems. Similarly, no defoamer is normally required, but we would recommend adding Degressal® SD 20 if severe foaming problems are encountered.

The alkyl-terminated Plurafac LF types form cloudy solutions in water, but the turbulence in the wash liquor is sufficient to keep them dispersed, and they do not have any tendency to separate. Very little water is left behind in the bottles after they have been cleaned, labels are easy to remove, and the bottles have a sparkling finish.

Formulations for bottle-washing detergents

All figures refer to parts by weight.

Detergent powder

- 5–10 Plurafac LF 131, LF 132, LF 231 or LF 431
- 3– 5 Sokalan PA 40 Powder or Sokalan CP 45 Powder/Granules
- 20–30 Sodium hydroxide
- 30–40 Sodium metasilicate
- 10–20 Pentasodium triphosphate (STP)
- 5–10 Complexing agent, e.g. Trilon B Powder or Trilon A 92

Acid additive

- 10–30 Plurafac LF 131, LF 132, LF 231 or LF 431
- 5–30 Hydroxyalkanephosphonic acid, aminoalkane phosphonic acid or phosphonobutane tricarboxylic acid
- 15–20 Phosphoric acid, 85 %
- 0–10 Isopropanol
- Balance Water

The latter of these two formulations is added to water containing 1–3 % sodium hydroxide at rates of around 0.3–1.0 kg/m³. Solutions should not contain less than 1 % sodium hydroxide, because this can cause foaming problems at low temperatures (see page 14).

The alkyl-terminated Plurafac LF types can also be used in high-pressure spray-cleaning formulations, spray cleaners for metal and car-wash detergents, etc.

Their wetting, dispersing and foam-inhibiting properties are useful in dishwasher detergents and rinse aids, especially in products destined for use in the institutional sector.

Solubilizers such as Lutensit TC-CS 40, Lutensol GD 70, Sokalan SOL or anionic surfactants from our Lutensit range have to be added to highly alkaline liquid formulations in order to stabilize them.

Plurafac LF 500

Plurafac LF 500 can be used in rinse aids with a low cloud point in order to improve their dispersibility in hot water.

It can also be used in hard surface cleaners in order to boost their wetting power.

Plurafac LF 600

Plurafac LF 600 is mainly used in products built with diphosphates and triphosphates, such as car-wash detergents and high-pressure spray cleaners for motor vehicles.

It can also be used in cleaners for workshop floors, plastics, metal and other hard surfaces.

Plurafac LF 700

Plurafac LF 700 is an effective, low-foaming wetting agent. Its main applications are in dishwasher detergents and rinse aids, and in dairy and brewery cleaners. It can also be used in light-duty laundry detergents and in technical cleaners to suppress foam formation.

Plurafac LF 711

Plurafac LF 711 is an effective, acid-resistant wetting agent. It is used in dishwasher detergents, rinse aids, and acid and alkaline cleaners for metal. It can also be used as a wetting agent for coal dust and other finely divided bulk solids.

Plurafac LF 1300

Plurafac LF 1300's main areas of application are the same as those for Plurafac LF 700. Its advantage is that it foams even less, which makes it useful as an antifoam in a variety of industrial processes.

Plurafac LF 1430

Plurafac LF 1430 is a wetting agent and antifoam. It is used in additives for highly alkaline bottle-washing detergents, either alone or in combination with other low-foaming surfactants from the Plurafac LF, Pluronic PE or Pluronic RPE ranges. Additives of this type can be acidic or slightly alkaline. Phosphorus compounds are used in products of this type to disperse lime and to prevent scale from forming.

Suggested formulations

Further suggestions for formulating products with Plurafac LF types are given in the following publications.

Specialty chemicals for metal pretreatment	TI/ES 1038 e
Cleaners and shampoos	TI/ES 1142 e
Liquid detergents	TI/ES 1148 e
Powder detergents	TI/ES 1154 e
Technical cleaners	TI/ES 1167 e
Formulations for dishwashers	TI/P 2836 e
Luwax [®] , Poligen [®]	
Applications in modern floor polishes	ESA/C 400
Applications in polishes and cleaners	ESA/C 401

Safety

We know of no ill effects that could have resulted from using the Plurafac LF types for the purpose for which they are intended and from processing them in accordance with current practice.

According to the experience that we have gained up to now and other information at our disposal, the Plurafac LF types do not exert any harmful effects on health, provided that they are used properly, due attention is given to the precautions necessary for handling chemicals, and the information and advice given in our Safety Data Sheets are observed.

Handling

All contact with the eyes and prolonged contact with the skin should be avoided. Safety glasses should be worn when handling the Plurafac LF types in their undiluted form.

Further details are given in our Safety Data Sheets.

Ecology

Most of the Plurafac LF types have an average minimum biodegradability of at least 90 %, as required by the German *Tensidverordnung* of 4 June 1986.

Only Plurafac LF 700, LF 711, LF 1300 and LF 1430 are less than 80 % biodegradable. Their use is generally allowed in applications in which they are not discharged as effluent, but legislation in many countries does still permit them to be used in certain applications even if they are discharged into the drains after use.

According to French regulations *Répression des fraudes*, No. 1227, of 1994, all Plurafac LF types are approved for use in detergents and cleaners for the food sector, dishwasher detergents and rinse aids, except for

Plurafac LF 1300
Plurafac LF 1430

Note

The information submitted in this publication is based on our current knowledge and experience. In view of the many factors that may affect processing and application, these data do not relieve processors of the responsibility of carrying out their own tests and experiments; neither do they imply any legally binding assurance of certain properties or of suitability for a specific purpose. It is the responsibility of those to whom we supply our products to ensure that any proprietary rights and existing laws and legislation are observed.

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