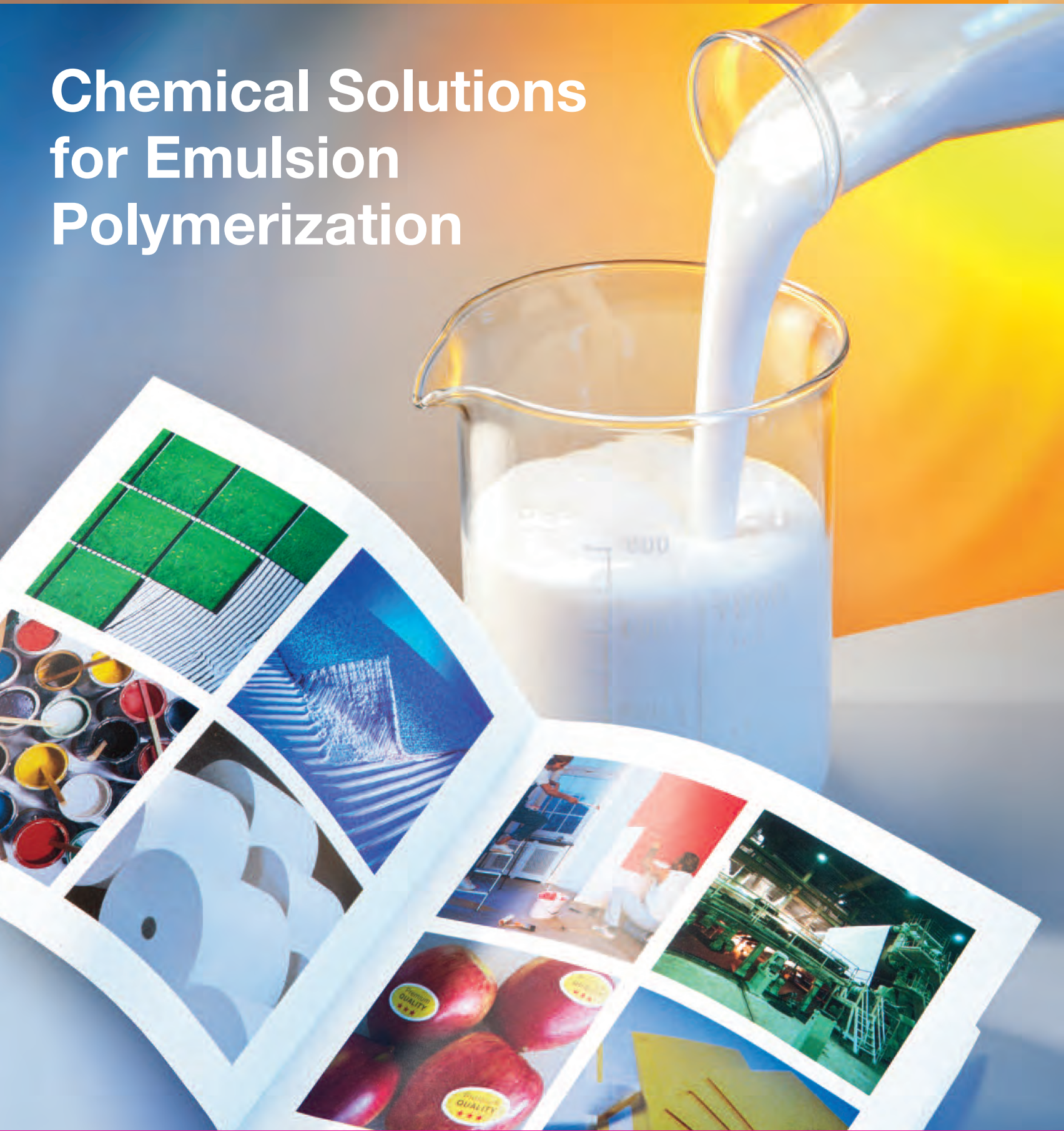


Chemical Solutions for Emulsion Polymerization



BASF's Care Chemicals for Emulsion Polymerization

Performance, safety, reliability and sustainable solutions are essential for the Emulsion Polymerization industry. To meet these tough challenges BASF offers a range of industry-proven solutions.

We produce innovative raw materials based on BASF's expertise in the manufacture of performance chemicals, process understanding and specific knowledge of market needs and legal requirements.

Emulsion Polymerization

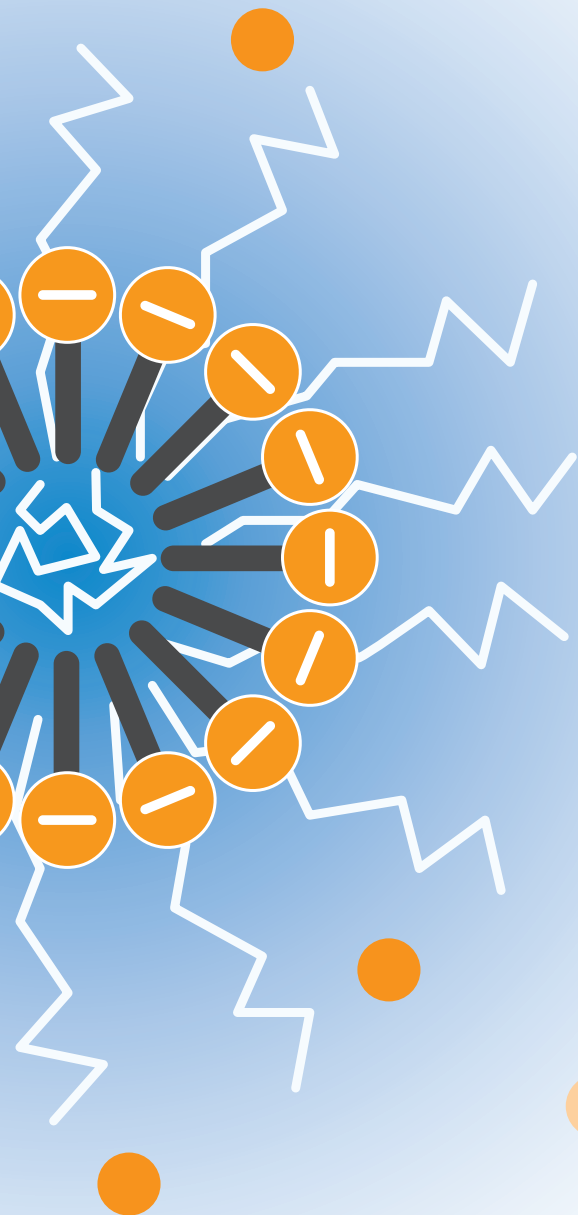
At BASF we use our know-how to deliver high performance products, of consistent high quality, to customers in the Emulsion Polymerization industry. Emulsion Polymerization is a complex technology employed to produce a variety of polymer dispersions which are then utilized in a variety of applications.

BASF surfactants and additives are the key to:

- Reliable polymer dispersion manufacture
- Control of particle size and stability during polymerization
- Post-polymerization stabilization of dispersions
- Meeting legal and market needs

This provides the basis for the long-term success of you and your customers.

It's because at BASF, we create chemistry.



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Safety

We know of no ill effects that could have resulted from using our products for the purpose for which they are intended and from processing them in accordance with current practice. According to the experience we have gained up to now and other information at our disposal, our products 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 sheet are observed.

Labeling

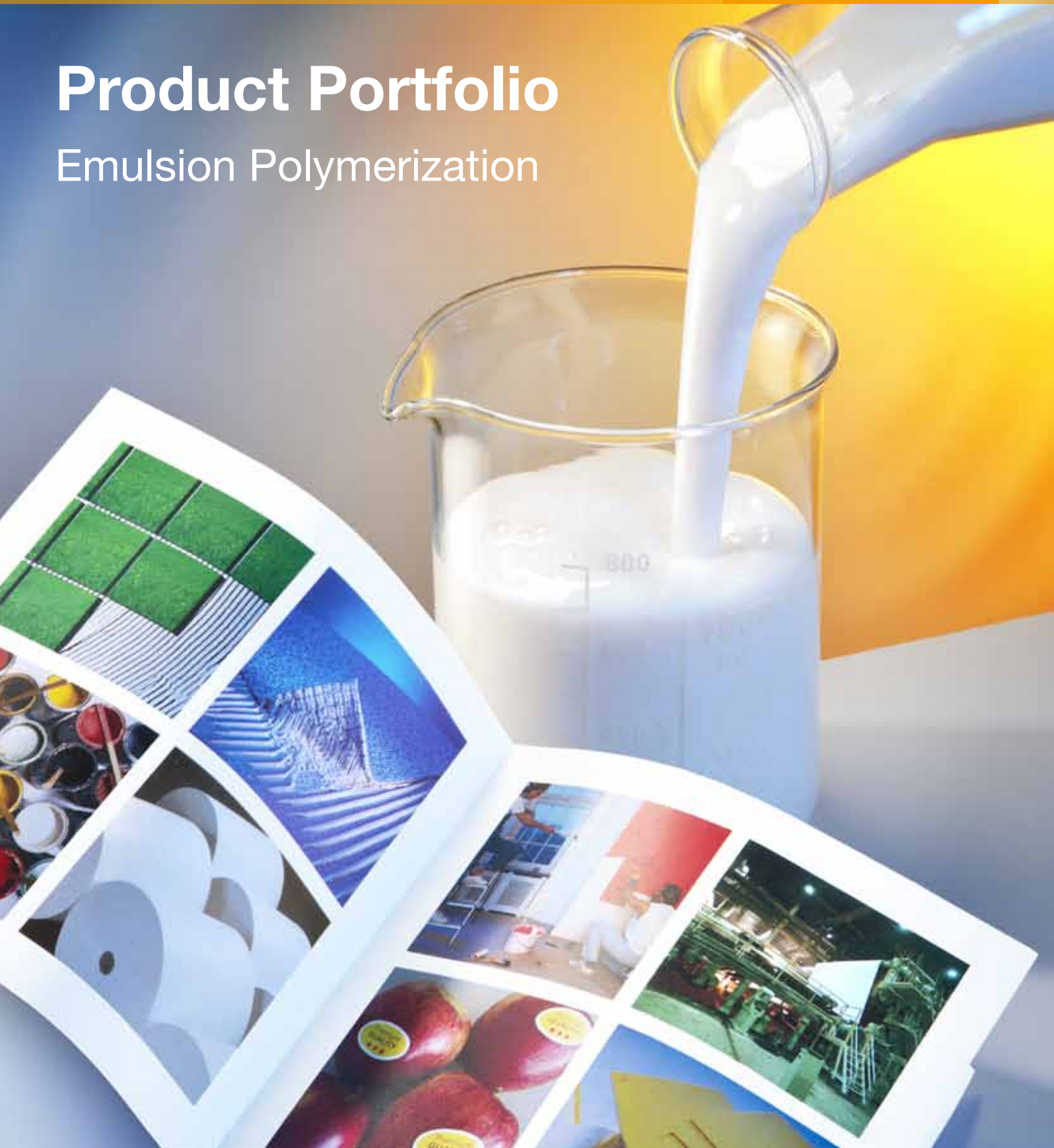
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Product Portfolio

Emulsion Polymerization



Product Portfolio

Emulsion Polymerization

Products for emulsion polymerization in process-control and post-stabilization: Disponil®, Emulan®, Lutensol® and Pluronic®.

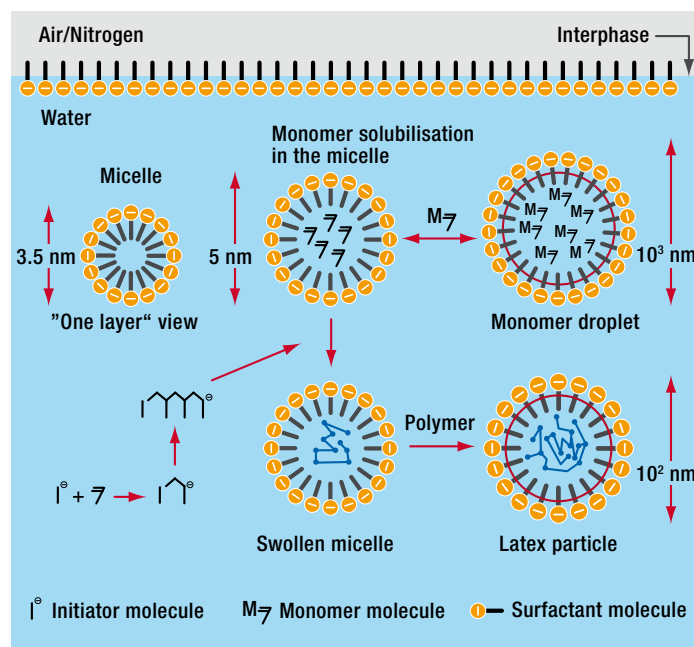
Surfactants are used in a very wide variety of applications on account of their ability to reduce surface tension. Apart from the main surfactant application areas in detergents, cleaners and cosmetics, there are many more technical applications, for example in the production of leather, paper, textiles, printing inks and coatings. A very special area of application for surfactants is as emulsifiers in aqueous emulsion polymerization processes.

Emulsion polymerization is a process that is used to manufacture polymer dispersions, such as homopolymers and copolymers of acrylic esters, styrene and vinyl acetate, and plastics such as E-PVC, PVC microsuspensions and synthetic rubber. In this process, the monomers – which are usually insoluble in water – are finely dispersed in the continuous phase, in this case water, by stirring. The aqueous phase contains one or more emulsifiers, usually at a concentration above the critical micelle concentration (CMC). This causes micelles to form that make it possible to solubilize the monomers. The polymerization process is started by adding a water-soluble initiator, and polymer chains are formed in the micelles during the course of the reaction.

Emulsifiers have an important part to play in the manufacture of polymer dispersions, and they also have a substantial influence on the performance characteristics of the final formulated product. Polymer dispersions are typically used in the coatings industry, in papermaking and paper coating, in adhesives and in the textile, leather and construction industries.

The properties of dispersions manufactured by emulsion polymerization are determined by the choice and mixtures of the various monomers, but these properties are also influenced to a large extent by the choice of emulsifiers and their quality. BASF's dedicated range of products for manufacturing polymer dispersions consists of a broad spectrum of surfactants for use in classical and modern latex applications.

Emulsifiers play two decisive roles in polymerization processes. One is to stabilize the monomer droplets during the manufacturing process and the other is to stabilize the cured polymer particles in the finished latex. However, the main role of surfactants is to form the micelles that enable the polymerization processes to take place. Anionic emulsifiers form micelles with a spherical structure in aqueous solutions. The free-radical polymerization reaction takes place in these micelles, which take on the function of a "mini-reactor". The monomer reacts with the water-soluble initiator to form free radicals and diffuses into the micelles, where further chain propagation takes place. The presence of a large number of emulsifier micelles in parallel creates a series of enclosed spaces in which the polymer particles gradually grow as the reaction progresses.

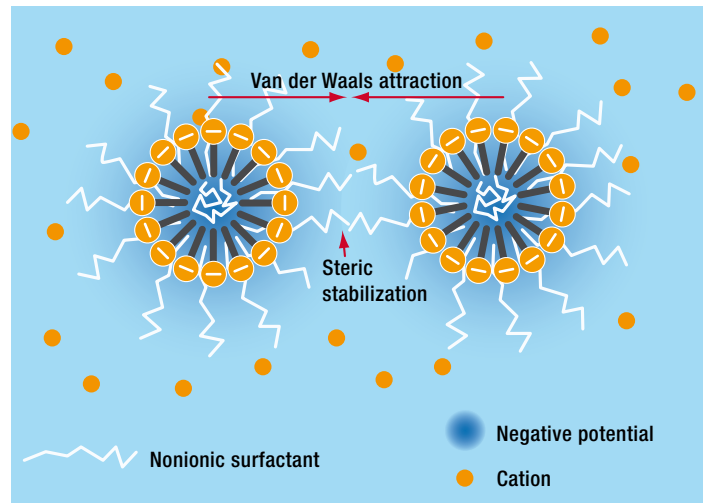
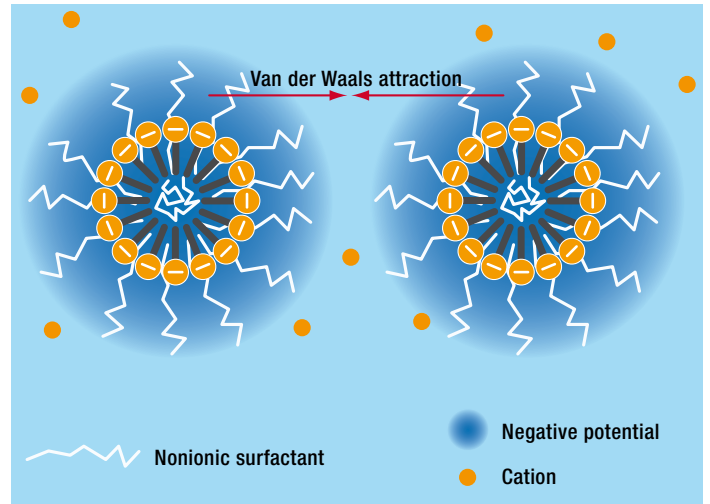


Schematic diagram of reaction

Generally speaking, the amount of emulsifier used in the polymerization process is sufficient to enable high-quality polymer dispersions to be manufactured that do not contain any coagulated solids. However, it is possible that insufficient emulsifier is present to be able to form a saturated adsorbed layer on the surface of the particles. The latex can be stabilized by means of electrostatic repulsion or steric hindrance between the polymer particles.

It can sometimes be necessary to add co-emulsifiers after the monomers have reacted in order to improve the stability of dispersions in storage. Apart from making them more stable in storage, nonionic emulsifiers can also be added to polymer dispersions to improve their mechanical stability and their stability in the presence of electrolytes.

The type of emulsifier, its consistency in quality and purity and its composition influence the formation and size of particles and the properties of the latex when it is applied. It is for this reason, and also because of the sensitivity of the emulsion polymerization reaction, that BASF additives and emulsifiers guarantee maximum quality and top performance.



Electrostatic stabilization and steric hindrance of latex particles

Product Portfolio

Anionic Surfactants

Product Groups		Chemical and Physical Properties					Applications														Features and Benefits	
		Typical Technical Data					Specific Recommendations by Polymer											Performance				
		Aggregate condition @ RT	Active matter [%]	Sodium sulfate [%]	Sodium chloride [%]	pH-value	Vinyl acetate homopolymer	Vinyl acetate homopolymer with protective colloid	Vinyl acetate copolymer	Styrene acrylic	Acrylic	Styrene butadiene	ABS	SBR	Emulsion-PVC	Microsuspension-PVC	Alkyd emulsion	APEO free	Post polymerization stabilization	Wetting		Foaming agent
Product Name	Description																					
Fatty alcohol sulfates																						
Disponil® ALS 33	C ₈ C ₁₄ -Fatty alcohol sulfate, ammonium salt	Liquid	~ 35	0 – 7 ^{a)}	0 – 1.5 ^{b)}	6.0 – 7.0 ⁵⁾		○	○	○	○	●	●	●	●	●	●	●	●	●	●	<ul style="list-style-type: none"> ▶ Basic surfactants ▶ Excellent particle size control
Disponil® EHS 47	2-Ethylhexyl sulfate, sodium salt	Liquid	~ 45	0 – 2	0 – 0.5	10.0 – 11.5 ²⁾		□	□	□	□	□	□	□	●	●	●	●	●	●	●	<ul style="list-style-type: none"> ▶ Foaming agents, e.g. for carpet backing, textile
Disponil® SDS 15*	C ₁₂ -Fatty alcohol sulfate, sodium salt	Liquid	~ 15	0 – 0.8	0 – 0.3	8.0 – 9.0 ¹⁾		○	○	●	●	●	●	●	●	●	●	●	●	●	●	
Disponil® SDS G*	C ₁₂ -Fatty alcohol sulfate, sodium salt	Granules	~ 97	0 – 2.5	0 – 1.0	8.5 – 10.5 ²⁾		○	○	●	●	●	●	●	●	●	●	●	●	●	●	
Disponil® SLS 101 Special	C ₁₂ C ₁₆ -Fatty alcohol sulfate, sodium salt	Liquid	~ 30	0 – 1.0	0 – 0.25	7.5 – 9.5 ⁵⁾		○	●	●	●	●	●	●	●	●	●	●	●	●	●	
Disponil® OCS 27	C ₁₆ C ₁₈ /C _{18:1} -Fatty alcohol sulfate, sodium salt	Paste like	~ 27	0 – 0.6	0 – 0.3	8.3 – 11.5 ⁵⁾		○	●	●	●	●	●	●	●	●	●	●	●	●	●	
Linear dodecyl benzene sulfonates																						
Disponil® LDBS 25*	linear dodecyl benzene sulfonate, sodium salt	Liquid	~ 25	0 – 0.7	0 – 0.2	7.0 – 8.5 ⁵⁾		○	●	●	○	●	●	●	●	●	●	●	●	●	●	<ul style="list-style-type: none"> ▶ Basic surfactants ▶ Especially for seed latex ▶ Stable against hydrolysis ▶ Suitable for all types of monomers
Fatty alcohol ethersulfates																						
Disponil® FES 27	Fatty alcohol ether sulfate + 2 EO, sodium salt	Liquid	~ 27	0 – 0.5	0 – 0.1	6.4 – 7.5 ⁵⁾		○	○	○	●	●	●	●	●	●	●	●	●	●	●	<ul style="list-style-type: none"> ▶ Alternatives to APEO-sulfates ▶ Yield improved stabilization properties in the latex over alkyl sulfates
Disponil® FES 32	Fatty alcohol ether sulfate + 4 EO, sodium salt	Liquid	~ 31	0 – 0.8	–	7.0 – 8.5 ⁵⁾		○	○	●	●	●	●	●	●	●	●	●	●	●	●	
Disponil® FES 147	Fatty alcohol ether sulfate + 7 EO, sodium salt	Liquid	~ 27	0 – 0.8	–	7.0 – 8.5 ⁵⁾		○	○	●	●	●	●	●	●	●	○	●	●	●	●	<ul style="list-style-type: none"> ▶ Adaptable to monomer system: <ul style="list-style-type: none"> - lower ethoxylated products more suitable for all acrylics - medium ethoxylated products more suitable for styrene acrylics. - higher ethoxylated products more suitable for vinyl acetate homo- and copolymers and as emulsifiers for alkyd resins.
Disponil® FES 993	Fatty alcohol ether sulfate + 12 EO, sodium salt	Liquid	~ 30	0 – 0.8	–	7.0 – 8.5 ⁵⁾		●	●	●	●	●	○	○	○	○	○	●	●	○	●	
Disponil® BES 20	Isotridecyl ether sulfate + 20 EO, sodium salt)	Liquid	~ 29	0 – 1.0	–	7.0 – 8.5 ⁵⁾		●	●	●	●	○	○	○	○	○	○	●	●	●	●	
Disponil® FES 77	Fatty alcohol ether sulfate + 30 EO, sodium salt	Liquid	~ 33	0 – 0.8	–	7.0 – 8.5 ⁵⁾		●	●	●	○	○	○	○	○	○	○	●	●	○	●	
Disponil® FES 61	Fatty alcohol ether sulfate + 50 EO, sodium salt	Liquid	~ 32	0 – 0.8	–	7.0 – 8.5 ⁵⁾		●	●	○	○	○	○	○	○	○	○	●	○	○	●	

* Also available in other concentrations

- a) ammonium sulfate
- b) ammonium chloride
- c) sulfate content (potentiometric titration with an aqueous solution of barium chloride (c = 0,1 mol/l)
- 1) as is
- 2) DIN EN 1262: 1% in water
- 3) 3% in water
- 4) DIN EN 1262: 5% in water
- 5) 10% in water

● Highly recommended as sole surfactant or as co-emulsifier ○ Recommended as sole surfactant or as co-emulsifier □ Recommended as co-emulsifier

Product Portfolio

Anionic Surfactants

Chemical and Physical Properties							Applications														Features and Benefits		
							Specific Recommendations by Polymer											Performance					
							Vinyl acetate homopolymer	Vinyl acetate homopolymer with protective colloid	Vinyl acetate copolymer	Styrene acrylic	Acrylic	Styrene butadiene	ABS	SBR	Emulsion-PVC	Microsuspension-PVC	Alkyd emulsion	APEO free	Post polymerization stabilization	Wetting		Foaming agent	
Product Groups		Aggregate condition @ RT	Active matter [%]	Sodium sulfate [%]	Sodium chloride [%]	pH-value																	
Product Name	Description																						
Other surfactants																							
Disponil® SUS 87 Spez.	Mono-alkyl sulfosuccinate, sodium salt + 5 EO	Liquid	~ 30	0 – 1.0	–	5.0 – 6.0 ³⁾		○	●	●	●	○								●			▶ Suitable for manufacturing of small particle latices (hydrosols)
Disponil® SUS IC 10	Di-isodecyl sulfosuccinate, sodium salt	Liquid	~ 64.5	0 – 1.0	–	6.0 – 8.0 ³⁾	□	□	□	□	□								●	●	●	●	▶ Highly efficient wetting agents ▶ Applicable for viscosity adjustment of PVC-pastes
Disponil® SUS IC 875	Di-isooctyl sulfosuccinate, sodium salt	Liquid	~ 75	0 – 1.0	–	5.5 – 7.5 ⁵⁾	□	□	□	□	□								●	●	●	●	
Disponil® ODSLS	Mono-alkenyl sulfosuccinamate, sodium salt	Partly crystallized	~ 35	–	–	7.5 – 9.5 ²⁾		○	●	●	●	○								●		●	▶ Characteristic foaming behavior
Disponil® FEP 6300	Acid phosphoric ester of a fatty alcohol ethoxylate + 3 EO	Liquid	~ 100	–	–	–	○	○	●	●	●									●			▶ Stable against hydrolysis ▶ Recommended for corrosion protection latices
Oleic acid sulfonates																							
Disponil® OSS 50 KS	Oleic acid sulfonate, potassium salt	Liquid	~ 51	0 – 3.0 ^{a)}	–	6.0 – 7.0 ³⁾			○		●	○							○		●		

a) potassium sulfate

1) as is

2) DIN EN 1262: 5% in water

3) DIN EN 1262: 10% in water

4) DIN EN 1262: 5% in water

5) 10% in water

● Highly recommended as sole surfactant or as co-emulsifier ○ Recommended as sole surfactant or as co-emulsifier □ Recommended as co-emulsifier

Product Portfolio

Nonionic Surfactants

Chemical and Physical Properties							Applications														Features and Benefits		
							Specific Recommendations by Polymer												Performance				
							Vinyl acetate homopolymer	Vinyl acetate homopolymer with protective colloid	Vinyl acetate copolymer	Styrene acrylic	Acrylic	Styrene butadiene	ABS	SBR	Emulsion-PVC	Microsuspension-PVC	Alkyd emulsion	APEO free	Post polymerization stabilization	Wetting		Foaming agent	
Product Groups		Aggregate condition @ RT	Active matter [%]	Cloud point [°C]	Pour point [°C]	HLB																	
Product Name	Description																						
Alkyl polyglycosides																							
Disponil® APG 215	C ₈ -C ₁₀ -Alkyl polyglucoside	Liquid	~ 64	–	–	–				■	■	■	■	■	■	■	■	■	●	●	●	▶ 100% renewable based surfactant	
Disponil® APG 425	C ₈ -C ₁₄ -Alkyl polyglucoside	Liquid	~ 50	–	–	–				■	■	■	■	■	■	■	■	■	●	●	●		
Low-foaming nonionic surfactants																							
Pluronic® PE 6100	PO-EO-block polymer 10% EO	Liquid	~ 100	~ 23 ¹⁾	~ -30	–													●	●		▶ Block polymers with low EO content show defoaming behavior	
Pluronic® PE 6400	PO-EO-block polymer 40% EO	Liquid	~ 100	~ 60 ¹⁾	~ 16	–				■	■	■	■	■	■	■	■	■	●	●		▶ Block polymers with high EO content act as emulsifiers and dispersants	
Pluronic® PE 6800	PO-EO-block polymer 80% EO	Powder	~ 100	~ 88 ²⁾	–	–				■	■	■	■	■	■	■	■	■	●	●			
Pluronic® PE 10100	PO-EO-block polymer 10% EO	Liquid	~ 100	~ 40 ⁴⁾	~ -25	–													●	●			
Pluronic® PE 10500	PO-EO-block polymer 50% EO	Solid	~ 100	~ 75 ²⁾	–	–				■	■	■	■	■	■	■	■	■	●	●			
Pluronic® RPE 1740	EO-PO-block polymer 40% EO	Liquid	~ 100	~ 50 ¹⁾	~ 9	–													●	●			
Pluronic® RPE 3110	EO-PO-block polymer 10% EO	Liquid	~ 100	~ 31 ⁴⁾	~ -30	–													●	●			

* According to ISO 3016

1) EN 1890 (method A): 1 g product + 100 g water
 2) EN 1890 (method B): 1 g product + 100 g NaCl-solution (5%)
 3) EN 1890 (method C): 1 g product + 100 g NaCl-solution (10%)
 4) EN 1890 (method D): 5 g product + 45 g butyldiglycol-solution (25%)

● Highly recommended as sole surfactant or as co-emulsifier ■ Highly recommended as co-emulsifier □ Recommended as co-emulsifier

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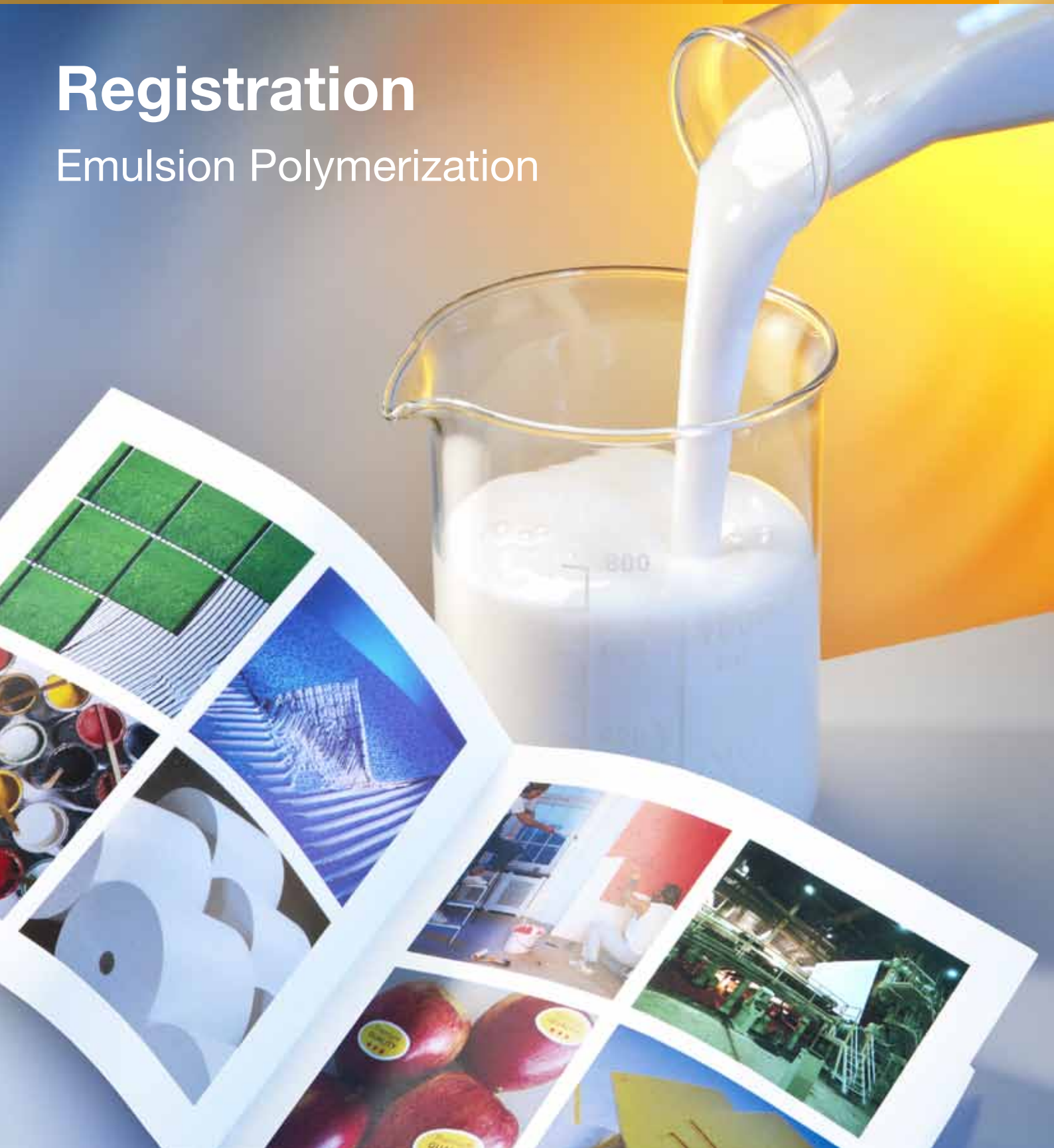
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Registration

Emulsion Polymerization



Registration

Anionic Surfactants

Product Name	Registration Status									
	AICS	DSL	IECSC	REACH*	ENCS	ECL	NZIOC	PICCS	CHEMINV	TSCA
	Australia	Canada	China	EU	Japan	Korea	New Zealand	Philippines	Switzerland	USA
Fatty alcohol sulfates										
Disponil® ALS 33	●		●	●	●	●	●	●	●	●
Disponil® EHS 47	●	●	●	●	●	●	●	●	●	●
Disponil® SDS 15	●	●	●	●	●	●	●	●	●	●
Disponil® SDS G	●	●	●	●	●	●	●	●	●	●
Disponil® SLS 101 Special	●	●	●	●	●	●	●	●	●	●
Disponil® OCS 27			●	●	●		●		●	●
Linear dodecyl benzene sulfonates										
Disponil® LDBS 25	●		●	●	●	●	●	●	●	●
Fatty alkohol ethersulfates										
Disponil® FES 27	●	●	●	●	●	●	●	●	●	●
Disponil® FES 32	●	●	●	●	●	●	●	●	●	●
Disponil® FES 147	●		●	●		●	●			●
Disponil® FES 993	●	●	●	●	●	●	●	●	●	●
Disponil® BES 20		●	●	●			●	●		●
Disponil® FES 77	●	●	●	●	●	●	●	●	●	●
Disponil® FES 61	●	●	●	●	●	●	●	●	●	●
Other surfactants										
Disponil® SUS 87 Spez.	●	●	●	●	●	●	●	●	●	●
Disponil® SUS IC 10	●		●	●	●		●		●	●
Disponil® SUS IC 875	●	●	●	●	●	●		●	●	●
Disponil® ODSLS	●		●	●	●		●		●	●
Disponil® FEP 6300	●	●	●	●	●	●	●	●		●
Oleic acid sulfonates										
Disponil® OSS 50 KS	●		●	●	●	●	●	●	●	●

Nonionic Surfactants

Product Name	Registration Status									
	AICS	DSL	IECSC	REACH*	ENCS	ECL	NZIOC	PICCS	CHEMINV	TSCA
	Australia	Canada	China	EU	Japan	Korea	New Zealand	Philippines	Switzerland	USA
Alcohol ethoxylates										
Lutensol® AT 18 20%	●	●	●	●	●	●	●	●	●	●
Lutensol® AT 25 E	●	●	●	●	●	●	●	●	●	●
Lutensol® XP 100	●		●	●	●	●	●			●
Lutensol® XP 149	●		●	●	●	●	●	●	●	●
Unsaturated alcohol ethoxylates										
Disponil® OC 5	●	●	●	●	●	●	●	●	●	●
Disponil® OC 25	●	●	●	●	●	●	●	●		●
Special surfactants										
Disponil® A 1080	●	●	●	●	●	●	●	●	●	●
Disponil® A 1580	●	●	●	●	●	●	●	●	●	●
Disponil® A 3065	●	●	●	●	●	●	●	●	●	●
Disponil® A 4065	●	●	●	●	●	●	●	●	●	●
Disponil® AFX 9580	●	●	●	●	●	●	●	●	●	●
Disponil® AFX 2075	●	●	●	●	●	●	●	●	●	●
Disponil® AFX 4030	●	●	●	●	●	●	●	●	●	●
Emulsifiers and Solubilizers										
Emulan® TO 2080	●	●	●	●	●	●	●	●	●	●
Emulan® TO 3070	●	●	●	●	●	●	●	●	●	●
Emulan® TO 4070	●	●	●	●	●	●	●	●	●	●
Alkyl polyglycosides										
Disponil® APG 215	●	●	●	●	●	●	●	●	●	●
Disponil® APG 425	●	●	●	●	●	●	●	●	●	●
Low-foaming nonionic surfactants										
Pluronic® PE 6100	●	●	●	●	●	●	●	●	●	●
Pluronic® PE 6400	●	●	●	●	●	●	●	●	●	●
Pluronic® PE 6800	●	●	●	●	●	●	●	●	●	●
Pluronic® PE 10100	●	●	●	●	●	●	●	●	●	●
Pluronic® PE 10500	●	●	●	●	●	●	●	●	●	●
Pluronic® RPE 1740	●	●	●	●	●	●	●	●	●	●
Pluronic® RPE 3110	●	●	●	●	●	●	●	●	●	●

* The products in this European product catalogue as supplied by BASF in the EU/EEA are in compliance with the requirements of REACH, i.e. the ingredients shall either be pre-registered, registered, exempted or there is no obligation to register due to small volume. But we strongly recommend to contact BASF prior to import and for uses not covered by the Safety Data Sheet.

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Safety

We know of no ill effects that could have resulted from using our products for the purpose for which they are intended and from processing them in accordance with current practice. According to the experience we have gained up to now and other information at our disposal, our products 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 sheet are observed.

Labeling

Details about the classification and labeling of our products and further advice on safe handling are contained in the current safety data sheets.

Note

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