ABIL® EM 90

Emulsifier for the formulation of cosmetic W/O creams and lotions

- Low usage concentration of 1.5 – 2.5%
- High compatibility with active ingredients
- Emulsifier for "light" W/O emulsions with pleasant application properties
- Emulsions with high heat and freeze stability
- Stable emulsions without co-emulsifiers and with low amounts of consistency-enhancing waxes
- Formulations with all kinds of cosmetic oils
- Liquid at room temperature

Personal Care

INCI name (PCPC name)

Cetyl PEG/PPG-10/1 Dimethicone

Chemical and physical properties (not part of specifications)	
Form	liquid
HLB-value	approx. 5

Application

ABIL® EM 90 is a non-ionic W/O emulsifier which is based on silicone.
The high emulsion stabilizing potential of ABIL® EM 90 is caused by the polymeric and polyfunctional structure.

- ABIL® EM 90 is suitable for the formulation of W/O creams and lotions.
- Substances which can be processed include not only paraffin oils, which from the emulsion-technological point of view provide relatively few problems, but also fatty acid esters of short- and long-chain alcohols, silicone derivates and vegetable triglycerides which are known to be difficult to emulsify.
- The amount used, referred to the emulsion, is only 1.5 - 2.5%. In formulations with high water content the additional use of about 1% ISOLAN® GI 34 is recommended to improve the application properties.
- Consistency-providing or emulsion-stabilizing waxes are required only in amounts up to 2%. Amongst others, hydrogenated castor oil in combination with high-melting hydrocarbon waxes or beeswax are suitable.
- The optimum range for the content of oil phase is between 22 and 35%.
- Substances with specific properties, such as UV filters, plant extracts, moisturizers and antiperspirants, are well tolerated by the emulsion.
- The creams and lotions are distinguished by high stability towards heat and freezing stress; stability between -25 °C and +60 °C is attainable.
- ABIL® EM 90 can be used for the preparation of multiple emulsions of the type W/O/W and O/W/O. [P. Hameyer, K.R. Jenni, Emulsifiers for Multiple Emulsions - Optimization of stability by constitution and Molecular Weight, Parfümerie und Kosmetik 12 (1994), 842 - 850].
- Emulsions in which the oil phase contains predominantly substances with good spreading properties have good rub-out characteristics and are rapidly absorbed by the skin. On the other hand, creams which contain only highly viscous oils as emulsifiable substances, e. g. vegetable triglycerides, have a "heavy" action, whilst maintaining pleasant application properties.

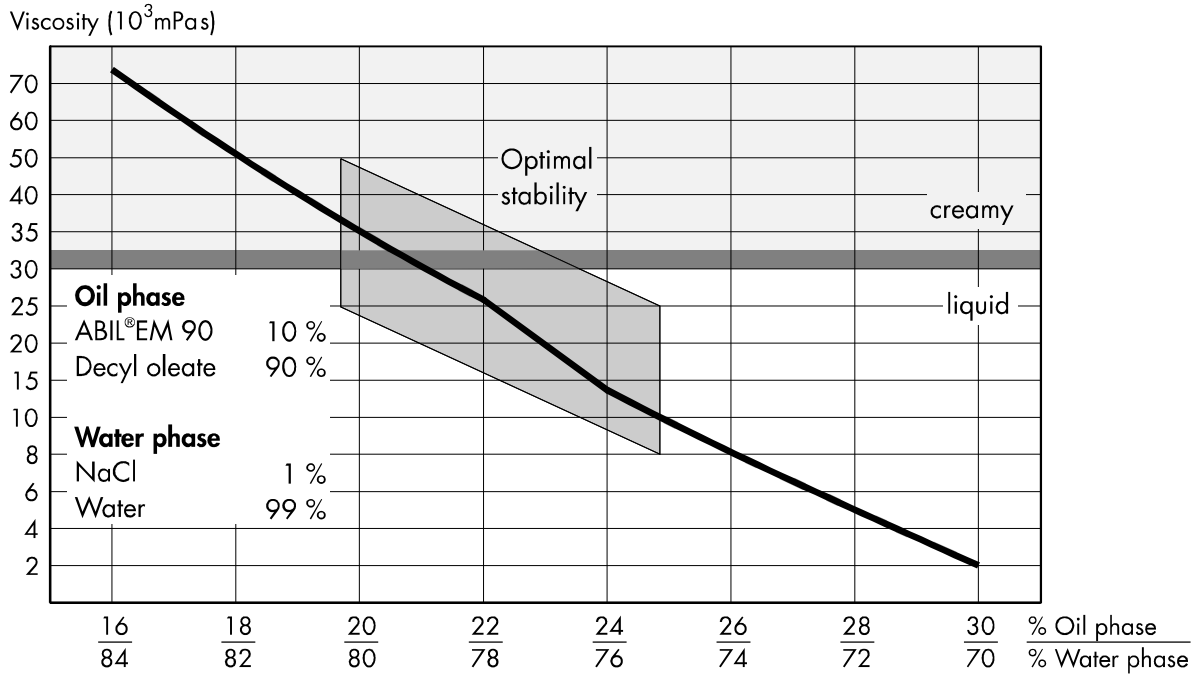
Influence on the viscosity of the emulsion
The viscosity of the W/O emulsions based on ABIL® EM 90 can be regulated via three variables.

1. Viscosity of the oil phase
The viscosity of the external phase correlates directly with the viscosity of the emulsion. This means that it increases when low viscosity oils in a formulation are replaced by more viscous oils or when waxes are added; the latter show distinct effects even at 0.5 - 1.0 %.

2. Phase ratio
In emulsions with predominant content of dispersed phase - as in the cosmetic W/O preparations - the viscosity increases significantly when the proportion of the dispersed phase is increased. The reason for this is the interaction between the dispersed water droplets which becomes stronger with increasing packing density. Therefore ABIL® EM 90 creams on average have lower oil contents than lotions. Depending on the emulsifiable substances, creams can be prepared about 20 - 33% of oil phase, lotions about 25 - 35%.
A given oil phase can be processed to form stable viscous liquid or cream-like emulsions when its proportion is in the optimum range for stability of the emulsion. E. g. decyl oleate forms creams with 19 - 21% of oil phase and lotions with 22 - 25% (see graph).

Outside these limits the stability of the emulsion is reduced because the dispersed water phase is too high or the viscosity of the emulsion too low. This working range is displaced to higher percentages when oils or oil/wax mixtures with higher viscosity are used.

3. Degree of dispersion
An additional parameter having an influence on viscosity is the degree of dispersion, which, however, should not be used for regulation of viscosity due to its effect on the stability of the emulsion. The viscosity increases when, due to mechanical processing, the diameter of the droplets is reduced and the specific boundary area between the phases is thereby increased. For this reason cream formulations are still liquid in the pre-emulsion state because of their coarse degree of dispersion.



Preparation

A pre-requisite is the careful adjustment of the formulation (phase ratio, viscosity of the oil phase) and optimum emulsification. The particle size for creams which are stable over a long period of time is below 1 µm, for lotions approx. 2 - 4 µm. More coarsely dispersed emulsions tend to separate. Thorough, but not too intensive homogenization is required. Extreme energy input frequently causes the formation of highly viscous, metastable secondary structures which break down on storage. Under such conditions lotions can transiently assume cream-like consistency, e. g. by several passages through a colloid mill.

Optimum manufacturing conditions correspond to the principles of normal production processes for W/O emulsions. The water phase is incorporated slowly into the oil phase which contains the emulsifier while stirring intensively. The coarsely dispersed pre-emulsion is then homogenized. The final homogenization should be performed below 30 °C.

The temperature programme is variable and can take the form of:

- hot/hot procedure (H/H)
- hot/cold procedure (H/C)

In addition to the traditional hot/hot procedure (both phases 80 - 90 °C) the hot/cold procedure can be used. It is characterized by incorporation of the cold water phase (15 - 30 °C) into the hot oil phase which significantly shortens the time of manufacture. Homogenization should be carried out below 30 °C in order to ensure that the waxes are largely recrystallized.

The decisive criterion for production is the viscosity. Mechanical processing is discontinued when the viscosity is equal to that of the standard emulsion developed and tested in the laboratory.

Emulsifying machines

Stirring equipment or planetary mixers with high sheering force are very suitable for the manufacture of creams and lotions on the laboratory and production scale, provided that they guarantee uniform work-up of the emulsion. Machines predominately used in the cosmetic industry, which are equipped with stirrer, stripper and rotor-stator homogenizer, fulfil all requirements for optimum emulsification. However, utilization of their maximum capacity may result in over-emulsification. High-pressure emulsifiers may cause problems because of the danger of over-emulsification and liberation of water due to cavitation.

Recommended usage concentration

1.5 - 2.5% of ABIL® EM 90

Packaging

180 kg drum

Hazardous goods classification

Information concerning

- classification and labelling according to regulations for transport and for dangerous substances
- protective measures for storage and handling
- measures in case of accidents and fires
- toxicity and ecological effects

is given in our material safety data sheets.

Guideline Formulations

W/O Extra Moisture Cream F 72/96	
Phase A	
ABIL® EM 90	2.00%
Mineral Oil (30 mPas)	17.00%
Hydrogenated Castor Oil	0.40%
Microcrystalline Wax (Paracera W 80, Paramelt B.V.)	0.60%
Phase B	
Sodium Chloride	0.50%
Water	59.5%
Phase C	
Urea	10.00%
Water	10.00%
Phase Z	
Preservative, Perfume	q.s.

Preparation:

1. Heat phase A to approx. 80 °C.
2. Add phase B (80 °C or room temperature) slowly while stirring.
3. Homogenize for a short time.
4. Cool with gentle stirring and add phase C below 40 °C.
5. Homogenize again below 30 °C.

W/O Silk Body Milk F 8/99	
Phase A	
ABIL® EM 90	2.00%
Beeswax	0.50%
Hydrogenated Castor Oil	0.50%
Mineral Oil (30 mPas)	10.50%
TEGOSOFT® DC (Decyl Cocoate)	8.00%
Cyclomethicone	6.00%
Tocopheryl Acetate	0.50%
Phase B	
Sodium Chloride	0.50%
Glycerin	3.00%
Water	63.50%
Phase C	
Alcohol	5.00%
Phase Z	
Preservative, Perfume	q.s.

Preparation:

1. Heat phase A to approx. 80 °C.
2. Add phase B (80 °C or room temperature) slowly while stirring.
3. Homogenize for a short time.
4. Cool with gentle stirring and add phase C below 40 °C.
5. Homogenize again below 30 °C.

Light and refreshing Sun Lotion with medium SPF AL 9/12-27	
Phase A	
ABIL® EM 90	2.50%
TEGOSOFT® DEC (Diethylhexl Carbonate)	11.80%
TEGOSOFT® CT (Caprylic/Capric Triglyceride)	5.90%
TEGOSOFT® XC (Phenoxyethyl Caprylate)	5.90%
Octocrylene	4.00%
Ethylhexyl Methoxycinnamate	3.00%
Butyl Methoxydibenzoylmethane	2.50%
Bis-Ethylhexyloxyphenol Methoxyphenyl Triazine (Tinosorb S, BASF SE)	2.00%
Hydrogenated Castor Oil	0.20%
Microcrystalline Wax (Paracera W 80, Paramelt B.V.)	0.20%
Phase B	
TEGO® Sun T 805 (Titanium Dioxide; Trimethoxy-caprylylsilane)	2.00%
Phase C	
Water	3.5%
Phenylbenzimidazole Sulfonic Acid (Eusolex 232, Merck KGaA)	1.00%
Tris(hydroxymethyl)aminomethane	0.44%
Phase D	
Water	49.00%
Glycerin	3.00%
Sodium Chloride	0.50%
Phase E	
Alcohol	2.50 %
Phase Z	
Preservative, Perfume	q.s.

Preparation:

1. Heat phase A to approx. 85 °C.
2. Disperse TEGO® Sun T 805 in phase A.
3. Mix ingredients of phase C. Add to phase D.
4. Add phase C/D (room temperature) slowly while stirring to phase A/B.
5. Add phase E below 40 °C.
6. Homogenize.

Remarks:

SPF* (*in vitro*): 23
UVA PF*: 10
Critical Wavelength*: 375 nm
*Labsphere 2000 S; 0.75 mg/cm²; on PMMA slide
Tested preservative: 0.7 % Phenoxyethanol, Ethylhexylglycerin (Euxyl PE 9010, Schülke&Mayr GmbH)

W/O Sun Face Fluid (Shake Shake) SPF 20 UV A SG 21/10-2	
Phase A	
ABIL® EM 90	1.00%
TEGOSOFT® XC (Phenoxyethyl Caprylate)	11.00%
TEGOSOFT® DEC (Diethylhexyl Carbonate)	2.50%
TEGO® Sun T 805 (Titanium Dioxide; Trimethoxy-caprylylsilane)	2.00%
Cyclomethicone	12.00%
Octocrylene	6.00%
Ethylhexyl Salicylate	2.00%
Butyl Methoxydibenzoylmethane	0.80%
Bis-Ethylhexyloxyphenol Methoxyphenyl Triazine (Tinosorb S, BASF SE)	1.50%
VP/Hexadecane Copolymer (Antarone V-216, Ashland)	0.50%
Phase B	
Water	4.43%
Sodium Hydroxide	0.07%
Phenylbenzimidazole Sulfonic Acid (Eusolex 232, Merck KGaA)	0.50%
Phase C	
Water	46.40%
Glycerin	6.00%
Distarch Phosphate (MAIS PO4 PH"B")	1.50%
Alcohol	1.00%
Phase D	
Dipropylene Glycol; Methylparaben; Ethylparaben; Aqua; Methyliso-thiazolinone (Microcare MEM, Thor)	0.80%
Phase Z	
Perfume	q.s.

Preparation:

1. Heat phase A to approx. 85 °C.
2. Disperse TEGO® Sun T 805 in phase A.
3. Prepare phase B.
4. Add phase C to phase B.
5. Add phase B/C (80 °C or room temperature) slowly while Stirring to phase A.
6. Homogenize for a short time.
7. Cool with gentle stirring and add phase D below 40 °C:
8. Homogenize again below 30 °C.

Remarks:

SPF* (*in vitro*): 22 UVA-Balance*: 34%
Critical Wavelength*: 374 nm
Calculated values**: SPF: 20; UVA-Balance: 0,34

* Labsphere 2000S; 1.0 mg/cm²; on PMMA slide
** BASF Sunscreen Simulator

Dual-Action Wrinkle Serum MK 3/10-25	
Phase A	
ABIL® EM 90	1.50%
ABIL® EM 97 S (Bis PEG/PPG-14/14 Dimethicone; Dimethicone)	1.00%
Cyclopentasiloxane	12.00%
TEGOSOFT® DEC (Diethylhexyl Carbonate)	3.00%
HyaCare® Filler CL (Aqua; Ethylhexyl Stearate; Sodium Hyaluronate Cross-polymer; Polyglyceryl-4 Diisostearate/ Polyhydroxystearate/Sebacate; Sodium Isostearate)	2.50%
Tocopherol	0.50%
Zinc Stearate	0.50%
Phase B	
Water	69.70%
Glycerin	4.00%
Butylene Glycol	4.00%
Sodium Chloride	0.80%
TEGO® Pep 4-17 (Tetrapeptide-21; Glycerin; Butylene Glycol; Aqua)	0.50%
Phase Z	
Preservative, Perfume	q.s.

Preparation:

1. Heat phase A to approx. 80 °C.
2. Add phase B (80 °C or room temperature) slowly while stirring.
3. Homogenize for a short time.
4. Cool with gentle stirring below 30 °C and homogenize again.

W/O Antiperspirant Roll-on H 13/09-27	
Phase A	
ABIL® EM 90	1.50%
ABIL® EM 97 S (Bis PEG/PPG-14/14 Dimethicone; Dimethicone)	1.50%
TEGOSOFT® DEC (Diethylhexyl Carbonate)	10.60%
Dimethicone (5 mPas)	10.60%
Silica (Aerosil R 812, Evonik Industries)	0.30%
Zinc Stearate	0.50%
Phase B	
Water	51.30%
Glycerin	3.00%
Sodium Chloride	0.70%
Aluminum Chlorohydrate (Reach 501 L, Summit Reheis)	20.00%
Phase Z	
Preservative, Perfume	q.s.

Preparation:

1. Disperse Zinc Stearate with ultra-turrax in emulsifiers and oils of phase A.
2. Disperse Aerosil R 812 in phase A.
3. Prepare phase B separately and add slowly while stirring to phase A.
4. Homogenize.

Remarks:

Suitable preservative systems:
0.05 % Bronopol or 0.70 % Phenoxyethanol, Ethylhexylglycerin (Euxyl PE 9010, Schülke&Mayr GmbH)

Viscosity: 9 Pas (Brookfield RVT, spindle 4, 5 rpm)

Winter Skin Moisturizer MAC 499/3/3	
Phase A	
ABIL® EM 90	2.00%
Hydrogenated Castor Oil	0.50%
Microcrystalline Wax (Paracera W 80, Paramelt B.V.)	0.50%
TEGOSOFT® CT (Caprylic/Capric Triglyceride)	10.00%
Isocetyl Palmitate	10.00%
TEGOSOFT® DEC (Diethylhexyl Carbonate)	5.00%
Phase B	
TEGO® Smooth (Betaine; Urea; Potassium Lactate; Sodium Polyglutamate; Hydrolyzed Sclerotium Gum)	10.00%
Sodium Chloride	0.50%
Water	61.50%
Phase Z	
Preservative, Perfume	q.s.

Preparation:

1. Heat phase A to approx. 80 °C.
2. Add phase B (80 °C or room temperature) slowly while stirring.
3. Homogenize for a short time.
4. Cool with gentle stirring below 30 °C and homogenize again.

Skin Nutrition Lotion MAC 694/2/3	
Phase A	
ABIL® EM 90	2.00%
Hydrogenated Castor Oil	0.50%
Microcrystalline Wax (Paracera W 80, Paramelt B.V.)	0.50%
TEGOSOFT® CT (Caprylic/Capric Triglyceride)	10.00%
TEGOSOFT® DEC (Diethylhexyl Carbonate)	10.00%
TEGOSOFT® OP (Ethylhexyl Palmitate)	5.00%
Phase B	
TEGO® Cosmo C 100 (Creatine)	0.50%
Sodium Chloride	0.50%
Water	69.00%
Phase C	
TEGO® Arjuna S (Terminalia Arjuna Bark Extract, Pentylene Glycol)	2.00%
Phase Z	
Preservative, Perfume	q.s.

Preparation:

1. Heat phase A to approx. 80 °C.
2. Add phase B (80 °C or room temperature) slowly while stirring.
3. Homogenize for a short time.
4. Cool with gentle stirring and add phase C below 40 °C.
5. Homogenize again below 30 °C.

Evonik Industries AG Goldschmidtstraße 100 45127 Essen, Germany
P.O. BOX 45116 Essen PHONE +49 201 173-2854 FAX +49 201 173-1828
personal-care@evonik.com www.evonik.com/personal-care

EVONIK INDUSTRIES