ABIL® EM 180

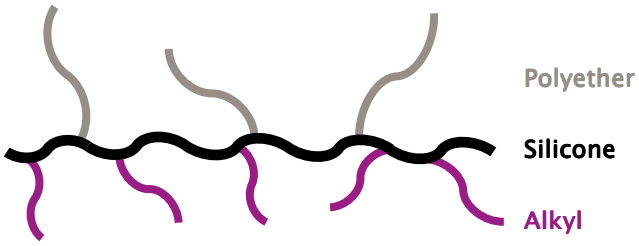
High performance emulsifier for all types of W/O formulations

- Very low usage concentration of down to 0.5 %
- Excellent stabilization in difficult systems
- Enhanced performance at high temperatures
- Great flexibility with electrolytes, UV filters and active ingredients
- For hot and cold processing of creams, lotions and gels

Personal Care

INCI name

Cetyl PEG/PPG-10/1 Dimethicone



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

Application

ABIL® EM 180 is a non-ionic W/O emulsifier which is based on silicone. The high emulsion stabilizing potential of ABIL® EM 180 is caused by the polymeric and polyfunctional structure.

- ABIL® EM 180 is suitable for hot processed creams and lotions as well as for cold processed creams, lotions and gels.
- General use level is from 0.5 – 2.5 % for the production of W/O creams, lotions and gels.
- The emulsifier is optimal for challenging formulations:
  - ABIL® EM 180 can handle a high amount of UV filters (oil phase level up to 55 % with a typical SPF of 65+).
  - ABIL® EM 180 is able to stabilize a high amount of oil phase.
  - Emulsions containing up to 20 % alcohol are possible.
  - ABIL® EM 180 can create stable quick break systems.
- Due to the polyfunctional structure ABIL® EM 180 provides formulations with an extraordinary high temperature stability.
- ABIL® EM 180 offers great flexibility with respect to electrolytes. For example, the possible usage range of sodium chloride is 0.05 % – 5.0 %. The recommended usage concentration of sodium chloride is 0.5 – 1.0 %
- ABIL® EM 180 is suitable for a wide pH range from 4.5 to 9.0.
- ABIL® EM 180 is an easy-to-handle liquid product.
- The typical range for the oil phase content is between 20 and 40 %.
- ABIL® EM 180 can be used to emulsify all types of cosmetic oils (e.g. esters, ethers, silicones or hydrocarbons).
- Substances with specific properties, such as UV filters, plant extracts, moisturizers and antiperspirants, are typically well tolerated by emulsions based on ABIL® EM 180.
- At the very low use level of approx. 0.5 % an addition of 3 – 5 % polyalcohol such as propylene glycol or glycerin is recommended for freeze stability.
- ABIL® EM 180 can typically be used as a sole emulsifier. However, it can also be applied as a co-emulsifier in order to improve the overall emulsion stability.

Influence on the viscosity of the emulsion

The viscosity of the W/O emulsions based on ABIL® EM 180 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 180 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 – 40 %.

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 program is variable and can take the form of:

- hot/hot procedure
- hot/cold procedure
- cold/cold procedure

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. A final homogenization step should be carried out below 30 °C in order to ensure that the waxes are homogeneously distributed in the formulation.

It is possible to manufacture W/O lotions based on ABIL® EM 180 in a cold process. In such formulations additives like zinc stearate can be used to improve the overall stability.

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.

Recommended usage concentration

0.5 - 2.5 % of ABIL® EM 180

- Gels 0.5 - 1.0 %
- Lotions 0.5 - 1.5 %
- Creams 1.0 - 2.5 %

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 Lotion with 0.5 % Emulsifier and 20 % Ethanol DCA-5631-190	
Phase A	
ABIL® EM 180	0.50 %
Mineral Oil (30 mPas)	10.00 %
Bees Wax	0.50 %
Hydrogenated Castor Oil	0.50 %
TEGOSOFT® OS (Ethylhexyl Stearate)	10.00 %
Cyclopentasiloxane	6.00 %
Tocopheryl Acetate	0.50 %
Phase B	
Water	47.80 %
Sodium Chloride	0.50 %
Glycerin	3.00 %
Phase C	
Ethanol	20.00 %
Phenoxyethanol, Methylparaben, Propylparaben, Ethylparaben (Phenonip XB, Clariant International Ltd.)	0.70 %
Phase Z	
Perfume	q.s.

Processing:

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

Quick-Breaking W/O Emulsion H 8/10-7	
Phase A	
ABIL® EM 180	0.80 %
ABIL® Wax 9801 (Cetyl Dimethicone)	1.60 %
TEGOSOFT® DEC (Diethylhexyl Carbonate)	4.00 %
ABIL® 350 (Dimethicone)	1.00 %
Cyclopentasiloxane	4.00%
Magnesium Stearate	0.30 %
Phase B	
Water	81.50 %
Sodium Chloride	1.00 %
Propylene Glycol	5.00 %
Phase C	
Dipropylene Glycol, Methylparaben, Ethylparaben, Aqua, Methylisothiazolinone (Microcare MEM, Thor GmbH)	0.80 %
Phase Z	
Perfume	q.s.*

Processing:

1. Mix phase A and B separately.
2. Add phase B to phase A slowly while stirring.
3. Add phase C.
4. Homogenize.

* Stability tests and scale-up were performed with 0.10% perfume.

High SPF Sunscreen Lotion with EU Approved Filters, SPF 30* **SZ 24/11-1**	
Phase A	
ABIL® EM 180	2.00 %
Tocopheryl Acetate	0.50 %
Zinc Stearate	0.80 %
Phase B	
TEGOSOFT® XC (Phenoxyethyl Caprylate)	9.00 %
TEGOSOFT® DEC (Diethylhexyl Carbonate)	6.00 %
TEGOSOFT® TN (C12-15 Alkyl Benzoate)	6.00 %
Ethylhexyl Methoxycinnamate	3.00 %
Ethylhexyl Salicylate	2.00 %
Octocrylene	9.00 %
Phase C	
TEGO® SUN T 805 (Titanium Dioxide, Trimethoxycaprylylsilane)	4.00 %
Phase D	
Sodium Chloride	0.50 %
GluCare® S (Sodium Carboxymethyl Beta-Glucan)	0.20 %
Allantoin	0.10 %
Water	56.20 %
Phase E	
Phenoxyethanol, Methylparaben, Propylparaben, Ethylparaben (Phenonip XB, Clariant AG)	0.70 %
Phase Z	
Perfume	q.s.

Processing:

1. Mix and heat phase B to 80°C until the UV-filters are dissolved, cool down.
2. Add titanium dioxide (phase C) and homogenize with full speed (Ultra Turrax).
3. Add phase B/C to phase A.
4. Charge phase A/B/C and add the water phase (D) slowly while stirring (490 rpm).
5. Add phase E.
6. Homogenize.

* SPF 38 (*in-vitro* measurement, Labsphere 2000S, 1.00 mg/cm2 on PMMA slide)
UVA-balance: 50%

Very High SPF Sunscreen with US Approved Filters SPF 50+** **DCA-5787-144**	
Phase A	
ABIL® EM 180	2.00 %
Ethylhexyl Methoxycinnamate	7.50 %
Ethylhexyl Salicylate	5.00 %
Homosalate	15.00 %
Butyl Methoxydibenzoylmethane	3.00 %
Benzophenone-3	6.00 %
Octocrylene	10.00 %
TEGOSOFT® TIS (Triisostearin)	2.00 %
Microcrystalline Wax	1.20 %
Hydrogenated Castor Oil	0.80 %
ABIL® Wax 9801 (Cetyl Dimethicone)	2.00 %
TEGOSOFT® DEC (Diethylhexyl Carbonate)	2.00 %
Phase B	
Water	40.00 %
Sodium Chloride	0.10 %
EDTA	0.10 %
Propylene Glycol	3.00 %
Phase C	
Propylene Glycol, Diazolidinyl Urea, Methylparaben, Propylparaben (Germaben II, ISP)	0.30 %
Phase Z	
Perfume	q.s.

Processing:

1. Heat phase A to approximately 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.

** Static SPF: 88 (*in-vivo* measurement according to FDA)

DHA Gel with Quick Break Action DCA-5787-38	
Phase A	
ABIL® EM 180	0.80 %
TEGOSOFT® DEC (Diethylhexyl Carbonate)	1.00 %
Cyclopentasiloxane	5.00 %
TEGOSOFT® SH (Stearyl Heptanoate)	1.00 %
TEGOSOFT® TN (C12-15 Alkyl Benzoate)	1.00%
ABIL® Wax 9801 (Cetyl Dimethicone)	0.50 %
Aerosil® R812S (Silica Silylate)	0.80 %
Phase B	
Water	32.70 %
Dihydroxyacetone	4.50 %
Sodium Chloride	0.90 %
Glycerin	29.00 %
Butylene Glycol	18.00 %
Ethanol	4.50 %
Citric Acid (10 % aq.)	q.s.
Phase C	
Propylene Glycol, Diazolidinyl Urea, Methylparaben, Propylparaben (Germaben II, ISP)	0.30 %
Phase Z	
Perfume	q.s.

Processing:

1. Mix phase A and B separately.
2. Adjust the pH of phase B to 3.5 – 4.0.
3. Add phase B to phase A slowly while stirring.
4. Add phase C.
5. Homogenize.

Color Foundation DCA-5787-166	
Phase A	
ABIL® EM 180	2.50 %
TEGOSOFT® CT (Caprylic/Capric Triglyceride)	5.00 %
TEGOSOFT® OP (Ethylhexyl Palmitate)	5.00 %
Dimethicone (10 mPas)	20.00 %
Titanium Dioxide	6.40 %
Red Iron Oxide	0.78 %
Yellow Iron Oxide	0.85 %
Black Iron Oxide	0.27 %
Phase B	
Water	56.10 %
Sodium Chloride	0.80 %
Propylene Glycol	2.00 %
Propylene Glycol, Diazolidinyl Urea, Methylparaben, Propylparaben (Germaben II, ISP)	0.30 %
Phase Z	
Perfume	q.s.

Processing:

1. Mix phase A until uniform.
2. Mix phase B.
3. Add phase B to phase A slowly while stirring.
4. Homogenize.

B 10/2011

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