

Technical Information

# ABIL® EM 180

## High performance emulsifier for all types of W/O formulations

### Intended use

W/O emulsifier

### Benefits at a glance

- 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.

### INCI (PCPC name)

Cetyl PEG/PPG-10/1 Dimethicone



### Chemical and Physical Properties (not part of specifications)

Form	liquid
HLB value	approx. 5

### Properties

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 poly-functional 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 poly-functional structure ABIL® EM 180 MB provides formulations with an extra-ordinary 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 glycerine 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 to 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%

### Hazardous goods classification

Information concerning

- classification and labelling according to regulations for transport of chemicals
- protective measures for storage and handling
- measures in case of accidents and fire
- toxicological and ecotoxicological effects

is given in our safety data sheets.

## Guideline formulations

### Moisture Caring BB Cream SPF 15 (SG 13/16-1)

#### Phase A

<b>ABIL® EM 180</b> (Cetyl PEG/PPG-10/1 Dimethicone)	2.00%
<b>ABIL® Wax 9801</b> (Cetyl Dimethicone)	2.00%
Ethylhexyl Methoxycinnamate; Diethylamine Hydroxyben-zoyl Hexyl Benzoate (Uvinul A Plus B, BASF SE)	10.00%
Cyclopentasiloxane <sup>1</sup>	2.00%

<b>HyaCare® Filler CL</b> (Aqua; Ethylhexyl Stearate; Sodium Hyaluronate Cross-polymer; Polyglyceryl-4 Diisostearate/ Polyhydroxystearate/Sebacate; Sodium Isostearate)	2.00%
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<b>Phytosphingosine</b>	0.10%
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Hydrogenated Castor Oil	0.50%
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Microcrystalline Wax	0.50%
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#### Phase B

Talc (Micro Talk IT Extra-AW)	2.00%
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CI 77891, Titanium Dioxide, Alumina, Triethoxycaprylylsilane (Hombitan AC 360, Huntsman)	4.00%
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CI 77492, Iron Oxides (Unipure Yellow LC 182, Sensient)	0.36%
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CI 77491, Iron Oxides (Unipure Red LC 381, Sensient)	0.12%
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CI 77499, Iron Oxides (Unipure Black LC 989, Sensient)	0.08%
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Silica Dimethylsilylate (AEROSIL R 972 V, Evonik Industries AG)	0.50%
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Nylon-12	2.00%
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<b>TEGOSOFT® OS</b> (Ethylhexyl Stearate)	5.00%
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<b>TEGOSOFT® DEC</b> (Diethylhexyl Carbonate)	6.00%
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#### Phase C

Water	54.29%
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<b>HyaCare®</b> (Sodium Hyaluronate)	0.05%
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Glycerine	5.00%
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Sodium Chloride	0.80%
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#### Phase D

Phenoxyethanol; Ethylhexylglycerin (EUXYL PE 9010, Schülke&Mayr GmbH)	0.70%
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#### Preparation:

1. Disperse the pigments/powders homogeneously in phase B.
2. Heat phase A to approx. 85 °C.
3. Add phase B to phase A with stirring and keep the temperature.
4. Add phase C (80 °C or room temperature) to phases A/B slowly while stirring.
5. Homogenize for a short time.
6. Cool with gentle stirring below 30 °C and add phase D.
7. Homogenize again.

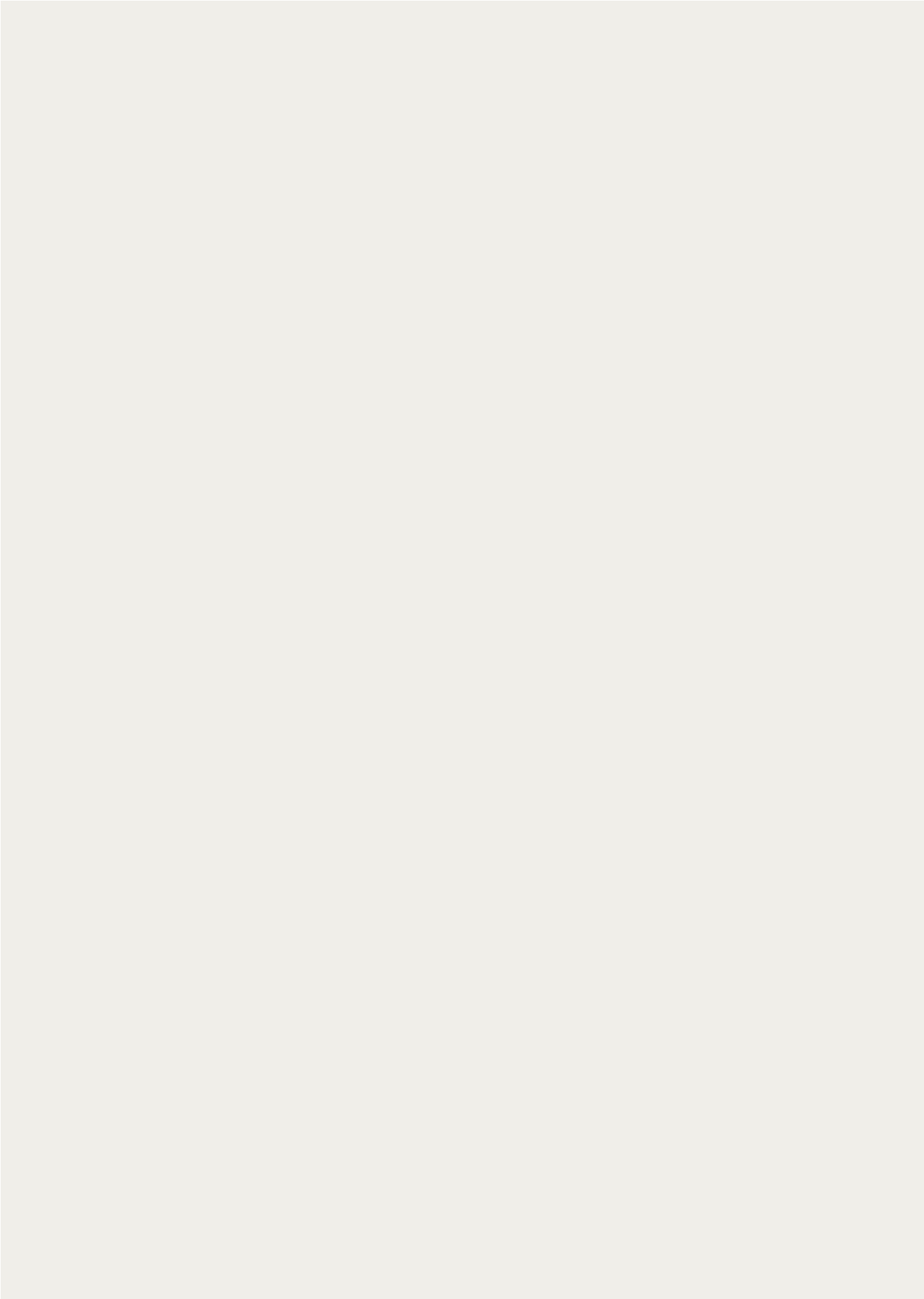
#### Remarks:

Viscosity: 16 Pas (Brookfield RV DV-I, sp. 5, 10 rpm)

Microbiological safety: Challenge test not performed

<sup>1</sup>This formulation contains cyclic silicones (D5 or D6) in relevant concentrations (> 0.1%). Within the European Union and other European countries there will be new regulations shortly in place. Only 0.1% of each compound will be allowed in consumer products.

Therefore this formulation is not anymore suitable for the European market.



### W/O Lotion with 0.5% Emulsifier and 20% Alcohol (H 12/18-2)

#### Phase A

ABIL® EM 180 (Cetyl PEG/PPG-10/1 Dimethicone)	0.50%
Hydrogenated Castor Oil	0.50%
Cera Alba	0.50%
TEGOSOFT® DEC (Diethylhexyl Carbonate)	10.00%
Mineral Oil (30 mPas)	10.00%
Dimethicone (5 mPas)	6.00%
Tocopheryl Acetate	0.50%

#### Phase B

Glycerin	3.00%
Water	47.50%
Sodium Chloride	0.50%

#### Phase C

Alcohol	20.00%
Verstail® PC (Phenoxyethanol; Caprylyl Glycol)	1.00%

#### 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.

#### Remarks:

Viscosity: 10 Pas (Brookfield RV-DV, sp. 5, 10 rpm)

Microbiological safety: Challenge test passed

### Melting Day Shield SPF 20 (BR 16/17-3)

#### Phase A

ABIL® EM 180 (Cetyl PEG/PPG-10/1 Dimethicone)	0.40%
TEGOSOFT® SH (Stearyl Heptanoate)	7.00%
TEGOSOFT® TN (C12-15 Alkyl Benzoate)	2.00%
TEGOSOFT® MM MB (Myristyl Myristate)	1.00%
Dimethicone (20 mPas)	5.00%
Kahlwax 7511 (Ozokerite)	5.00%
Ethylhexyl Methoxycinnamate	6.00%
Diethylamino Hydroxybenzoyl Hexyl Benzoate	2.50%
Tinosorb S (Bis-Ethylhexyloxyphenol Methoxyphenyl Triazine)	2.50%
Ethylhexyl Salicylate	2.00%
Verstail® PC (Phenoxyethanol; Caprylyl Glycol)	1.00%

#### Phase B

Water	60.40%
Glycerin	2.00%
Sodium Chloride	0.20%
Butylene Glycol	3.00%

#### Preparation:

1. Heat phase A & B separately to 85 °C.
2. Add phase B to phase A at 240rpm within 2min.
3. Add phase C, stir well.
4. Homogenize at 1000rpm 2min.

#### Remarks:

SPF: 20, UVA-PF/SPF: 0.44  
(Calculated values, BASF Sunscreen Simulator)

Microbiological safety: Challenge test passed

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