Technical Information

ABIL® EM 120

Multipurpose PEG-free W/O emulsifier with performance benefits in colour cosmetics

Intended use

W/O emulsifier

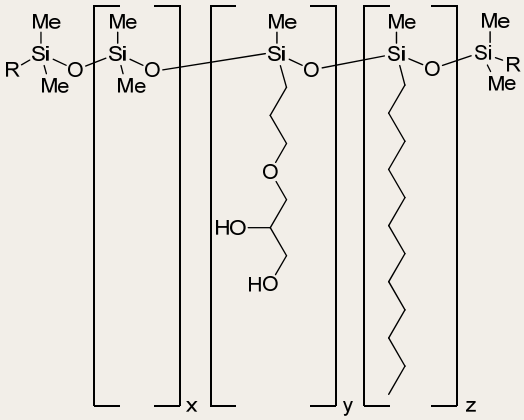
Benefits at a glance

- Enhanced pigment stabilization provides beneficial colour effects in colour cosmetics
- Compatible with both hydrophilic and hydrophobically modified iron oxides
- High performance PEG-free emulsifier for all types of white emulsions
- Recommendable for the formulation of PEG-free W/O AP/Deo emulsions with low whitening effect
- Suitable for hot and cold processing

INCI (PCPC name)

Bis-(Glyceryl/Lauryl) Glyceryl Lauryl Dimethicone (and) Caprylic/Capric Triglyceride

Structure



R = Methyl
Lauryl
Glyceryl

Properties

ABIL® EM 120 is a clear to slightly turbid, odourless liquid. It has an HLB value of approx. 4. The emulsifier content is 86.5 – 89.5 %. The product contains 10.5 % – 13.5 % Caprylic/Capric Triglyceride.

Performance testing

Several colour and stability comparisons have been done to show the performance benefits of ABIL® EM 120. The tested formulations had a comparable viscosity and comparable oil phase content. They either contain waxes or are wax-free systems. The evaluation was done using the L-a-b colour space for describing the colour parameters.

Values were measured in emulsions and on the skin, respectively. One important parameter evaluated was the colour trueness of ABIL® EM 120. The term “colour trueness” describes the colour deviation of a foundation in an emulsion vs colour of the foundation on the skin. It can be shown that ABIL® EM 120 supports the colour trueness of a formulation while applying on the skin resulting in no perceivable difference (figure 1).

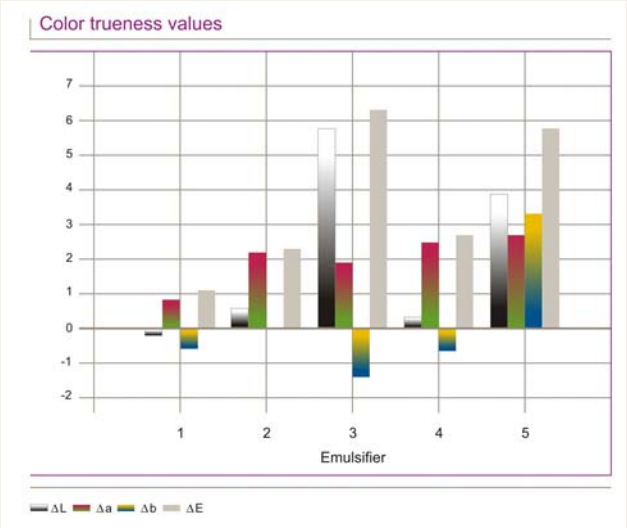


Fig. 1: Colour trueness effect (1 – ABIL® EM 120; 2 – Cetyl PEG/PPG-10/1 Dimethicone; 3 – Cetyl PEG/PPG-10/1 Dimethicone: Polyglyceryl-4 Isostearate 2:1; 4 – Lauryl Polyglyceryl-3 Polydimethylsiloxyethyl Dimethicone; 5 – Amodimethicone Glycerocarbamate).

Another test shows that ABIL® EM 120 is able to enhance the colour intensity of black iron oxides.

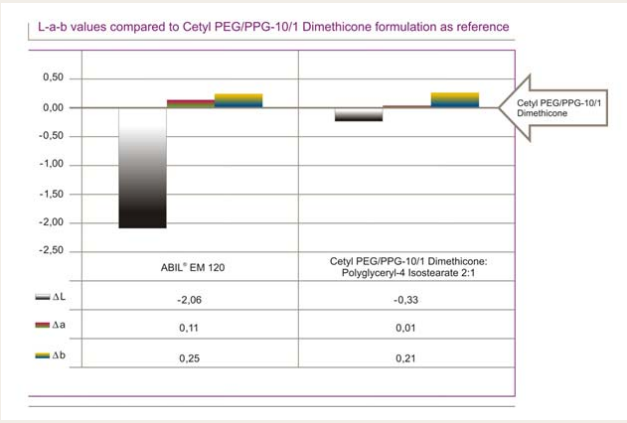


Fig. 2: Colour comparison test based on black iron oxide.

Detailed information is available on request.

Application characteristics

ABIL® EM 120 is a PEG-free W/O silicone-based emulsifier. Because of its polymeric and polyfunctional structure ABIL® EM 120 provides excellent stabilization of W/O emulsions. Due to its chemical structure, ABIL® EM 120 effectively wets pigments resulting in increased formulation stability and beneficial colour effects.

- For make-up formulations an emulsifier concentration in the range of 3.0 – 4.5 % is required to stabilize additional pigment-related interfaces. As typical usage concentration for white emulsions 2.0 – 3.0 % ABIL® EM 120 is recommended. In general no co-emulsifiers are needed to obtain stable emulsions.
- ABIL® EM 120 is especially suitable for pigment containing products like (liquid) foundations, BB creams (Blemish Balm), CC creams (Colour Control) or primers. Even formulations with high pigment loads, e.g. mascaras or eyeliners are possible.
- The compatibility with both hydrophilic and hydrophobized iron oxides is given. Several iron oxide pigments of different suppliers were successfully tested. For titanium dioxides, the use of coated pigments is recommended. ABIL® EM 120 can also be used in combination with organic pigments, e.g. Red 7 lake or chlorophyllin whereas the tolerance towards carbon black is limited.
- ABIL® EM 120 can be generally applied for the formulation of cosmetic W/O creams and lotions.
- ABIL® EM 120 is suitable for the formulation of PEG-free AP/Deo products.
- ABIL® EM 120 can also be used to formulate sun care products.
- Combinations with other emulsifiers can be used to obtain W/O emulsions with different viscosities or sensorial properties, e. g. ABIL® EM 97 S (Bis PEG/PPG-14/14 Dimethicone; Dimethicone) for increased silky skin feel, ABIL® EM 180 (Cetyl PEG/PPG-10/1 Dimethicone) for enhanced stability, ISOLAN® GPS (Polyglyceryl-4 Diisostearate/Polyhydroxystearate/Sebacate) for lower emulsion viscosities or ISOLAN® PDI (Diisostearoyl Polyglyceryl-3 Dimer Dilinoleate) for higher formulation viscosities.
- In general lotions can be formulated at oil phase contents of 25 – 35 % whereas creams require lower oil phase contents in the range of 20 – 30 %.

- ABIL® EM 120 is compatible with all types of cosmetics emollients. This includes silicone and mineral oils as well as fatty acid esters of short and long-chained alcohols and vegetable triglycerides which are often difficult to emulsify.
- Consistency-enhancing or emulsion-stabilizing waxes can be used in combination with ABIL® EM 120. Recommended is a 1 : 1 combination of hydrogenated castor oil and microcrystalline wax.
- It is possible to use ABIL® EM 120 for the cold processing of W/O lotions or foundations. In such formulations a viscosity enhancing and stabilizing system in the oil phase is mandatory. 0.5 % disteardimonium hectorite or zinc stearate proved to be most effective.
- Electrolytes are required in amounts of 0.8 to 2.0 %. Sodium chloride or magnesium sulfate heptahydrate are the most common options that can be recommended for this purpose. For pigment-containing emulsions the use of magnesium sulfate heptahydrate can be beneficial in order to obtain a constant long-term viscosity.
- The addition of 3.0 – 5.0 % of polyols such as glycerin can be beneficial to enhance the freeze stability of W/O emulsions. For colour cosmetics, in some cases, especially the use of propanediol or butylene glycol can support emulsion stability and constant long term viscosity.

Influence on the viscosity of the emulsion

The viscosity of W/O emulsions based on ABIL® EM 120 can be adjusted by 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 if low viscous oils in a formulation are replaced by higher viscous oils or if waxes are added; even at a concentration of 0.5 to 2.0 %.

2. Phase ratio

In emulsions with a high content of dispersed phase – as in the cosmetic W/O emulsions – the viscosity increases significantly when the proportion of the dispersed internal phase is increased.

The reason for this is the interaction between the dispersed water droplets which becomes stronger with the increased packing density. Therefore ABIL® EM 120 creams on average have lower oil content than lotions. Beside increasing the internal water phase also addition of particles as pigments are leading to more densely packed external oil phases and thus to higher viscosities.

3. Degree of dispersion

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

Preparation

A pre-requisite for this is 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 may transiently reach 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. Homogenization should be carried out below 30 °C in order to ensure that the waxes have recrystallized.

It is possible to manufacture W/O Lotions based on ABIL® EM 120 in a cold process. In such formulations additives like disteardimonium hectorite or 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.

For processing pigment containing formulations it is favourable to prepare a pre-mixture of ABIL® EM 120, pigments, waxes and a part of the oils and homogenize it with an Ultra Turrax until the pigments are uniformly distributed. Alternatively, a three roll mill can be used to prepare the pre-mixture. After adding the other components of the oil phase, subsequent manufacturing is identical to the standard procedures for processing W/O emulsions described before.

Emulsifying machines

Stirring equipment or planetary mixers with high sheering force are suitable for the manufacture of creams and lotions in the laboratory and production scale, provided that they can insure 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

3.0 – 4.5 % ABIL® EM 120 for colour cosmetics
2.0 – 3.0 % ABIL® EM 120 for white emulsions

Packaging

25 kg canister
200 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 **F 53/10-12**	
Phase A	
ABIL® EM 120 (Bis-(Glyceryl/Lauryl) Glyceryl Lauryl Dimethicone (and) Caprylic/ Capric Triglyceride)	2.50%
Zinc Stearate	0.50%
TEGOSOFT® OP (Ethylhexyl Palmitate)	8.00%
TEGOSOFT® AC (Isoamyl Cocoate)	9.00%
Prunus Amygdalus Dulcis Oil	4.00%
Phase B	
Glycerin	3.00%
Sodium Chloride	1.00%
Water	72.00%
Phase Z	
Preservative*, Perfume	q.s.

Processing

1. Charge phase A and add phase B slowly while stirring.
2. Homogenize.

Remark

Formulation has been tested with 0.70% Phenoxyethanol; Methylparaben, Propylparaben, Ethylparaben (Phenonip XB, Clariant AG).

Mattifying Make-Up Foundation SZ 24/13-1	
Phase A	
ABIL® EM 120 (Bis-(Glyceryl/Lauryl) Glyceryl Lauryl Dimethicone (and) Caprylic/ Capric Triglyceride)	4.50%
TEGOSOFT® CT (Caprylic/Capric Tri-glyceride)	5.00 %
Dimethicone (5 mPas)	8.80%
TEGOLON® ECO 10-10 (Nylon-10/10)	2.00%
Unipure White LC 987 AS-EM (Titanium Dioxide; Triethoxycaprylylsilane (CI 77891)	5.00%
Unipure Yellow LC 182 AS-EM (Iron Oxides (CI 77492))	0.60%
Unipure Red LC 381 AS-EM (Iron Oxides (CI 77491))	0.35%
Unipure Black LC 989 AS-EM (Iron Oxides (CI 77499))	0.10%
Phase B	
Cyclopentasiloxane	3.50%
Bentone 38 V CG (Disteardimonium Hectorite)	1.00%
Propylene Carbonate	0.50%
Phase C	
Water	62.15%
Magnesium Sulfate Heptahydrate	1.50%
Glycerin	5.00%
Phase Z	
Preservative*, Perfume	q.s.

Processing

1. Preparation of phase B: Charge cyclopentasiloxane, add disteardimonium hectorite slowly while stirring (dispers disc), mix until uniform (disperser disc), add propylene carbonate and mix until uniform (disperser disc).
2. Mix phase A until uniform (Ultra Turrax).
3. Add phase B to phase A and stir well.
4. Add phase C to phases A/B slowly while stirring.
5. Homogenize.

Remarks

Formulation has been tested with 0.70% Euxyl PE 9010 (Schülke & Mayr GmbH) and with 0.50% Versatil PC (Dr. Straetmans).

Clear W/O Sun Care Fluid SPF 30 1/3 UVA SG 64/12-4	
Phase A	
ABIL® EM 120 (Bis-(Glyceryl/Lauryl) Glyceryl Lauryl Dimethicone (and) Caprylic/ Capric Triglyceride)	4.00%
Ethylhexyl Methoxycinnamate	5.00%
Cyclopentasiloxane	15.00%
Phase B	
Glycerin	25.00%
Sodium Chloride	1.00%
Disodium Phenyl Dibenzimidazole Tetra-sulfonate (22% aq., pH value adjusted to 7.0 with Triethanolamine)	50.00%
Phase Z	
Preservative, Perfume	q.s.

Processing:

1. Prepare phase A and B separately.
2. Add phase B to phase A slowly while stirring.
3. Homogenize.

Remark

To obtain a clear product the refractive index of phases A and B must be identical.

Colour Control Fluid SPF 25 SG 36/14-1	
Phase A	
ABIL® EM 120 (Bis-(Glyceryl/Lauryl) Glyceryl Lauryl Dimethicone (and) Caprylic/ Capric Triglyceride)	4.00%
TEGOSOFT® DEC (Diethylhexyl Carbonate)	6.20%
TEGOLON® 12-20 (Nylon-12)	2.00%
Cyclopentasiloxane	8.00%
Uvinol A Plus B (Ethylhexyl Methoxy-cinnamate; Diethylamino Hydroxybenzoyl Hexyl Benzoate)	10.00%
Micro Talc IT Extra-AW (Talc)	2.00%
Hombitan AC 360 (CI 77891, Titanium Dioxide, Alumina, Triethoxycaprylylsilane)	5.00%
Unipure Yellow LC 182 (CI 77492, Iron Oxides)	0.50%
Unipure Red LC 381 (CI 77491, Iron Oxides)	0.20%
Unipure Black LC 989 (CI 77499, Iron Oxides)	0.10%
Timiron Splendid Gold (Titanium Dioxide; Mica; Silica)	0.25%
Phase B	
Cosmedia Gel CC (Dicaprylyl Carbonate; Stearalkonium Hectorite; Propylene Carbonate)	5.00%
Phase C	
Water	48.25%
Glycerin	3.00%
Sodium Chloride	1.50%
TEGO® Cosmo C 250 (1-Methylhydantoin-2-Imide)	1.00%
TEGO® Pep 4-Even (Tetrapeptide-30; Glycerin)	2.00%
TEGO® Stemlastin (Cyanadium Caldarium Extract; Water)	1.00%
Phase Z	
Preservative*, Perfume	q.s.

Processing

1. Prepare phase A and disperse the pigments/powders with Ultra Turrax until uniform.
2. Add phase B to phase A and stir well.
3. Prepare phase C separately.
4. Add phase C slowly while stirring to phases A/B.
5. Homogenize.

Remarks

Formulation has been tested with 1.0% Benzyl Alcohol, Ethylhexyl Glycerin (Euxyl K 900, Schülke & Mayr GmbH).

Anti-Aging Day Care MK 1/13-1	
Phase A	
ABIL® EM 120 (Bis-(Glyceryl/Lauryl) Glyceryl Lauryl Dimethicone (and) Caprylic/ Capric Triglyceride)	3.00%
TEGOSOFT® AC (Isoamyl Cocoate)	7.50%
TEGOSOFT® DEC (Diethylhexyl Carbonate)	7.00%
HyaCare® Filler CL (Water, Ethyhexyl Stearate, Sodium Hyaluronate Crosspolymer, Polyglyceryl-4 Diisostearate/Polyhydroxystearate/Sebacate, Sodium Isostearate)	2.50%
Tocopherol	0.50%
TEGOLON® ECO 10-10 (Nylon-10/10)	2.00%
Phase B	
Water	62.10%
Sodium Chloride	0.80%
Glycerin	4.00%
Butylene Glycol	4.00%
TEGO® Pep 4-Even (Tetrapeptide-30; Glycerin)	2.50%
Sodium Ascorbyl Phosphate	1.50%
Urea	2.50%
Sodium Bisulfite	0.10%
Phase Z	
Preservative*, Perfume	q.s.

Processing

1. Prepare phases A and B separately and adjust the pH of phase B to 7.0.
2. Add phase B to phase A slowly while stirring.
3. Homogenize.

Remark

Formulation has been tested with 0.70% Phenoxyethanol; Ethylhexylglycerin (Euxyl PE 9010, Schülke & Mayr GmbH).

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