ABIL® WE 09

Emulsifier for the formulation of W/O creams and lotions

- Formulations of sunscreen products with high sun protection factor
- Formulations with all kinds of cosmetic oils
- High compatibility with active ingredients
- Emulsions with high heat and freeze stability
- Liquid at room temperature

Personal Care

INCI name (CTFA name)

Polyglyceryl-4 Isostearate; Cetyl PEG/PPG-10/1 Dimethicone; Hexyl Laurate

Chemical and physical properties (not part of specifications)

Form	liquid
HLB-value	approx. 5

Application

ABIL® WE 09 is a liquid nonionic W/O emulsifier which is distinguished by high emulsifying and emulsion-stabilizing action. The extremely favourable usage characteristics are achieved by the combination of a polyglycerol fatty acid ester with a silicone surfactant, the characteristic of which is the polymeric and polyfunctional structure.

- ABIL® WE 09 allows the preparation of cosmetic W/O creams and lotions.
- The amount required, referred to the emulsion, is 4 - 6 %.
- Waxes for adjusting consistency and stabilizing the emulsions are required in amounts of 1.5 - 3.0 %. Amongst others, hydrogenated castor oil in combination with high-melting hydrocarbon waxes or beeswax are suitable.
- The content of the oil phase (including the emulsifiers) can be varied between 19 % and 35 %.
- In principle, all known lipoid bases can be incorporated: fatty acid esters of short- and long-chain alcohols, paraffin oils, native triglycerides, lanolin and silicone derivates.
- Substances with specific properties, such as plant extracts, UV-filters, moisturizers and antiperspirants, are well tolerated by the emulsions.
- Creams and lotions are distinguished by high stability towards heat and freezing. Stable emulsions between -25 °C and +60 °C are attainable.
- Emulsions, the oil phase of which consists predominantly of substances with good spreading properties, can be easily rubbed into the skin and are rapidly absorbed by the latter. On the other hand, creams which contain high viscous oils, e. g. vegetable triglycerides, for a "more rich" skin feeling, maintain good application properties.
- Sunscreen preparations are distinguished by high sun protection factors with respect to the amount of filter used.

Influence on the viscosity of the emulsion

The viscosity of the W/O emulsions based on ABIL® WE 09 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 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® WE 09 creams on average have lower oil contents than lotions. Depending on the emulsifiable substances, creams can be prepared about 19 - 30 % of oil phase, lotions about 23 - 35%.

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.

Interactions between content of oil phase, degree of dispersion and stability

These mutual influences, which are stability-determining, may be illustrated as follows: The viscosity of the emulsions decreases, when the content of oil phase is increased; it increases when the emulsification is intensified and the degree of dispersion is thereby made finer.
Thus, for example, moderate stirring of 20 % of a mixture of ABIL® and paraffin oil and 80 % of aqueous phase forms a viscous lotion. An emulsion of the same viscosity is formed when 30 % of the above oil phase and 70 % of aqueous phase are homogenized very intensively using a colloid stirrer. Preparations, in which the oil phase content lies between these limits can be prepared by appropriate

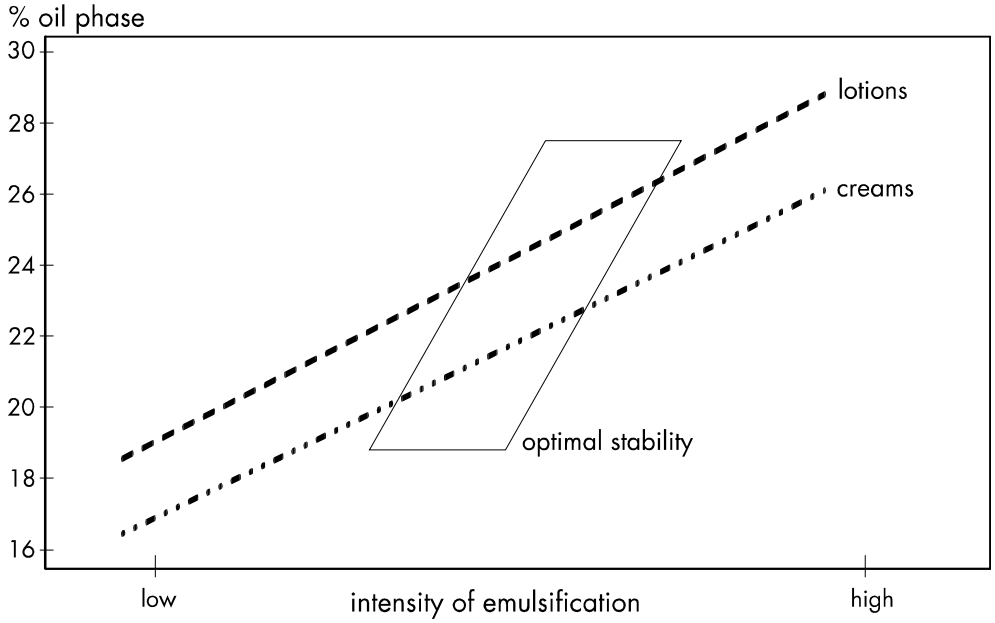
stepwise reduction of the energy of emulsification. In contrast to the viscosity, the stabilities of these emulsions are at different levels. 22 – 24 % lotions of paraffin oil which have been prepared by intensive stirring or comparable emulsification in a rotor-stator apparatus, lie in the optimum range. Paraffin oil creams of equal viscosity which have been prepared under appropriate conditions contain 16 – 26 % of oil phase; the optimum stability range is 19 – 21 % (see graph).

The graphs are based on emulsions of the following composition:

ABIL® WE 09/paraffin oil (1 : 4)
16.0 – 30.0 %

Aqueous sodium chloride solution (1 %)
84.0 – 70.0 %

The viscosity of the lotions is about 5.000 mPas, that of the creams about 22.000 mPas (rotation viscosimeter).



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 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 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

4.0 - 6.0 % ABIL® WE 09

Packaging

190 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.

Guide Line Formulations

W/O Lotion BK 05/94	
Phase A	
ABIL® WE 09	5.0 %
TEGOSOFT® OS (Ethylhexyl Stearate)	6.0 %
TEGOSOFT® liquid (Cetearyl Ethylhexanoate)	6.0 %
Isohexadecane	6.0 %
Microcrystalline Wax (Paracera W 80, Paramelt B.V.)	0.5 %
Hydrogenated Castor Oil	0.5 %
Phase B	
Sodium Chloride	0.5 %
LACTIL® (Sodium Lactate; Sodium PCA;Glycine; Fructose;Urea; Niacinamide; Inositol; Sodium Benzoate; Lactic Acid)	2.0 %
Water	73.5 %
Preservative, Parfum	q.s.

W/O Cream F 1/95	
Phase A	
ABIL® WE 09	5.0 %
Jojoba (Buxus Chinensis) Oil	2.0 %
Mineral Oil	8.0 %
ABIL® Wax 9801 (Cetyl Dimethicone)	2.0 %
TEGOSOFT® CT (Caprylic/Capric Triglyceride)	2.0 %
Microcrystalline Wax (Paracera W 80, Paramelt B.V.)	1.2 %
Hydrogenated Castor Oil	0.8 %
Phase B	
Sodium Chloride	0.5 %
Water	78.5 %
Preservative, Parfum	q.s.

W/O Cream with Avocado Oil BK 03/94	
Phase A	
ABIL® WE 09	5.0 %
TEGOSOFT® CT (Caprylic/Capric Triglyceride)	10.0 %
Avocado (Persea Gratissima) Oil	10.0 %
Microcrystalline Wax (Paracera W 80, Paramelt B.V.)	1.2 %
Hydrogenated Castor Oil	0.8 %
Phase B	
Sodium Chloride	0.5 %
Water	72.5 %
Preservative, Parfum	q.s.

W/O Sun Protection Cream (high SPF) Ma 28/98	
Phase A	
ABIL® WE 09	5.00 %
ISOLAN® GI 34 (Polyglyceryl-4 Isostearate)	1.00 %
Mineral Oil (30 mPas)	2.00 %
Cyclopentasiloxane	6.25 %
ABIL® Wax 9801 (Cetyl Dimethicone)	3.00 %
Ceresin	1.00 %
Hydrogenated Castor Oil	0.50 %
Tocopheryl Acetate	1.00 %
Retinyl Palmitate	0.25 %
Ethylhexyl Methoxycinnamate	7.50 %
Zinc Oxide; Dimethicone (Z-Cote HP 1, BASF)	10.00 %
Phase B	
Phenylbenzimidazole Sulfonic Acid (30 %)	10.00 %
Sodium Chloride	0.50 %
Water	52.00 %
Preservative, Parfum	q.s.

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