Technical Information

May 2010

Cremophor® RH Grades

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BASF
The Chemical Company

Personal Care Ingredients

Chemical nature

The Cremophor RH Grades are non-ionic solubilizers and emulsifying agents obtained by reacting hydrogenated castor oil with ethylene oxide.

The main constituents of both Cremophor RH Grades are glyceryl polyethylene glycol oxystearate, which, together with fatty acid glyceryl polyglyceryl esters, form the hydrophobic part of the product. The hydrophilic part consists of polyethylene glycol and glyceryl ethoxylate.

Grades

Cremophor RH 40 conforms to the current Ph. Eur./USP requirements, whereas the Cremophor RH 60 conforms to the Ph. Eur. requirements. The Cremophor RH 410 is a cosmetic grade.

Product	INCI name	CAS No.	PRD No.*
Cremophor RH 40 Surfactant	PEG-40 Hydrogenated Castor Oil	61788-85-0	30035134
Cremophor RH 410 Surfactant	PEG-40 Hydrogenated Castor Oil	61788-85-0	30035135
Cremophor RH 60 Surfactant	PEG-60 Hydrogenated Castor Oil	61788-85-0	30035153

* BASF´s commercial product numbers.

Properties

The undiluted Cremophor grades are white to yellowish soft or flowing pastes at 23 °C. The diluted Cremophor grade RH 410 is a colorless to yellowish, slightly cloudy, viscous liquid at 23 °C.

All Cremophor grades have the outstanding feature that their aqueous solutions have a very faint odor.

The information in the following table is correct at the time of going to press. It does not necessarily form part of the product specification.

Cremophor	Unit	RH 40	RH 410	RH 60
Density at 23 °C	g/cm³	approx. 1.04	approx. 1.07	approx. 1.04
Viscosity at 23 °C at 60 °C	mPa·s	– approx. 195	approx. 2100 approx. 250	– approx. 200
pH value, 5 % aqueous	–	6 – 8	6 – 8	6 – 8
Concentration	%	100	90	100
Solidification point	°C	approx. 10	< 5	approx. 15
Melting point	°C	approx. 20	< 5	approx. 27
Dropping point	°C	approx. 28	< 5	approx. 32
Surface tension, 1g/l at 23 °C	mN/m	approx. 41	approx. 42	approx. 40
HLB value	–	14 – 16	14 – 16	15 – 17
Molecular weight	g/mol	approx. 2500	approx. 2500	approx. 2800

Specification

See separate document: “Standard Specification” available via BASF’s WorldAccount: https://worldaccount.basf.com (registered access).

Solubility

Cremophor grades form nearly clear solutions in water, ethanol and isopropanol, and in essential oils and other hydrophobic compounds, e.g. vitamins and alpha-bisabolol.

Cremophor grades can be mixed with other Cremophor grades. With gentle heating, they form clear mixtures with fatty acids and fatty alcohols.

Stability

Non-diluted Cremophor grades are chemically very stable. Prolonged exposure to heat can cause phase separation once the product cools down. But the product can be restored to its original form by homogenization.

The Cremophor grades are stable in aqueous-alcoholic solutions. They are also largely stable in purely aqueous solutions within a pH range of 4 to 8. The use of strong bases or acids should be avoided due to saponification of the esters.

Cremophor grades in formulations can be sterilized by heating to 120 °C. Allowance must be made for the fact that this can cause a slight decrease in the pH value. The aqueous solution can be stabilized by common cosmetic preservatives.

Cremophor Grades are largely insensitive to water hardness.

Shelf life

The Cremophor grades are stable for at least 2 years if stored in the original sealed containers in a dry place at room temperature.

Storage

a) The Cremophor grades should be stored indoors in a dry place. Storerooms must not be overheated.

b) The Cremophor grades are hygroscopic, and care needs to be taken to exclude moisture. Drums must be tightly resealed each time they are opened.

c) The storage temperature should not be allowed to fall below the melting point if at all possible.

d) Drums that have solidified or that have begun to precipitate should be reconstituted by gently stirring and heating, preferably in a heating cabinet. The temperature must not be allowed to exceed 60 °C. This also applies if drums are heated by external electric elements. Internal electric elements should not be used because of the localized anomalies in temperature that they cause.

e) The method for production of the Cremophor grades ensures that they are practically sterile. If the containers are repeatedly opened, microorganisms may grow in the product, particularly if the equipment used is not sterile.

Application

The Cremophor grades are used to solubilise ethereal oils, perfume compositions, vitamins and hydrophobic active substances in aqueous- alcoholic and purely aqueous solutions. The finished preparations are particularly stable.

The Cremophor grades show little tendency to foaming, which is particularly important for solutions in aqueous ethanol. Further foam suppression can be obtained by adding a small amount of defoamer.

As an example of the solubilising capacity it is given for Cremophor RH 40 in the table below. The table is a rough guide, showing the content of Cremophor RH 40 needed to solubilize 1 g of essential oil in 30 g ethanol or isopropanol.

1 g of essential oils and perfumery synthetics	Content of Cremophor RH 40 in 30 g ethanol	Content of Cremophor RH 40 in 30 g isopropanol
Bergamot oil	2.5	1.1
Geranium oil, African	1.4	1.4
Eucalyptus oil 1 a extra rect. 80/85%	0.6	0.5
Lavender oil	1.5	1.2
Patchouli oil, Singapore	2.5	1.1
Peppermint oil, double rect.	1.1	1.2
Vetiver oil, Reunion	1.6	1.5
Isophytol	2.1	1.5
Linalool	1.5	1.5
Linavi acetate	2.0	1.1
Nerolidol	2.1	2.1
Methyl anthranilate	2.1	0.9

The following two diagrams demonstrate the concentrations of Cremophor RH 40 which are needed to solubilize vitamin A palmitate and vitamin E acetate in a clear aqueous solution.

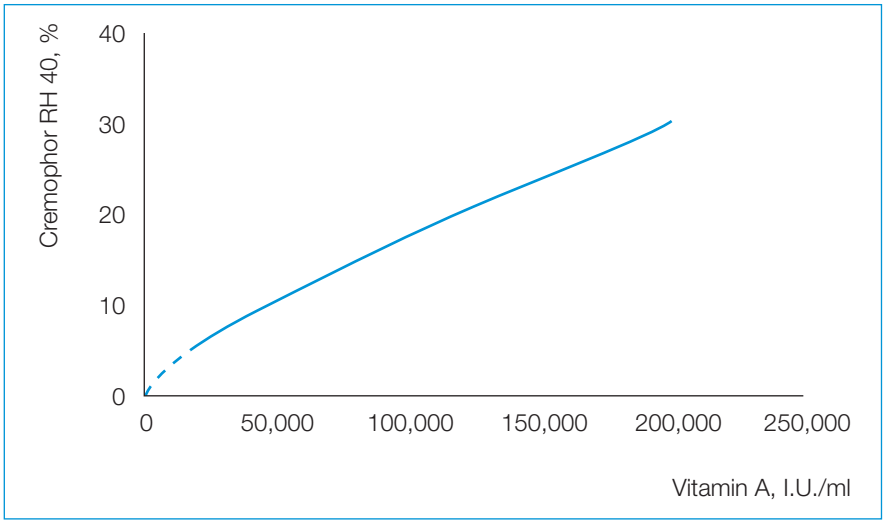

Fig. 1 Solubilization of vitamin A palmitate 1.7 million I.U./g

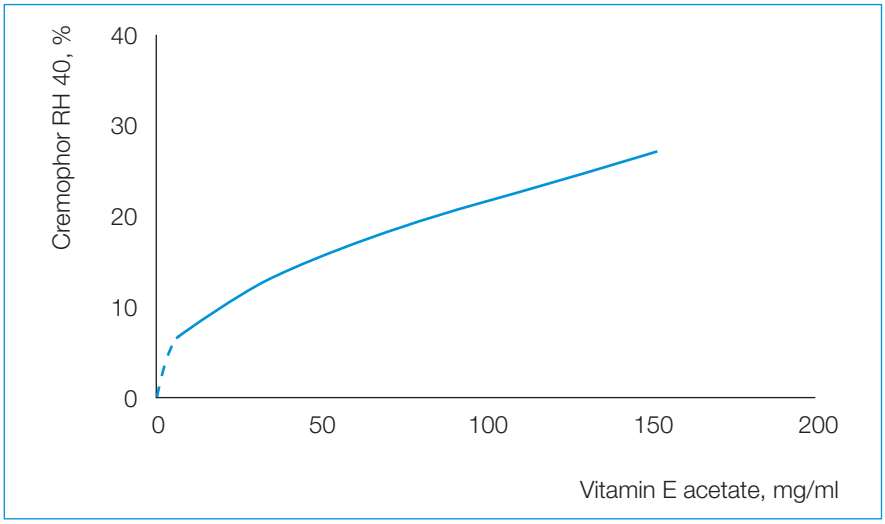

Fig. 2 Solubilization of vitamin E acetate

Processing notes

Before use the product should be homogenized by heating to max. 60 °C and stirring.

The general use of Cremophor as solubilizer is as followed:

Mix the fragrance with the solubilizer and dissolve this mixture in the alcohol before adding the specified quantity of water. With very low alcohol concentrations, and particularly with purely aqueous preparations, it is recommended to add the water very slowly with vigorous stirring at 35 – 40 °C. The viscosity initially increases, as a result of hydration, reaching a maximum at approx. 40 % of water. The viscosity then decreases as further water is added.

If water is initially added too quickly, a turbid solution may result.

Typical formulations

Skin conditioning gel with vitamins **No. 62/00099 V003**

	%	Ingredients	Supplier	INCI name
A	4.00	Cremophor RH 410	(1)	PEG-40 Hydrogenated Castor Oil
	15.00	Ethanol		Alcohol
	0.10	Bisabolol rac.	(1)	Bisabolol
	0.50	Vitamin E-Acetate Care	(1)	Tocopheryl Acetate
	q.s.	Perfume		
B	3.00	D-Panthenol USP	(1)	Panthenol
	0.60	Carbopol 940 Polymer	(6)	Carbomer
	76.00	Water dem.		Aqua dem.
C	0.80	Triethanolamine Care	(1)	Triethanolamine

Production: Dissolve phase A clearly.
Allow phase B to swell and neutralize it with phase C.
Stir phase A into the neutralized phases B + C and homogenize.

Properties: Viscosity: 57,600 mPa·s Brookfield RVD VII+
pH value: 7.7

Sun protection cream, SPF 20 **No. 53/00484 V001**

	%	Ingredients	Supplier	INCI name
A	7.00	Uvinul MC 80	(1)	Ethylhexyl Methoxycinnamate
	4.00	Tinosorb S	(1)	Bis-Ethylhexyloxyphenol Methoxyphenyl Triazine
	4.00	Cremophor RH 40	(1)	PEG-40 Hydrogenated Castor Oil
	0.40	Cremophor WO 7	(1)	PEG-7 Hydrogenated Castor Oil
	4.00	Cetiol B	(27)	Dibutyl Adipate
	4.00	Cosmacol ESI	(11)	Tridecyl Salicylate
	2.00	Lanette O	(27)	Cetearyl Alcohol
B	4.00	T-Lite Max	(1)	Titanium Dioxide, Dimethoxydi-phenylsilane/ Tricrosspolymer
C	0.20	Edeta BD	(1)	Disodium EDTA
	3.00	Glycerin 86 – 88%	(20)	Glycerin
	0.80	Keltrol	(66)	Xanthan Gum
	62.10	Water dem.		Aqua dem.
D	3.00	Xiameter PMX-0245 Cyclopentasiloxane	(16)	Cyclopentasiloxane
	1.00	Euxyl K 300	(42)	Phenoxyethanol, Methylparaben, Butylparaben, Ethylparaben, Propylparaben, Isobutylparaben
	0.50	Vitamin E-Acetate Care	(1)	Tocopheryl Acetate

Production: Heat phase A to 80 °C, add phase B and homogenize for 3 minutes. Heat phase C to 80 °C and stir it into combined phases A + B while homogenizing. Cool to 40 °C while stirring, add phase D and homogenize again.

Properties: Viscosity: 4,350 mPa·s Brookfield RVD VII+
pH value: 5.7
Sun Protection Factor: 20

Hair tonic **No. 03/00019 V001**

	%	Ingredients	Supplier	INCI name
A	1.50	Cremophor® RH 40	(1)	PEG-40 Hydrogenated Castor Oil
	q.s.	Perfume		
	0.10	Bisabolol rac.	(1)	Bisabolol
	73.90	Water dem.		Aqua
B	2.00	D-Panthenol 50 P	(1)	Panthenol, Propylene Glycol
	2.00	Luviquat® FC 550	(1)	Polyquaternium-16
	0.50	Luviskol® K 30	(1)	PVP
	20.00	Ethanol 96%		Alcohol

Production: Solubilize phase A. Weigh phase B into phase A and dissolve clearly.

Properties: pH value: 7.0

Bath oil **No. 57/00014 V000**

	%	Ingredients	Supplier	INCI name
A	10.00	Luvitol EHO	(1)	Cetearyl Ethylhexanoate
	30.00	Cremophor RH 410	(1)	PEG-40 Hydrogenated Castor Oil
	1.00	Pine Oil	(212)	Pine (Pinus Sylvestris) Oil
	2.00	Sweet Almond Oil		Prunus Amygdalus Dulcis (Sweet almond) Oil
	1.00	Vitamin E-Acetate Care	(1)	Tocopheryl Acetate
	0.20	Bisabolol rac.	(1)	Bisabolol
	0.20	DL-alpha Tocopherol Care	(1)	Tocopherol
	25.60	Cetiol HE	(27)	PEG-7-Glyceryl-Cocoate
B	30.00	Texapon WW99	(27)	MIPA-Laureth Sulfate, Laureth-3, Cocoamide DEA

Production: Mix the components of phase A.
Add phase B into phase A.

Safety

An investigation of the raw material gave no indication of harmful effects to health if the substance is used for the stated applications and concentrations. Due to large variety of applications and possible combinations with other products, users are responsible for their own safety assessment of their products.

Please refer to the latest safety data sheets for detailed information on classification, labelling and product safety.

Supplier

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20. **Merck KGaA**
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27. **Cognis Deutschland GmbH – Care Chemicals**
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