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Ethylhexylglycerin – Tips, Tricks and Things to Think About

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the plus of pure performance



Formulation Factors

Surface tension

Contact angles of aqueous solutions



Theory - ethylhexylglycerin reduces interfacial tension on cell wall of organisms





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Test organism: Pseudomonas aeruginosa, contact time: 1 min



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Synergy

Germ count reduction in tap water



0.1 % Ethylhexylglycerin
0.9 % Phenoxyethanol
1.0 % PE / EHG blend

cfu = colony forming units

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Germ count reduction in tap water









Effect of ethylhexylglycerin on stability

- · Surfactant-like molecular structure may influence stability and/or viscosity
- HLB value of approximately 7.5 is between the typical HLB values of emulsifier systems. This can cause a shift toward the opposite emulsion type and potentially destabilize some formulations

When to incorporate ethylhexylglycerin

- Usually, stability of emulsions is not influenced by the method of incorporating ethylhexylglycerin
 - · can be added to the oil phase, to the water phase or after emulsification
- · Occasionally, order of addition might effect stability of emulsion
 - · emulsions stabilized by liquid crystals order of addition is critical

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HLB effects

O/W Lotion

O/W emulsion I

INCI	% w/w
PHASE A	
Ceteareth-12	1.5
Ceteareth-20	1.5
Glyceryl stearate	4.0
Cetearyl alcohol	1.0
Isopropyl palmitate	4.0
Isononyl isononanoate	4.0
C 12-15 Alkyl benzoate	2.0
Ethylhexylglycerin	3.0
PHASE B	
Aqua	q.s.
Glycerin	3.0
Xanthan gum	0.1

O/W emulsion II

INCI	% w/w
PHASE A	
Ceteareth-12	2.0
Ceteareth-20	2.0
Glyceryl stearate	4.0
Cetearyl alcohol	1.0
Isopropyl palmitate	4.0
Isononyl isononanoate	4.0
C 12-15 alkyl benzoate	2.0
Ceterayl alcohol, sodium cetearyl sulfate	2.0
PHASE B	
Aqua	q.s.
Glycerin	3.0
Xanthan gum	0.3
PHASE C	
Ethylhexylglycerin	3.0

Solutions to restore stability of O/W emulsions

- · Increase the HLB of the emulsifier system by:
 - · changing the ratio of emulsifiers
 - · changing the emulsifier system
- Increase the amount of main emulsifier
 - ethylhexylglycerin affects the emulsion interface. By increasing the amount of main emulsifier the interface will be strengthened.
- Addition of a polymeric emulsifier (e.g. inulin lauryl carbamate)
 - polymeric emulsifiers are quite HLB independent. The decrease in HLB caused by ethylhexylglycerin will not destabilize the emulsion
 - polymeric emulsifiers prevent the agglomeration of the dispersed phase by steric shielding



Cold-processed W/O lotion

W/O emulsion I

INCI	% w/w
PHASE A	
PEG-7 hydrogenated castor oil	3.0
Polyglyceryl-3-diisostearate	1.0
Zinc stearate	1.0
Hexyl laurate	6.0
Cetearyl isononanoate	7.0
Dicaprylylether	7.0
Hexyldecanol	3.0
Ethylhexylglycerin	3.0
PHASE B	
Water	q.s.
Glycerin	5.0
Magnesium sulfate	1.0

W/O emulsion II

INCI	% w/w
PHASE A	
PEG-7 hydrogenated castor oil	3.8
PEG-30 Dipolyhydroxystearate	0.8
Zinc stearate	2.0
Hexyl laurate	5.2
Cetearyl isononanoate	6.1
Dicaprylylether	5.2
Hexyldecanol	2.5
Ethylhexylglycerin	3.0
PHASE B	
Water	q.s.
Glycerin	5.0
Magnesium sulfate	1.0

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HLB effects

Solutions to restore stability of W/O emulsions

- Decrease the HLB of the emulsifier system by:
 - · changing the ratio of emulsifiers
 - · changing the emulsifier system
- Increase the amount of main emulsifier
 - ethylhexylglycerin affects the emulsion interface. By increasing the amount of main emulsifier the interface will be strengthened
- · Increase the amount of salt
 - ethylhexylglycerin increases the solubility/dispersability of the emulsifier in water. By increasing the salt, the solubility of the emulsifier in water is decreased
- Addition of a polymeric emulsifier (e.g. PEG-30 Dipolyhydroxystearate)
 - polymeric emulsifiers are quite HLB independent. The increase in HLB caused by ethylhexylglycerin will not destabilize the emulsion

Solutions to restore viscosity of W/O emulsions

- Optimize homogenization. A too high speed or too long homogenization can destabilize W/O emulsions.
 - ethylhexylglycerin stabilizes meta-stable small droplets, which can affect the viscosity



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HLB effects

Summary

- Higher concentrations of ethylhexylglycerin may negatively influence the stability of emulsions
- · Stable emulsions can be achieved by
 - · changing the manufacturing system
 - · increasing or modifying the emulsifier system
 - · adjusting viscosity
 - · adjusting the HLB value
 - · adding consistency agents

Formulating – High Oil Phase Systems

O/W Sun Lotion SPF 30

INCI Name	Function	%
PHASE A		
Water		Q.5
Microcrystaline cellulose, cellulose	Thickening agent	1.5
Xanthan gum	Thickening agent	0.2
Glycerin	Humectant	3.0
Tetrasodium dicarboxymethyl glutamate (38% aq)	Chelating agent	0.5
Citric acid	pH-Adjuster	0.4
Potassium cetyl phosphate	Emulsifier	2.0
PHASE B		
C12-15 alkyl benzoate, dipropylene glycol dibenzoate, PPG-15 stearyl		
ether benzoate	Emollient	11.5
Octocrylene	UVB filter	10.0
Bis-ethylhexyloxyphenol methoxyphenyl triazine (BEMT)	UVA/UVB filter	2.0
Ethylhexyl methoxycinnamate		
(Octinoxate)	UVB filter	1.5
Butyl methoxydibenzoylmethane		
(Avobenzone)	UVA filter	2.5
Tricontanyl PVP	Film former, water- resistance improver	1.0
Cetyl alcohol	Co-emulsifier	0.3
Glyceryl stearate	Co-emulsifier	1.0
Titanium dioxide (95%), trimethoxycaprylylsilane	UVA/UVB filter	3.0
PHASE C		
Alcohol	Solvent	5.0
PHASE D		
Ethylhexylglycerin	Skin care additive	Q.5
, , , , ,	Preservative / multifunctional	
	additive	0.5
		100.0

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Formulating – High Oil Phase Systems

O/W Sun Lotion SPF 30

			Inoc	ulation Cy	cles		
	0	1	2	3	4	5	6
Unpreserved	-	+++ M	+++ M	./.			
+ 1.0% phenoxyethanol/ ethylhexylglycerin blend	-	++ M	+ M	+ M	+ M	+ M	+ M
+ 1.0% phenoxyethanol/ ethylhexylglycerin blend + 0.5% ethylhexylglycerin	-	-	-	-	-	-	-

0	= Sterility control	-	= free of microbial growth
В	= Bacteria	+	= slight growth
M	= Moulds	++	= moderate growth
Sp	= Sporeforming Bacteria	+++	= massive growth
Y	= Yeasts		-

Formulating – High Ethoxylate Rinse-off

Gentle Skinfeel Foam

INCI Name	Function	%
PHASE A		
Sodium laureth sulfate	Surfactant	21.00
Sodium cocoyl apple amino acids	Fruit surfactant	5.00
Fragrance	Fragrance	0.10
Water		Q.S.
PHASE B		
Lactic acid	Humectant	0.15
Preservative	Preservative	Q.S.
		100.00

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Formulating – High Ethoxylate Rinse-off

Gentle Skinfeel Foam

	Inoculation Cycles						
	0	1	2	3	4	5	6
Unpreserved	-	+++ B	+++ B	+++ B,M,Y	./.		
+ 1.0% phenoxyethanol/ ethylhexylglycerin blend	-	++ B	++ B	+++ B	+++ B	./.	
+ 0.1% CMI/MI blend	-	-	-	-	-	-	-
+ 1.0% phenoxyethanol/ paraben blend	-	+ B	+ B	+ B	++ B	++ B	++ B
+ 1.0% diazolidinyl urea/ organic acid blend	-	-	-	-	-	-	-

0	= Sterility control	-	= free of microbial growth
В	= Bacteria	+	= slight growth
M	= Moulds	++	= moderate growth
Sp	 Sporeforming Bacteria 	+++	= massive growth
Y	= Yeasts		-

Aesthetic Factors

Skin Feel

Skin-feel

Skin care additive

- Ethylhexylglycerin improves the skin-feel of cosmetic formulations, especially if high amounts of glycerin are used
- Test design:
 - · sensory assessment of a moisturizing cream
 - test material: O/W formulations with glycerin
 - · 20 test subjects
 - · application on the inner forearms
 - evaluation from 0 10

cream with 8% glycerin

cream with 8% glycerin and 1% ethylhexylglycerin

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Overall impression

- Ethylhexylglycerin improves the overall impression of a cream.
 - Also tested:
 - reduced tackiness
 - increased speed of penetration
 - reduced soaping
 - reduced greasiness

Fragrance-fixative

Results

Ingredient Name	Boosting	Fixating	Fresher Scent	Softer Scent
Cinnamyl Alcohol	Х	Х		
Aldehyde C-10 (Decanal)	Х	Х		
Aldehyde C-16 (Ethyl Methylphenylglycidate)	Х	Х		
Citral*			Х	
Citronellal			Х	
Hydroxycitronellal*		Х		
Cinnamal*	Х	Х		
Musk Ketone	Х	Х		
Diphenyl Ether		Х		
Citronellol*			Х	
Linalool*			Х	
Alpha-Terpineol	Х	Х		

* 76/768/EEC Article 6 (1)(g) substance

Results

Ingredient Name	Boosting	Fixating	Fresher Scent	Softer Scent
Amyl Salicylate		Х		
Anethole			Х	
Benzyl Acetate				Х
Isobornyl Acetate	Х	Х		
Linalyl Acetate				Х
Linalyl Isobutyrate	Х	Х		Х
Menthanyl Acetate				Х
Methyl Anthranilate	Х			
Caryophyllene	Х	Х		
Amande Amère	Х	Х		
Niaouli			Х	
Patchouli Brun Huile Essence				Х

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Fragrance-fixative

Conclusion

- Ethylhexylglycerin is a booster and fixative for many fragrance ingredients
 - lower use concentration
 - longer lasting fragrance



Conclusion

- No correlation between effect and structure of fragrance ingredients
- Interactions might occur between single ingredients in perfume compositions
- · Influence of cosmetic formulations on performance and scent of perfume

Panel test on the influence of ethylhexylglycerin on perfumes in different formulations

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• = most noticeable scent with ethylhexylglycerin

Conclusion

- Boosting and fixating properties of ethylhexylglycerin depends on perfume and formulation of the final product
- The effect of ethylhexylglycerin is strongest in the perfume with the lowest
 substantivity
- · Each perfume should be checked on a case-by-case basis



Formulation Factors:

- · Surface tension boosts preservation by lowering surface tension on cell wall
- · Synergy with other traditional / non-traditional preservatives
- HLB 7.5 some changes to emulsification system or order of addition may be required to improve stability
- · Not effective in highly ethoxylated rinse-off systems
- · Higher levels plus chelating agent needed in high oil phase systems

Aesthetic Factors:

- · Skin-feel can alter aesthetics of product
- Fragrance-fixing can improve adhesion of milder fragrances
 - other oily substances sunscreens? transfer-resistant lip products?

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Thank you for your kind attention!

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