

EASTMAN

Eastman **GEM**[™]
retinyl linoleate

Antiaging formulation with
Eastman GEM[™] retinyl linoleate
and sustainably produced
Eastman GEM[™] 2-ethylhexyl palmitate

Maximize the efficacy of retinyl linoleate in a formulation optimized for skin by science.

This retinyl linoleate formulation uses Eastman GEM™ 2-ethylhexyl palmitate and other carriers to create a liquid crystalline lamellar-phase emulsion base for enhanced delivery of lipophilic actives like retinyl linoleate. The liquid crystal emulsion structure shows superior moisturization when compared to conventional emulsion structures and can provide enhanced resistance to wash off.¹

Part	Ingredient/INCI name	Wt%	Product name	Suggested manufacturer	Function
A	—	60.9	Water	—	—
A	Cetearyl alcohol (and) sodium cetearyl sulfate	6.0	Kolliphor® CS A	BASF	Emulsifier
A	Propanediol	10.0	Zemea®	DuPont Tate & Lyle	Solvent
A	Betaine	1.0	Genencare® OSMS BA	DuPont	Active
B	Ethylhexyl palmitate	20.0	Eastman GEM™ 2-ethylhexyl palmitate	Eastman	Emollient
B	Retinyl linoleate	0.1	Eastman GEM™ retinyl linoleate	Eastman	Active
C	Acacia senegal gum	1.0	KerrPoly GA	Kerry	Polymer
D	Caprylhydroxamic acid (and) caprylyl glycol (and) glycerin	1.0	Spectrastat™	Inolex	Preservative

Procedure

1. Heat and mix part A until uniform and fully melted/dispersed.
2. Remove heat, and propeller stir at medium speed.
3. Add part B with medium stirring when part A reaches 45°C or below.
4. Add part C with propeller stirring.
5. Add part D with propeller stirring.

Formulation notes

Solubility models of different formulation ingredients and skin models predict that efficacy of retinyl linoleate can be maximized using either 2-ethylhexyl palmitate or triheptanoin as an emollient in formulation. Both of these emollients are predicted to have the proper balance of solvency and molar volume to help retinyl linoleate achieve optimal bioavailability. The use of a liquid crystal emulsifier can further enhance the stability and aesthetics of your formulation containing retinyl linoleate.

¹Mark Chandler, ACT Solutions and FFE software; Kim et al., July 18, 2013, *Cosmetics & Toiletries*

Five reasons why you should use Eastman GEM™ retinyl linoleate in your antiaging formulation

1. Better bioavailability and efficacy

Retinyl linoleate is a liquid at room temperature. In their pure forms, retinol and retinyl palmitate are both solids. Topical liquids diffuse 10,000 times faster into skin than solids. Retinyl linoleate has been shown to have greater bioavailability than retinyl palmitate in an in vitro skin model, and molecular models predict superior stratum corneum interaction of retinyl linoleate compared with either retinol or retinyl palmitate.²

2. Reduced irritation

Retinol is an excellent topical antiaging ingredient proven to reduce the signs of skin aging. Retinol can be irritating when applied to skin, so it is often delivered in the form of a pro-retinol ester. Retinyl linoleate was proven to be less irritating to skin than retinyl acetate.³

3. Stability

Retinol can be very difficult to stabilize in a formulation, and advanced formulation techniques and technology may be required. Retinol is sensitive to heat, light, oxidation, pH extremes, and chemical degradation and reactivity, especially in a formulation. Retinyl linoleate is more formulation stable over time than either retinol or retinyl acetate. Eastman GEM retinyl linoleate is also stable for at least 48 months when stored unopened at room temperature.⁴

4. Ease of formulation

Pure retinol (vitamin A) palmitate is a thick, waxy solid at room temperature and must be melted prior to formulation. When retinol is stabilized in a blend, it can add unwanted ingredients to a formulation, such as oils or preservatives. Eastman GEM retinyl linoleate is available in a 100% active form that is a liquid at room temperature and can be formulated in a cold process.

5. Quality and sustainability

Eastman's enzymatic esterification process yields a high-purity ingredient without using harsh solvents or producing unwanted by-products. Since the conditions of the GEM enzymatic process are less severe than typical chemical synthesis processes, the end-product color is lower than retinyl linoleate made by chemical esterification.⁵

² M. Chandler & G. Baki, 2014, *EuroCosmetics* 3: 26–28; <http://www.jwsolutions.com/>. The active skin gap (ASG) is a prediction of the capability of a molecule to interact with the stratum corneum based on molecular modeling. A low ASG indicates good bioavailability in a variety of formulations. The ASG of retinyl linoleate (5.93) is lower than either retinol or retinyl palmitate (6.20 and 9.11).

³ Kafi et al., 2007, *Archives of Dermatology* 143: 606–612; A. Barua & H Furr, 2007, *Properties of Retinoids, Methods in Molecular Biology* Vol. 89, C. Redfern Ed. Humana Press; U.S. Patent 5,885,595

⁴ A. Barua & H Furr, 2007, *Properties of Retinoids, Methods in Molecular Biology* Vol. 89, C. Redfern Ed. Humana Press; U.S. Patent 5,885,595

⁵ U.S. Patent 7,566,795



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