ELEVATE ALL SUNSCREEN FORMULATIONS WITH *ENHANS*

Koster Keunen's *Enhans* products deliver SPF efficiency, superior esthetics, broad spectrum protection and cost-effective economics in sunscreen formulations. As a result of changing regulations and consumer needs, sunscreen formulations must provide benefits beyond UV protection. These requirements trigger challenges during the course of formulation that can be solved using *Enhans* chemistry.

Enhans Products by Koster Keunen

Koster Keunen created a line of multi-functional ingredients ideal for use in sun care applications. The Enhans portfolio offers effective sunscreen boosting technology, moisturization, and increase broad spectrum results.

Enhans CY-62: Bis-PEG-12 Dimethicone Candelillate

Enhans PC-38: Polyethylene, Polycyclopentadiene, Stearoxy Dimethicone

Enhans PE-65: Polyethylene, Stearoxy Dimethicone

Enhans SB-63: Bis-PEG-12 Dimethicone Beeswax

Enhans SC-78: Copernicia Cerifera (Carnauba) Wax, Stearoxy Dimethicone

Enhans SB-63 and *Enhans* PC-38

Enhans SB-63 and *Enhans* PC-38 work synergistically in sunscreen formulations. Studies show the following results:

- Increased SPF on average of 15% in a sunscreen formula versus the same formula with conventional ingredients.
- Maintained SPF values while reducing the amount of sunscreen filters by up to 20%.
- Proven cost savings by reducing traditional film formers, boosters, and sunscreen ingredients.
- Improved emulsion esthetics.
- Measured moisture in treated vs untreated skin with an increase up to 130% hydration.

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Increase SPF in Sunscreen Emulsions *With Enhans SB-63 and Enhans PC-38*

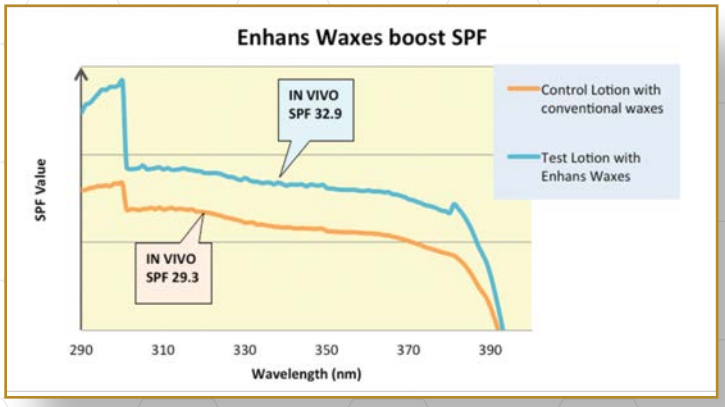


Figure 1. UV-VIS spectrum and In Vivo SPF Boost

SPF boosts were observed in test formulas when ***Enhans SB-63*** and ***Enhans PC-38*** were used to replace conventional waxes. Initial screening tests were performed in-house on a UV/VIS Spectrometer (DU 500, Beckman Coulter, Inc.) to estimate SPF values. Samples were sent to a 3rd party laboratory for In-Vivo testing to determine SPF values. The results show an SPF boost on all In-Vivo tested products utilizing ***Enhans Waxes***.

Improve Sunscreen Emulsion Esthetics *With Enhans SB-63 and Enhans PC-38*

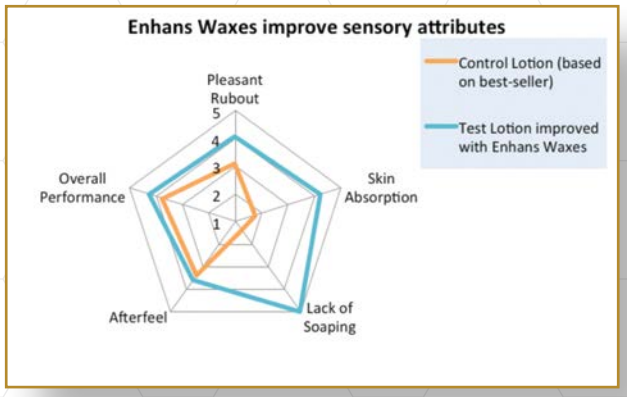


Figure 3. Panel results - Sensory

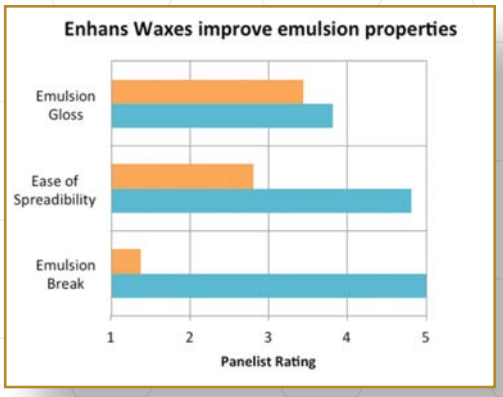


Figure 4. Panel Results - Emulsion

Overwhelming esthetic improvements were seen by a 17 participant panel (13 females and 4 males; ages 25-55). The panel was presented with two SPF 30 facial moisturizers*. Panelists evaluated all aspects of sensory experience from initial appearance of the product to rub out properties, absorption and after feel. Ratings were given from a scale of 1 (strongly dislike) to 5 (strongly like).

*The control (LB5C-30): based on a top best-selling facial moisturizer with SPF 30.
*The test product (LB6E-30): based on above with Enhans SB-63 and Enhans PC-38 formulated in and the sunscreen filters reduced by 12%.

Reduce Costs in Sunscreen Emulsions *With Enhans SB-63 and Enhans PC-38*

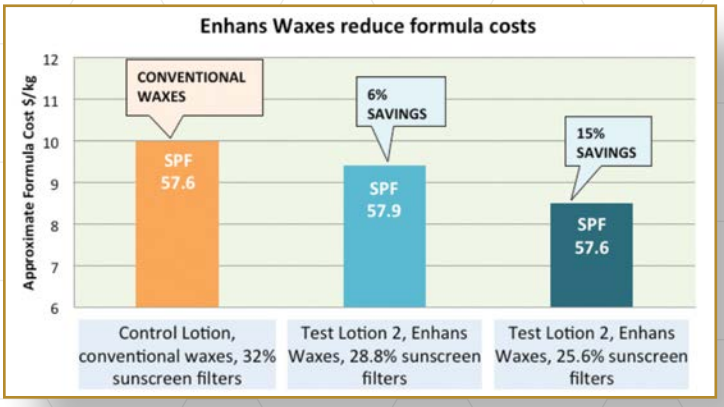


Figure 2. Approximate formula costs with and without Enhans Waxes.

Test formulations were prepared with 10% and 20% reduction in organic sunscreens compared to control formulas. Initial screening tests were performed in-house on a UV/VIS Spectrometer (DU 500, Beckman Coulter, Inc.) to estimate SPF values based on absorption. Based on this initial screening, samples were sent to a 3rd party laboratory for In-Vivo testing to determine SPF values. These results show that by adding ***Enhans SB-63*** and ***Enhans PC- 38***, SPF values remain constant while decreasing formulation cost.

Boost Skin Moisturization *With Enhans SB-63 and Enhans PC-38*

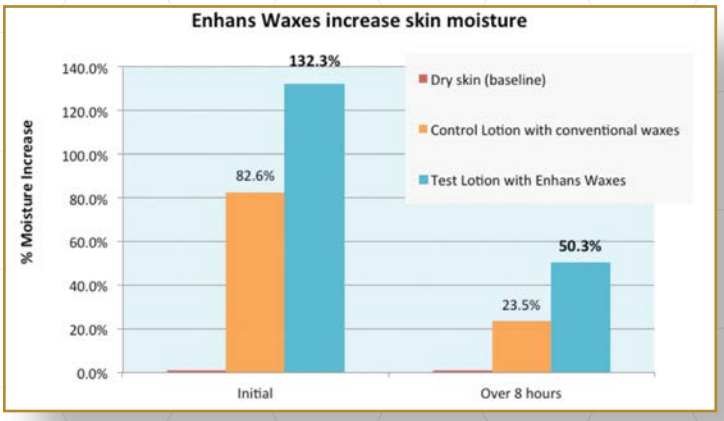
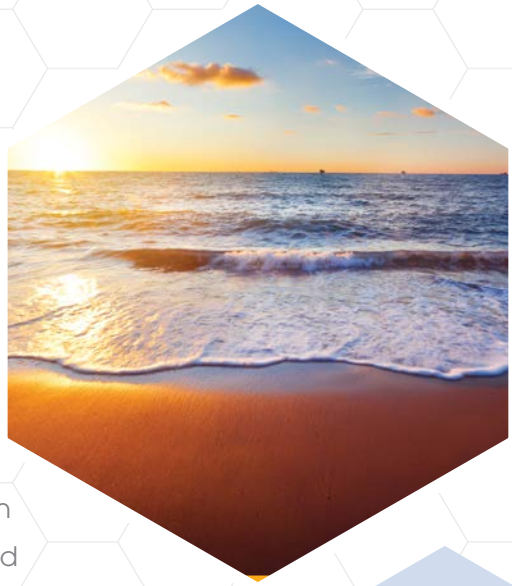


Figure 5. Moisture increase in SPF50+ Sunscreen Lotions



Skin moisturization increases were found following a multi-subject skin moisture test. Results show that all test formulas with Enhans SB-63 and Enhans PC-38 increase skin moisture versus control formulas without, regardless of SPF value, chemical composition or subject skin type. The moisture was measured using a skin impedance meter (DPM 9003, Nova Technology Corporation).

Sunscreen Lotion SPF 30	Control Lotion LB5C-20	Test Lotion LB6E-20
Ingredient Name	%	%
Phase A		
Aqua, Glycerin, Phenoxyethanol, Caprylyl Glycol, Xanthan gum, Disodium EDTA	64.0	64.0
Phase B		
Kostol PGP	3.0	3.0
Kester Wax K-82P	0.5	0.5
Beeswax	3.0	--
Polyethylene	1.5	--
Enhans SB-63	--	3.0
Enhans PC-38	--	1.5
Avobenzone	3.0	3.0
Octisalate	5.0	5.0
Homosalate	10.0	10.0
Octocrylene	10.0	10.0
In Vivo SPF	29.3	32.9

Table 1: Sunscreen formula pairs sent for In Vivo testing

Sunscreen Lotion SPF 50	Control Lotion LB5C-50	Test Lotion LB9E-50	Test Lotion LB10E-50
Ingredient Name	%	%	%
Phase A			
Aqua, Glycerin, Phenoxyethanol, Caprylyl Glycol, Xanthan gum, Disodium EDTA	59.0	62.2	65.4
Phase B			
Kostol PGP	4.0	4.0	4.0
Kester Wax K-82P	0.5	0.5	0.5
Beeswax	3.0	--	--
Polyethylene	1.5	--	--
Enhans SB-63	--	3.0	3.0
Enhans PC-38	--	1.5	1.5
Homosalate	13.0	11.7	10.4
Octocrylene	7.0	6.3	5.6
Octisalate	5.0	4.5	4.0
Oxybenzone	4.0	3.6	3.2
Avobenzone	3.0	2.7	2.4
In Vivo SPF	57.6	57.9	57.6
Approximate Cost $/kg*	10.0	9.4	8.5
Cost Savings		6%	15%

Table 2: Sunscreen formulas SPF 50+ with estimated costs
*MOQ prices from raw material sources

Facial Moisturizer SPF 30	Control Lotion LB5C-30	Test Lotion LB6E-30
INCI Name	%	%
Phase A		
Aqua, Glycerin, Phenoxyethanol, Caprylyl Glycol, Acrylates/C10-30 Alkyl Acrylates Crosspolymer, Sodium Hydroxide, Disodium EDTA	75.5	76.9
Phase B		
Permulgin D	1.0	1.0
Glyceryl Stearate, Peg-100 Stearate	2.0	2.0
Behenyl Alcohol	3.0	--
Polyethylene	1.5	--
Enhans SB-63	--	3.0
Enhans PC-38	--	1.5
Avobenzone	2.0	1.7
Octisalate	4.0	3.6
Homosalate	4.0	3.6
Octocrylene	2.0	1.7
Isononyl Isononanoate	5.0	5.0
Estimated SPF (In Vitro)	30	30
Approximate Cost $/kg	5.7	5.7

Table 3: Facial moisturizer SPF 30 formulas for panel testing

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