



POLARGEL® UV SPF Boosting Technology

Polargel® UV is a multifunctional additive that provides the following benefits to OTC sunscreen products:

- Boosts the SPF of sunscreen formulations to achieve target SPF values using lower concentrations of UV filters – reducing formula costs.
- Reduces the greasiness associated with the use of organic sunscreens - yields formulations with a more elegant dry, silky feel.
- Provides powerful polyphenolic antioxidant properties to formulations.

Polargel® UV is a viscous, aqueous dispersion of sodium bentonite clay, a wood extract, a pigment and dispersants that is produced via a proprietary manufacturing process.

Product	INCI Names	Recommended Use Levels	Description and Typical Use
Polargel® UV - 1416	Water, bentonite, larix europeae wood extract, sodium polyacrylate, titanium dioxide*, xanthan gum, phenylpropanol, propanediol, caprylyl glycol and tocopherol	3 – 5%	Polargel® UV 1416 is recommended for facial products with SPF where improved skin feel is desired. Also recommended for beach products and other moderate to high SPF formulas requiring water resistant performance.

I. Performance: Polargel® UV was evaluated in both in-vivo and in-vitro studies for its ability to boost SPF. In Figure 1, a typical SPF 15 water-in-oil formula was made with and without Polargel® UV. As indicated by the chart, the inclusion of just 3.75% Polargel® UV resulting in over a 2x boost in measured SPF values based on both in vitro and clinical studies.

Figure 1

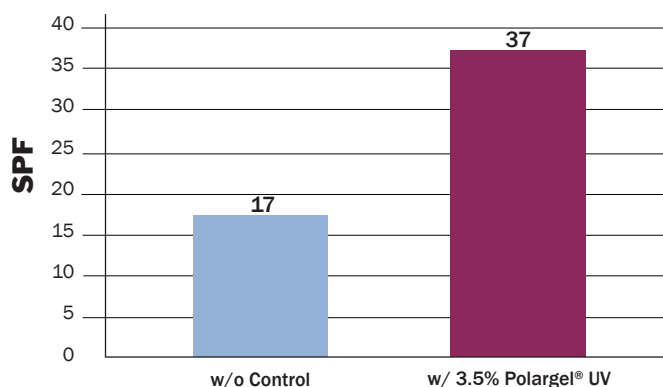
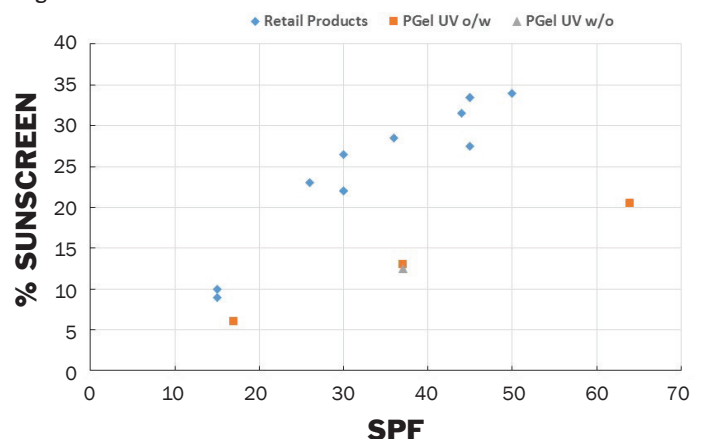


Figure 2

SPF VS. SUNSCREEN ACTIVE CONCENTRATION



*The titanium dioxide used in the formula is a pigment additive and does not function as a sunscreen in formulations using Polargel® UV.

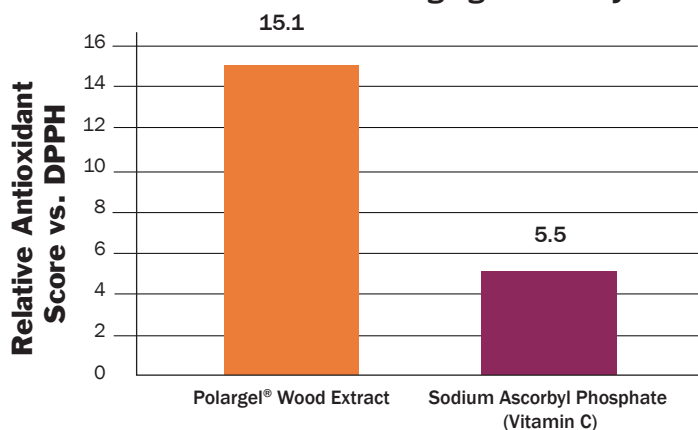




An important benefit of Polargel® UV-1416 is the cost savings achieved by using less sunscreen actives to achieve a desired SPF value. Figure 2 shows the results of a survey of commercially available water-resistant sunscreen products. SPF values were plotted against total sunscreen content for each of the products. Figure 2 also contains data for Polargel® UV containing sunscreens (both o/w & w/o formulations) that compares sunscreen concentrations with SPF values obtained via 20 person in-vivo SPF testing. The results of the comparison indicate that, with the use of Polargel® UV, target SPF values can be achieved using less of the expensive sunscreen actives – as much as 50% less as shown in the data.

Another important benefit of Polargel® UV in sunscreen formulations is its powerful antioxidant properties. The wood extract present in the product (larix europeae wood extract) is a polyphenolic compound that quenches free radicals. The data in Figure 3 shows the ability of the extract to quench free radicals via reaction with a standard free radical (Diphenylpicryl hydrazyl; DPPH). The results show that the extract in Polargel® UV is 2.7 times more effective at quenching free radicals than sodium ascorbyl phosphate (a form of vitamin C) which is a widely used antioxidant.

Figure 3 **Free Radical Scavenging Efficiency**



II. Use Guidelines:

Polargel® UV should be added to the water phase. It is recommended to make a slurry with a portion of water. If using Carbomer or other anionic thickener, the emulsion should be made first and the Polargel® UV should be post added. Carbomer concentrations below 0.3% are recommended. Non-ionic thickeners such as xanthan gum are recommended for additional viscosity and product stabilization. In o/w emulsions, Polargel® UV performance is maximized by using anionic emulsifiers such as lactylates, stearates, and cetyl phosphate. Sodium hydroxide is recommended as a neutralizer.

III. Formulations – Example formulations have been developed and SPF tested that include SPF values from SPF 15 – 70. These include sprays and lotion formulas and employ organic and mineral sunscreen actives. These formulas are available upon request. An example of an SPF 70 sunscreen formulation featuring Polargel® UV 1416 is provided below.





Example Formulation – SPF 70 Sunscreen Featuring Polargel® UV 1416

Phase	Ingredient	Wt. %
A	Water	57.515
	Acrylates/C10-30 Alkyl Acrylate Crosspolymer ¹	0.375
	Phenoxyethanol / Ethylhexylglycerin ²	0.970
	Disodium EDTA	0.050
	Butylene Glycol	3.000
	Aloe Extract	0.150
	Ascorbyl Phosphate	0.030
	Chlorphenesin	0.250
	Sodium Cetearyl Sulfate	1.200
B	Homosalate	9.000
	Octisalate	5.000
	Octocrylene	2.000
	Oxybenzone	6.500
	Avobenzone	3.000
	Methyl Glucose Sesquistearate	1.000
	Glyceryl Stearate	1.000
	Cetearyl Alcohol (70/30)	1.000
	VP/Eicosene Copolymer ³	2.800
	Tocopheryl Acetate	0.100
	Retinyl Palmitate	0.010
	Dimethicone (10 cst)	1.000
C	Sodium Hydroxide (50 %)	0.300
D	POLARGEL® UV 1416	3.750
Total		100.000

Formulation Guidelines

Mix Phase A ingredients together and heat to 75 °C. Combine Phase B ingredients together and heat to 75 °C. Once both Phases are at temperature, add Phase B into Phase A and homogenize to make a stable emulsion. Add Phase C to bring the pH of the emulsion between 7 and 7.5 and begin to cool the emulsion down to ambient. Phase D can be added at any time during the cooling down of the product. Alternatively, POLARGEL® 1416 can be added to Phase A at the start of the process with similar results.

SPF Results

Control product (without POLARGEL® UV 1416)	SPF 34
Formulation with POLARGEL® UV 1416	SPF 74

¹CARBOPOL® Ultrez 21 – product of The Lubrizol Corporation

²Euxyl PE 9010 – product of Schülke & Mayr GmbH

³Ganex V-220 – Ashland Inc.

⁴POLARGEL® UV 1416 – product AMCOL Health and Beauty Solutions. POLARGEL is registered trademark of AMCOL International Corporation.

