

DERMACRYL® AQF Film Forming Polymer

Efficient in systems containing organic and inorganic UV actives



Today's sunscreens go everywhere! Considered an everyday necessity, sunscreens are being incorporated into skin care and makeup products that require excellent aesthetics while still providing rub-off and water resistance. DERMACRYL AQF polymer offers proven *in-vivo* water resistance that is paired with a great skin feel.

DERMACRYL AQF polymer (INCI Name: Acrylates Copolymer) is well suited for use as a water resistant film former in emulsion sunscreen formulations. It is a virtually universal ingredient suited for formulating spray emulsions as well as traditional creams and lotions. The DERMACRYL AQF polymer works well in systems that contain organic UV actives, inorganic actives, or combinations of the two. In addition, both UVA and UVB filters may be incorporated into these formulations, thereby allowing the formulation of systems that offer broad-spectrum protection.

Application Areas

Daily wear moisturizers with SPF, recreational sun protection products, tinted sun protection products, color cosmetics, face, body and hand creams and lotions.

Features and Benefits

Feature	Benefit
Film-formation	Proven water resistance and SPF retention Resistant to rub off
Low Viscosity, Polymer Emulsion	Easy-to-use No heat or neutralization required Exceptional sprayability in spray emulsion No impact on formulation viscosity
Broad Acceptability	Safety tested for use in spray applications Globally approved

Suggested Use Levels (as supplied)

Application	% Total Solids
Sun Protection	2.0% - 5.0%
SPF Daily Wear Moisturizer	1.0% - 3.0%
Tinted Sunscreens	1.0% - 5.0%
Color Cosmetics	1.0% - 20.0%
Creams and Lotions	1.0% - 5.0%

Suggested pH range of final formulation: 5 - 7



Formulation Guidelines

Supplied as a liquid aqueous emulsion, DERMACRYL AQF polymer is easily dispersed in the water phase of oil-in-water emulsions. DERMACRYL AQF polymer can either be added into the water phase prior to forming the emulsion or post added after the emulsion is formed. It requires no heat or neutralization and can be used in either hot or cold emulsification processes. The material can be used at typical sunscreen formulation pH ranging from pH = 5 to 7.

Compatibility

Sunscreen Actives

DERMACRYL AQF polymer performs well in the typical sunscreen formulation pH range, pH 4 to 8. It has excellent compatibility with commonly used sunscreen actives, including Ethylhexyl Methoxycinnamate (Octinoxate), Ethylhexyl Salicylate (Octisalate), Benzophenone-3 (Oxybenzone), Homosalate, Octocrylene, Avobenzene, and Zinc Oxide. DERMACRYL AQF polymer is sensitive to some coatings in Titanium Dioxide (TiO₂) dispersions. The following grades of titanium dioxide dispersions have good compatibility with the polymer and can be used as starting points when formulating TiO₂ containing sunscreens with DERMACRYL AQF polymer.

Table 1: Titanium Dioxide Compatibility

Supplier	Trade Name	INCI Designation
Croda	Tioveil AQ-G	Titanium Dioxide (and) Alumina (and) Silica (and) Sodium Polyacrylate
	Solaveil CT 100	C12-15 Alkyl Benzoate (and) Titanium Dioxide (and) Polyhydroxystearic Acid (and) Aluminum Stearate (and) Alumina
	Solaveil CT-10W	Water (and) Titanium Dioxide (and) Isodeceth-6 (and) Oleth-10 (and) Aluminum Stearate (and) Alumina (and) Simethicone
	Tioveil 50 FIN	C12-15 Alkyl Benzoate (and) Titanium Dioxide (and) Polyhydroxystearic Acid (and) Aluminum Stearate (and) Alumina
Kobo	GCP50VTTS	Caprylic / Capric Triglyceride (and) Titanium Dioxide (and) Alumina (and) Polyhydroxystearic Acid (and) ITT/ TCS Crosspolymer
Granula	Granlux MSN50	Titanium Dioxide (and) Apricot Kernel Oil PEG 40 Esters (and) Cetearyl Alcohol (and) Cetearyl Glucoside (and) Hydrogenated Decene Oligomers (and) Dimethicone (and) Alumina

Pigment Coatings

DERMACRYL AQF polymer shows good compatibility with commonly used pigment coatings. These pigments were tested at a 10% use level in a screening emulsion containing Ethylhexyl Methoxycinnamate and included pigments coated with the following: Dimethicone Copolyol, Triethoxy Caprylylsilane, Triethoxy Caprylylsilane, Isopropyl Titanium Triisostearate, Perfluoroalcohol Phosphate, bonded Dimethylpolysiloxane, Disodium Steroyl Glutamate.

Salts

For formulations containing electrolytes, (i.e. water in oil or water in silicone emulsions), DERMACRYL AQF polymer has good salt tolerance. The polymer (4% active tested) can tolerate up to 1% and 2% of magnesium sulfate and sodium chloride, respectively, as well as any level of sodium citrate (maximum salt level tested: 4% by weight).

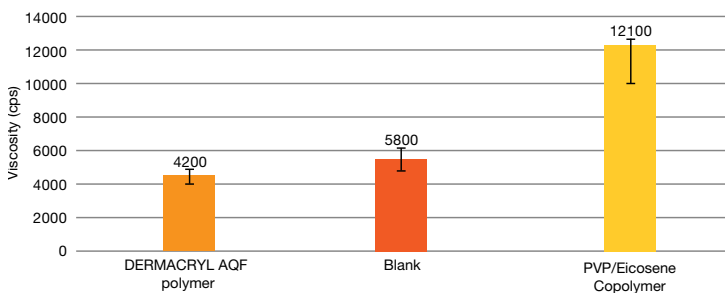
Other

DERMACRYL AQF polymer is also compatible with a wide range of commonly used cosmetic ingredients: Carbomer, Xanthan Gum, Acrylates/C12-30 Alkyl Acrylate Crosspolymer, and other frequently used thickeners and emulsifiers.

Spray Emulsions

Although DERMACRYL AQF polymer can be used in a broad range of sunscreen emulsions, it is particularly well suited for sunscreen spray emulsions. The polymer does not increase formulation viscosity which allows the formulator to create water resistant spray emulsion sunscreens with excellent spray aesthetics. A spray system (Table 2) was formulated to demonstrate the impact of film forming polymers on formulation viscosity (Figure 1) and spray performance (Figure 2). The system containing DERMACRYL AQF polymer was less viscous than a similar systems formulated with PVP/Eicosene Copolymer.

Figure 1: Viscosity Benefit on Spray Formulation



* Viscosity was measured using the Brookfield DV-I, spindle #6 at 10rpm, at 23°C.

Figure 2: Spray Characteristics



In Figure 2, the spray pattern on the left is for an emulsion formulated with DERMACRYL AQF polymer and on the right is the same emulsion formulated with PVP/Eicosene copolymer. The product on the left has excellent spray aesthetics including less particle drift which results in more uniform coverage.

Table 2: Sunscreen Spray Formulation

	% w/w	
Phase A	12689-109F1A	12689-109F1C
Deionized Water	q.s. to 100	q.s. to 100
Disodium EDTA, DISSOLVINE® NA2-S Chelate	0.04	0.04
Acrylates/C10-30 Alkyl Acrylate Crosspolymer	0.20	0.20
Glycerin 99.5%	3.00	3.00
Phenoxethanol (and) Methylparaben (and) Ethylparaben (and) Butylparaben	1.00	1.00
DERMACRYL AQF polymer (45% active)	4.40	0.00
Phase B		
Ethylhexyl Methoxycinnamate	7.50	7.50
Ethylhexyl Salicylate	5.00	5.00
Benzophenone-3	4.00	4.00
Cetearyl Alcohol	0.30	0.30
Sorbitan Oleate	0.45	0.45
PVP/ Eicosene Copolymer	0.00	2.00
Phase C		
Triethanolamine	q.s. to pH 6.5	q.s. to pH 6.5
Total	100.00	100.00

Performance Properties

In-Vivo SPF Evaluation

DERMACRYL AQF polymer provides the ability to create water resistant sunscreen emulsions. The polymer exhibits excellent SPF retention after immersion in water in both in-vitro and in-vivo testing.

The sunscreen emulsion systems were evaluated by Florida Suncare Testing, Inc. SOPs #2011-04, 2011-01, Static and 80 Minute Water Resistant SPF Testing as set forth by the FDA, 21 CFR Sec. 201.327, subpart (i), SPF Test Procedure, Sunscreen Drug Products for Over-the-Counter Human Use, Final Monograph, Federal Register, Vol. 76, No. 117, June 17, 2011.

Two similar sunscreen formulations were compared for their ability to retain SPF after 80 minute immersion in water. These formulations vary in their use level of the film former. The formulation (Table 3) and results (Figure 3) are described below. A copy of the complete *in-vivo* report is available upon request.

Results

Formulas with both 1% and 2% active Dermacryl AQF polymer tested as 80 min very water resistant in SPF 50 target systems

Table 3: In-vivo SPF Testing Formulation

Formula #2710-48	
Raw material name	Wet %
Phase A	49.33
Water (Aqua)	45.83
Disodium EDTA-Dissolvine® NA2-S chelate	0.10
Propylene Glycol	2.00
Phenoxyethanol (and) Ethylhexylglycerin	1.00
Acrylates/C10-30 Alkyl Acrylate Crosspolymer	0.40
Phase B	41.50
Avobenzone	3.00
Homosalate	13.00
Ethylhexyl Salicylate	5.00
Octocrylene	5.00
Benzophenone-3	6.00
Glyceryl Stearate (and) PEG-100 Stearate	2.50
C12-15 Alkyl Benzoate	5.00
Dimethicone	2.00
Polymer B	see note
Phase C	9.04
Triethanolamine	0.60
Water (Aqua)	4.00
Phase D	
Polymer A	see note
Phase E	
Citric Acid (and) Water	q.s
Total	100.00

A: Dermacryl E polymer, 1.0%wt% active, 2.2 wt% supplied; Dermacryl E polymer, 2.0%wt% active, 4.4 wt% supplied

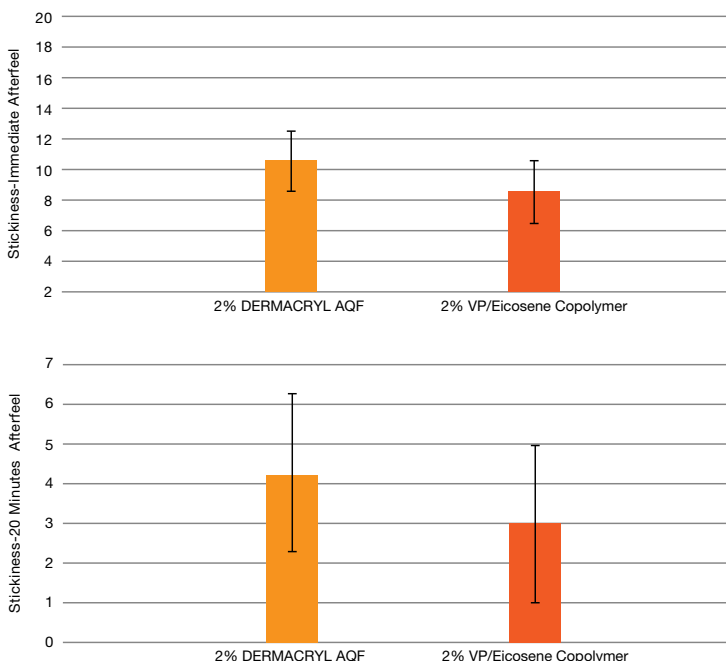
Sensory Evaluation

The sensory evaluation was performed by expert panelists trained in Skinfeel Descriptive Analysis methodology.

Results

Dermacryl AQF polymer was shown to have statistically similar tack as compared to VP/Eicosene Copolymer at both immediate and 20 minute afterfeel timepoints. Testing was performed at Sensory Spectrum.

Figure 3



Storage and Handling

DERMACRYL AQF polymer should be protected from freezing. Avoid extreme temperatures during storage. Good industrial hygiene practices should be followed when working with this polymer. Please read the SDS before working with this or any other chemical. This product is best used within 12 months of manufacture.

Health and Safety

A health and safety summary related for DERMACRYL AQF polymer is available on request. Information on DERMACRYL AQF polymer relating to EU Cosmetic Directive 76/768/EEC is also available upon request.

The suitability of the final formulations should be confirmed in all respects by appropriate evaluation. The marketer is advised to evaluate the final formulation with regard to performance and health and safety.

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North America

USA and Canada:

Akzo Nobel Surface Chemistry LLC
525 West Van Buren Street
Chicago IL 60607-3823
T +1-800-906-9977
T +1-312-544-7000
E personalcare.usa@akzonobel.com

Mexico:

Akzo Nobel Chemicias S.A. de C.V.
Av Ejército Nacional 418 – 507
Chapultepec Morales
CP 115770 Mexico DF
México
T +52 55 5261 7896/95
E personalcare.mexico@akzonobel.com

Europe

Akzo Nobel Surface Chemistry AB
Stenunge Allé 3
SE-444 85 Stenungsund
Sweden
T +46 303 85000
E personalcare.europe@akzonobel.com

South America

Akzo Nobel LTDA
Rodovia Akzo Nobel, 707
Itupeva
Sao Paulo, 13295-000
Brazil
T +55 11 4591 8870
E personalcare.southamerica@akzonobel.com

Asia Pacific

China:

Akzo Nobel Chemicals (BoXing) Co., Ltd.
Shanghai Branch
22F Eco City
No. 1788 West Nan Jing Road
Shanghai, 200040
China
T +86 21 2220 5000
E personalcare.china@akzonobel.com

Singapore:

Akzo Nobel House Surface Chemistry
3 Changi Business Park Vista #05-01
Singapore 486051
T +65 66355183
E personalcare.sea@akzonobel.com

Australia:

Akzo Nobel Pty Limited
8 Kellaway Place
Wetherill Park
NSW 2164
Australia
T +61 2 9616 6940/6900
E personalcare.australia@akzonobel.com

India:

Akzo Nobel India Limited
Plot No 1/1, TTC Industrial Area
Thane Belapur Road, Koparkhairane
Navi Mumbai – 400710, Maharashtra
India
T +91 22 2778 7378
E personalcare.india@akzonobel.com