Formulating Low pH Skin Care With Naturally Derived Ingredients

AkzoNobel
Tomorrow's Answers Today

Low pH skin care formulations, including auto-bronzers, anti-acne products, and anti-aging creams, continue to grow at robust annual rates. This healthy growth is a testament to their popularity with consumers and proof that the products deliver on the promise of performance. The actives used in these formulations, however, like dihydroxyacetone, glycolic acid and other low pH ingredients, present formulation challenges in the areas of stability, pH drift, and skin feel.

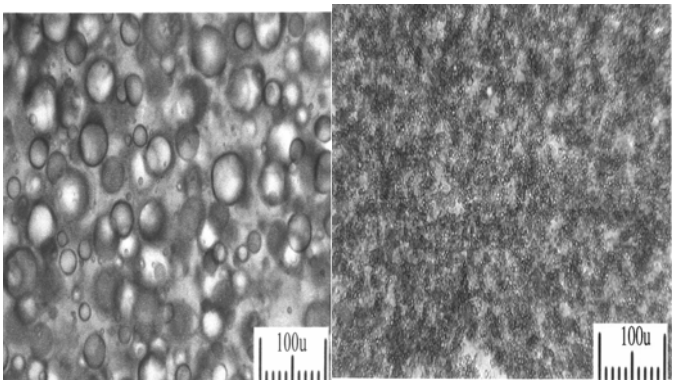
Naturally-derived thickening and stabilizing ingredients may be incorporated into formulations containing low pH actives. These ingredients are efficient thickeners and provide emulsion stabilization, rheology modification, and a unique conditioned skin feel. Select naturally-derived polymers, including starch and xanthan gum, offer the benefit of stability and the assurance of consumer-desirable sensory attributes in formulations with a low pH range. This paper looks at formulations that include renewable, sustainable ingredients as a strategy for maintaining stability and trouble-free manufacturing of low pH range formulas.

Auto-Bronzers

With auto-bronzer lotions and sprayable emulsions containing 5% or more dihydroxyacetone (DHA), the pH of the finished formulations may be as low as 3.5. A naturally derived polymer based on potato starch (STRUCTURE® SOLANACE starch) functions in this low pH environment to provide stable viscosity and pH over time, both at ambient and accelerated aging conditions. The novel thickener and emulsion stabilizer – characterized by its ability to create emulsions with small particle size – is noted for its soft, velvety feel. Figure 1 shows the small emulsion particle size that supports both emulsion stability and the benefit of sensory enhancement.

Figure 1: STRUCTURE SOLANACE starch (TEA/Stearate Emulsion)

0% **2% STRUCTURE SOLANCE starch**



Formulation 1 with a pH range of 3.5-4.5 is tested as stable at a 2.00 % w/w addition rate of Potato Starch Modified.

Formulation 1: Auto-Bronzer (Self Tanner)

Ingredients	INCI Designations	% W/W
Phase A		
Deionized Water	Water (Aqua)	64.95
Propylene Glycol	Propylene Glycol	3.00
STRUCTURE SOLANACE starch	**Potato Starch Modified**	**2.00**
Dissolvine NA2	Disodium EDTA	0.05
Phase B		
Estol 1474	Glyceryl Monostearate SF	2.00
Myrj 59	PEG-100 Stearate	1.00
Cetiol LC	Coco-Caprylate/Caprate	5.00
Crodacol C-95	Cetyl Alcohol	2.00
Dermol DOA	Diethylhexyl Adipate	3.00
Crodacol 1618	Cetearyl Alcohol	1.00
Estol 1543	Ethylhexyl Palmitate	3.00
Span 40	Sorbitan Palmitate	0.50
DC 200 Fluid (100cst)	Dimethicone	0.50
Cetiol MM	Myristyl Myristate	1.00
Phase C		
Deionized Water	Water (Aqua)	5.00
Dihydroxyacetone	Dihydroxyacetone	5.00
Phase D		
Phenonip	Phenoxyethanol (and) Methylparaben (and) Ethylparaben (and) Propylparaben (and) Isobutylparaben	1.00
Citric Acid (50%)	Citric Acid	qs
Total		**100.00**

Procedure
Combine Phase B, heat to 80°C, mix for 20 minutes. Combine Phase A, heat to 80°C. Add Phase A to Phase B at 80°C, mix for 10 minutes. Cool to 65°C. Combine Phase C, mix until complete. Add to Phase A and Phase B at 65°C. Cool to 40°C. Add Phase D, mix thoroughly. Cool to room temperature and package. Adjust to final pH to 3.5-4.5 if necessary.

Anti-Aging Formulations

Glycolic acid, low pH natural extracts, hyaluronic acid and other active ingredients afford marketers the ability to include benefit claims on the labels of popular anti-aging skin creams and lotions. Demand for these functional products continues to rise at 10% per year. Yet as more functional skin care products are formulated for the mass market, a need arises for a solution that simultaneously supports efficient thickening, emulsion stability (in the presence of low pH actives) and sensory enhancement. Formulation 2, Anti-Aging Multifruit Lotion, is one example of a functional formula containing low pH extracts that is easy to thicken, stabilize and

manufacture with a 1.75% w/w addition of Potato Starch Modified (STRUCTURE SOLANACE starch).

Formulation 2. Anti-Aging Multifruit Lotion

Ingredients	INCI Designations	% W/W
Phase A		
Deionized Water	Water (Aqua)	q.s.
Veegum Ultra	Magnesium Aluminum Silicate	0.80%
Phase B		
STRUCTURE SOLANACE starch	**Potato Starch Modified**	**1.75%**
Keltrol T	Xanthan Gum	0.05%
Natrosol 250 HR CS	Hydroxyethylcellose	0.15%
Methylparaben	Methylparaben	0.20%
Phase C		
Myritol 318	Caprylic/Capric Triglyceride	10.00%
Crodacol S-95 NF	Stearyl Alcohol	0.50%
Glyceryl Stearate	Glyceryl Stearate	3.25%
Tween 20	Polysorbate 20	1.50%
Emerest 2380	Propylene Glycol Stearate	1.50%
Crodamol SS	Cetyl Esters	0.75%
DC 200 Fluid (100cst)	Dimethicone	1.00%
Glycerin	Glycerin	0.50%
Propylparaben	Propylparaben	0.10%
Phase D		
Deionized Water	Water (Aqua)	5.00%
Germal II	Diazolidinyl Urea	0.20%
Phase E		
Multifruit BSC	Water, Bilberry (Vaccinium Myrtillus) Extract, Sugar cane (Saccharum Officianarum) Extract, Sugar Maple (Acer Saccharinum) Extract, Orange (Citrus Aurantium Dulcis) Extract, Lemon (Citrus Medica Limonium) Extract	3.00%
Total:		**100.00%**

Procedure
Slowly add Veegum Ultra to the water and mix for 15 minutes using homogenizer at 5500 rpm. Blend ingredients of Phase B and sift to Phase A while mixing. Heat Phase A/B up to 80°C and mix for 25-30 minutes. Add methylparaben. Combine Phase C together, heat to 80°C. Add Phase C to A/B. Premix Phase D and add at 40°C into batch, then add Phase E.

Anti-Acne Cleansers

Salicylic acid is one of the most common actives found in anti-acne formulations today. At relatively low addition rates, it is demonstrated to control sebum and acne efficiently. Creams

and lotions containing salicylic acid will typically range from pH 4.0 to 4.5. A polymer that functions efficiently within this pH range - called Dehydroxanthan Gum (AMAZE® XT polymer) - offers thickening and suspension with very low tack. The naturally-derived polymer, certified with Ecocert France SAS, is easy to use in low pH cleansers containing salicylic acid. Formulation 3 is an example of a simple anti-acne cleanser containing 1.5% w/w Dehydroxanthan Gum.

Formulation 3. Anti-acne Facial Cleansing Gel

Ingredients	**INCI Designation**	**%W/W**
Phase A		
Deionized Water	Water (Aqua)	75.80
Propylene Glycol	Propylene Glycol	3.00
AMAZE™ XT polymer	**Dehydroxanthan Gum**	**1.50**
Phase B		
Monateric CAB-LC	Cocamidopropyl Betaine	8.50
Plantacare 2000N	C8-16 Decyl Glucoside	5.00
Glydant Plus Liquid	DMDM Hydantoin (and) Iodopropynyl Butylcarbamate	0.50
Phase C		
Salicylic Acid	Salicylic Acid	0.50
Purasal S/COS	Sodium Lactate	1.00
Irgasan DP 300	Triclosan	0.10
1,3 Butylene Glycol	Butylene Glycol	3.00
Phase D		
Frescolat Plus	Methyl Lactate	0.40
Cremophor RH-40	PEG-40 Hydrogenated Castor Oil	0.40
Phase E		
Lipobead Blue-T	Lactose (and) Cellulose (and) Hydroxypropyl Methylcellulose (and) Ultramarine Blue (and) Triclosan	0.30
		100.00

Procedure
In Phase A, disperse AMAZE XT polymer into Propylene Glycol, then add the water with mixing to swell AMAZE XT polymer, add Incronam, adjust to moderate mixing, heat to 80°C and keep for 30 minutes. Cool down to RT. In Phase B, mix all the ingredients together, heat to 50°C to accelerate the dissolution of salicylic acid if needed. Premix Phase C, then add Phase C into Phase B and mix well. Add Phase BC to Phase A with adequate mixing, then add Phase D in turn. Continue mixing until homogeneous.

Conclusion

With strong demand for functional skin care formulas containing low pH actives, there is a need to utilize thickening and stabilizing polymers specifically designed for difficult-to-thicken environments. Naturally-derived starches and polymers offer the formulator and manufacturer a solution to thicken and stabilize these low pH formulations. A naturally derived thickener based

on potato starch (STRUCTURE SOLANACE starch) functions at low pH to provide stable viscosity and pH over time, both at ambient and accelerated aging conditions. Dehydroxanthan Gum (AMAZE XT polymer), a naturally-derived polymer, may be used in low pH formulations, like anti-acne facial cleansers, for thickening and suspension.