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FUNCTIONAL COSMETIC INGREDIENTS OF SHOWA DENKO K.K.

TECHNICAL INFORMATION

Contents:

VER.1705NA_EN DIGEST

Chart for Efficacies and Claims

Our product lineups can answer your challenge !

Product Name			APM (ASCOMATE-C™)	APPRÉCIER™	TPNa™	HCAP™	DL-Cysteine HCl /DL-Cysteine	SPIERA™
Quasi Drug (JP)			Active Additive		Active Additive		Active	
REACH (EU)			○	○	○	in progress	in progress	in progress
CFDA (CN)			○	○	○		○	
Expected Efficacies	Skin Care	Brightning	○	○				
		Anti-Wrinkle	○	○				
		Anti-Aging	○	○		○		
		Hydration			○			
		Acne Care	○	○	○			
		Eye Care			○			
	Hair Care	Protection	○					
		Perm					○	○
		Coloring Aids						○
	Body Care	Slimming				○		
	Others	Anti-Oxidation	○	○	○			
		Anti-Inflammatio			○			
		Protection from UV Damage	○		○			
		Cell Activation				○		
Usable Concentration			1~8%	0.5~1%	0.2~2%	0.2~1%	~7%	2~5%
Usable pH			>pH7.0	pH7~8	-	-	-	-
Recommended Formula			Serum, Gel, Cream	Serum, Emulsion, Cream	Serum, Emulsion, Cream	Serum, Emulsion, Cream	Perm Solution / Cream	Perm Solution / Cream
Related Pages			3-5	6-8	9-11	12-14	15	16-18

*NB) The INCI name may be subject to be variation without notice.

This booklet only explains the extracts of our product properties. If you have an interest in any of our products, we can provide full-written files of "Technical Information" for efficacies and formulation tips and also product samples.

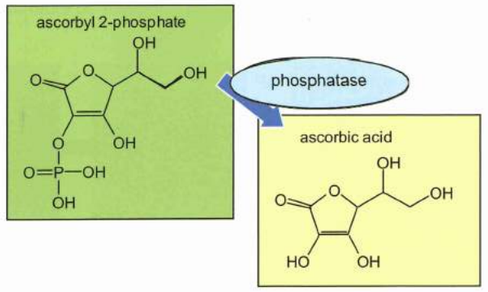
Please feel free to contact our division near you printed on the back cover of this booklet.

Magnesium L-Ascorbyl 2-Phosphate/ASCOMATE-C™ (APM)

Stable Provitamin C, an Active Ingredient for Japanese QD

Ascorbyl 2-phosphate magnesium salt (APM) is the stable and active provitamin C, and officially approved active ingredient for Japanese quasi-drugs, claiming prevention for spots and freckles caused from ultraviolet exposure.

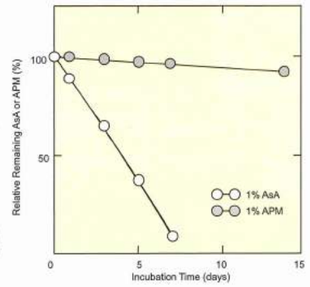
By the modification of sensitive hydroxyl group in ascorbate with phosphoric ester, APM is stable against oxidation. Also, as the phosphoric ester is easily hydrolyzed by phosphatase and releases ascorbate in the skin, APM can not only easily formulate in cosmetic products but also effectively deliver into the skin.



High Stability in Aqueous Solution

The chemical stabilities of APM compared with ascorbate in aqueous solutions.

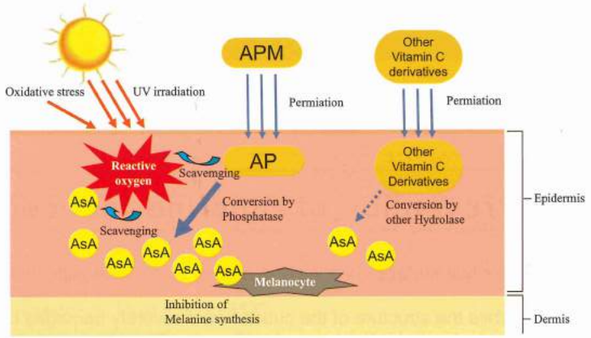
While ascorbate (AsA) was very unstable (open circle) and degraded within a week, on the other hand, **more than 90% of APM remained even after 2 weeks.**



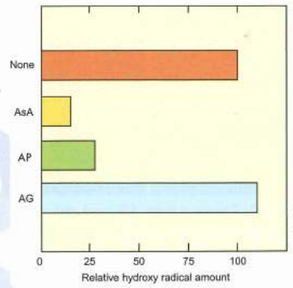
[Methods] Each substance was dissolved in distilled water at a concentration of 10 mg/ml (1%) and incubated at 60˚C for 2 weeks.

Mechanism of APM Function

An ascorbic acid derivative is converted to its bioactive form, AsA, by enzyme in the skin.
There are some types of AsA derivatives. APM is derivatized with phosphate group and is hydrolyzed by phosphatase. The others are modified glucoside group, acyl group and sulfate group etc.. They are converted by glucosidase or esterase etc. Since phosphatase acts more effectively than these other enzymes, APM can supply more AsA and shows high and various effects in the skin.



Radical Scavenging Activity



The radical-scavenging effect of AP was confirmed by ESR spin-trap method in human reconstructed skin models.

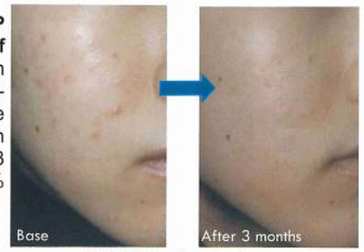
The hydroxyl radicals generated by UV irradiation were effectively scavenged by AsA or AP. **As AP enriched the intradermal AsA effectively, the free radical scavenging ability of AP was quite effective compared with ascorbyl 2-glucoside (AG).**

[Methods] Each sample solution (200 mM : AsA 3.5%, AP 6:4%, AG 6.8%) was applied on the top of the skin model and incubated for 2 hours at 37˚C under 5% CO_2 atmosphere, then the skin was irradiated with UV.

Effect on Acne Treatment

A series of clinical studies was carried out to examine the efficacy of AP on acne.

By treating with AP lotion, efficacy rate of acne was better than sulfur lotion or no topical application. Acne spots and inflammation were improved after 3 month-treatment of 5% AP lotion.



5% AP Lotion Treatment

Treatment of acne Vulgaris

Medication		Efficacy(%)	# of patients
Topical	Oral		
2% AP	MC	57	12
3% AP	MC	88	25
5-7% AP	MC	93	40
6% sulfur	MC	44	27
None	MC	40	15

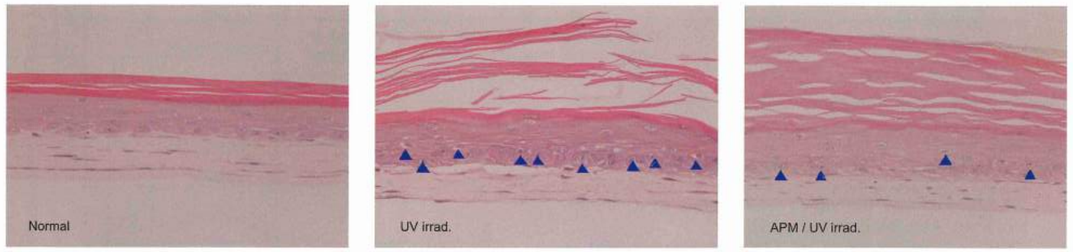
MC: minocycline 50 mg/day

[Methods] The acne patients were treated with AP lotion and orally administrated 50 mg minocycline as a basal medication. After 3 months, efficacy rate was determined by scoring using Dr. Lookingbill's method.

Protecting Effect against UV Damages

The protective effect of APM against UV irradiation was examined using a human reconstructed skin model.

The sunburn cells and stratum corneum layers by UV exposure were effectively suppressed by the treatment with 3% APM.

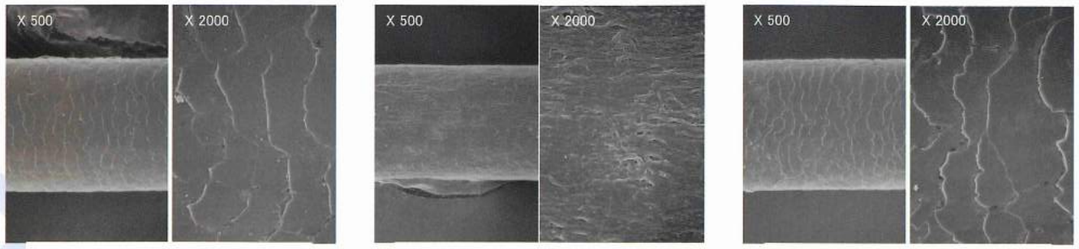


[Methods] Human reconstructed skin was irradiated with UVB and then performed hematoxylin-eosin staining. The UV-damaged cells were stained darker (sunburn cells, blue arrows).

Prevention of Chlorine-Induced Hair Damage

The hair surface chemically damaged by chlorine water was observed under electron microscopy .

While the structure of the cuticles was severely damaged by oxidation in chlorine treated hair (B), **AP-treated hair prevented cuticle damages significantly** (C) and remain attached same as normal hair (A).



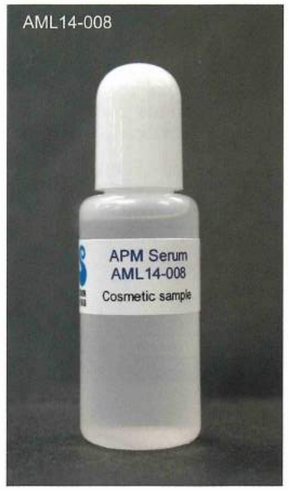
A. Normal hair B. Treated with chlorine C. Treated with AP and chlorine

[Methods] Normal hair (A) was treated with water containing 480 ppm (6.8 mM) of chlorine (B) for 30 minutes at room temperature. (C) During chlorine treatment, 0.3 % (10 mM) AP was added.

Formulation Examples

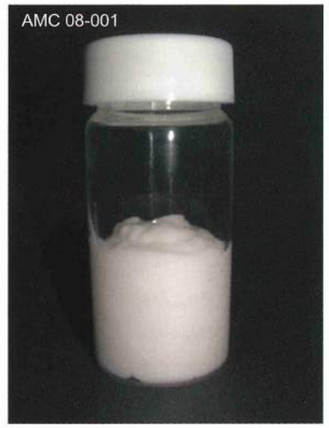
◇ **Serum (for Japanese Quasi Drug)**

Formula# AML 14-008	(Ingredients)	w/w (%)
(A)	pure water	76.6
	magnesium ascorbyl phosphate (APM)	6.0
(B)	glycerin	4.0
	butylene glycol	4.0
	sodium hyaluronate (1%)	4.0
	dipotassium glycyrrhizate	0.2
	methylparaben	0.1
(C)	potassium citrate	5.1
	/Total	100
	pH	7.7



Direction:
1) Premix Phase A.
2) Add phase B ingredients to phase A one by one.
3) Add phase C to phase A, B and mix well.

◇ **Cream**



Formula# AMC 08-001	(Ingredients)	w/w (%)
(A)	hydrogenated rape seed alcohol	3.2
	isononyl isononanoate	4.8
	squalane	9.6
	octyldodecyl myristate	4.4
	polyglyceryl-10 stearate	1.5
	glyceryl stearate	0.5
	tocopherol	0.2
	propylparaben	0.05
	xanthan gum	0.1
(B)	butylene glycol	4.0
	glycerin	4.8
	magnesium ascorbyl phosphate (APM)	3.0
	metylparaben	0.1
	pure water	63.8
	/Total	100
	pH	7.5

Direction:
1) Heat phase A up to 85˚C.
2) Dissolve APM in water and add other phase B ingredients. Heat it up to 85˚C.
3) Slowly add phase B into phase A with gentle mixing a homomixer.
4) Allow to stand under ambient condition till 60ºC, then start cooling.
5) Keep mixing till 30ºC.

Notes for Formulation

◆ **Formula pH**

The formulation might be prepared with pH higher than 7.0, preferably 7.5 to 8.0.

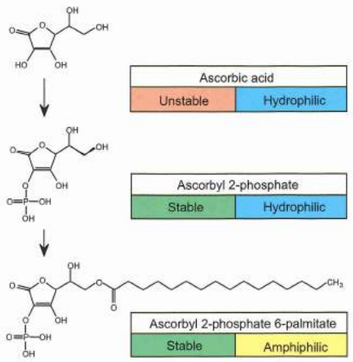
; APM has a potency to be hydrolyzed to ascorbic acid which is easily oxidized by atmospheric oxygen. Hydrolyzed APM by oxidation causes brownish colorization or caramel-like smell in cosmetic formulations.

◆ **Recrystallization of APM**

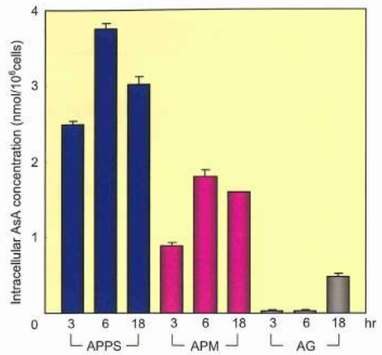
; due to the interaction between phosphorous group and magnesium ion, APM sometimes recrystallizes and precipitates in cosmetic formulations, especially at high concentrations.

Improvement of VC-Delivery to Cell and Skin

Trisodium ascorbyl 6-palmitate 2-phosphate (APPRÉCIER™, APPS) is a newly designed amphiphilic derivative of ascorbyl 2-phosphate (AP). Thanks to its moderate hydrophobicity, APPS penetrates effectively into dermis and is enzymatically converted to ascorbate (AsA) during transdermal permeation.



In human epidermal keratinocytes, APPS showed its superiority in elevation of intracellular AsA delivery compared with ascorbyl 2-phosphate magnesium salt (APM), or ascorbyl 2-glucoside (AG).

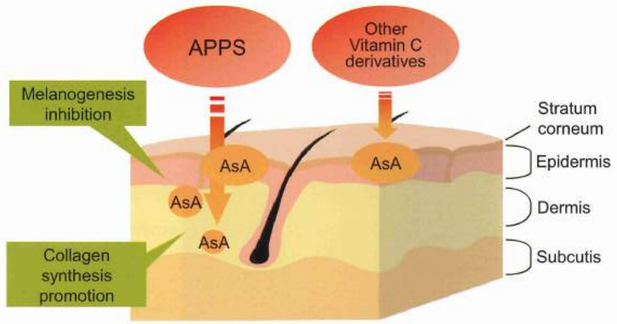


[Methods] Human epidermal keratinocytes were cultivated with 100 μM vitamin C derivatives, and were measured the changes of intracellular AsA concentration.

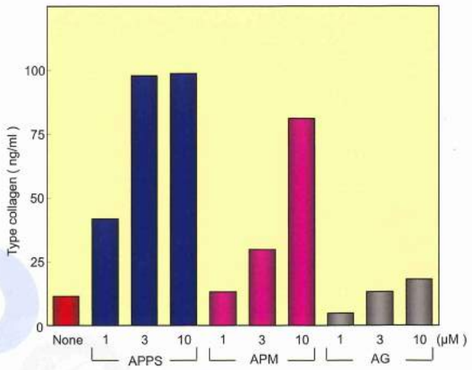
Mechanism of APPS Function

The skin cells have the site-specific functions, for example, melanin pigments are synthesized by melanocytes in the basal layer of epidermis, and collagen is produced by fibroblasts in dermis.

To deliver ascorbic acid (AsA) to all the skin layers, APPS permeates deeply thanks to its amphipathic property. Then, APPS is converted to AsA by cellular hydrolases not only in the epidermis but also in the dermis. Delivered AsA molecules can effect on both of the melanogenesis inhibition and collagen synthesis promotion.



Enhancement of Collagen Synthesis



In dermal fibroblasts, APPS showed efficient enhancement of collagen synthesis even at the lowest concentration compared with other vitamin C derivatives.

[Methods] Human dermal fibroblast was cultivated with APPS, APM, or AG at concentrations of 1 μM to 10 μM for 72 hours. The amount of type I collagen was measured by ELISA.

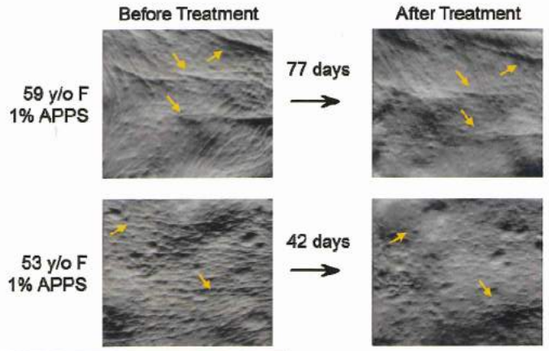
(10 μM : APPS 0.0005%, APM 0.0003%, AG 0.0003%)

Clinical Tests on "Crow's Feet"

Clinical test was done with healthy female volunteers on their fine lines, so-called "crow's feet", of eye areas using 1% of APPS lotion.

The application of APPS lotion exhibited effective visual improvement on replicas after 1-3 months.

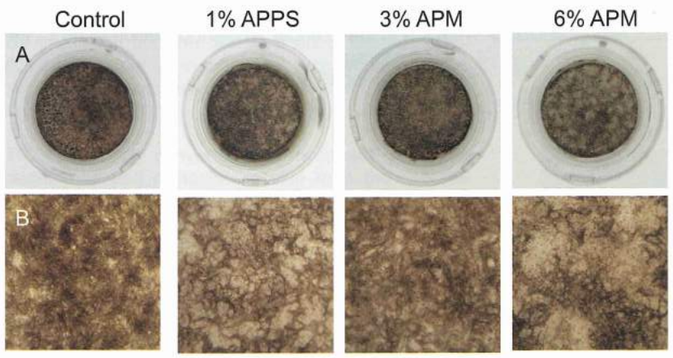
[Methods] Healthy female 21 volunteers were applied with the lotion containing 1% APPS twice a day for 1-3 months. Before and after test period, replicas of fine lines around eye area were collected and assessed. The figures show typical examples.

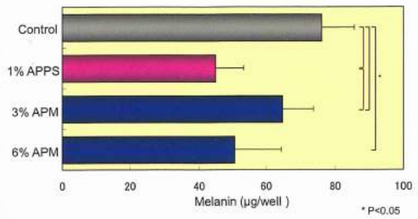


Inhibition of Skin Pigmentation

The inhibitory effect of APPS on melanin formation was estimated using the human reconstructed skin (MEL-300, Asian).

The effects of 1% APPS was comparable to that of 6% APM, better than that of 3% APM (the approved lowest QD concentration).





[Methods] Human model skin was cultivated with or without vitamin C derivatives. After visual observation under microscope, the skins were harvested to serve for measuring melanin contents by optical densitometer (the upper graph).

Notes for Formulation

◆ **Formula pH**

<u>The formulation should be prepared with neutral to weak alkaline pH.</u>

; APPS might get hydrolyzed in the formula with acidic condition especially pH below 6.0.

◆ **Stability of APPS**

<u>Using dihydric alcohol in the aqueous formula is recommended.</u>

; to avoid hydrolysis of APPS in aqueous solution, the usage of dihydric alcohol, especially 1,2-hexandiol, is effective.
ex) 1% APPS solution added with 2-3% of 1,2-hexandiol or 5-6% of pentylene glycol is preferable.

◆ **Resolution of sodium palmitate from APPS**

<u>Adding 1,2- hexandiol is recommended.</u>

; sodium palmitates released by APPS hydrolysis make solution cloudy. The addition of dihydric alcohol, such as pentylene glycol and 1,2- hexandiol, makes the solution clear.

◆ **Usage of xanthan gum**

<u>Note that hydrolyzing activity of xanthan gum might be tested before formulating with APPS.</u>

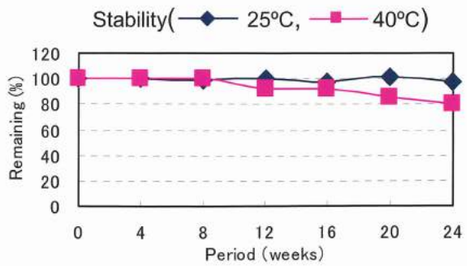
; Some natural products have hydrolyzing activity of APPS. Some of the commercial xanthan gum have negligible hydrolyzing activity, but as the activity differs among the production lots, preliminary tests are highly recommended.

APPRÉCIER™ (APPS)

Formulation Examples

◇ Cream

Formula# APC 02-001	(Ingredients)	w/w (%)
(A)	hydrogenated rape seed alcohol	4.2
	isononyl isononanoate	6.0
	squalane	9.6
	octyldodecyl myristate	4.8
	polyglyceryl-10 stearate	2.0
	glyceryl stearate	1.0
	tocopherol	0.2
	methylparaben	0.1
	propylparaben	0.05
	xanthan gum	0.1
(B)	butylene glycol	4.8
	glycerin	4.8
	trisodium ascorbyl palmitate phosphate (APPS)	1.0
	sodium citrate	0.4
	pure water	60.95
	/Total	100
	pH	7.2



Direction:
1) Heat phase A up to 85°C.
2) Heat phase B up to 85°C .
3) Add phase B to phase A slowly and emulsify with a homomixer.
4) Allow to stand under ambient condition till 60°C, then start cooling.
5) Keep mixing till 30°C.

◇ Serum with Nano Emulsion

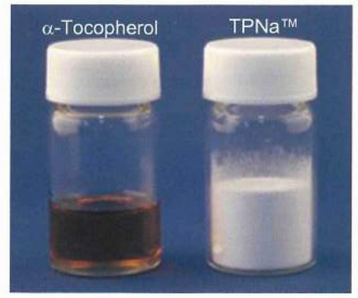
Formula# APL 11-001	(Ingredients)	w/w (%)
(A)	polyglyceryl-10 oleate	1.35
	polyglyceryl-2 oleate	0.65
	squalane	2.0
(B)	butylene glycol	4.0
	glycerin	4.0
	trisodium ascorbyl palmitate phosphate (APPS)	1.0
	phenoxyethanol	0.5
	pure water	86.5
	/Total	100
	pH	7.8
	emulsion size	av.55 nm
stability (remaining APPS)	25°C, 24weeks	84%
	40°C, 24weeks	63%

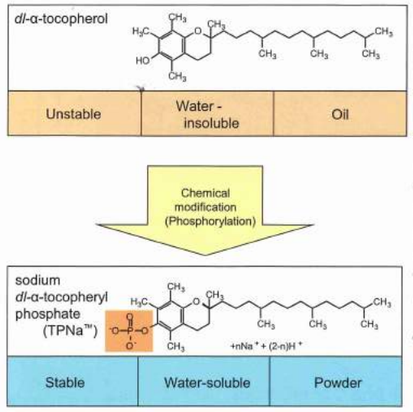
Direction:
1) Heat phase A up to 85°C.
2) Heat phase B up to 85°C.
3) Add phase B to phase A under mixing.
4) Allow to cool down under ambient condition.

TPNa™

Water-soluble & Powdery provitamin E

Known as one of the most important vitamins for cosmetics, α-tocopherol protects skin cells from oxidative attacks of radicals and peroxides. As α-tocopherol is easily oxidized and quickly loses the activity, and has oily texture and poor solubility in water, the usage of α-tocopherol in cosmetic formula is quite limited.





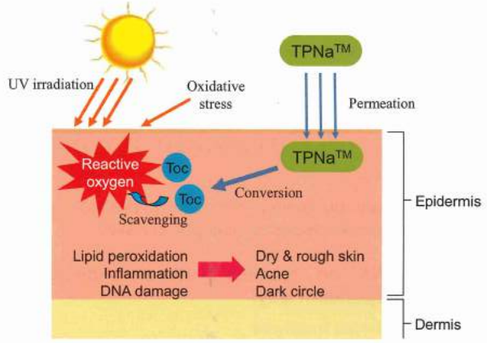
To solve this problem, our tocopherol derivative, **sodium dl-α-tocopheryl phosphate (TPNa™), is designed as water-soluble powder.** Since the oxygen-sensitive hydroxyl group of α-tocopherol is chemically modified and protected, TPNa™ is quite stable but it will be readily converted to the active α-tocopherol via hydrolysis catalyzed by cellular phosphatase.

TPNa™ is an officially approved active ingredient for Japanese quasi drugs, claiming the efficacy of prevention of rough skin.

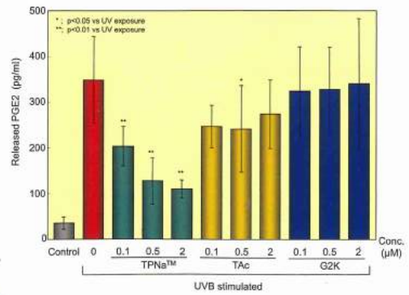
Mechanism of TPNa™ Function

UV irradiation and the oxidative stress induces reactive oxygen species in the skin, which causes various skin troubles such as comedo formation, rough and dry skin etc.

TPNa™ is easily converted to α-tocopherol after skin penetration and protects the skin from the reactive oxygen by its strong anti-oxidative property. As a result, TPNa™ inhibits lipid peroxidation, inflammation and DNA damages in the skin.



Prevention of Inflammation



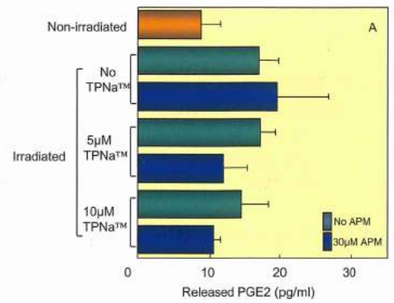
[Methods] Human keratinocytes were cultivated with the medium containing TPNa™ or other chemicals for 24 hours and then were irradiated UVB. After 24 hours culture, the production of PGE2 was measured by ELISA.

(2 μM : TPNa™ 0.0001%, TAc 0.0001%, G2K 0.0002%)

Anti-inflammatory property of TPNa™ was assessed compared with tocopherol acetate (TAc) and dipotassium glycyrrhizate (G2K) which are well known as anti-inflammatory reagent.

TPNa™ exhibited better inhibitory effect on the production of inflammation marker, prostaglandin E2 (PGE2), than that of TAc and G2K at the same concentration. (the left figure)

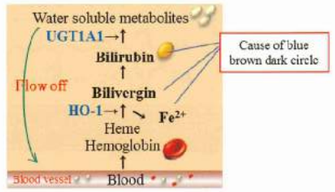
Moreover, **administration of APM significantly enhanced inhibitory effects of TPNa™ on PGE2 synthesis.** (the right figure)



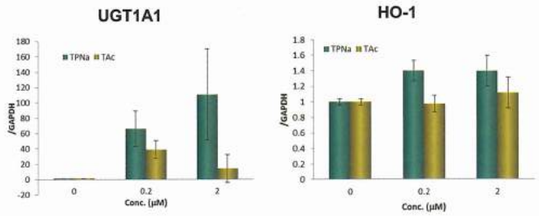
(30 μM APM : 0.0009%)

Effects on Dark Circles around Eyes

One of the causes of dark circles around eyes is the accumulation of blood origin pigments such as bilirubin, bilivergin and iron ions. The enzymes called hemeoxygenase-1 (HO-1) and uridine diphosphate (UDP)-glucuronosyl transferase 1A1 (UGT1A1) promote digestion of the pigments.



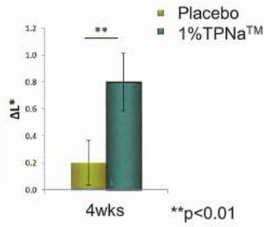
TPNa™ efficiently elevated the gene expression of both enzyme compared with TAc suggesting that TPNa™ can improve blue-brown dark circles around eyes.
In the clinical study, the L* parameter was improved in 82% of subjects after TPNa™ application.



[Methods] Gene expressions of enzymes working on digestion of pigments were assessed by quantitative RT-PCR, when TPNa™ and TAc were applied on human dermal fibroblasts (NRGB1) for 48 hrs. The graphs above are shown relative levels of gene expression against GAPDH, a house keeping gene.

(2 μM : TPNa™ 0.0001%, TAc 0.0001%)

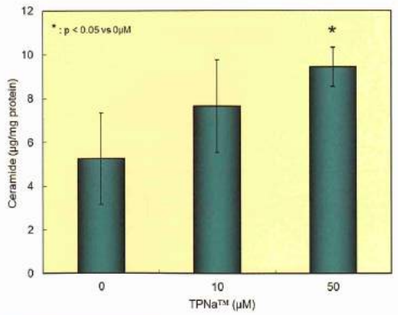
[Methods] Tested on 21 Caucasian female subjects, between 31 and 49 years old with dark circles in the eye area. Each subject applied a placebo cream and a cream containing 1% TPNa™ on the each hemi-face twice a day for 4 wks. The anti-dark circle effect is assessed by measurement of cutaneous color of each eye area using Spectrocolorimeter and image analysis.



Promotion of Ceramide Synthesis

Ceramide is a key substance for skin hydration, but the amount of ceramide in the skin decrease by aging or dry skin.

The effect of TPNa™ on ceramide synthesis showed a significant elevation in dose dependent way.



[Methods] Human keratinocytes were cultivated with the medium containing TPNa™ for 24 hours and the ceramide was then determined.

(10 μM : 0.0005%, 50 μM : 0.0027%)

Notes for Formulation

◆ **Incompatibility: Divalent Cations**

Avoid formulating with divalent cations such as salts of calcium, magnesium etc.

; TPNa™ is a phosphoric ester compound which makes water-insoluble salt with divalent cations. If the formulation with divalent cations is unavoidable, the application of an appropriate amount of sequestering agents is recommended.

◆ **Incompatibility: Phosphatases**

Note that all ingredients in the formula should contain no phosphatases.

; TPNa™ is hydrolyzed by a phosphoric ester hydrolytic enzyme. It is important to confirm that TPNa™ is not hydrolyzed with natural origin ingredients in your formulation which may contain phosphatases.

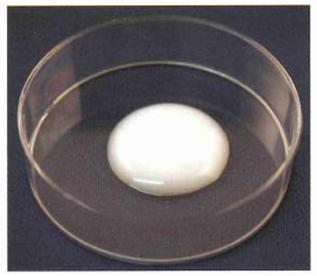
Formulation Examples

◇ **Serum (for Japanese Quasi Drug)**

Formula# VEL 09-003	(Ingredients)	w/w (%)
1	**sodium tocopheryl phosphate (TPNa™)**	2.0
2	glycerin	4.0
3	citric acid (1% aq.)	7.0
4	pentylene glycol	3.0
5	methylparaben	0.2
6	pure water	83.8
	/Total	100
	pH	6.8

Direction:
1) Pre disperse TPNa™ ingredients 2 and 4.
2) Add water to dissolve TPNa™.
3) Add remaining ingredients. Mix well.

◇ **Milky Lotion (for Japanese Quasi Drug)**



Formula# TPNa-VEC 08-002	(Ingredients)	w/w (%)
A	cetearyl alcohol	1.0
	glyceryl stearate	2.5
	glyceryl stearate SE	0.5
	squalane	5.0
	cyclopentasiloxane	2.0
	triethylhexanoin	1.0
	ethylhexyl palmitate	1.5
	propylparaben	0.1
B	**sodium tocopheryl phosphate (TPNa™)**	2.0
	glycerin	5.0
	dipropylene glycol	3.0
	pentylene glycol	2.0
	carbomer	0.2
	methylparaben	0.2
	pure water	68.8
C	arginine	0.2
	pure water	5.0
	/Total	100
	pH	7.2

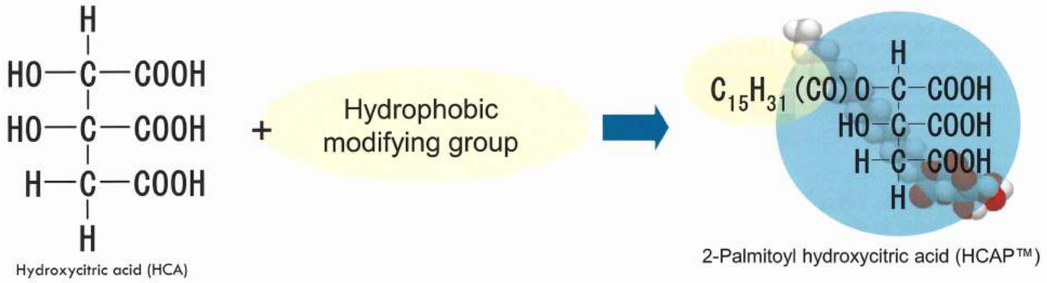
Direction:
1) Heat phase A up to 75°C.
2) Heat phase B up to 75°C.
3) Add phase A to phase B maintaining temperature at 75°C.
4) Emulsify with a homomixer.
5) Add phase C and then cool down to 35°C under mixing.

A New Stable Hydroxycitrate Derivative

Hydroxycitric acid (HCA) is a kind of organic acid which is rich in some edible southeast Asian fruits, such as Garcinia cambogia. Recently, **HCA has been drawn attention as an oral slimming supplement by blocking fat synthesis**.

HCA, however, is highly hydrophilic and incapable of penetrating into the deep inside of the skin by transdermal administration. Additionally, HCA is stabilized as a Ca salt which is not suitable for cosmetic use in formulation and texture.

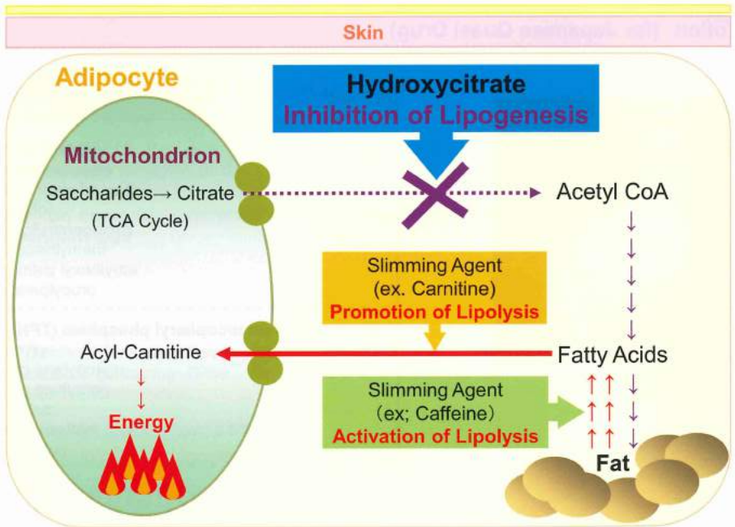
To effectively administrate in cosmetic formulation, 2-Palmitoyl hydroxycitric acid (HCAP™) was designed as a HCA derivative which gives high transdermal permeability and stability.



Hydroxycitric acid (HCA)

2-Palmitoyl hydroxycitric acid (HCAP™)

Roles of HCA in Fat Synthesis



The cartoon above describes the different mechanisms of slimming efficacy by HCA and other slimming agents.

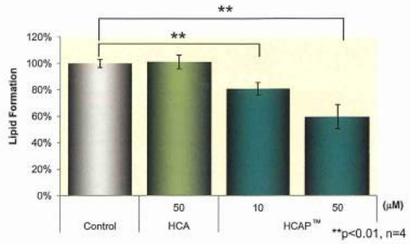
Hydroxycitrate; active compound of HCAP™
"Inhibits Fat Production and Reduce Fat Accumulation" by blocking enzyme of fat synthesis.
Slimming agents; ex. Carnitine, Caffeine
"Promotes Accumulated Fat Digestion" by activating the import of fatty acids to mitochondria

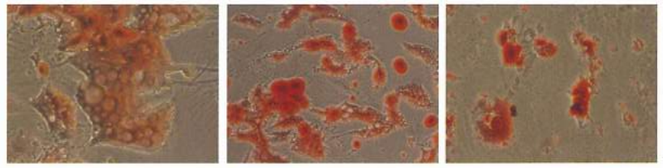
HCAP™ and other slimming agents play different roles in fat accumulation and support slimming. Also, existed slimming reagents such as caffeine and carnitine activate the process of lipolysis, expecting that HCAP™ might provide synergistic effects with those differently work reagents on slimming.

Prevention of Fat Production by HCAP™

The graph shows the intracellular lipid amount in each culture condition. **HCAP™ showed the higher efficacy on inhibition of lipid accumulation than HCA.**

In fact, the cells of control included a big lipid droplets causing the obesity, on the other hand, **in the cell treated with HCAP™, a number and the volume of lipid droplets decreased.**





Control 50 μM HCA 50 μM HCAP™

[Methods]
Adipocytes were treated with HCAP™ or HCA for 20 days, and were stained by Oil Red O (Left panels). Lipid particles in the cells were stained in red. Then, cells were lysed and measured fat quantity by photospectrometer (upper graph).

(50 μM : HCAP™ 0.002%, HCA 0.001%)

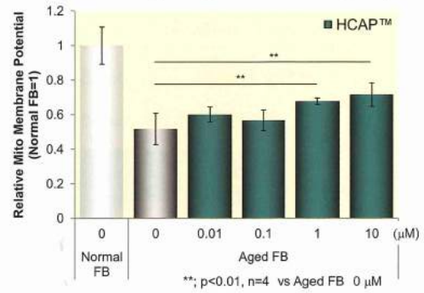
Mitochondria Activation and Anti-Aging Effects by HCAP™

Mitochondria (Mt) is an organelle generating energy for cells. In aging, Mt is decreasing in number and changing in morphology, which induces low energy metabolism and anti-oxidative function.

In dermis, aged fibroblasts have low resistance against oxidation and cellular energy. Inadequate energy metabolism induces reduction of cellular matrix synthesis such as elastin, which causes wrinkles, sagging, dull skin etc.

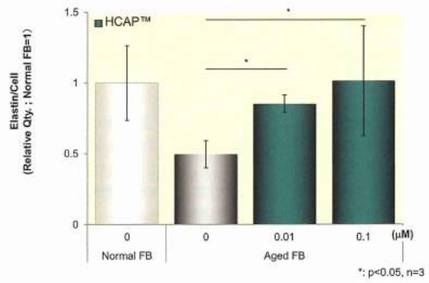
The Mt membrane potential in aged FBs was only a half of normal cells. HCAP™ significantly elevated Mt potential, suggesting **HCAP™ can activate cell activity and energy production efficiency in Mt.**

【Mt Activity in Aged Fibroblasts (FBs)】



(0.1 μM : 0.000004 %)

【Elastin Synthesis in Aged Fibroblasts】



Furthermore, in the aged FBs, although showing the half level of elastin synthesis by normal FBs, the cells applied with HCAP™ remained the level of elastin as in normal FB, suggesting that **HCAP™ can effectively promote elastin production.**

From these result, **the elevation of energy production by HCAP™ through Mt activation promotes effective cellular metabolism such as elastin synthesis.**

Notes for Formulation

◆ **Resolution of palmitate from HCAP™**
Adding dihydric alcohol is recommended.

; palmitates released by HCAP™ hydrolysis make solution cloudy. The addition of dihydric alcohol, such as pentylene glycol and 1,2- hexandiol, makes the solution clear.

Formulation Examples

◇ Serum

Formula# HCAL10-01	(Ingredients)	w/w (%)
1	**hydroxycitryl palmitate (HCAP™)**	0.5
2	dipropylene glycol	4.0
3	butylene glycol	4.0
4	1,2-hexanediol	5.0
5	arginine	0.7
6	methylparaben	0.1
7	pure water	85.7
	/Total	100
	pH	8.5

Direction:
1) Dissolve 1 and 2 in water
2) Add remaining ingredients. Mix well.

◇ Milky Lotion

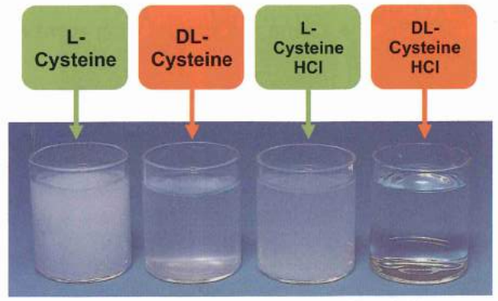
Formula# HCAM05-02	(Ingredients)	w/w (%)
A	cetearyl alcohol	1.0
	glyceryl stearate	2.5
	glyceryl stearate SE	0.5
	squalane	5.0
	cyclopentasiloxane	2.0
	triethylhexanoin	1.0
	ethylhexyl palmitate	1.5
	hydroxycitryl palmitate (HCAP™)	0.5
	propylparaben	0.1
B	glycerin	5.0
	dipropylene glycol	3.0
	pentylene glycol	2.0
	carbomer	0.2
	methylparaben	0.2
	pure water	64.0
C	arginine(10% aq.)	11.5
	/Total	100

Direction:
1) Heat phase A up to 75°C.
2) Premix phase B and heat it up to 75°C.
3) Add phase A to phase B maintaining temperature at 75°C.
4) Emulsify with a homomixer.
5) Add phase C and then cool down to 35°C under mixing.

High Water Solubility

Previously, Cysteine-type permanent wave agents were difficult to use because their low solubility which caused the segmentation of active perming agents in the aqueous solution and cloudy appearance.

As the new and improved DL-Cysteine agents oxidize to become DL-Cystine, it won't recrystallize after dissolving in water.



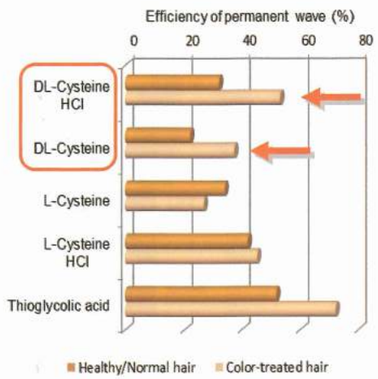
[Methods] Each Cysteine-type agent was dissolved in alkaline water with monoethanolamine. The changes in appearance were observed after air bubbling to oxidize the cysteine reagents in the solution.

High Performance on Perm

Among existing Cysteine-type permanent wave agents, **the new DL-Cysteine formula provide higher performance on permanent wave, especially on the color treated damaged hair** by providing amino acids which flow out of the hair.

Test item	Friction test		Bending test	
	Slipperiness	Polish	Stiffness	Recovera-bility
DL-Cysteine HCl	◎	○	◎	◎
L-Cysteine	○	○	△	△

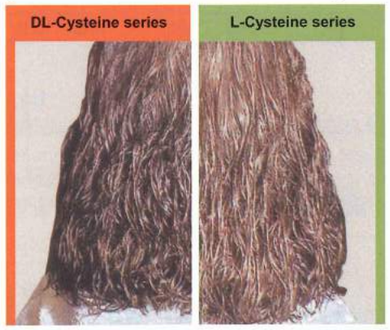
[Methods] Efficiency of permanent wave was assessed by Kilby method.



Gentle on Hair and Hands

For Hair

The new DL-Cysteine will restore color-treated hair's elasticity and texture by adding amino acids which lost during color treatment. **It produces a smoother, more lustrous finish than other Cysteine perm agents.**

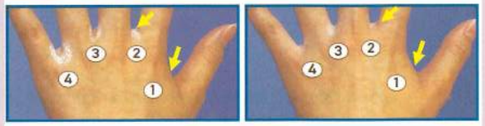


For Hand

Existing perming agents give irritation and damages on the skin of hair designers by leaving residue. **DL-Cysteine series successfully reduce the amount of powdery residue and can be easily washed out it with water.**

Applying perming reagents between fingers.

Rinsing with warm water and drying.

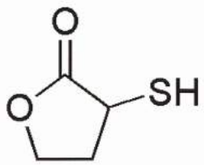


① DL-Cysteine HCl
② DL-Cysteine
③ L-Cysteine HCl
④ L-Cysteine

Mild Acidity but High Performance Perm Agent

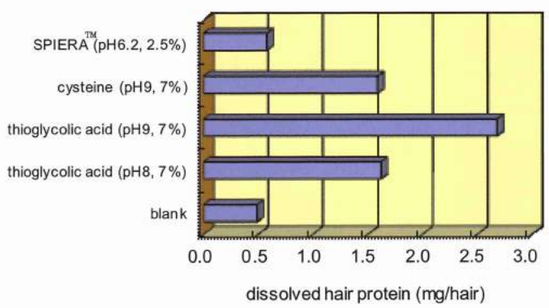
"SPIERA™" is a perm and straight perm agent with mild acidity and superior performance developed by the original technology of Showa Denko K.K.

Current perming techniques give damages on hair by swelling during alkaline processing treatments. Alkaline treatments also have weak points such as strong chemical odors and retardation of hair color. **To solve these problems, "SPIERA™" has been developed as an efficient perm reagent without damages.**



IUPAC	:	**2-Mercapto-4-butanolide**
CAS	:	**14032-62-3**
INCI	:	**Butyrolactonethiol**
TRADE NAME	:	**SPIERA™**

Mild on Hair



The cuticles of hair surface are hydrophobic but the inside of the hair is hydrophilic. Taken in account of these properties of the hair, SPIERA™ has been developed to have both of these features and the high curling formation ability with mild acidic condition. SPIERA™ is also desirable to use for treating damaged hair that is too fragile for alkaline treatments.

To assess the damages on hair, the elution of hair protein after treatment was assessed. **SPIERA™ processed hair lost a little protein with remaining natural-looking appearance.**

[Methods] The hair was soaked in each perm solutions at room temperature. After soaking for 15 minutes, total eluted hair proteins were measured.

Long-Lasting, High Perm Performance

SPIERA™ can achieve strong perming efficiency which is totally different from other existing mild, acid-based perming reagents. With only 2.5 % of SPIERA™ in acidic conditions, all variety of curls can be set.

The curling performance of SPIERA™ was exhibited powerful curling action in the natural pH condition of the hair.

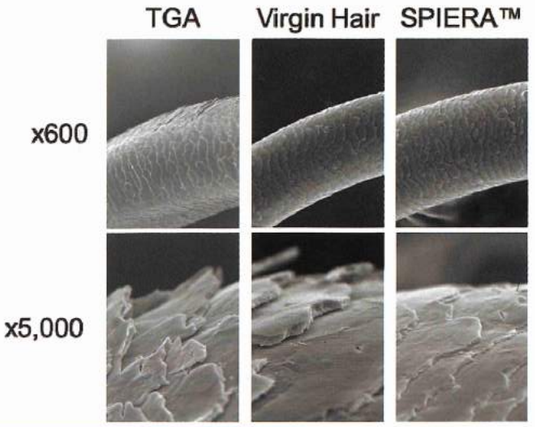
reducing agents	thioglycolic acid 7 %		cysteine 7 %		SPIERA™ 2.5 %
pH	pH9	pH6	pH9	pH6	pH5.6
curling efficiency	86%	32%	62%	25%	67%

[Methods] Efficiency of permanent wave was assessed by Kilby method.

Excellent Texture

SPIERA™ leaves hair texture like virgin hair. Even damaged hair can become silky and smooth after treatment with SPIERA™.

Hair cuticles remained smooth after repeated applications of SPIERA™, while treatment of thioglycolic acid (TGA) made hair cuticles rough and sparse.

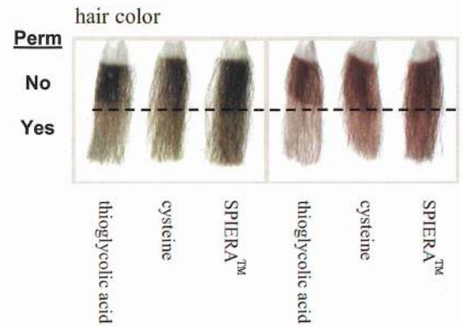


[Methods] The hair surface after treatment was observed by scanning electron microscope (SEM). The concentration of reagents : SPIERA™ 2.5%, TGA 7%.

Excellent Compatibility with Hair Color

SPIERA™ shows not only strong perm performance on damaged hair by color treatment but also protective effect on color retardation, which enables the reaction of perm and color at the same time.

The hair color fading test shows that SPIERA™ treatment faded little color, while other perm reagents show color retardation after washing.



[Methods] Dyed Yak hair was treated by perming reagents. The concentration of reagents : SPIERA™ 2.5%, thioglycolic acid 7%, cysteine 7%.

Notes for Formulation

- **Prepare Liquid 1 at time of use.**

  ; SPIERA™ gets hydrolyzed in water solution. To prevent hydrolysis of SPIERA™, not putting water into SPIERA™ concentrate formula and mixing SPIERA™ concentrate and Base liquid immediately before using are recommended.

- **Incompatibility: Plastics**

  ; SPIERA™is not compatible with all types of plastics. Test the material before use. Among them, plastics composed of polypropylene (PP) and high-density polyethylene (HDPE) are comparatively stable, however polyethylene terephthalate (PET) and chloride (PVC) plastics may change when they come into contact with SPIERA™.

- **Formula pH**

  The solution containing SPIERA™ should be conditioned with acidic pH

  ; Recommended pH of Base liquid (before adding SPIERATM): pH4-7.
  After adding SPIERA™ concentrate, the pH level becomes more acidic (approx. pH3 to pH5).
  In alkaline condition or with alkaline substance, SPIERA™ might show inefficient performance.

- **Masking the odor**

  Using a masking fragrance is recommended to improve the odor.

Formulation Examples

◇ Liquid1 : Reduction treatment liquid

Example 1)
SPIERA™ 2.5%-type formulation for one person:
Mix 10g of SPIERA™ concentrate with 90g of Base liquid to prepare Liquid 1 immediately before using.

Example 2)
SPIERA™ 2.5%-type formulation for one person:
Mix 5g of SPIERA™ concentrate with 95g of Base liquid to prepare Liquid 1immediately before using.

1) SPIERA™ concentrate

Example1) SPIERA™ 25%-type (10g per person)

Ingredients	(%)
SPIERA™	25
Bulking (Ex. WILBRIDE S-753 (NOF Corporation))	74.5
Essence (Masking) (Ex. SP-Series (KOBAYASHI PERFUMERY CO.,Ltd))	0.5

Example 2) SPIERA™ 50%-type (5g per person)

Ingredients	(%)
SPIERA™	50
Bulking (Ex. WILBRIDE S-753 (NOF Corporation))	49
Essence (Masking) (Ex. SP-Series (KOBAYASHI PERFUMERY CO.,Ltd))	1

2) Base liquid

Example 1)

Ingredients	(%)
Water	to 100
Citric acid	0.05
Citric sodium	0.5
Propylene glycol	3
POE hydrogenated castor oil (60E.O)	2
Essence (Masking) (Ex. PX-Series (KOBAYASHI PERFUMERY CO.,LTD))	Moderate amount (0.1～0.2)

Example 2)

Ingredients	(%)
Water	to 100
Citric acid	0.05
Citric sodium	0.5
Propylene glycol	3
POE hydrogenated castor oil (60E.O)	2
Essence (Masking) (Ex. PX-Series (KOBAYASHI PERFUMERY CO.,LTD))	Moderate amount (0.1～0.2)

◇ Liquid 2 : Oxidation treatment liquid

Ingredients	(%)
Water	to 100
Sodium bromate	5~10
Penetrant (Example: Polyoxyethylene lauryl ether)	moderate amount (approx.1)
pH adjuster (Example: Citric acid)	moderate amount (to approx. pH7)