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New Amphiphilic Coupling Agents in Cosmetic Formulae: Isopentyldiol (IPD) and 3-Methoxy-3-Methyl-1-Butanol (MMB)

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Amphiphilic Glycols

It is unusual to observe a set of different functional characteristics in small molecules (1). In order to get flexible behaviors in different cosmetic systems, some structural conditions are necessary. Firstly, it is mandatory to have a certain degree of asymmetry of polarity in the molecule, so to identify in its structure one or more polar sites and the lipophilic moiety. Moreover, the relative weights of these parts should be balanced. Finally, large compatibility with most usual blends making the aqueous and the oil phases is necessary. From unique synthesis technologies and high tech purification processes some original amphiphilic molecules are today ready to expand the formulator' tools for new cosmetic recipes.

Abstract

Short chain glycols and alcohol ethers are multifunctional ingredients in cosmetic formulae. They can solve, among others, solubility problems, wetting difficulties, incorporation of active principles, offer new formulation possibilities. Two ingredients belonging to those categories have been studied and their properties described.

Isopentyl Diol

Isopentyldiol (IPD) is a isoprene-diol. It is a branched chain bi-alcohol with a 5 carbon atoms backbone, with formula 3-methyl-1,3-butanediol (**Fig. 1**). Its special molecular structure, the relatively small molecular size and the presence of two 'strategically positioned' hydroxyl groups provide special performances. The molecule may interact both with hydrophilic and lipophilic substances. It is subject to the Japanese standards for quasi-drug ingredients, therefore IPD is highly rated in its safety level.

The behavior of IPD with common cosmetic ingredients is quite special. Many experiments were carried out to determine its solvent, coupling and humectant properties. Its influence on sensory performances of finished products and the potentiality in protecting hair were previously investigated (3).

For its short hydrocarbon chain, provided of an ethereal methoxyl group and one primary alcohol group, also MMB (3-methoxy-3-methyl-1-butanol) could be functioning as a good polar solvent, a wetting agent and an hydrotrope. Indeed, it is miscible with water in all proportions

Miscibility with Oils

Because of the asymmetry of the molecular structure, with two hydrophilic sites and a lipophilic non-polar site, IPD is miscible with some light fatty esters, resulting in transparent phases, without turbidity or separation. The blending results are reported in **Table 1**. Generally IPD seems to increase the spreading time, and to improve the emollient feel

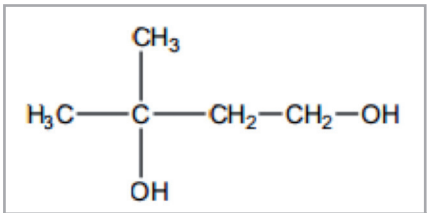


Fig. 1 Chemical formula of Isopentyldiol.

and shine effects compared to pure oils. The addition of MMB to oils at 1:1 ratio does not modify their massageability and emollient feel while gloss of the blends is generally enhanced.

Solubilizing and Carrier Properties

Isopentyldiol solvent properties were tested with both hydrophilic and lipophilic actives at room temperature (**Table 2**). IPD shows good to excellent solubilising properties: remarkable amounts of glycyrrhetinic acid, salicylic acid, resveratrol and Boswellia extracts are dissolved. IPD solubilises efficiently also trimethylglycine and glabridin. Solubility values are practically independent from temperature.

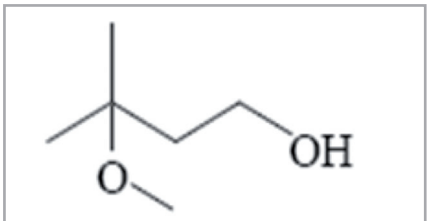


Fig. 2 Chemical formula of 3-Methoxy-3-methyl-1-butanol MMB.

*Isopentyldiol and MMB are produced by Kuraray.

MMB shows outstanding solvent properties for difficult to dissolve lipophilic active ingredients, while it is not a good solvent for hydrophilic ingredients.

Oil	Aspect
Dibutyl adipate	*Miscible, transparent*
Diisopropyl sebacate	*Miscible, transparent*

Table 1a List of oils resulting miscible with Isopentyldiol.

Oil	Aspect
Cyclopentasiloxane	*Miscible, transparent*
Dicaprylyl ether	*Miscible, transparent*
Dibutyl adipate	*Miscible, transparent*
Diisopropyl sebacate	*Miscible, transparent*
Caprylic/capric triglyceride	*Miscible, transparent*
Triethylhexanoin	*Miscible, transparent*

Table 1b List of oils resulting miscible with MMB.

Solubility values @ 25°C	
Glycyrrhetinic acid	2 %
Salicylic acid	20 %
Resveratrol	8 %
Boswellia serrata extract	20 %
Allantoin	1 %
Trimethylglycine	8 %
Inositol	1 %
Escin	1 %
Glabridin	5 %

Table 2a List of active principles tested and their solubility in Isopentyldiol.

Solubility values @ 25°C	
18-beta Glycyrrhetinic Acid	7.4 %
Salicylic Acid	31 %
Resveratrol	8.3 %
Boswellia Serrata Extract	12 %

Table 2b List of active principles tested and their solubility in MMB.

Sunscreen	(%w/w) at RT	(% w/w) at 4°C
Diethylamino hydroxybenzoyl hexyl benzoate	30 %	20 %
Ethylhexyl triazone	30 %	30 %

Table 3 Maximum solubility percentage (%w/w) in MMB of best sunscreen performers.

Perfumes and Flavors

Usually, flavor and fragrances are perfectly miscible with IPD (commonly at ratio 1:1). The addition of IPD (10 %) to a hydro-alcoholic solution containing 1 % perfume allows to reduce (from 30 % to 20 %) the alcohol necessary for keeping the solution transparent. This property can be used to realize skin-friendly perfumes, without resorting to traditional solubilizers which leave a residual sticky after-feel.
This is also the case for MMB: this solvent might completely substitute alcohol in hydro-alcoholic perfumes and aqueous solutions containing it at concentrations between 30 and 50 % could easily dissolve 1 % of different fragrances giving transparent solutions

Wetting Power

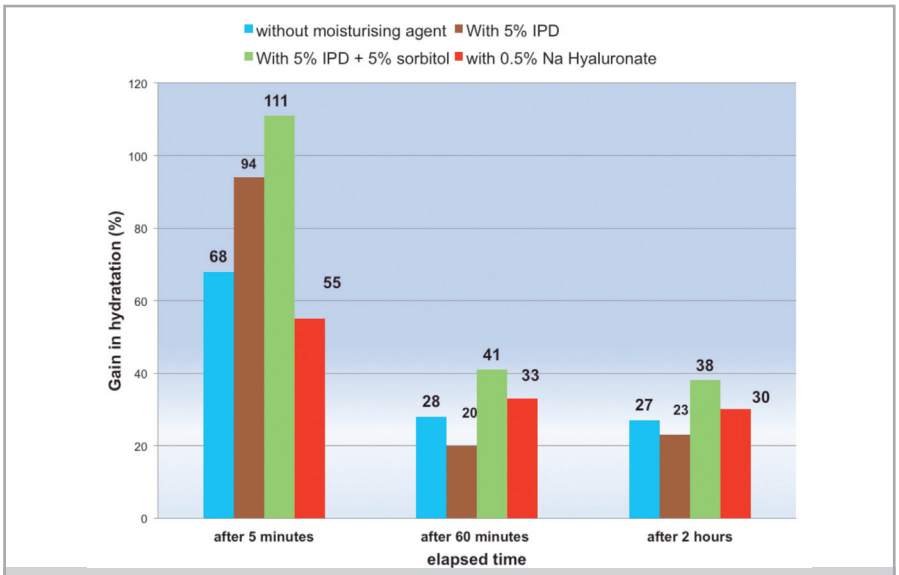
For its two polar hydroxyl groups, IPD was tested with some pigments and fillers to determine its wetting capability. The pigments were titanium dioxide and iron oxide CI 77492, while the fillers were two different hydrated silica gels and a common grade of hydrophilic fumed silica.
IPD shows good wetting properties of iron oxide pigment (ratio 1:1) and titanium dioxide (ratio 4:5, TiO_2 : IPD). In combination with two types of hydrated and fumed silica, IPD gives colourless gels, from soft and transparent to hard and opalescent. Dispersions seem well better than with sorbitol in the case of hydrophilic fumed silica. Consequently, IPD is particularly suitable for toothpastes, both transparent and traditional, for its good wetting properties for silica powders and solubilizing capacity of the aroma. Moreover, as will be later described, it may act as foam stabilizer. MMB is a powerful wetting agent for Zinc Oxide. The solid load in dispersions can reach 80 % when using MMB as dispersing agent.

Solvent Power for Sunscreens

The solvent power of MMB towards UV sunscreens has been evaluated. Best results (stable solutions at 4°C for one week) were obtained with two of them, that show some solubility limits in the usual organic solvents.

Aqueous Gels

Aqueous gels of 1% ammonium acryloyldimethyltaurate/VP copolymer, 0.5% carbomer, 1% cellulose gum, 1% hydroxyethylcellulose and 0.5% xanthan gum were compared after the addition of 5% IPD, that slightly increased their transparency, without affecting their thickness values. Only the viscosity of hydroxyethylcellulose gel increased considerably (by about 20%). This shows a more efficient swelling of this polymer and more extended hydrogen bonds. The preparation of pre-dispersions of cellulose gum, xanthan gum or ammonium acryloyl dimethyltaurate/VP copolymer in IPD to be added to bulk water, makes easier the industrial dispersion of the polymers in water. Moreover, IPD acts as efficient dispersion aid, by helping powders to swell more rapidly in water. In the case of MMB, this solvent does not provide special advantages to the dispersion of these polymers. Viscosity of the gels keep their values, meaning that the addition of MMB does not influence the coordination of water molecules around the polymers.



Graph 1 Moisturising effect of IPD and its combination with sorbitol in comparison to sodium hyaluronate and the base cream without active principles. 5 volunteers – application on forearm – average value after 10' measurements by Corneometer.

Cleansing Systems

Foam height and stability, rheology and sensory profiles of many formulae were evaluated after the addition of IPD. With sodium laureth sulfate (SLES) IPD increases the foam height and stability, quite proportionally to its concentration. In mild surfactant systems, best results take place at 2% IPD, that can be considered a valid alternative to traditional foam boosters. 1%-1.5% IPD influences positively the viscosity values of SLES-based systems, while the final skin feel of cleansing formulations results less dry and has a more emollient feel. MMB has practically no influence of foam properties nor the rheology of the systems.

Oil-in-Water (o/w) Emulsions

Generally, IPD was introduced at 5% in the oil phases, or in combination with the emulsifying system or in the water phase:

1. Blending IPD and solid O/W emulsifiers creates pasty/viscous blends with the benefits of minimization of energy input and time of manufacture. A blend IPD + emulsifier(s) can be easily added to the water/oil system by simply homogenising with blades and turbine. The optimum ratio IPD: emulsifier(s) depends on the type used;
2. if added to the water phase, IPD allows to get smaller oil droplets, and better homogeneity and stability of the system, if compared to the emulsion without IPD.

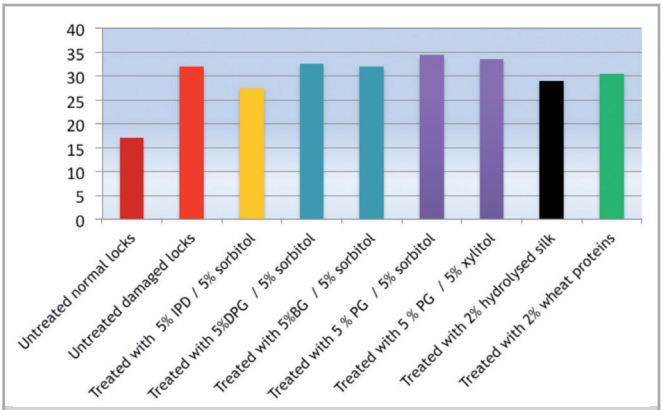
The sensory evaluation shows the good influence of IPD in O/W emulsions: in fact all parameters proved to be positively affected by IPD.

Moisturising Base Cream	
Ingredients (INCI names)	**% w/w**
Aqua/Water	to 100
Carbomer	0.15
Glyceryl Stearate, PEG 100 Stearate	3.00
Cetyl Alcohol	1.00
Paraffinum liquidum	3.00
Triethanolamine	0.60
Preservant System	qs

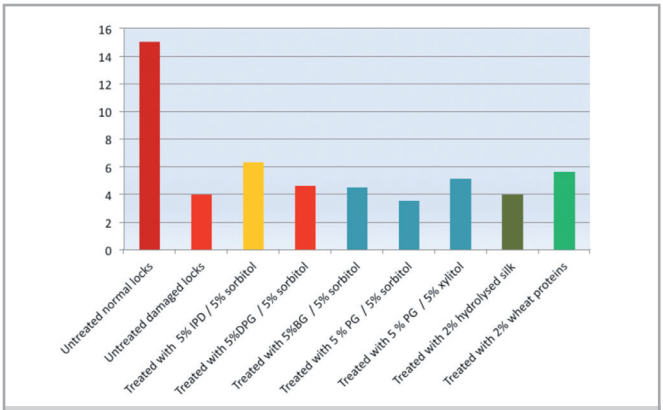
Table 4 Quali-quantitative basic formula tested in the clinical determination of moisturising power of Isopentyldiol.

Skin Moisturization

The hydrating power of IPD was examined during a preliminary clinical test on five volunteers (4). A simple O/W emulsion (**Table 4**) containing additional 5% IPD showed immediate hydrating effect 5' after application. The combination of IPD (5%) with sorbitol (5%) showed extraordinary moisturization effects, extending this effect up to 2 h. These results (**Graph 1**) overtook those of sodium hyaluronate (at 0.5%).



Graph 2 Static friction results. IPD and sorbitol (1:1) protect hair shafts if compared with dipropylene glycol (DPG), butylene glycol (BG), propylene glycol (PG) and hydrolyzed proteins – study on caucasian hair locks.



Graph 3 Drop height results. IPD and sorbitol show their hair protection power if compared with dipropylene (DPG), butylene (BG), propylene (PG) glycols and hydrolyzed proteins - study on caucasian hair locks.

Hair Care

The sensorial properties and repairing effects of IPD on damaged hair were considered.

1. IPD with sorbitol (5 %+5 %) give synergistic effects and improve the aspect of damaged hair: their smoothness increases if compared to IPD used alone, or to hydrolyzed proteins or to the addition of other glycols to sorbitol. Results are shown in **Graph 2** and **3**. The repair effect is also seen by microscopic analysis (**Fig. 3**).

2. IPD has a good influence on the foam of cleansing systems and is able to improve the hair shining effect of cleansing formulae containing an oil phase. Oil shampoos containing IPD provide ease of combing and soft feel on hair.

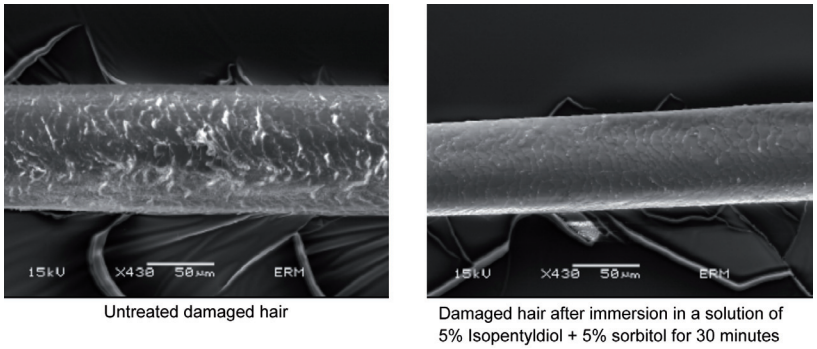
Make-Up

The addition of IPD to make up products was evaluated on four different types of formulations. Firstly, the inclusion of IPD into the powders, after the addition of the binder permitted to obtain formulae with reduced the amount of binders. The compact acquires good break resistance and also easily noticeable shining effects. 5-6 % IPD generally improve the pick-up characteristics. In lipsticks: IPD at 2.5 %-3 % can significantly improve the applicative performances (soft feel, high sliding, long-lasting shine, trace uniformity) without effects on drop point. Higher percentages could give negative results. In cast foundations the addition of IPD to a difficult-to-pour foundation (too viscous) improves the casting phase. Skin application like pick-up, spreading and sliding are also improved. Finally, in liquid foundations, IPD increases transparency and natural look without affecting spreading time, shine and massage time.
MMB can be added to lipsticks up to at least 10 %, where it increases the ease of application and the emollient feel, the shine and colour intensity of the trace. Moreover, even at this high percentage, MMB did not induce sweating or crystallization of the sticks. In compact eye shadows, MMB can improve the binder characteristics , while positively influencing the trace shine and the silky feel during application.

Conclusions

Isopentyldiol can be easily added to all types of cosmetic formulae, in consistent amounts, without inducing significant incompatibility problems. It supplies a series of benefits in cosmetic formulae:

- Easier addition of hydrophilic actives into anhydrous formulas and lipophilic additives into aqueous systems;
- good solvent power and decrease of alcohol concentration in perfumes;



Untreated damaged hair

Damaged hair after immersion in a solution of 5% Isopentyldiol + 5% sorbitol for 30 minutes

Fig. 3 Repairing effect of Isopentyldiol + sorbitol, clearly visible by SEM.

- good foam stabilizer, silica dispersant and aroma carrier in oral care products;
- transparency enhancer and dispersant aid for polymers in aqueous gels;
- extraordinary skin feel in toiletries, skin care and make up products;
- foaming and thickening properties in surfactant systems with SLES;
- very efficient skin moisturisation;
- repairing effect on damaged hair, in combination with sorbitol;
- binder aid in compact powders, improving breakage resistance;
- manufacturing aid: processes of many cosmetic formulations become easier.

On the other side, MMB, thanks to its amphiphilic structure is easily miscible both with many oils and water, working as coupling agent between the two phases in an emulsion. Moreover, it provides the following benefits:

- Dissolve high amounts of lipophilic actives and sunscreens,
- Dissolve perfumes and create no-alcohol colognes
- Compatibility with most cosmetic ingredients and low toxicity
- Optimum wetting power for pigments and fillers, especially Zinc Oxide.
- Binding agent in compact powders
- Color enhancing in make-up products

Certainly a new tool for solving new and old formulation problems.

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SAMPLE FORMULATIONS WITH ISOPENTYLDIOL

LIPSTICK

PHASE	TRADE NAME	INCI NAME (EU)	% W/W
A	CASTOR OIL	RICINUS COMMUNIS OIL	25.90
	HOMBITAN (disp 40 %)	CI 77891, RICINUS COMMUNIS OIL	10.00
	A 406 TUDOR MAHOGANY (disp 40 %)	CI 77491, RICINUS COMMUNIS OIL	7.50
	D&C RED 7 CALC LAKE W 005 (disp 30 %)	CI 15850, RICINUS COMMUNIS OIL	3.30
B	COSMOLL 222	DIISOSTEARYL MALATE	15.00
	BHT	BHT	0.10
	PERFORMALENE 500	POLYETHYLENE	1.50
C	FANCOL VB	LIMNANTHES ALBA SEED OIL (and) BUTYROSPERMUM PARKII BUTTER	10.00
	BEESWAX WHITE	CERA ALBA	5.00
	CANDELILLA WAX	CANDELILLA CERA	6.50
	OZOKERITE T 319	OZOKERITE	5.00
	SUPERSTEROL ESTER	C10-30 CHOLESTEROL/LANOSTEROL ESTERS	6.50
D	TOCOPHERYL ACETATE	TOCOPHERYL ACETATE	1.00
	FRAGRANCE	PARFUM	0.20
E	ISOPENTYLDIOL	ISOPENTYLDIOL	2.50
			100.00

Appearance: solid, red colour
Drop point: 66°C
Production method: add in sequence the ingredients of phase A, while stirring until complete homogeneity of colour is obtained. Heat at 80°C. Melt phase B at 90-95°C until the Polyethylene is completely dissolved. Melt phase C at 80°C while stirring. Add in sequence phase B to phase A, and then phase C to phase A + B, while stirring until complete homogeneity is obtained. Add in sequence phase D (pre-mixed) and E while stirring until complete homogeneity is obtained. At 75-80°C pour into mould.

AFTERSHAVE GEL

PHASE	TRADE NAME	INCI NAME (EU)	% W/W
A	DEMIN. WATER	AQUA	82.95
	NATRLQUEST E30	AQUA (and) TRISODIUM ETHYLENDIAMINE DISUCCINATE	0.30
	INOSITOL	INOSITOL	1.00
	ALLANTOIN	ALLANTOIN	0.10
	GERMALL II	DIAZOLIDINYL UREA	0.25
A1	CARBOPOL ULTREZ 10	CARBOMER	0.55
B	GLYCERIN	GLYCERIN	2.50
	PHENOXYETANOL	PHENOXYETANOL	0.80
C	ISOPENTYLDIOL	ISOPENTYLDIOL	5.00
	BOSWELLIA SERRATA EXTRACT	BOSWELLIA SERRATA EXTRACT	0.10
	GLABRIDRIN	GLABRIDRIN	0.05
D	HYDROVANCE	HYDROXYETHYL UREA	2.00
E	SODIUM HYDROXIDE (SOL.10 %)	SODIUM HYDROXIDE (and) AQUA	1.40
F	BLUE PATENT (SOL. 0.2 %)	CI 42051 (and) AQUA	0.40
	YELLOW N°9 (SOL. 0.5 %)	CI 19140 (and) AQUA	0.20
G	ALCOHOL DENAT.	ALCOHOL DENAT.	2.00
	FRAGRANCE	PARFUM	0.20
	SOLUBILISANT LRI	PPG-26-BUTETH-26 (and) PEG-40 HYDROGENATED CASTOR OIL	0.20
			100.00

Appearance: green gel
Production method: add in sequence the ingredients of phase A, while stirring until complete solution of ingredients. Add A1 homogenizing and stirring until complete dispersion of polymer. Add slowly in sequence phase B (pre-mixed), phase C (pre-mixed), D, E, phase F (pre-mixed) and phase G (pre-mixed) while stirring after each addition until complete homogeneity is obtained. Cool to room temperature, if necessary.

SAMPLE FORMULATIONS WITH ISOPENTYLDIOL

EYE SHADOW

PHASE	TRADE NAME	INCI NAME (EU)	% W/W
A	MAGNESIUM STEARATE	MAGNESIUM STEARATE	3.00
	AEROSIL 200	SILICA	2.00
	TALCO MICRON 10 DEC	TALC	30.00
	TRE'S BN COSMETIC POWDER PUHP 1108	BORON NITRIDE	5.00
B	TIMIRON STARLASTER MP 115	MICA (and) CI 77891	27.50
	MICA BLACK	CI 77499 (and) MICA (and) CI 77891	17.50
C	CERAPHYL 375	ISOSTEARYL NEOPENTANOATE	6.70
	WITCOTACK 145	CERA MICROCRISTALLINA	1.50
	PHENOXYETHANOL	PHENOXYETHANOL	0.80
D	ISOPENTYLDIOL	ISOPENTYLDIOL	6.00
			100.00

Appearance: pearled powder, colour grey
Production method:
Preliminary action: melt ingredients C at 70-75°C while mixing.
Method: mill ingredients A until complete micronization of powders in an appropriate equipment. Add ingredients B and mix until complete homogeneity of powders. Add in sequence phase C and D until complete homogeneity of product. Sift once and repeat a second time before pressing

TOOTHPASTE

PHASE	TRADE NAME	INCI NAME (EU)	% W/W
A	DEMIN. WATER	AQUA	32.69
	SODIUM SACCHARIN	SODIUM SACCHARIN	0.25
	SODIUM MONOFLUOROPHOSPHATE	SODIUM MONOFLUOROPHOSPHATE	0.76
	SORBITOL (Sol. 70%)	SORBITOL (and) AQUA	28.00
	ISOPENTYLDIOL	ISOPENTYLDIOL	4.00
A1	VISCARIN PC 389	CHONDRUS CRISPUS EXTRACT	0.50
B	DICALCIUM PHOSPHATE	DICALCIUM PHOSPHATE	3.00
C	DEMIN. WATER	AQUA	3.00
	A310 TUDOR ASPEN	TITANIUM DIOXIDE	1.00
D	TIXOSIL 73	HYDRATED SILICA	8.00
	TIXOSIL 43	HYDRATED SILICA	10.00
	AEROSIL 200	SILICA	2.00
E	DEMIN. WATER	AQUA	4.00
	EMPICOL LZV	SODIUM LAURYL SULFATE	1.40
F	IRGASAN DP 300	TRICLOSAN	0.20
	AROMA	AROMA	1.20
			100.00

Production method:
Preliminary actions: 1) Mix the ingredients of phase C homogenizing until complete dispersion of powder.
2) Mix the ingredients of phase E heating at 60-65°C until complete dissolution of powder.
Method: Add in sequence the ingredients of phase A while stirring until complete dissolution of powders. Add A1 homogenizing and stirring until complete dispersion and swelling of polymer. Add B while homogenizing until complete dispersion of powder. Add C while homogenizing until complete dispersion and homogeneity of white colour. Add in sequence the ingredients of phase D while homogenizing after each addition until complete dispersion of each powder. Add in sequence phase E and F homogenizing after each addition until complete homogeneity.
Note: the product must be prepared under maximum vacuum.

SAMPLE FORMULATIONS WITH ISOPENTYLDIOL

COMPACT FACE POWDER

PHASE	TRADE NAME	INCI NAME (EU)	% W/W
A	UNIPURE YELLOW LC 182	CI 77492	2.00
	UNIPURE RED LC 381	CI 77491	0.30
	UNIPURE BROWN LC 889	CI 77491 (and) CI 77499	0.50
	UNIPURE BLACK LC 989	CI 77499	0.20
	UNIPURE WHITE LC 981	CI 77891	13.00
B	TALCO 10 DEC	TALC	23.50
	SERICITE DNN	MICA	50.00
	MAGNESIUM STEARATE	MAGNESIUM STEARATE	2.00
C	DERMOFEEL BGC	BUTYLENE GLYCOL DICAPRYLATE/DICAPRATE	2.00
	BEESWAX	CERA ALBA	0.50
	PHENOXYETHANOL	PHENOXYETHANOL	0.80
C1	FRAGRANCE	PARFUM	0.20
D	ISOPENTYLDIOL	ISOPENTYLDIOL	5.00
			100.00

Appearance: beige powder
Production method:
Preliminary action: melt ingredients C at 70-75°C while mixing. Add C1 just before the introduction in the main container and stir.
Method: mill the ingredients A until complete micronization of powders and homogeneity of colour. Add in sequence ingredients B milling after each addition until complete homogeneity of powders. Add in sequence phase (C+C1) and D milling until complete homogeneity of product. Sift once and repeat a second time before pressing.

ANTI-AGE CREME

PHASE	TRADE NAME	INCI NAME (EU)	% W/W
A	PROLIX RB	POLYGLYCERIL-3 RICE BRANATE	5.00
	LANETTE O	CETEARYL ALCOHOL	0.50
	CETIOL OE	DICAPRYLYL ETHER	3.00
	MYRITOL 318	CAPRYLIC/CAPRIC TRIGLYCERIDE	4.00
	JOJOBA OIL	SIMMONDSIA CHINENSIS SEED OIL	1.50
	TEGIN M	GLYCERYL STEARATE	1.00
B	DEMIN. WATER	AQUA	20.25
	XANTHAN GUM 80 MESH	XANTHAN GUM	0.10
B1	DEMIN. WATER	AQUA	53.00
	ISOPENTYLDIOL	ISOPENTYLDIOL	4.00
	NATRLQUEST E 30	AQUA (and) TRISODIUM ETHYLENDIAMINE DISUCCINATE	0.15
	TREHALOSE 100	TREHALOSE	1.50
	NATURAL EXTRACT AP	BETAINE	1.50
C	SF 1202	CYCLOPENTASILOXANE	3.00
D	GERMABEN II	PROPYLENE GLYCOL (and) DIAZOLIDINYL UREA (and) METHYLPARABEN (and) PROPYLPARABEN	1.00
E	FRAGRANCE	PARFUM	0.50
			100.00

Appearance: white cream
Production method:
Preliminary action: add Xanthan gum to water (phase B) homogenizing and stirring for about 5 minutes, then heat at 75°C homogenizing until complete dispersion and swelling of polymer.
Method: melt ingredients A at 75°C while mixing. Add phase B to phase A homogenizing and stirring for about 10 minutes. Add slowly B1 (pre-mixed) homogenizing and stirring. If necessary, cool to 40°C and add in sequence C, D and E, homogenizing and stirring until homogeneity is obtained. Cool to room temperature while stirring.

SAMPLE FORMULATIONS WITH ISOPENTYLDIOL

CLEANSING MILK

In this formula MMB was used instead of hydrogenated polydecene, so improving the make-up removal properties and emollient feel.

PHASE	INCI	% W/W
A	AQUA	60.65
	TETRASODIUM GLUTAMATE DIACETATE	0.30
	GLYCERIN	4.00
	INOSITOL	1.00
	ALLANTOIN	0.20
	CITRIC ACID	1.10
	ARGININE	2.20
A1	XANTHAN GUM	0.60
B	3-METHOXY-3METHYL-1-BUTANOL	10.00
	LIMNANTHES ALBA SEED OIL, BUTYROSPERMUM PARKII BUTTER	8.00
	PENTAERYTHRITYL TETRA-DI-T-BUTYL HYDROXYHYDROCINNAMATE	0.10
	TOCOPHERIL ACETATE	0.30
	CETEARYL ALCOHOL	0.50
	PHENOXYETHANOL	0.80
	STEARETH 2	2.00
	STEARETH 21	2.00
C	ZINC COCETH SULFATE	4.00
D	AQUA	2.00
	DIAZOLIDINYL UREA	0.25
		100.00

Production method

Add A ingredients one by one in the main mixer, blending after reach addition to clear solution. Disperse A1 in phase A while homogenizing with turbine, initially at room temperature then at 40°C, until complete swelling of the polymer. Melt ingredients of phase at 70 °C and heat phase A+A1 to 70°C. Add slowly phase B to A+A1 while homogenizing with turbine for 15'. Cool the emulsion below 40 °C, then add ingredient C and phase D while homogenizing 5'-10' after each addition. Cool the emulsion to 25°C.