SOLIANCE

The formulator's choice for active, natural ingredient

DHA : DIHYDROXYACETONE

A NATURAL SELF-TANNING AGENT

TECHNICAL FILE

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SUMMARY

THE NATURAL ORIGIN OF THE DHA PRODUCED BY SOLIANCE

1. DHA : the most important self-tanning agent

Dihydroxyacetone (DHA) is a physiological substance, present in plant, animal, and human cells. This molecule is of major importance in the carbohydrate metabolism, as it is an intermediate in the Krebs cycle **(1)**.

DHA is the simplest member of the family of ketoses. The production of this active molecule relies on fermentation: it is currently obtained by microbial conversion of glycerol.

Before being considered as a powerful self-tanning agent, DHA was used for its therapeutic potential **(2)**:

- **In the early 1920s**, DHA was used to treat diabetics who tolerated it better than glucose. This was the first observation of a browning effect on skin and teeth.
- **In 1957,** Eva Wittgenstein, a doctor at children's hospital, validated the hypothesis relative to the coloration of teeth and skin by the degradation products of glucose: DHA and glyceraldehyde.
- **In 1959,** the first self-tanning product "Man-Tan" was launched in the United States. It was immediately successful.

Since the 1960s, the market of self-tanners has been growing, particularly in the United States and Europe. And in the past few years, there was an amazing development of products containing DHA, giving a natural tan without sun exposure or UV radiation.

Despite the knowledge that excessive exposure to sunlight may lead to skin damage, cancer, and accelerated cutaneous aging, the desire for a suntanned look is still very strong.

Even if several alternative self-tanning agents have been tested since the 1960s, none performed as well as DHA for the substantivity and the safety of the coloration.

2. Production of DHA by bioconversion:

SOLIANCE has developed an original biotechnological process to produce **a very high quality of DHA**, and proposes this **self-tanning agent** under two cosmetic forms: a pure powder, and syrup.

This process (Cf. ***figure 1***) consists in the bioconversion of glycerol extracted from palm oil or rapeseed:

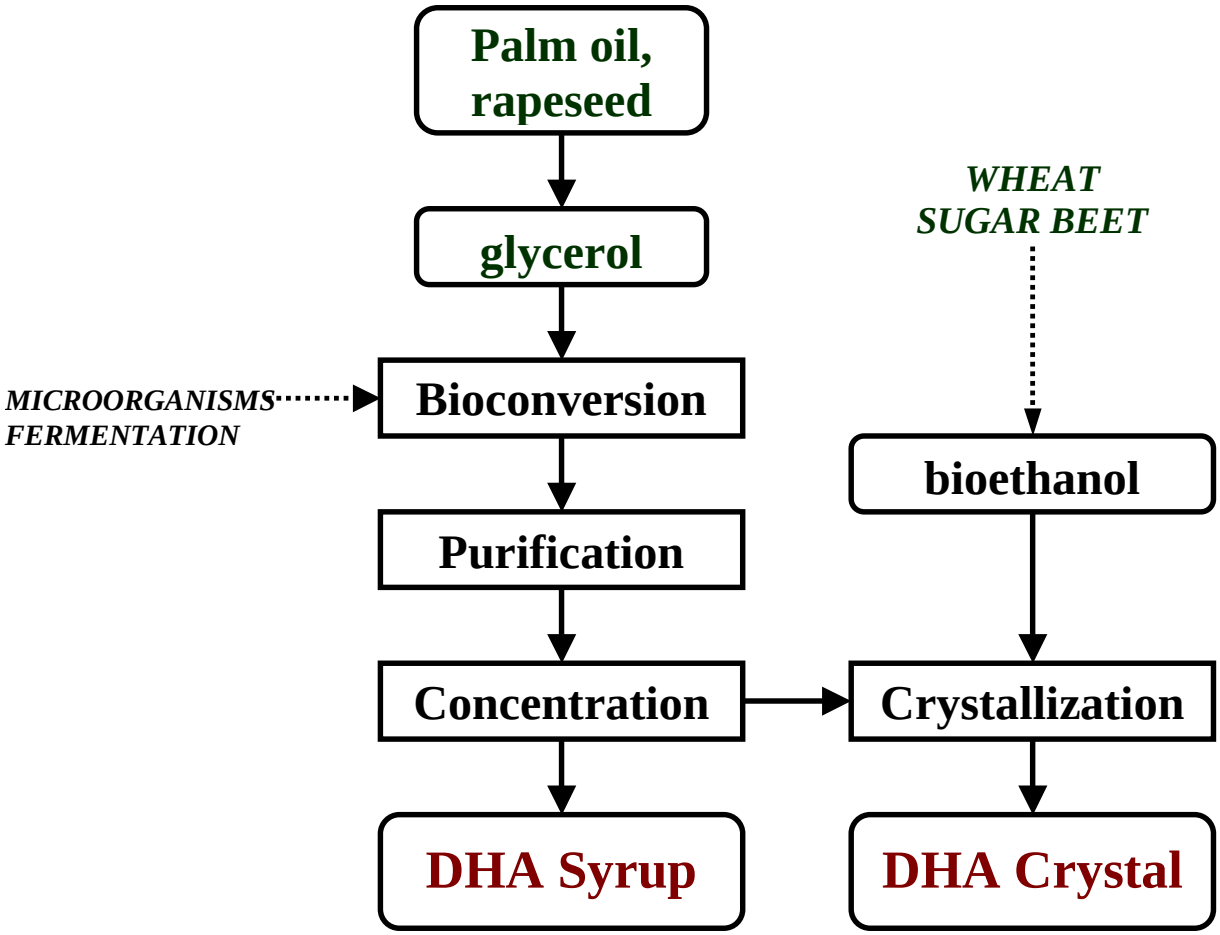
- Micro-organisms of a selected strain (Non genetically modified *Gluconobacter suboxidans*) are grown on a vegetable substrate, and produce the enzyme that will catalyze the bioconversion.
- Bioconversion of glycerol, followed by purification and concentration, allows obtaining the DHA syrup.
- A crystallization using bioethanol (produced by bioconversion of sugar beet and wheat) leads to a DHA powder of very high purity.

To avoid any degradation of DHA, temperature is maintained less than 40 °C during all the production steps.

All the originality of the process developed by **SOLIANCE** is based on the utilisation of **vegetable and renewable substrates** for the fermentation, and on the exclusive use of **bioethanol** for the crystallisation step.

This process makes of the DHA produced by SOLIANCE an entirely natural derived cosmetic ingredient.

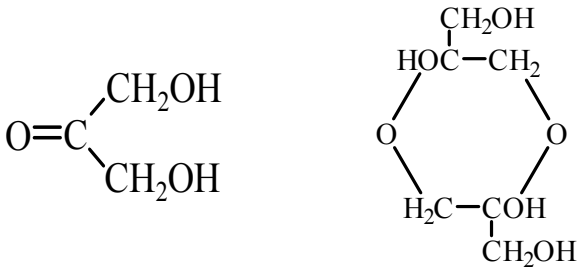
Figure 1 : ***Production of DHA by bioconversion***



CHEMICAL STRUCTURE

1. Chemical structure

Pure dihydroxyacetone ($C_3H_6O_3$) occurs as a mixture of monomers and dimers **(3)** :



Monomer ***Dimer***

Figure 2: ***Chemical structures of DHA***

The monomer is the only active form for skin tanning.

The crystalline form mainly consists in dimers, which convert to monomers in case of fusion or dissolution. Those dimers exist under four different molecular structures that depend on the conformation of the exocyclic CH_2OH and OH groups:

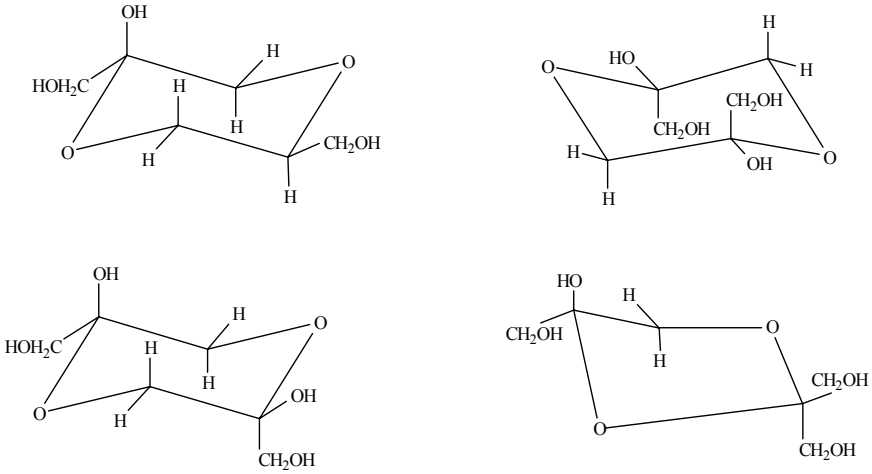


Figure 3: ***The four possible structures of the dimeric form of DHA***

2. Crystal structures

DHA has been found to crystallize in five different crystal forms, obtained by dissolving DHA in methanol at different temperatures between 45 and 65 °C, named as the α, β, χ, δ et ε from higher to lower temperatures of dissolution **(3)**.

Four of them (α, β, χ, δ) consist in dimers, and the fifth (ε) in monomers.

ANALYTICAL DATA

1. Solubility of DHA

SOLVENT	SOLUBILITY
Water (HPLC)	**98 %** (58% in 1 hour)
Ethanol (HPLC)	**12%** (0,8% in 1 hour)
Glycerol (HPLC)	**47%** (5% in 1 hour)

The very high solubility of DHA in water allows an easy formulation: saturation is reached at 7 kg/l at 25°C.DHA just has to be incorporated in the water phase of the emulsion. It can also be incorporated in the water/alcohol mix.

2. Infra-Red spectrum of DHA

Depending on the proportions of dimers and monomers, and on the different crystal forms, several spectrums can be obtained **(3)** (Cf. ***figure 4***).

In consequence, an InfraRed analysis is not relevant to characterize DHA.

But it must be noticed that a different proportion of dimers and monomers from one lot to another isn't synonymous of any problem of quality. Indeed, once dissolved and incorporated in the cosmetic formulation, the all DHA recovers its monomeric, and active form.

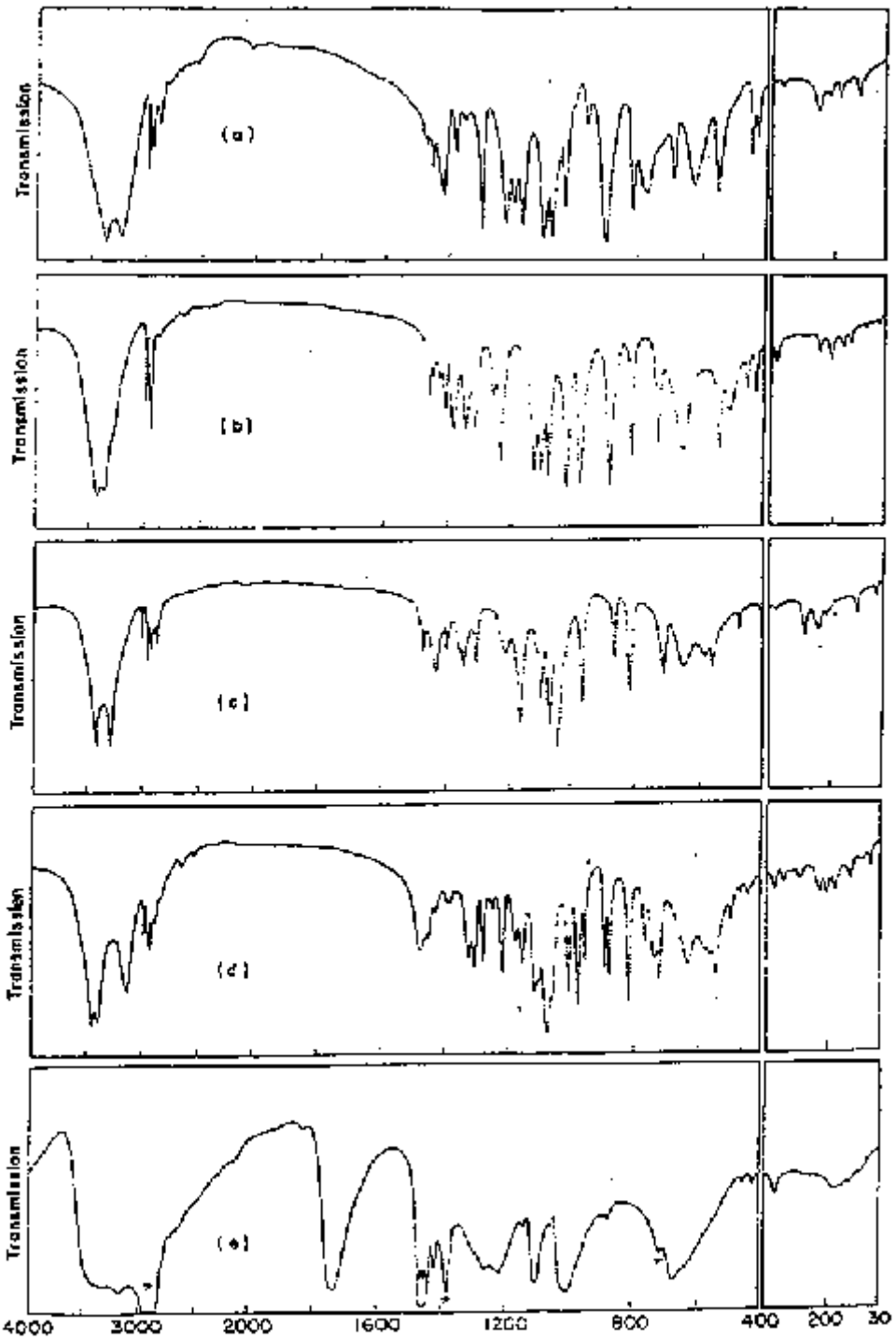


Figure 4 : ***IR spectrums of DHA (from (3))***
a) α form, b) β form, c) χ form, d) δ form, e) ε form

3. High Performance Liquid Chromatography

A HPLC procedure has been developed in our laboratories to have a precise and quantitative measurement of the purity of DHA.

Material conditions:

- Column : packed with a cation exchange resin in the hydrogen form;
- Detection: UV detector and differential refractometer.

Operational conditions:

Column:	BIORAD HPX 87H
Solvent:	H_2SO_4 0,008 N
Debit:	0,6 ml / min
Pressure:	70 bars
Temperature:	35 °C
UV Detection:	210 nm
Retention time:	Between 13 and 15 min.
Evaluation:	External standards

Procedure:

- Prepare a solution with a maximum concentration of 2g/l of the tested DHA;
- Make a calibration with 3 solutions (0.5g/l, 1g/l, 2g/l) of the standard DHA. (standards commonly used are Sigma DHA powder)

4. A reactive ingredient

DHA exhibits a very important reactivity. As a consequence, particular cautions should be taken during storage and formulation.

See our advice to handle DHA page 22 !

SPECIFICATIONS

		DHA Powder	DHA Syrup
Appearance		White powder	Clear solution, slightly yellow
Odor		Slight, characteristic	Slight, characteristic
Composition		DHA	55 –65 % DHA in water
Melting point		60 – 90 °C	-
Solubility (*) (% w/w)	In water	98%	Miscible
	In alcohol	12%	-
	In glycerol	47%	-
PH (5% DM solution in demineralised water)		4.0 – 6.0 (5% solution)	4.0 – 6.0 (5% of dry matter)
Purity (HPLC method)		≥ 98%	≥ 92%
Water (Karl fisher)		≤ 0.1%	-
Residue on ignition		≤ 0.1%	-
Total nitrogen (Kjeldahl) (*)		≤ 0.01%	-
HAZEN Coloration (LICO® 300 DR LANGE)		≤ 20 (25% DM solution in demineralised water)	≤ 25 (25% DM)
Microbial count Total germs		≤ 100 germs/g	≤ 100 germs/g
Heavy metals (*)	as Pb	< 10 mg/kg	< 10 mg/kg
	As	< 3 mg/kg	< 3 mg/kg
	Fe	< 20 mg/kg	< 20 mg/kg

(*) This parameter is not assessed for all lots. However, controls are performed periodically.

Using dose: 3% to 5% of DHA in self-tanning preparations

DESIGNATION

CAS N°:	**96-26-4**
EINECS N°:	**202-494-5**
INCI NAME:	**Dihydroxyacetone**
IUPAC / CHEMICAL NAME:	**1,3 dihydroxyacetone**

Custom tariff : 29 14 40 90 00 00 K

CAS : *Chemical Abstracts Service*

EINECS: *European Inventory of Existing commercial Chemical Substances*

INCI: *International Nomenclature of Cosmetic Ingredients*

IUPAC: *International Union of Pure and Applied Chemistry*

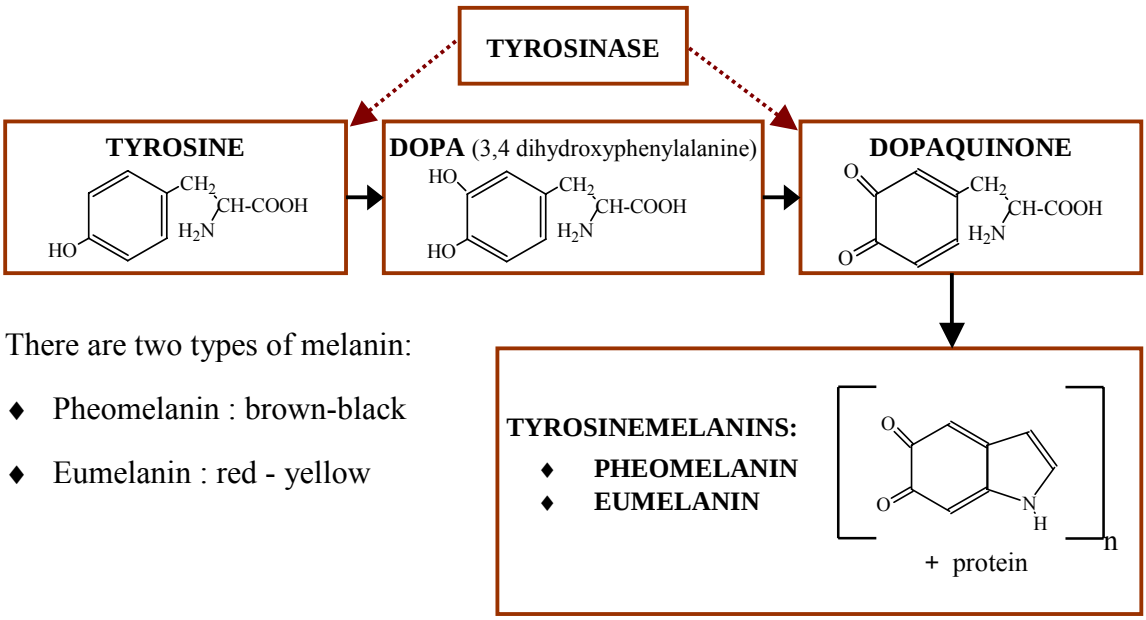
THE SELF-TANNING EFFECT OF DHA

1. Natural tanning induced by sun exposure

1.1. Melanogenesis

Skin color is produced by **melanin**, which derives from **tyrosine**, by a complex oxido-reduction mechanism (Cf. ***figure 5***). The key steps in this reaction process are the hydroxylation of tyrosine to DOPA (1,4 dihydroxyphenylalanine), and the oxidation of DOPA to DOPAQUINONE by means of the catalytic action of the enzyme **tyrosinase**, a copper containing oxidase **(4)**.

Melanogenesis takes place in unicellular glands: melanocytes. Those melanocytes are present in many parts of the body, but dermal coloration originates from those present in the basal layer of the epidermis. Melanocytes contain melanosomes, which have all the necessary components for melanin production. Those melanosomes are transferred in the epidermal keratinocytes, where their final distribution determines the skin tone.



There are two types of melanin:

- Pheomelanin : brown-black
- Eumelanin : red - yellow

***Figure 5:** Melanogenesis*

1.2. Melanin reaction to UV rays

The releasing of melanin by melanosomes is under the influence of UV radiation.

The UVB range is responsible for producing sunburn, and for initiating reactions in the basal layer that lead to the formation of melanin.

The UVA range is believed to be responsible for the direct tanning of skin (by photo-oxidation of the melanin already present in the upper layers of skin), without a preliminary inflammation (erythema). But UVA range is responsible for the long-term effects of sun exposure (skin aging or cancer).

2. Self-tanning with DHA

2.1. Self-tanning mechanism

Natural tanning and self-tanning mechanisms are totally different: the self-tanning effect is not melanin pigmentation but **a coloration of the upper layer of skin** (Stratum Corneum) **(1).**

DHA interacts with the amines, peptides, and free amino acids in the horny layer to generate brown polymers: melanoïdins.

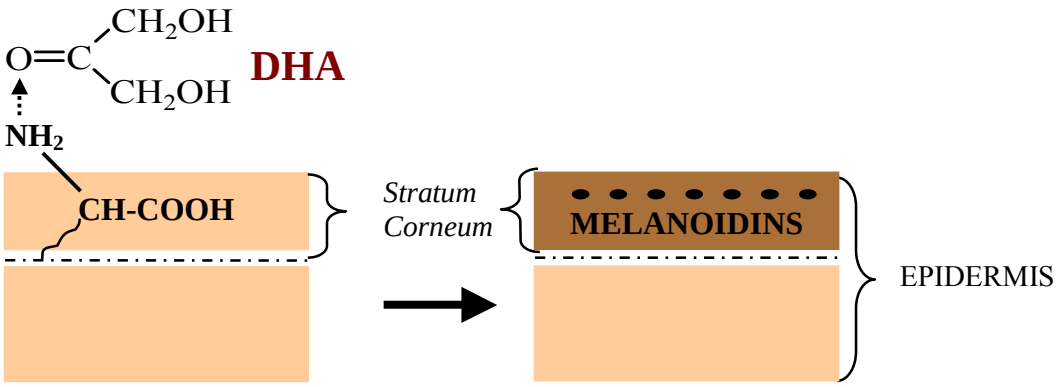


***Figure 6:* Reaction of DHA with the amino-acids of the Stratum Corneum**

This mechanism is in fact a **Maillard reaction**. This well-known reaction has been studied for its commercial and biological implications, particularly in food preservation industry **(2)**.

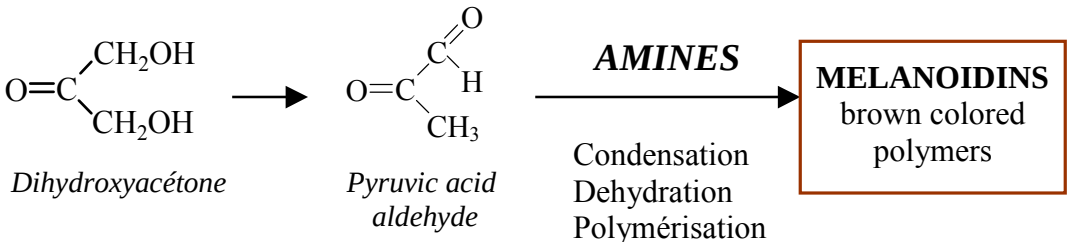


***Figure 7:* Maillard reaction mechanism**

The induced polymers are referred as melanoïdins, to indicate that their visual effect on skin is similar to those of UV induced melanin. They are however chemically very different.

2.2. Properties of the tan induced by DHA

- The coloration is absolutely **water resistant** and diminishes only as the dead cells of the horny layer flake off (usually within one or two weeks) **(5)**.
- On clear phototypes, maximal coloration is proportional to the number of applications on skin. For darker skins, coloration does not depend on the number of applications.
- Most persons can achieve their desired tanned appearance with 2 or 4 successive applications separated by several hours. This appearance can be maintained by continued applications every 2 to 4 days.
- Slight variations can be also observed depending on the anatomic location. Indeed, the depth of color is closely related to the thickness of the Stratum Corneum. To achieve a uniform tan, a previous peeling is recommended before applying DHA formulation.

DHA is a safe and effective mean to obtain a natural looking tanned appearance without exposure to UV rays.

UVA PHOTOPROTECTION INDUCED BY DHA

1. Protection by natural melanin

Natural melanin has an overall photo-protective effect, which protects the cells from alterations caused by UV or visible rays.

But melanin is made up of two polymers, whose proportions vary depending on the subject and its phototype : phaeomelanins and eumelanins.

SKIN TYPE	CARACTERISTICS	MELANIN
I	White skin Always burn, never tan	Phaeomelanins
II	White skin Often burn, sometimes tan	Phaeomelanins
III	White skin Sometimes burn, progressively tan	Eumelanins
IV	Mat skin Rarely burn, easily tan	Eumelanins
V	Dark skin Never burn, always tan	Eumelanins
VI	Very dark skin Never burn	Eumelanins

***Table I:* Skin phototypes**

Eumelanin is abundant in phototypes III, and especially IV, V and VI. It has a very effective photo-protective effect, and acts in two different ways :

- Eumelanin, acting like a filter, spreads light and absorbs energy which is transformed into heat;
- Eumelanin neutralizes free radicals ($O_2^{\bullet}$, $OH^{\bullet}$) induced by exposure to rays.

Phaeomelanin doesn't protect the lipids from peroxidation, but on the contrary releases free radicals $OH^{\bullet}$ and $HO_2^{\bullet}$ when exposed to UV rays, and could therefore be harmful. This explains why individuals of a lighter complexion are more exposed to the photo-induced skin alterations.

2. UVA protection induced by DHA

Unlike the melanin pigments, polymers derived from DHA don't absorb significant amounts of UV light, and therefore, cannot protect against UVB radiation.

However, a DHA tan can be considered as UVA sunscreen, as its brown polymers absorb long wavelength UVA (300-380 nm). This protection against UVA radiation is of major importance, as UVA penetrate deep into the dermis and are responsible for cutaneous aging.

Several studies have been carried out to determine the photo-protective effect of a DHA tan :

- Furaso and al. calculated an average sun protective factor (SPF) of 2,7 with DHA applied on the skin the day before sun exposure. Better results are obtained when DHA is associated with juglone (from walnut stain) or lawsone (from henna) **(6)**.
- With measurements of the immediate pigment darkening induced by DHA, the UVA protective factor (UVA PF) was found close to 2 **(7)**.

This shows that a short pretreatment of the skin by DHA provides a significant protective effect against the UVA. DHA can also be used in association with conventional sunscreens (that mainly absorb UVB and shorter UVA), to provide larger protection and a rapid tanning effect.

DHA : A RAPID AND INTENSE TANNING EFFECT

1. Measurement of the induced coloration

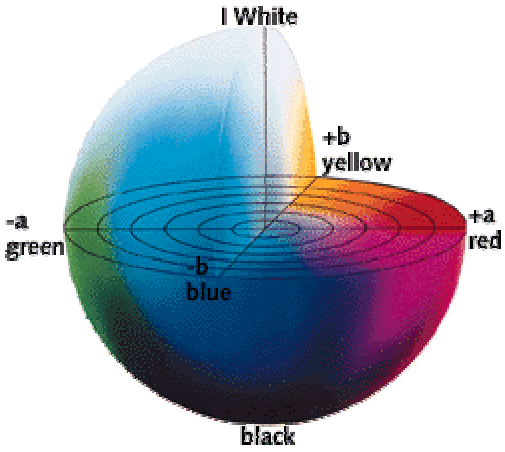
A MINOLTA chromameter (Ref. CR 200) is used to carry out quantitative measures of the coloration induced by DHA. According to this equipment, color is the combination of three parameters:

- L* : Luminance (L* = 0 : Black ; L* = 100 : White)
- a*, b* : Chrominance (coloration and saturation): - a* : green-red axis;
  - b* : yellow-blue axis.

Color can therefore be quantified by its tridimentional coordinates: L*, a*, b*.

Figure 8:

La*b* colorimetric space

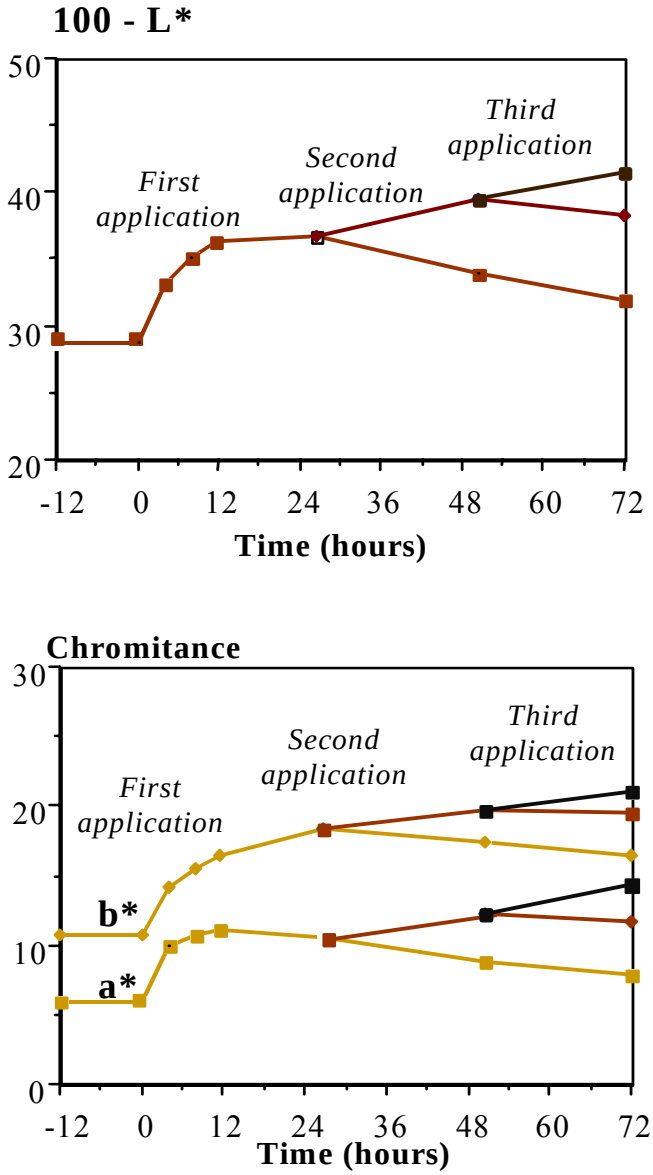


To carry out this study, 20 µl of a 5% DHA solution have been uniformly applied on a delimited zone (3 cm of diameter) on the forearm of a pale phototype person.

The self-tanning efficiency will be all the more important as L* is low, and a* and b* are high.

2. Results

***Figure 9:** Self-tanning effect of SOLIANCE DHA on a clear phototype.*



The intensity of the color induced is maximal within 12 hours after application. The tan remains constant until 26 hours, and then slowly decreases with the desquamation of the Stratum Corneum.

Application of DHA allows obtaining rapidly a natural looking tan. Repeated applications improve the intensity and the remanence of the induced coloration.

HOW TO HANDLE DHA ?

1. DHA : a delicate active ingredient

When applied on skin, DHA gives a visible tan within two hours only after application. This very short reaction time suggests a tremendous reactivity of DHA. This molecule can therefore be degraded in particular conditions **(8)**.

The most damageable factors to the stability of DHA are:

- An elevated temperature;
- An elevated pH;
- UV light;
- Incompatible ingredients in the formulation.

The degradation of DHA results in several consequences:

- A yellow or brown coloration of the product;
- The formation of several degradation products, as formic acid and formaldehyde;
- A fall of pH;
- A loss of efficacy.

Regarding the high reactivity of this raw material, caution needs to be taken during storage, handling and formulating, to avoid any degradation of DHA.

2. Formulating DHA

Despite its high reactivity, DHA can remain very stable in formulation over a long period of time if some rules are taken into consideration (8) (9).

2.1. Influence of pH

DHA undergoes rapid degradation at alkaline pH levels, but the quantity of DHA degraded can be reduced significantly for pH lower than 5.

It is consequently recommended to use acidic pH (lower than 5) to achieve the best stability. The use of buffers is not recommended as they could initiate DHA degradation.

Even if the theoretical optimum pH for the Maillard browning reaction are 5 to 6, using lower pH will not be harmful to the quality of the coloration, as skin has the capacity to adjust the pH of the applied formulation to pH 5 to 6.

In fact, when DHA is incorporated into a formulation, pH drops during storage because of a formic acid production (one of the degradation products). This lowering of pH during storage is consequently a self-stabilizing mechanism, as its stops the degradation process.

2.2. Influence of temperature

An elevated temperature drastically reduces the stability of DHA.

In consequence, DHA should be kept at temperature lower than 40°C during formulation, and products containing DHA can be stored at room temperature.

The DHA powder itself should be refrigerated and stored at 4°C.

2.3. Influence of packaging

To avoid any degradation caused by UV rays, opaque packaging is preferable.

2.4. Influence of the concentration of DHA

The intensity of the induced tan depends on the concentration of DHA. There is however a ceiling pigmentation, even with repeated applications.

Advised concentrations:

- Self-tanning preparations : 3% to 5% of DHA
- Sunscreen preparations : 0,5% to 3% of DHA

2.5. Interaction with other ingredients

- **AMINES: Of course, DHA is incompatible with any kind of amines, as they initiate the Maillard browning reaction.** The use of EDTA, amino acids, proteins, and any product containing amine groups must be avoided.
- **PHOSPHATES** must be avoided: They induce an oxidative process and degrade 100 % of DHA in 6 months.
- **OXIDATIVE MEDIUMS** and **STRONG REDUCTIVE MEDIUMS** must be avoided.
- **PRESERVATIVES:** The pH of the formulations containing DHA tends to be low, and thus inhospitable to germs. In consequence, small amounts of preservatives are sufficient. Parabenz or phenolic alcohol can be used (Phenonip® gives very good results).
- **GELLING AGENTS:** DHA is incompatible with Carbopol gels.
- **EMULSIFYING BASE:** The use of a non-ionic self-emulsifying base (**EMULIANCE ®** for example) improves the stability of DHA.
- **PIGMENTS:** Soluble colorants (type carotene) should be used rather than inorganic pigments.
- **SUNSCREENS:** DHA can be combined with all organic sunscreens that do not contain amines. Inorganic sunscreens should be avoided.

2.6. Improvement of the tanning preparation

- Water in the formulation is necessary for a good tanning effect. The best results are obtained with oil in water emulsions (with 70 to 80 % of water).
- Addition of penetration agents will give a better tan.
- Addition of moisturizing agents will improve the sensorial qualities of the formulation, as DHA slightly dries the skin.
- DHA is highly compatible with sugars.

DHA : THE BEST NATURAL TANNING AGENT

A NATURAL PRODUCT

A natural origin

- Use of **vegetable substrate** only;
- **Non genetically modified bacteria** used for the fermentation;
- **No chemical solvent** used for the crystallization.

A biodegradable substance

An ecological process

The production process is based on **renewable raw materials**, with **environment-caring technologies**

THE BEST SELF-TANNING AGENT

DHA provides a natural looking brown or golden hue, without exposure to the sun.

The induced tan provides photo-protection against UVA radiation.

MANY COSMETIC APPLICATIONS

Self tanning products

DHA is the ideal ingredient for all cosmetic formulations aiming **to prepare or to prolong bronzing**.

DHA can also be used as a **supplement in conventional sunscreen preparations**, to give an intense tan with **less exposure**, and provide **UVA protection**.

Several galenic forms

Both **lotions** and **creams** can be formulated with **DHA**, depending on the result that is expected. Lotions and sprays can be applied very easily, resulting in a uniform tan, whereas creams give a more intense tan, because the applied film is thicker.

Using dose:

- **Self-tanning preparations : 3% to 5% of DHA**
- **Sunscreen preparations : 0,5% to 3% of DHA**

A TOTAL BIOCOMPATIBILITY

Tests have been performed with a 7% solution of the crude product.

- **Cutaneous primary irritation test (CPI): NON-IRRITANT FOR THE SKIN**
- **Ocular irritation test (OI): SLIGHTLY IRRITANT FOR THE EYE**

(Class I of the DRAIZE classification that does not contain any non-irritant)

DHA is a natural substance, present in the human body. In consequence the risk of an allergic response is very low.

Moreover it has been demonstrated that chronic applications of **DHA** do not induce any carcinogenic effect **(10)**.

FORMULARY

WATERPROOF SELF-TANNING CREAM

WATERPROOF SELF-TANNING CREAM

(with **EMULIANCE** and **DHA**)
Stable 3 months at 45 °C

A	
EMULIANCE (self emulsifying base)	**4.0 %**
Fluid paraffin oil [4]	2.0 %
Miglyol® 812 N [5]	3.0 %
Isostearyl isostearate [6]	3.0 %
Dimethicone (350cps) [7]	2.0 %
Glycerol stearate [1]	2.0 %
B	
Glycerol [2]	10.0 %
Phenonip® [3]	0.5 %
Water	QS to 100 %
C	
DHA (Dihydroxyacetone, self tanning agent)	**5.0 %**
Water	10.0 %
D	
Fragrance [1]	QS

PROCEDURE

1. Prepare A in a Bain Marie at 75 °C ;
2. Prepare B in a Bain Marie at 75 °C ;
3. Put A under stirring at 1000 rpm ;
4. Slowly add B in A and continue stirring a few minutes at 75 °C ;
5. Remove from the Bain Marie ;
6. Reduce stirring to 300 rpm until a 30 °C temperature is achieved ;
7. Adjust pH if necessary ;
8. Prepare C and add in the emulsion as well as fragrance ;
9. Stop agitation.

SUPPLIERS OF THE RAW MATERIAL

[1] Laserson SA
[2] Cognis
[3] Nipa Phenonip: Phenoxyethanol/MethylPOB/EthylPOB/
PropylPOB/ButylPOB/ isoButylPOB
[4] Esso distributed by Brentag
[5] Hüls distributed by Lambert-Rivière
[6] Gattefossé
[7] Ge Silicones distributed by Brentag

BIBLIOGRAPHY

(1) MEYBECK, **"Étude des mélanoïdines obtenues par réaction de la DHA avec les aminoacides"**,
PCA N°14, Mars/avril 1977, p. 63

(2) T. KURZ, **"Formulating effective self-tanners with DHA"**,
C&T, Vol. 109, Nov. 1994, p. 55

(3) Y. KOBAYASHI, T. IGARASHI, H. TAKAHASHI, K. HIGASHI, **"Infrared and raman studies of the dimeric structures of 1,3 dihydroxyacetone and DL-Glyceraldehyde "**
Journal of molecular structures, 1976, vol. 35, pp. 85-99

(4) P. ALEXANDER, **"Simulated sun- Taking the heat out of tanning"**
Manuf. Chem, vol.64, Jul 1992, pp. 18-19, 21

(5) S.B. LEVY, **"Dihydroxyacetone-containing sunless or self-tanning lotions"**
J. Am. Acad. Dermatol., 1992, vol. 27, N° 6, pp. 989-993

(6) JA. JOHNSON, RM. FUSARO, **"Protection against long ultraviolet radiation: topical browning agents and a new outlook"**
DERMATOLOGICA, 1987, VOL 157, N°2, PP. 53-57

(7) L. DUTEIL et al.,**"Évaluation colorimétrique du pouvoir photo protecteur en UVA de la DHA"**
Nouv. Dermatol., 1992, vol.11, N°5, p.338

(8) M.F. BOBIN, M.C. MARTINI, J. COTTE, **"Étude de la conservation de la dihydroxyacétone en fonction de la formulation"**,
Labo-Pharma, Probl. Tech.- 31, n°331, Mai 1983, p. 377

(9) T. KURZ, **"Formulation with DHA: how to gain stable formulas"**
Parfumerie und kosmetick, 1996, vol.77, N° 9

(10) FJ. MARKIN and E. MARLOW,
"Noncarcinogenicity of dihydroxyacetone by skin painting."
J. Environ. Pathol., Toxicol., Oncol. Vol 5 (4-5), pp 349-351, 1884

GENERAL INFORMATION

Because of its very high reactivity, **DHA** must be stored at **4°C, in a dry place, and kept away from light.**

No preservative is added.

Usual care has to be taken after partial use of the product in order to avoid any contamination and humidity. In particular, container must be hermetically sealed after using and **kept in a dry place**.

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This information is given according to our current best knowledge of the product and the bibliographic information relative to DHA, and self-tanning products.

MATERIAL SAFETY DATA SHEET

Conforming to directive 91/155/CEE

DIHYDROXYACETONE

1 - Identification

Product name : DIHYDROXYACETONE	Issue date : 09/09/97
CAS N°: 96-26-4	
Trade name : DIHYDROXYACETONE crystal	
Manufacturer : SOLIANCE	Emergency phone number : (33) 3 26 05 42 80

2 - Composition

Chemical family : Ketone
Chemical formula : $C_3H_6O_3$

3 - Hazards identification

In case of contact with eyes, rinse immmediately with water. Get medical attention.
Wear appropriate protective clothing.

4 - First aid measures

In case of contact with eyes, rinse immediately with large amounts of water for at least 15 minutes.
In case of contact with the skin, wash immediately with water and soap.
In case of inhalation, remove to fresh air.
In case of ingestion, rinse the mouth with water. Get medical attention.
Wash contaminated clothing before re-use.

5 - Fire fighting measures

Extinguishing media : water spray, appropriate dry chemical or foam.
Unusual fire and explosion hazards : none known.

6 - Accidental release measures

Wear a respiratory mask, safety glasses for chemicals, gumboots and thick impervious rubber gloves.
Sweep and collect spilled material into appropriate waste containers for disposal.
Avoid raising dust.
Air the place and wash the spreading area after recovering the material.

7 - Handling and storage

Storage : store at + 4°C in a dry and dark place.
Handling : DHA is a selftanning agent. Take the necessary caution to avoid a discoloration of the skin.

8 - Personal protection

No specific equipment required.

MATERIAL SAFETY DATA SHEET

Conforming to directive 91/155/CEE

DIHYDROXYACETONE

9 - Physical and chemical properties

Appearance : White to slightly yellow powder, slight characteristic odor.
Melting point : 60-90 °C
Solubility : Completely soluble in water, partially soluble in alcohol and glycerol.
pH : 4 - 6 (5% water solution)
Boiling point : no data
Density : 0,4 - 0,5

10 - Stability and reactivity

This product is a stable compound and hazardous polymerization will not occur.
Incompatibility : none known.
Hazardous decomposition products : none known.

11 - Toxicological information

Acute toxicity : no toxicity when administered in 7% (w/v) solutions at a 20 ml/kg dose on male and female mice.
Primary cutaneous irritation : the product is non irritating for the skin (IP = 0,1). The product will cause a brown discoloration at points of contact.
Ocular irritation : the product is very slightly irritating for the eye (IO ma = 2,83 / IO 48h = 0,67).

12 - Ecological information

13 - Disposal considerations

This product must be disposed of in accordance with all applicable federal, state and local regulations.

14 - Transport information

This product must be conveyed in accordance with all applicable federal, state and local regulations.

15 - Regulatory information

The material is not classified as hazardous for users.
EINECS N° : 202.494.5
Custom tariff : 29 14 40 9000 00 K

16 - Other information

None

The information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. SOLIANCE assumes no responsibility for personal injury or property damage caused by the material. Users assume all risks associated with the use of the material.