A Vegetan Premium: The First Cosmetic Active both Self-tanner and Antioxidant

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Abstract

Vegetan Premium is an active ingredient that is a synergistic combination of Dihydroxyacetone (DHA), the self-tanning reference obtained through a fermentation process and an allomelanin-like polymer (brown to black pigments naturally produced by plants and microorganisms) obtained through a patented process.

The self-tanning effect of Vegetan Premium is due to the colouration of the skin horny layer. DHA reacts with the amines, peptides and amino acids of the *stratum corneum*, producing brown polymers called melanoidins. The allomelanin-like polymer interacts with corneocytes on the skin surface to improve a natural looking tan.

Thanks to its unique composition, Vegetan Premium maximises the key factors for a "sun-kissed" look: a quick, intense and truly natural tan. Compared to a standard HA/erythrulose combination, Vegetan Premium significantly improves colour intensity and increases the speed of colouration. It also visibly induces a more natural skin colour.

More than a classic self-tanner, Vegetan Premium also protects the skin from oxidative stress (patented) and outperforms epicatechin, the antioxidant positive control.

Introduction

A tanned skin has become, in recent decades, an obvious sign of health and well-being. It has become a daily cosmetic gesture, such as skincare or make up. Consequently, the consumer (woman or man) is looking for a fast and natural-looking skin colouration.

As the expert of dihydroxyacetone production (the active ingredient reference), our company innovates by designing the first active self-tanner: Vegetan Premium. Much more than a classic self-tanner, Vegetan Premium acts in a simple, effective way. It results in a fast, natural and lasting colouration whilst protecting the skin from oxidative stress (patented).

Vegetan Premium

Vegetan Premium is an optimised combination of DHA and an allomelanin-like polymer.

DHA is a cetone of which the formula is $C_3H_6O_3$. In powder, DHA is mainly composed of dimers that transform after dissolution in monomers responsible for the self-tanning activity.

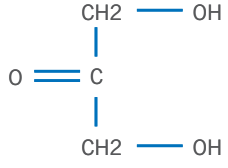

Figure 1: Monomer structure of DHA

DHA is a physiologic coumpound, naturally present in plant, animal and human cells. This molecule is actually an in-between molecule of the Krebs cycle.

Allomelanins form the most heterogenous group of melanins. They are brown to black pigments naturally produced by plants and micro organisms. They are chemically different from animal melanins such as eumelanin and pheomelanin (Hendry & Houghton, 1992). In fact, they are often macromolecules made of simple phenols.

In Vegetan Premium, caffeic acid is the phenolic molecule that polymerises in order to obtain an allomelanin-like compound.

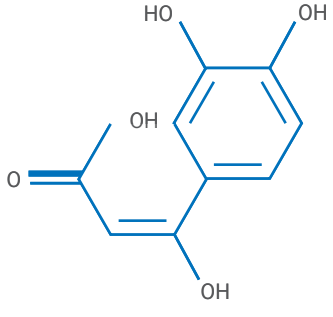

Figure 2: Caffeic acid structure

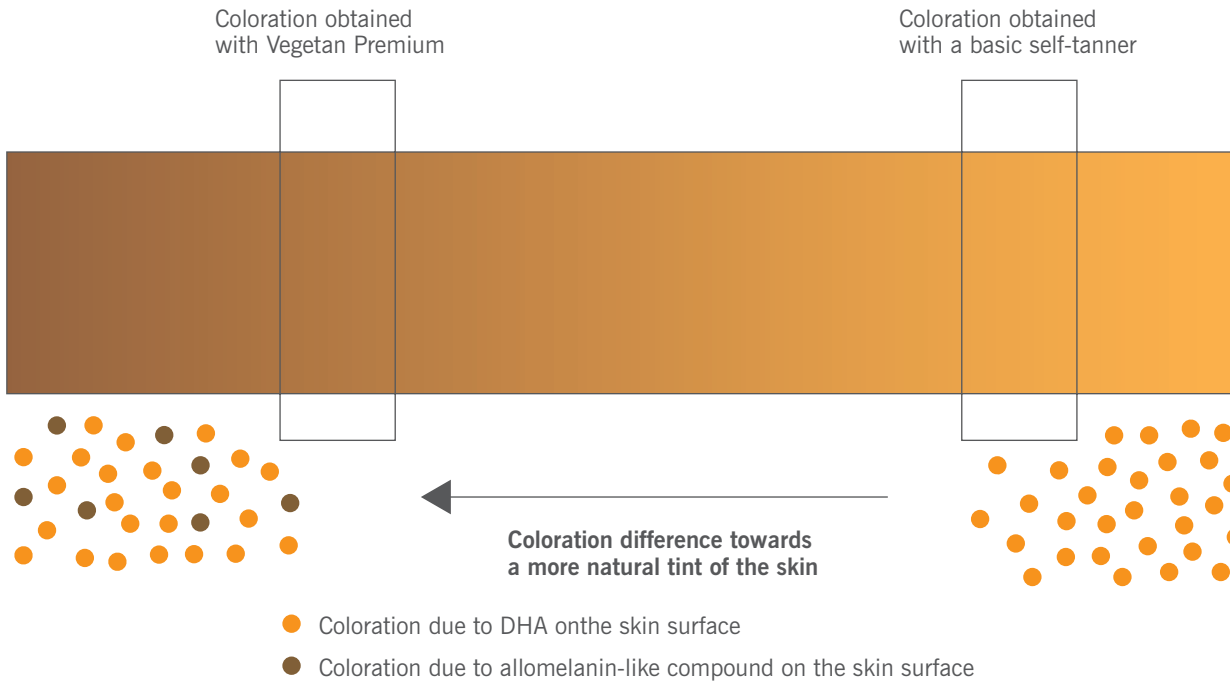

Figure 3: Stratum corneum colouration principle by both of the constituents of Vegetan Premium (DHA and allomelanin-like polymer)

Vegetan Premium Activity

The self tanning effect of Vegetan Premium is due to the colouration of the skin's horny layer. The DHA reacts with the amines, peptides and aminoacids of the *stratum corneum*, thus forming brownish-coloured polymers called melanoidins. This reaction is therefore totally different from the melanogenesis phenomenon resulting from UV-stimulation on the skin.

The allomelanin-like polymer interacts with corneocytes and offers a new way to adjust the skin colouration obtained with DHA and make it more natural-looking.

The colouration is totally water-proof. It fades away only when dead cells of the horny layer are eliminated (about one week after application).

On light skin, colouration intensity will be proportional to the number of applications. This is not true for darker skin. Tan intensity may be maintained by regular application of the product, every two or three days.

The colour intensity may vary depending on the treated zone. In fact, the thicker the skin, the more intense wiil be the colouration. In order to obtain an homogenous tan, a scrub is recommended before application.

Vegetan Premium is a potent ingredient made to obtain a fast and natural-coloured tan without sun ray exposure.

The allomelanin-like polymer present in Vegetan Premium protects the cells from oxidative stress due to Reactive Oxygen Species (ROS). It has been demonstrated and patented that this product protects DNA from ROS damage.

Vegetan Premium is the first antioxidant self-tanner

Efficacy Tests

Vegetan Premium in self tanning products (*in vivo* test)

This test consisted of measuring kinetics and colouration quality obtained with Vegetan Premium versus DHA + Erythrulose in a self-tanning product.

It was achieved via colour measurement and an auto-evaluation by 20 volunteers (15 with phototype I and 5 with phototype II). They responded to the question: "Which colouration is the most natural?"

Once a day volunteers applied two creams each containing Vegetan Premium and DHA + Erythrulose on two 2 cm-

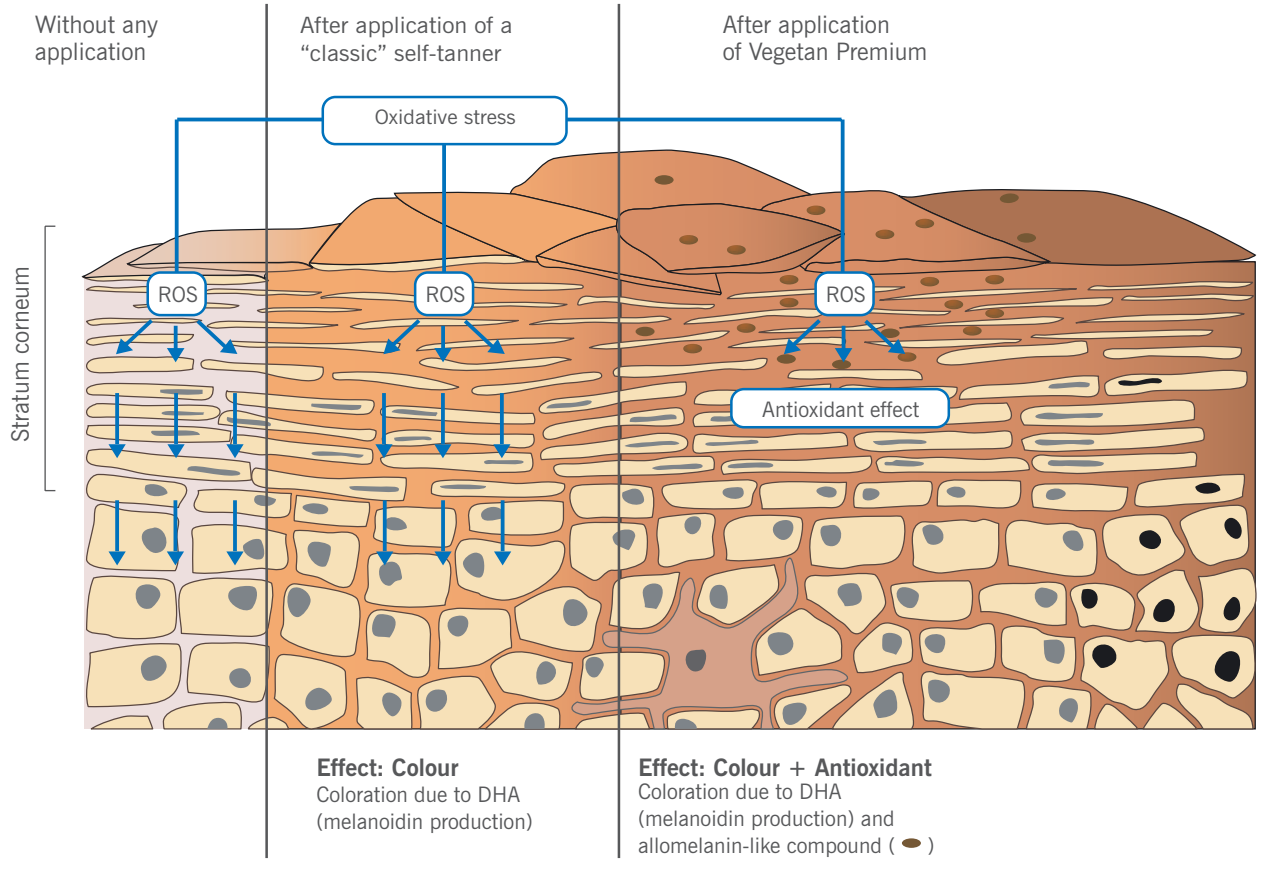

Figure 4: Vegetan Premium activity

diameter zones of the left and right forearms, 7 cm up from the wrist. Measurements of the saturation colouration were made at T0, T3h, T6h, T8h, and 48h with a chromameter.

As a reminder, this device splits light into three constituents:
L* = Luminance
C* = Saturation
h* = Tint Angle

Colour may thus be characterised by its three-dimensional coordinates : L*, C* and h*. The measured parameter is colour saturation. Scientific literature showed it is the most linked to skin colour (Ratan K. Chaudhuri and Cristina Hwang, 2001), Luminance L* being too sensitive to measurement conditions (lights, pressure of the device on the skin).

Analysis of results between the first day of application, the other control days, and between the data series was estimated by a Student test.

Results

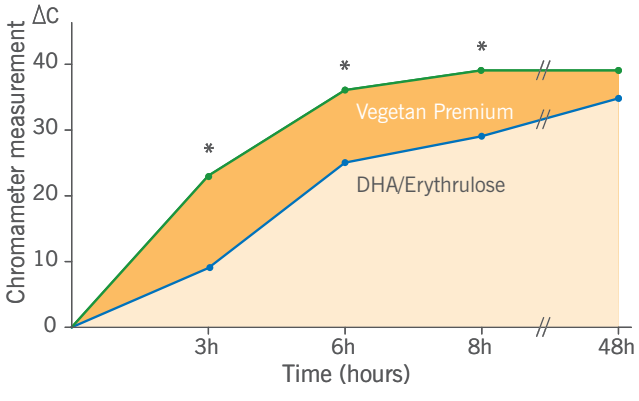

Figure 5: Self tanning kinetics

At 48h, colouration intensity was identical for both of the products. Vegetan Premium does not modify colouration remanence of the product.

Vegetan Premium increases the colouration kinetics of self-tanning products

Auto-evaluation by the panel

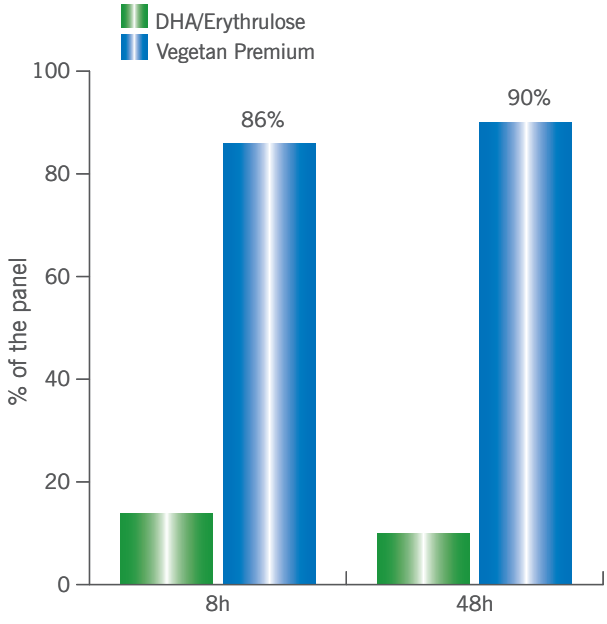

Figure 6: Auto-evaluation self tanning

Vegetan Premium makes the coloration of self-tanning products more natural

Vegetan Premium in glowing products (*in vivo* test)

This test consisted of measuring colouration quality obtained with Vegetan Premium vs DHA in a bronzing product.

As an auto-evaluation study, the test was carried out on 23 volunteers (14 with phototype I and 9 with phototype II).

Once a day, over 4 days volunteers applied two creams each containing Vegetan Premium and DHA on two 2 cm-diameter zones of the left and right forearms, 7 cm up from the wrist.

Results

65 % of the panel confirmed that Vegetan Premium makes the colouration of bronzing products more natural

Vegetan Premium: antioxidant effect (Test *in vitro*)

This test consisted of proving that the allomelanin-like polymer protects DNA from oxidative stress.

It was carried out *in vitro* on HeLa3S cells, cultivated in a MEM medium, in which 10% was calf foetal serum and 2mM glutamine. The positive control was epicatechin.

ROS effects were measured according to the following method:

- DNA damage was repaired with an enzymatic system, which incorporates biotine-marked nucleotides;
- marked nucleotides were recognised by the avidin-peroxydase enzymatic complex;
- a peroxydase chimioluminescent substrate was then added.

The chimioluminescent signal was measured with a luminometer.

Results are expressed in protection percentage:

$$\% = \frac{LRU_{\text{Oxidant}} - LRU_{(\text{Oxidant + product})}}{LRU_{\text{Oxidant}}}$$

(LRU = Light relative unit)

An IC50 may thus be calculated for each tested product.

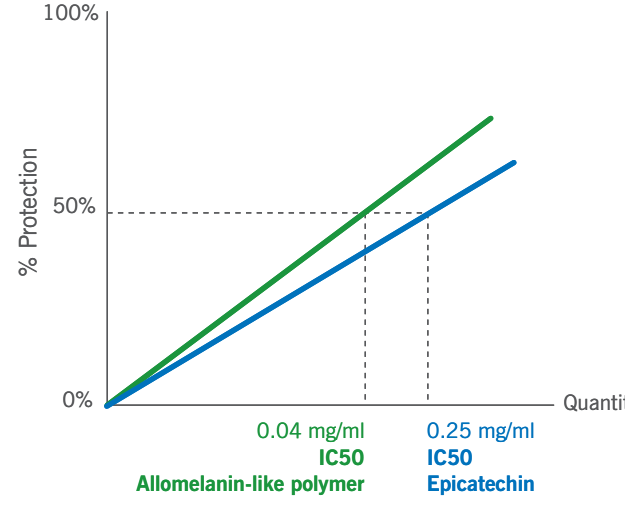

Figure 7: IC 50

IC50	
Allomelanin-like ingredient	0,04 mg/ml
Epicatechin	0,25 mg/ml

Vegetan Premium contains an ingredient with a strong antioxidant activity*

*This activity has been patented.

Conclusion

Vegetan Premium is the first ever self-tanning ingredient that shows antioxidant activity.

Acting directly on the uppermost layer of the *stratum corneum*, it has proved its self-tanning effect. Fast results as well as natural tint of the colouration have been tested and are obvious. The skin tans more quickly with a more natural colour.

Innovation of Vegetan Premium concerns also its antioxidant properties, which have been patented.

Therefore, Vegetan Premium offers a double benefit: a tanned skin and a skin protected against ROS damage. These molecules are also produced by the stress that our skin is daily subject to.

Vegetan Premium may be incorporated in various cosmetic products:

- Different kinds of self-tanning products, such as creams, sprays and lotions;
- Bodycare products;
- Bronzing products;
- In association with other cosmetic active ingredients (moisturising, anti-ageing, slimming...).

Vegetan Premium is an original active ingredient developed by our company, presenting complementary actions for an even tan.

Acknowledgement

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Authors' Biographies

Celina Rocquet has a Master of Science degree in Molecular Biology, Plant Physiology and Biotechnology. She specialized in Marketing via a Master of Business degree. After working in the cosmetic industry (SIPCA/Adedis, Clariant, LVMH-Parfums Christian Dior) and in a marketing and communication agency (Publicis), she became Marketing Manager at Soliance in 2006.

Romain Reynaud has a Master of Science in Formulation Chemistry. He worked in ARD (Agro Industrie Recherche et Développement) for three years, before becoming R&D Manager at Soliance.