luminescine

a revolutionary concept in skin radiance

Abstract

LUMINESCINE is the first natural active ingredient for cosmetics based on luminescence (Patent Pending). Its phytocomplex is able to protect the skin from harmful high energy UV radiations transforming them in a source of light that radiate directly from skin or hair making them looking more shiny, young and healthy.

A yellow flower of the Mediterranean species Great Mullen (*Vebascum thapsus*), has been studied for its luminescent properties using a patented enzymatic Bioliquefaction technology to recover the complete phytocomplex of the flower without compromising its ability to convert UV radiation into visible light to obtain LUMINESCINE (CTFA name: Hydrolyzed Verbascum Thapsus Flower), an active ingredient for cosmetics able to increase skin and hair radiance transforming UV radiation into new visible light (patent pending).

Spectrofluorimetric measures shown that LUMINESCINE is able to adsorb UV and visible light and to transform part of the adsorbed energy into visible light and the product was able to retain its luminescent properties after the formulation of finished cosmetic products.

To evaluate the ability of LUMINESCINE to increase skin radiance some *in vivo* test has been performed on volunteers. It was measured the skin radiance variation comparing the effect of a simple gel formulation containing LUMINESCINE 3% w/w with the effect delivered by a placebo. Data show a mean increase of the L parameter of *5.5* units *vs.* placebo after just one application, a clear in increase of skin radiance was therefore delivered by LUMINESCINE.

To assess the effect of LUMINESCINE in hair care applications several *ex vivo* test were performed on virgin hair swatches. The increase of L values recorded *vs.* placebo was directly related to the efficacy of the treatment used in delivery the active ingredient on hair surface, up to + 10,3 units as L variation, in a dose-dependent way. LUMINESCINE is therefore a very interesting natural product also for hair care applications to increase hair radiance.

The protective effect of LUMINESCINE against UV radiation was studied on keratinocytes cell lines. LUMINESCINE was able to reduce the formation of light mediated harmful radical species (up to -59%) acting as a strong protectant against photo-oxidative stress.

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www.phenbiox.it / info@phenbiox.it

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Introduction

Plants has developed through the evolution a wide, and often unsuspected, variety of strategies to survive, grow and reproduce. Plants are able to effectively defense themselves from external aggression and disease, can detect water, nutrients and light sources, and can establish effective communication strategies with other plants and even animals. These and several other features made plants to become the real dominant species on Earth as the 99.7% of the whole biomass is made of plants (humans and all other animals account just for the 0.3%!).

Reproduction is one of the most relevant, and often tricky, issue for plants as well. Also for that several different strategies has been developed, and flowers are one of the most brilliant example. Differences in shape, color, scent, etc. are not meant to please our senses, but are tools to attract and select pollinating insects, and in a spring blossoming field the competition is sky-high (Figure 1).

An unexpected tool that some flowers have developed in order to increase their visibility is luminescence. So on top of the light that the flower is able to reflect due to its colors, there is some extra brightness that is directly related to the ability of the chemical phytocomplex of the flower to convert some UV (invisible) radiation into visible light. This phenomenon is based on the luminescent properties of some molecules characterizing the plant phytocomplex. These phytocomplex are therefore able to adsorb harmful UV radiation transforming them into visible light.

Figure 1: Great Mullein flower with a pollinating butterfly.

Verbascum thapsus (Great or Common Mullein) is a Mediterranean species of mullein diffuse in Europe, northern Africa and Asia, that was introduced very early in the 18th century in the Americas and Australia. It is a hairy biennial plant that can grow to 2 meters tall or more. Its small yellow flowers are densely grouped on a tall stem, which bolts from a large rosette of leaves. It grows in a wide variety of habitats, but prefers well-lit disturbed soils, where it can appear soon after the ground receives light, from long-lived seeds that persist in the soil seed bank. It is a sun loving plant being intolerant of shade from other plants and unable to survive tilling.

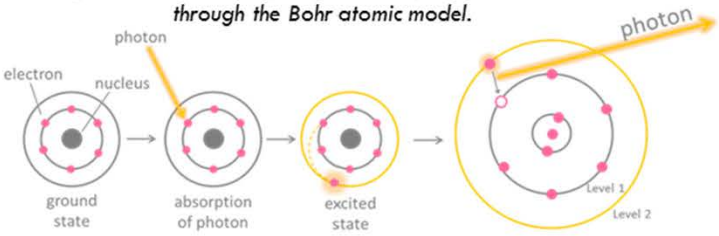
The specific epithet thapsus had been first used for an unspecified herb from the ancient Greek settlement of Thapsos, near modern Syracuse, Sicily. The Greek name *phlomos* has a root that is attributable to preindoeuropean "*bhle*", which means swell, but also shine. This derives from the fact that the plant was used as a wick for the lamps since ancient times.

Principles of photoluminescence

The term 'luminescence' was introduced at the end of 19th century and is the emission of light by a substance not resulting from heat. It can be caused by chemical reactions (chemiluminescence), electrical energy (electroluminescence), light (photoluminescence), etc.

Photoluminescence is phenomenon of light emission from any form of matter after the absorption of photons (electromagnetic radiation). The adsorption-emission radiation concept can be easily described using the Bohr atomic model and applying the energy quantization theory, when an atom adsorb energy through electromagnetic radiation an electron can jump to an higher energy orbital. The electron can go back to the ground state re-emitting electromagnetic radiation (photons) (Figure 2).

Figure 2: schematic representation of photoluminescence through the Bohr atomic model.



The phytocomplex obtained through our technologies from Great Mullein flowers allow to LUMINESCINE to perform this kind of energy transformations. Being the frequency (ν) equal to the speed of light (c) divided by the wavelength (λ) and, according to the Plank's law, the energy (E) equal to the Plank constant multiplied by the frequency, thanks to the "Quantum Shift" that LUMINESCINE is able to accomplish the incoming UV radiation having a short wavelength (λ_1) is transformed in a visible light emission with a longer wavelength (λ_2). Therefore the high incoming energy E1 associated to UV radiations is fragmented in several photons with lower emitting energy E2 (Figure 3).

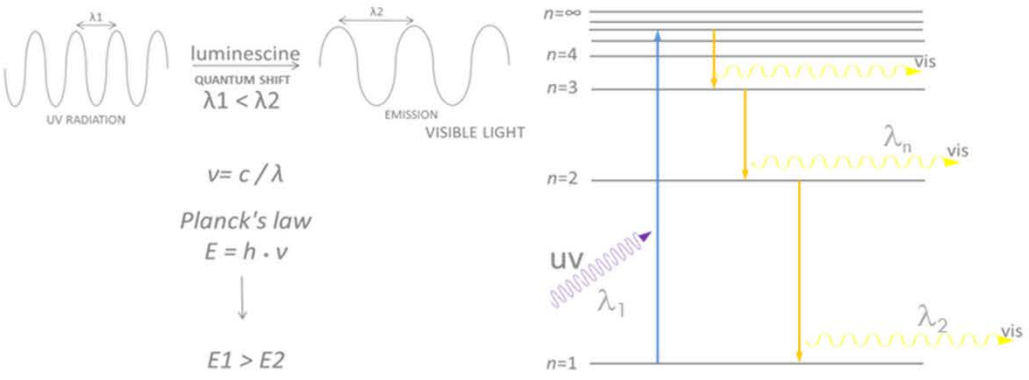


Figure 3: representation of the "Quantum Shift" phenomenon occurring due to LUMINESCINE.

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Luminescent behavior of LUMINESCINE

In order to evaluate the excitation-emission behavior of LUMINESCINE some analytical studies has been done using a spectrofluorimeter Edinburgh FLSP920.

According to the excitation-emission spectra recorded LUMINESCINE was able to adsorb UV and visible light with a maximum at 420 nm (data not reported) and to transform part of the adsorbed energy into visible light(Figure 4). The energy transformed by LUMINESCINE exciting the sample at 420 nm yield an emission spectra, light that is produced via luminescence, with 2 peaks at 522 and 675 nm. The excitation spectra recorded for the 2 peaks shown that the energy transformed covers wavelength from 300 to 440 nm therefore the incident energy converted into light is covering the UV and high energy visible fields.

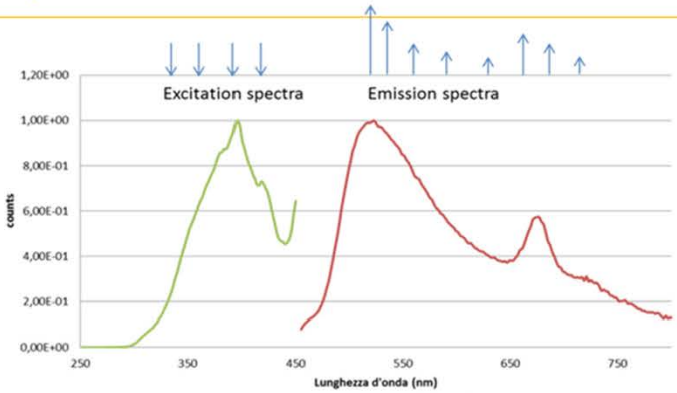
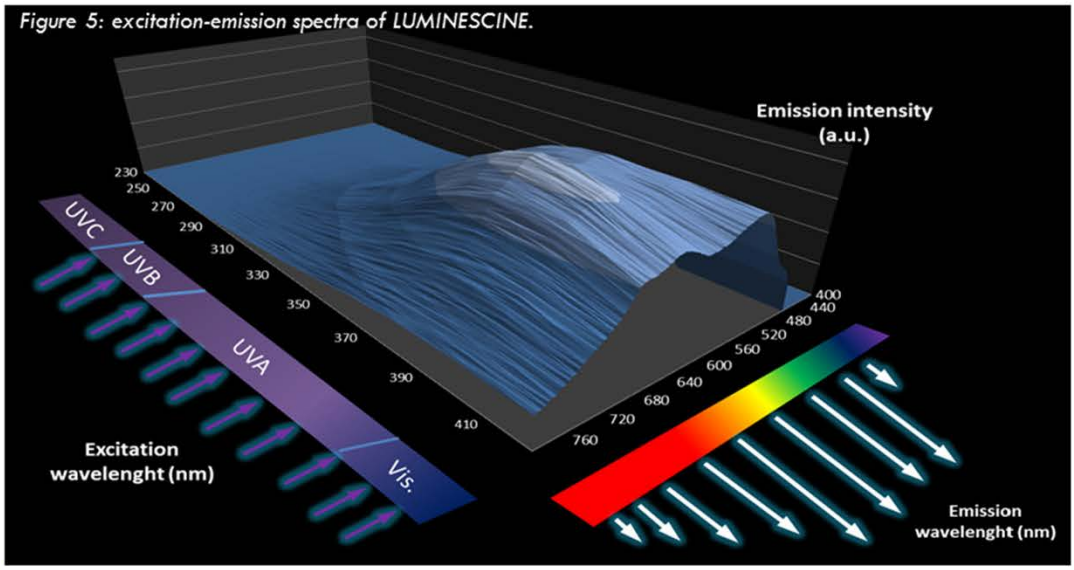


Figure 4: excitation-emission spectra of LUMINESCINE.

In order to better evaluate the ability of LUMINESCINE to transform the high energy incoming radiation into visible light via luminescence an excitation-emission map was performed (Figure 5). LUMINESCINE is able to transform UVB, UVA and violet-blu radiation into visible light. LUMINESCINE is able to emit visible light with a broad spectra and a consistent intensity at all the measured wavelengths. This emission is therefore able to improve the skin radiance and the hair shine. The glowing effect of a gel formulation containing the 3% of LUMINESCINE under a UV radiation at 365 nm is reported in Figure 6.



LUMINESCINE: *in vivo* test for skin care applications

To evaluate the ability of LUMINESCINE to increase skin radiance some *in vivo* test has been performed on 10 volunteers. It was measured the skin radiance variation (ΔL values in the L*a*b* CIELAB scale) comparing the effect of a simple gel formulation containing LUMINESCINE 3% w/w with the effect delivered by a placebo formulation after a single application using a solar simulator (Abiet 10500 CL solar simulator) as standard light source (Figure 7).

Data show a mean increase of the L parameter of 5.5 units vs. placebo after just one application. A clear in increase of skin radiance was therefore delivered by LUMINESCINE thanks to its ability to transform the high energy incoming radiations into visible light.

The radiance increase can be clearly seen applying a cosmetic formulation containing LUMINESCINE and going out in the full sun. In Figure 8 a gel formulation containing 4% of LUMINESCINE was applied on the right half of a forearm and the picture was taken at noon at the end of June in a sunny day.

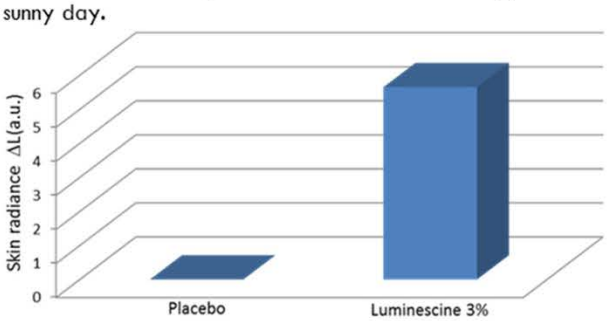


Figure 7: skin radiance (ΔL values) variation after a single application of a 3% LUMINESCINE containing gel vs. placebo

Figure 8: forearm treated on the right half part with a gel containing 4% w/w of LUMINESCINE, effect in full sun light.

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LUMINESCINE: *ex vivo* test for hair care applications

To assess the effect of LUMINESCINE in hair care applications some *ex vivo* test were performed on virgin brown hair swatches. Radiance variation of hair swatches was recorded comparing:

1. Untreated hair swatches just soaked in water
2. Swatches treated with a shampoo containing LUMINESCINE 3% w/w (hair wash simulation with rinsing)
3. Swatches treated with a water solution containing LUMINESCINE 3% w/w (after rinsing)
4. Swatches treated with a leave on spray containing LUMINESCINE 3% w/w

After treatments hair swatches were dried and placed under a solar simulator lamp. Radiance variation (ΔL values in the L*a*b* CIELAB scale) was measured after one and two treatments performed as described (Figure 9). The increase of L values recorded vs. placebo was directly related to the efficacy of the treatment in delivery the active ingredient on hair surface. Simulating a shampoo treatment the hair radiance was increased of +1,5 a.u., the presence of surfactants is therefore not excessively interfering with the ability of the product to be delivered on hair and perform its action. Just soaking the hair swatches in a 3% LUMINESCINE containing solution than rinsing it the effect was even more marked +2,8 a.u. confirming that the product is able to stay on hair even after the rinsing process. As expected the leave on treatment is the one that better perform as all the product loaded on hair it stays there as there is no other potentially interfering steps so an increase of + 4,8 a.u. was recorded. Doubling the number of treatment on hair there was also a relevant increase of the hair radiance recorded (treatment 2. + 3,5; treatment 3. + 6,8; treatment 4. + 10,3) indicating that LUMINESCINE is able to deliver a dose dependent effect on hair.

LUMINESCINE is therefore a very interesting natural product for hair care applications able to increase hair radiance/shine.

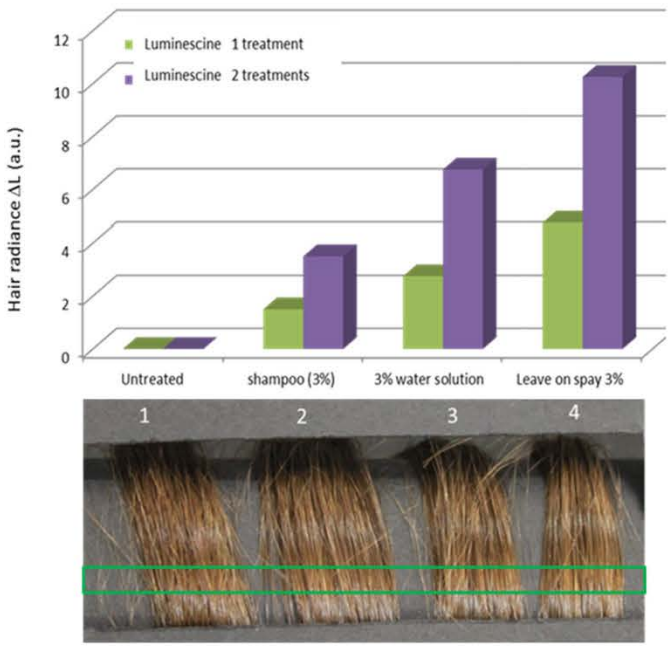

Figure 9: hair radiance (ΔL values) variation after one and two applications of 3% LUMINESCINE containing treatments vs. placeb and picture of hair swatches treated (twice) with LUMINESCINE as described in the text.

LUMINESCINE: *in vitro* test

The protective effect of LUMINESCINE on keratinocytes cell lines was also studied. Keratinocytes culture containing LUMINESCINE 3% w/w and 5% w/w were exposed for 60 minutes to a 5J/cm² UVA-vis light. The amount of Radicals Oxygen Species (ROS) generated by light exposure at the end of the treatment was assessed and expressed as % vs. untreated samples (Figure 10). LUMINESCINE was able to reduce the light mediated harmful radical species formation (-17% -59%) acting as a strong protectant against photo-oxidative stress generated by UV radiations.

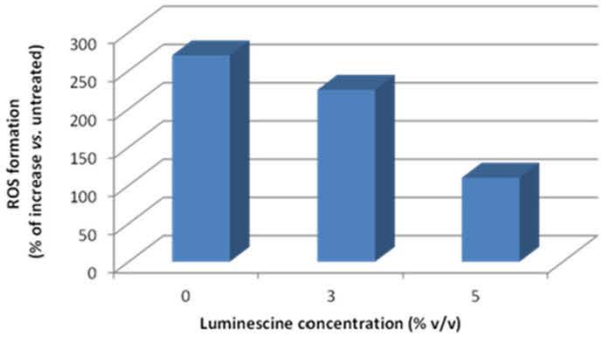

Figure 10: inhibition of ROS induced by UV-vis light in keratinocytes cultures by increasing amount of LUMINESCINE.

Technical specifications:

CTFA name: Glycerin (and) Hydrolyzed Verbascum Thapsus Flower.

Ingredients: Glycerin, Verbascum Thapsus Flower, citric acid, sodium benzoate, potassium sorbate.

Suggested concentration of use: 3-5% w/w
Solubility: soluble in water, glycerin
pH: 2.5 – 3.5
Stable in formulation with pH from 2 to 10
Add the product to cold formulation.

Suggested for:

- ✓ Skin Care (face and body creams and lotions, sun products, gels, professional treatments, bb-cream, etc.);
- ✓ Hair Care (shampoos, conditioners, styling products, hair treatments, hair creams and masks, hair dyes, etc.).
- ✓ Make-up (foundations, primers, mascara, etc.)

phenbiox

Phenbiox srl, Bologna, Italy

www.phenbiox.it / info@phenbiox.it /export@phenbiox.it