

# Natura-Tec SeaBerry Blue™

Biomimetically boosting SPF  
and the antioxidant anti-ageing effect

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Skin ageing due to oxidative processes is a well-known and extremely problematic phenomenon. So-called ROS (Reactive Oxygen Species) with their strong aggressive oxidative potential affect many biological processes and molecules, such as lipids, proteins, DNA, and contribute significantly to skin ageing through structural disorders up to and including apoptosis.

Solar radiation and additional blue light radiation are a most significant source for ROS. Therefore, in this article we will have a close look on how Natura-Tec SeaBerry Blue™ biomimetically helps to protect skin under solar and blue light radiation.<sup>3,4,5</sup>

## Skin's own defence mechanisms

The skin is a highly metabolizing tissue with a complex structure. As an outer protective layer, is particularly exposed to environmental attacks and thus to free radicals. A complex endogenous protection system, in which each skin layer is equipped with its own arsenal of defence molecules and systems, fights these attacks.

The skin uses four mechanisms to ward off oxidative stress:

- Stabilization of biological sites (thanks to the membranes)
- Repair (via DNA repair enzymes)
- Prevention (preventing the production of ROS) and
- antioxidant defence against ROS<sup>5,6</sup>

## What does oxidative stress mean for the skin

Oxidative stress means a mismatch between antioxidants and ROS in the skin. The redox balance is disturbed by a lack of antioxidants or an overconcentration of ROS. If this stress occurs, the

cells counteract the oxidative effects trying to restore the redox balance and thereby regulating the expression of various genes again.

Oxidative stress has a negative effect through various mechanisms: genetic, physiological and biochemical. Oxidative stress induces:

- DNA modifications
- Lipid peroxidation
- Protein alteration
- Signal transduction (transmission of signals into the cell)<sup>2,6,7,8,12</sup>

## Particularly important: protection against UV and blue light

Solar radiation is responsible for a multitude of positive and negative biological effects. If the exposure is too extensive, which is already the case if a few minutes per day are exceeded, the negative effects can get out of hand.

UV light is essential for our skin and body metabolism. However, too much UV radiation means excessive formation of ROS and thus an excess of oxidants. In the skin layers, into which this radiation penetrates (see Fig. 1), the extensive negative effects described above are started.<sup>3</sup>

Blue light radiation penetrates particularly deeply into the skin. Therefore, in addition to the well-known direct radiation effects of skin ageing<sup>3</sup>, it has another specifically important and problematic effect: the influence on the circadian rhythm of skin metabolism.

The circadian rhythm is the ability of an organism to synchronize physiological processes over a period of about 24 hours. The most important circadian rhythm is the sleep-wake cycle. Natural blue light occurs especially in the morning light and signals to the brain: sunrise! wake up! And change in biological rhythm is initi-

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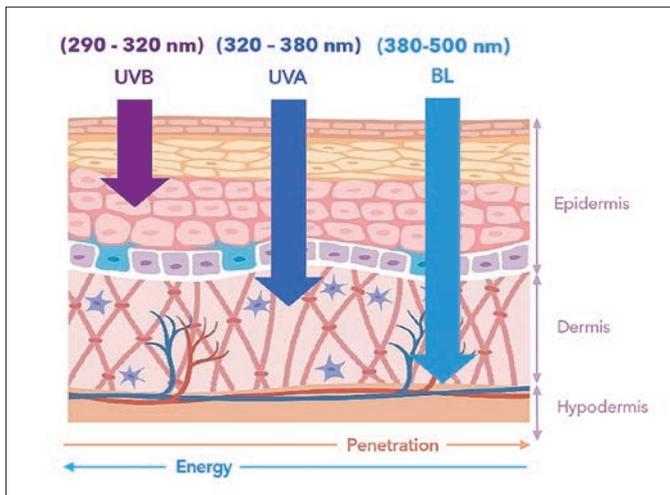


Fig. 1

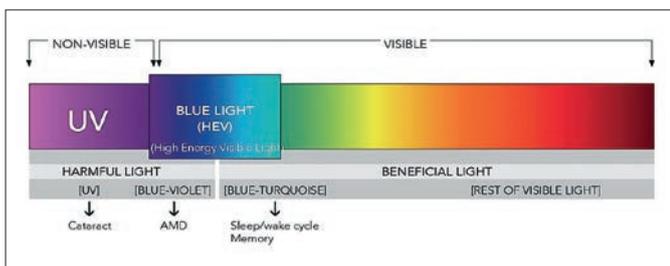


Fig. 2

ated. Blue light from computers or televisions is also known to interfere with falling asleep.<sup>4,8,12</sup> (Fig. 2<sup>13</sup>)

Blue light, however, still communicates to the skin during the night hours that it is day. The main repair phase will not start during blue light radiation and is therefore significantly shorter than naturally intended. People who stay up late and expose their skin to light and chemicals like alcohol and tobacco are more at risk of premature aging.<sup>10,11</sup>

For the skin, whose cells can react to Solar radiation, the rhythm between daylight and darkness plays an essential role with regard to its alternation between protection and repair phase. In the light periods, the metabolism is mainly set to protect, in the dark hours mainly to repair, since the protective effects can be reduced in radiation-free times. Blue light, however, can still communicate to the skin during the night hours that it is day. According to current scientific knowledge, the repair phase will not start during blue light radiation and is therefore significantly shorter than naturally intended.<sup>4,8,11</sup>

Therefore, in our modern rhythm of life it is important to support the skin especially in the protection phase, in order to relieve it in the shortened repair phase. On the one hand, protection from excessive radiation is essential. However, on the other hand, special attention should be paid to supporting the body's own protective functions against attacks by overexpressed ROS.<sup>4,8,10,11</sup>

## The skin's endogenous antioxidant shield

The skin has its own endogenous synergistic system to counteract the attack of free radicals. It includes three components

– Enzymatic antioxidants:

Examples: glutathione peroxidase (GPx), glutathione reductase, superoxide dismutase (SOD) and catalase (CAT) in the epidermis

– Non-enzymatic antioxidants:

Examples: Vitamin A (retinol (based on carotenoids)), vitamin C (ascorbic acid), vitamin E (tocopherol), glutathione, beta-carotene, etc.

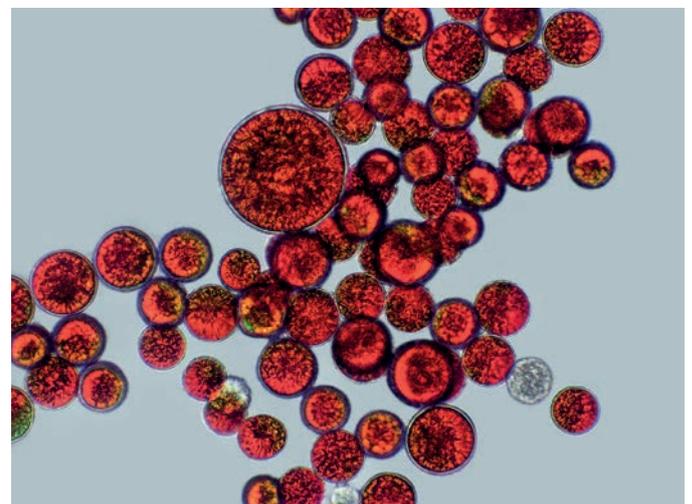
– Structural proteins

In the stratum corneum, some short-chain proteins of corneocytes (loricrin, involucrin, filaggrin, etc.) play a role along with SPRPs (small proline-rich proteins that are also present in SC)<sup>1,7,8</sup>

This system must be protected and promoted. In case of excessive exposure to radiation it should be supported, otherwise an overconcentration of free radicals may overwhelm the endogenous system.

## Natura-Tec SeaBerry Blue™, booster for endogenous protection against ROS

Natura-Tec SeaBerry Blue™ is a natural active and it is based on a highly efficient microalgae extract from the microalgae *Haematococcus pluvialis* in synergistic combination with cranberry oil, stabilized in an omega-9 triglycerides. *Haematococcus pluvialis* is the richest natural source that produces the carotenoid astaxanthin (Fig. 3).

Fig. 3: Microalgae *Haematococcus Pluvialis* with high carotenoid content

Natura-Tec SeaBerry Blue™ was developed as anti-aging ingredient to counteract issues which promote premature skin ageing. It is an antioxidant booster that actively promotes the skin's endogenous protective function against free radicals (ROS).

A study evaluated the effect of Natura-Tec SeaBerry Blue™ on promoting antioxidant concentration in human skin explants exposed to UV-A plus UV-B or blue light radiation.

## Antioxidant-boosting study

The background of the study is the fact that UV and blue light stress cause high ROS concentrations in the skin. These shift the oxidant/antioxidant balance, and the skin counteracts this by raising its endogenous protective shield.<sup>5,6,7</sup>

The purpose of this study is to investigate the effect of Natura-Tec SeaBerry Blue™ on antioxidant concentration in human skin under UV-A/UV-B or blue light exposure. It demonstrates the role Natura-Tec SeaBerry Blue™ can play in protecting skin from UV-A/UV-B and blue light damage by stimulating the skin's physiological ability to produce its own antioxidants.

The graphics 3 and 4 display the test procedure with regard to Natura-Tec SeaBerry Blue™ application and irradiation. The irradiation times were 40 minutes each. In the case of UV light irradiation, this corresponds to the UV exposure of 30 minutes in summer at noon. The blue light irradiation was carried out repetitively, to simulate the repetitive irradiation that corresponds to our lifestyle and for intensity of effect on the skin explants.<sup>8</sup>

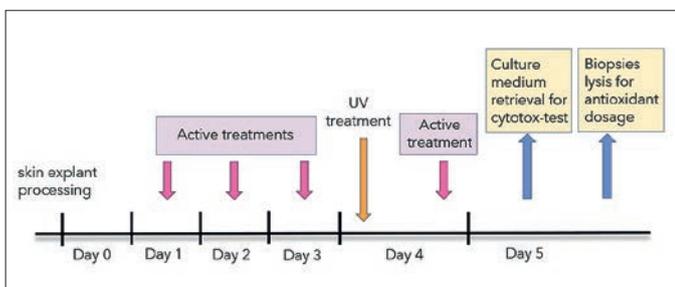


Fig. 4: Diagram of the test procedure for UV / UV-B radiation

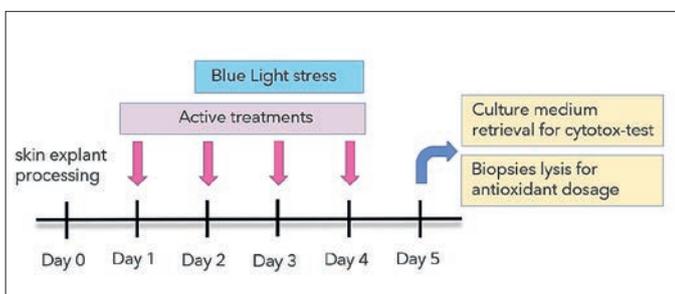


Fig. 5: Diagram of the test procedure with blue light radiation

The first and second columns in the graphs of figures 6 and 7 show the intrinsic increase in antioxidant activity due to irradiation, and thus that the defence mechanism in the skin explants is functional (UV-0% or BL-0%).

By adding 2% Natura-Tec SeaBerry Blue™, a significant increase in antioxidant activity was observed (UV + 2% Natura-Tec SeaBerry Blue™ or BL + 2% Natura-Tec SeaBerry Blue™). The study displays that the antioxidant concentration in skin explants treated with 2% Natura-Tec SeaBerry Blue™ and exposed to UV or blue light show a very notable increase compared to explants without Natura-Tec SeaBerry Blue™.

This additional antioxidant activity is significantly higher than could be generated by the penetration of antioxidant molecules from external sources alone. This increase in antioxidant activity is expressed by the skin itself, stimulated by Natura-Tec SeaBerry Blue™.

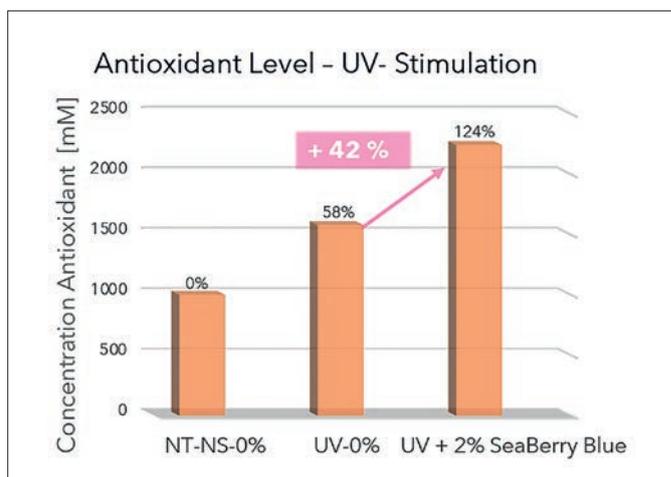


Fig. 6: Increase in antioxidant effect under UV radiation

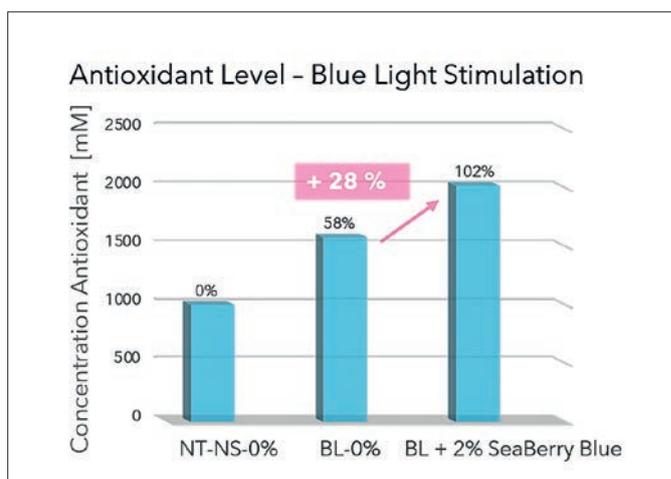


Fig. 7: Increase in antioxidant effect under blue light radiation



Fig. 8: Increase of SPF under solar radiation

## SPF Boosting study

Both, an in-vitro and an in-vivo study were performed with Natura-Tec SeaBerry Blue™ to prove its influence on the SPF of a sun protection formulation (based on Diethylamino Hydroxybenzoyl Hexyl Benzoate (5%), Bis-Ethylhexyloxyphenol Methoxyphenyl Triazine (4%) und Ethylhexyl Triazine (3%) → SPF approx. 20).

The in-vivo SPF test was performed according to ISO 24444:2019 using a solar simulator and following the procedure: exposition of UV radiation on 6 areas located in the back before or after applying a standardized quantity of formulations, applied for all three formulations: without, with 2% and with 4% of Natura-Tec SeaBerry Blue™.

The MED (Minimal Erythema Dose) was visually assessed as the lowest time interval or dosage of UV light radiation which caused a minimal perceptible erythema on unprotected skin. The SPFs were calculated for each individual and product. (Fig. 8)

Already 2% of Natura-Tec SeaBerry Blue™ increased the SPF by 5 units, with the addition of 4% an increase of 6 SPF units could be achieved in the test. For the test formulation with a SPF of 20 adding 2 % of Natura-Tec SeaBerry Blue™ means an increase of SPF to 25. This is what we call a real boosting effect! The results of the in-vivo tests were confirmed by the in-vitro test.

## Summary

UV light and blue light have a notable negative impact on skin health and ageing by significantly inducing the formation of ROS etc. Due to our modern lifestyle, we are exposed to an excess of blue light radiation, even in the evening hours. This leads to a shift in the circadian rhythm and thus to a significant reduction in the skin's repair phase. To compensate for this, the skin's antioxidant protective shield needs to be particularly well-supported during the light phase, when the skin puts repairs in the background in favour of protection.<sup>4,10</sup>

Boosting the SPF of a sun protection formulation by approx. 30% is a formidable result. Another convincing proof of the ef-

fectiveness of natural active ingredients in cosmetic applications.

Natura-Tec SeaBerry Blue™ clearly shows that it is up to the challenges of modern skin protection. It significantly supports the skin in its protective efforts against environmental pollution, especially UV and blue light radiation. This is proven by the studies on the stimulating effect of Natura-Tec SeaBerry Blue™ on the intrinsic increase in the antioxidant activity of the skin under UV and blue light radiation, as well as the significant increase in the sun protection factor.

## Literature

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