

**CURCUMIN**  
**IMPROVEMENT**  
**SMOOTHNESS**  
**CONDITION**  
**PHOTOPROTECTIVE**  
**ANTI-WRINKLE**  
**NATURAL**  
**RADIANCE**  
**FIRMING**  
**HEALTHY**  
**CURCUMIN**  
**SMOOTHNESS**  
**NATURAL**  
**PHOTOPROTECTIVE**  
**IMPROVEMENT**



**VECTICELL CURCUMIN**

**synthos**  
**CARE**

Curcuma (*Curcuma longa*), also known as Indian saffron, is a plant commonly known as a condiment of intense yellow colour, which gives a distinctive taste and aroma to dishes. However, it has a much wider variety of uses in Ayurvedic medicine. Its medicinal properties were described in medical books written on tablets of stone about 3000 years B.C. In India, Indonesia and Pakistan, it has been used for centuries as a panacea for pain, digestive problems, anemia, diabetes, and inhalations to relieve sinus congestion and reduce asthma symptoms.

Women in India have also appreciated its beneficial effects on the skin. Natural cosmetics in the form of curcumin-based masks mixed with water are used for reducing the symptoms of acne and inflammations, eczema, and psoriasis, as well as to achieve a uniform skin tone and to give the skin a golden glow.

Since 1910, it has been clear which active ingredient of curcuma is responsible for the wide spectrum of medicinal and skin care properties exhibited by the plant. This is **curcumin** – a polyphenol with strong antioxidant, anti-inflammatory, anti-bacterial, soothing, discoloration-brightening and photoprotective properties.

### VECTICELL Curcumin

Curcumin is poorly soluble in water, and as a result it is characterised by low bioavailability. To enable the diffusion of curcumin molecules through cytoplasmic membranes of the skin cells, VECTICELL Curcumin carrier was developed, which is biocompatible with epidermal lipids. The catalyzation of the transepidermal transport makes it possible for curcumin to penetrate into the deeper skin layers, showing strong antioxidant and anti-wrinkle effects. The controlled release of the active substance from the carrier reduces the risk of skin irritation and provides long-term effects resulting in brighter, smooth and radiant complexion. Inspired by

the traditions of Ayurveda and the most recent scientific reports, we carried out a number of in-depth *in vitro* and *in vivo* tests which confirmed the wide spectrum of properties of VECTICELL Curcumin and the significantly greater bioavailability, transepidermal penetration and skin absorption of the substance as compared to free curcumin.



## Benefits from using VECTICELL Curcumin

- Greater stability and effectiveness of curcumin on the skin
- Long – term effects thanks to the gradual, slow release of curcumin from the delivery system.
- Greater transepidermal penetration and skin absorption of curcumin.
- High antioxidant potential.
- Excellent anti-wrinkle effects.
- Protection of the skin against blue light emitted by screens, including smartphones, laptops, TV screens
- Protection of the skin against UV radiation



### In vitro studies

The effectiveness of an active substance on the skin is determined primarily by its stability, bioavailability, capability for transepidermal penetration, as well as an appropriate profile of release from the cosmetic substrate.

It is important to ensure that the active ingredient of a cosmetic product reaches the appropriate area of the skin, where it has biological effects.

### Release of Curcumin

The penetration of curcumin through the stratum corneum of the epidermis depends to a significant extent on curcumin bioavailability, i.e. its amount and release rate. The release of the active substance is the first, fundamental stage which determines the effects of the substance at the target site. The purpose of the tests was to demonstrate differences in the release of curcumin encapsulated in VECTICELL carriers as compared to the non-encapsulated substance. Solutions of VECTICELL Curcumin and free curcumin, containing the same concentration of the active substance, were dialysed into the acceptor solution, while observing changes in the release rate. The measurement was monitored for 24 hours and the concentration of the released substance was determined each time by absorption spectroscopy.

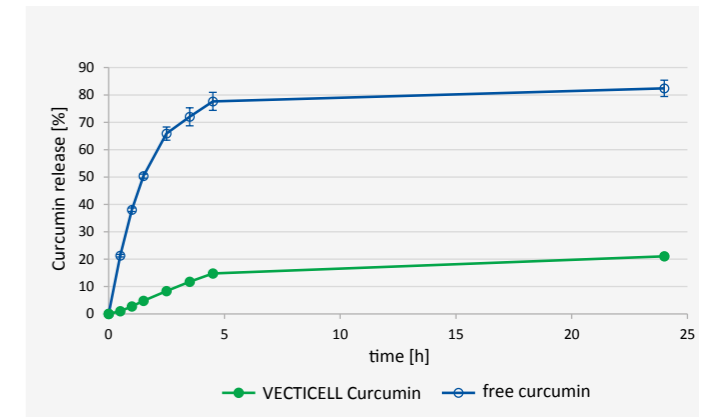
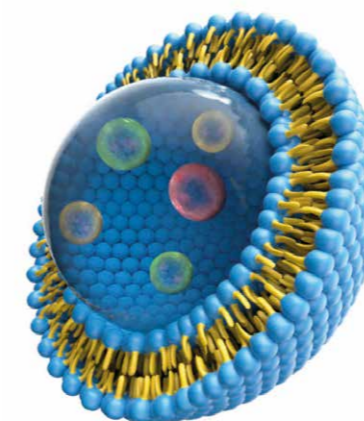


Figure 1: Quantity of released curcumin versus in time

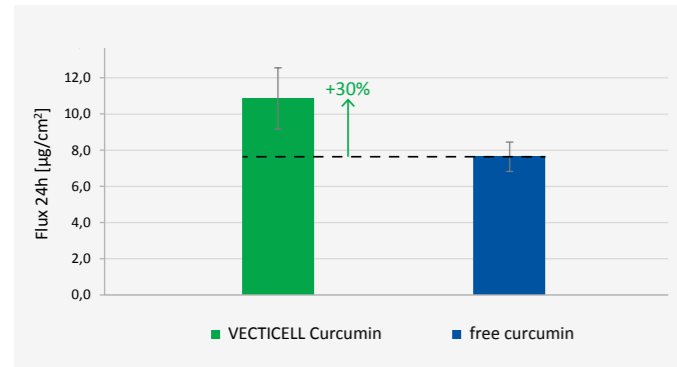
### Results:

As a result of the encapsulation of curcumin in VECTICELL Curcumin carrier, it was observed to be released much more slowly as compared to the solution of the non-encapsulated substance. The slower rate of release of the active substance extends its effective time, thus providing stronger and long-term effects on the skin.

### Skin penetration and absorption of Curcumin

The capability to penetrate deep into the skin depends e.g. on the properties of the penetrant. VECTICELL delivery system is small in size, biocompatible and compatible with lipids of cell membranes, and as such they act as promoters of transepidermal transport.

The purpose of the tests was to demonstrate the **greater skin permeability** of curcumin encapsulated in VECTICELL carriers as compared to the penetration capacity of free curcumin. To reflect *in vivo* conditions, the test was performed using skin section and Franz cell chambers. Solutions of VECTICELL Curcumin and the non-encapsulated substance were applied to the membrane at the same concentrations. The permeability was monitored for 24 hours, and the results were recorded at hourly intervals.

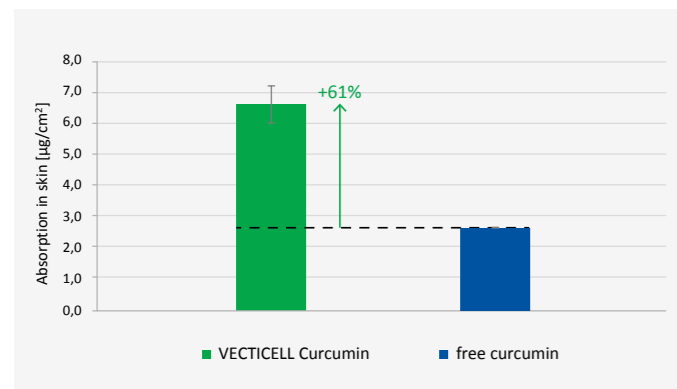


**Figure 2:** Increase in the skin permeability of curcumin encapsulated in VECTICELL carriers as compared to the permeability of non-encapsulated curcumin.

**Results:**

The permeability of curcumin encapsulated in VECTICELL carriers was observed to increase **by 30%** as compared to the solution of the non-encapsulated active substance. As a result of the flexible lipid bilayer, VECTICELL vesicles can penetrate into the deeper skin layers.

It was also confirmed that curcumin encapsulated in VECTICELL carriers shows **greater skin absorption**.



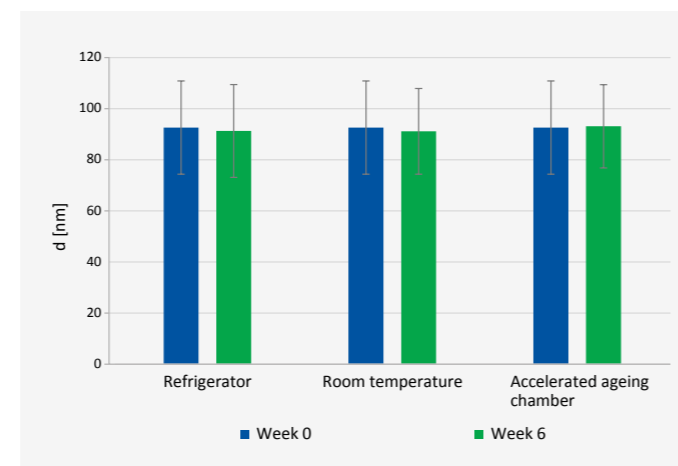
**Figure 3:** Increase in the skin absorption of curcumin encapsulated in VECTICELL Curcumin vs free curcumin.

The tests confirmed that the skin absorption of curcumin encapsulated in VECTICELL delivery system increased **by 61%** as compared to the solution of the non-encapsulated active substance. This shows that the bioavailability of curcumin encapsulated in VECTICELL carriers increased significantly.

**Stability of VECTICELL Curcumin**

Carriers of active substances are highly sensitive to auto-oxidation processes.

In order to confirm the stability of VECTICELL Curcumin carriers, the raw material was stored for 6 weeks at room temperature, in a refrigerator and an accelerated ageing chamber (40°C), and then the size of VECTICELL particles was measured using the dynamic light scattering (DLS) method at equal weekly intervals. Additionally, changes in the pH of the system were monitored using the same time intervals and a potentiometric method.



**Figure 4:** Changes in the size of VECTICELL Curcumin particles after 6 weeks.

**Results:**

The measurements carried out after 6 weeks showed a marginal change in the size of the particles under all test conditions. Additionally, a marginal change of pH from 3.6 to 3.5 was recorded for each of the systems under investigation. The constant size of VECTICELL Curcumin vesicles and the insignificant pH changes show the **high stability** of the test formula under all experimental conditions used during the tests. The stability of VECTICELL carriers guarantees their effectiveness also under elevated temperatures.

**Antioxidant properties**

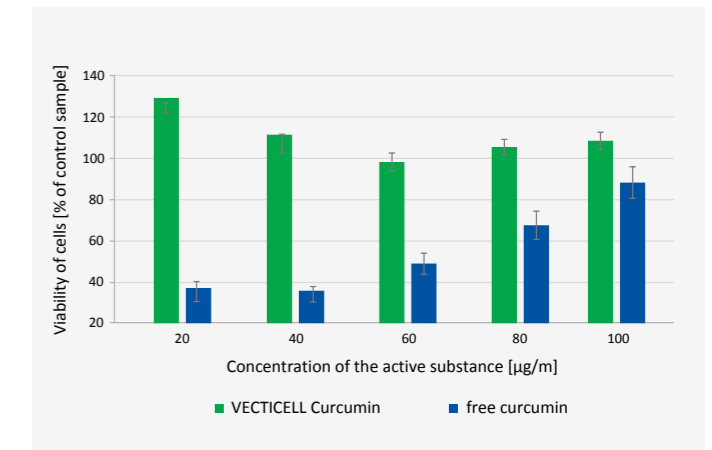
The purpose of the tests was to confirm the strong antioxidant properties of curcumin encapsulated in VECTICELL carriers as compared to pure curcumin. Cytotoxicity tests were performed, which showed a decrease in the mortality of cells after the application of VECTICELL Curcumin as compared to the application of the non-encapsulated substance.

The cytotoxicity tests were carried out using MTS tests against nHDF cell line. The culture was incubated for 24 hours after delivering curcumin encapsulated in VECTICELL Curcumin carriers, containing added hydrogen peroxide with the concentration of 1 µM. At the same time, comparative measurements were performed for free curcumin.

**Results:**

The observed decrease in the viability of cells was caused by the effects of free radicals generated due to the presence of hydrogen peroxide. The tests showed a significantly greater increase in the viability of cells after using curcumin encapsulated

in VECTICELL Curcumin delivery system than after delivering the non-encapsulated substance to cells. VECTICELL Curcumin is more effective in capturing free radicals, and thus it has stronger antioxidant properties as compared to free curcumin. Additionally, an experiment was carried out to demonstrate that as a result of exposure to radiation, free curcumin starts to decompose after 24 hours, which reduces its antioxidant activity, while curcumin encapsulated in VECTICELL carriers exhibits a stable level of antioxidant activity.



**Figure 5:** Viability of cells exposed to hydrogen peroxide.



### High energy visible (HEV) light filter

The purpose of the tests was to demonstrate the protective properties of VECTICELL Curcumin against high energy visible (HEV) light which is emitted by smartphones, tablets, computers and TV screens. Contrary to UVA and UVB radiation, HEV light does not cause any immediate skin redness or inflammatory reactions. Its effects accumulate over time, which is directly related to the generation of free radicals.

The test was performed using absorption spectroscopy, measuring the spectrum of VECTICELL Curcumin and free curcumin in the visible light range from 280 nm to 650 nm. Identical concentrations of both substances were used.

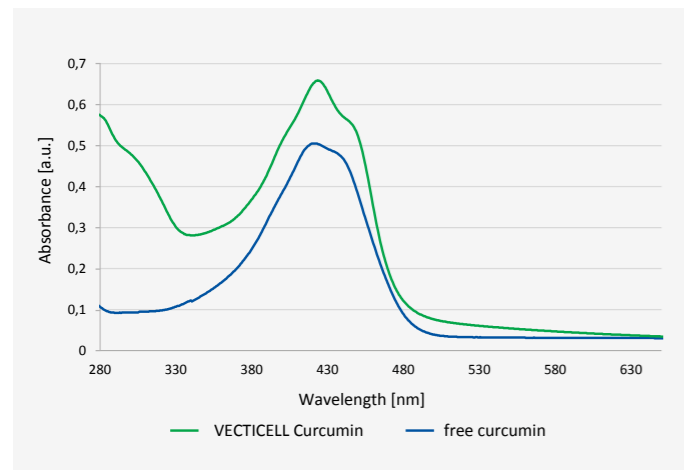


Figure 6: Absorption spectra of VECTICELL Curcumin and free curcumin.

Results:

The tests confirmed that VECTICELL Curcumin shows very low transmittance in the HEV light range (from about 400 nm to 480 nm) and stronger absorption as compared to free curcumin. This shows that VECTICELL Curcumin is an ideal HEV light filter, and as such it can protect the skin against HEV light effects.

### Photoprotective effects

The impact of UV radiation was checked on normal human fibroblasts nHDF, on which VECTICELL Curcumin has been delivered first. Photoprotective effects of curcumin encapsulated in VECTICELL Curcumin were analysed using MTS cytotoxicity tests. VECTICELL Curcumin was delivered directly into the cell culture, which was then exposed to UV radiation for 4 hours. At the same time, corresponding comparative tests were carried out for free curcumin.

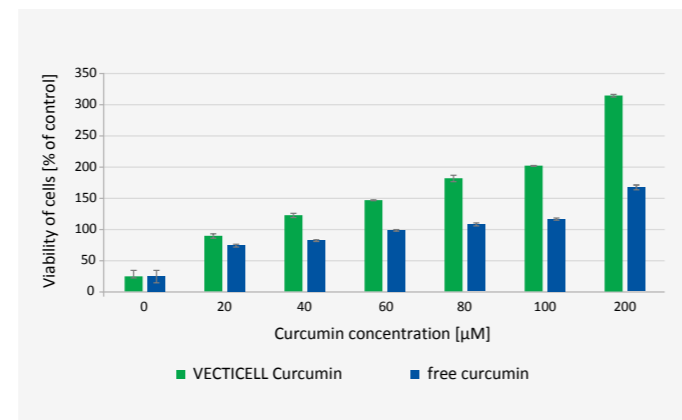


Figure 7: Viability of cells exposed to UV radiation versus the concentration of VECTICELL Curcumin and free curcumin.

Results:

The tests demonstrated that the photoprotective capability of the active substance is dose-dependent both for free curcumin and VECTICELL Curcumin. The delivery of VECTICELL Curcumin to the cells contributed to a significant increase in the viability of cells as compared to the non-encapsulated substance, which shows the considerably better photoprotective capacity of curcumin encapsulated in VECTICELL delivery system. This is associated with the greater bioavailability and lower toxicity of VECTICELL Curcumin.

### Stability of VECTICELL Curcumin in the cosmetic product

To confirm the presence of VECTICELL Curcumin vesicles in a cream, the Cryo-SEM method was used. The fracture surface of the cream frozen by liquid nitrogen, containing 5% of VECTICELL Curcumin, was photographed using SEM.

Results:

The Cryo-SEM imaging of the cream compound showed the existence of wide streaks rich in delivery systems of various size, embedded in the homogenous cream compound. The results confirm the stability of VECTICELL Curcumin in the finished cosmetic product, which shows the resistance of the raw material to technological processes related to the production of the cream, such as temperature, mixing, homogenisation.

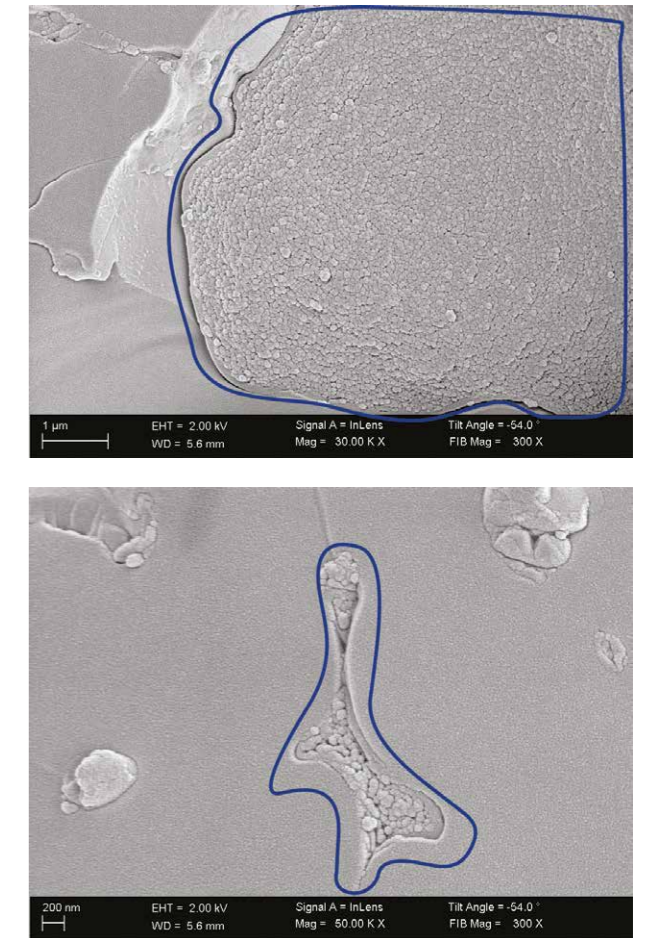


Figure 8: Topography of the fracture surface of a balm containing 5% of VECTICELL Curcumin.

— VECTICELL Curcumin carriers embedded in the cream compound



In vivo studies

In vivo tests of a cream\* containing 3% of VECTICELL Curcumin were performed by an independent test laboratory in a group of 30 females at the age above 55 years. The cream was applied to clean skin twice daily, in the morning and evening, for 4 weeks. During that time the subjects used no other products of identical or similar intended purpose. The results contain instrumental measurements as well as subjective opinion of the subjects after applying cream with VECTICELL Curcumin.

VECTICELL Curcumin smoothes skin

The level of skin smoothing was measured before the test and after 4 weeks of using the cream.

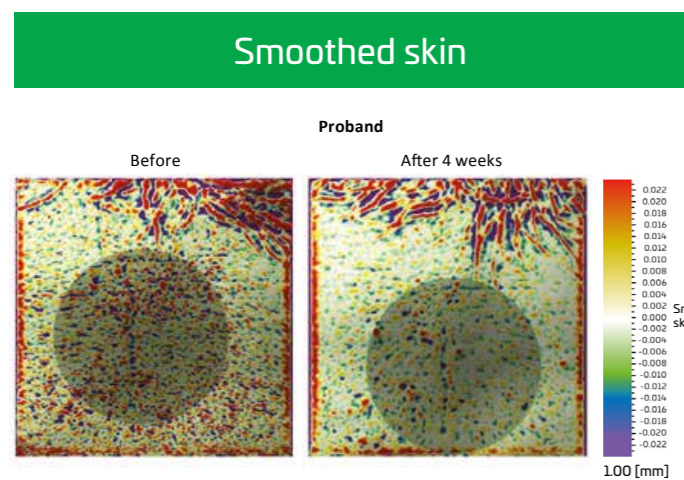


Figure 9: Comparison of the skin smoothness before a cream treatment containing 3% of VECTICELL Curcumin.

Results:

After 4 weeks of using a cream containing 3% of VECTICELL Curcumin was determined that the skin is

significantly **smoother by 10%** on average. The above pictures of the subject's skin clearly show and confirm **that the skin is smoother, the length and depth of wrinkles are minimised, and the pores are reduced.**

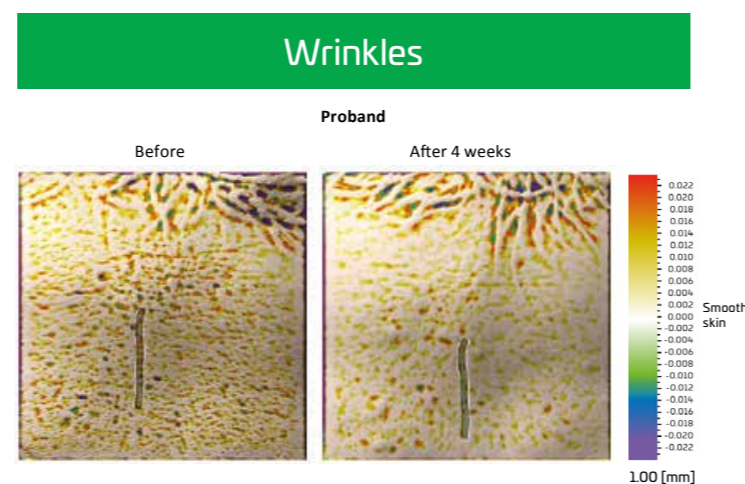


Figure 10: Comparison of wrinkle reduction before and after the cream treatment containing 3% of VECTICELL Curcumin.

VECTICELL Curcumin reduces wrinkles

Results:

Obtained results confirm **wrinkle depth reduction by 9%** on average. The above pictures of the topography of skin non-treated with a cream containing VECTICELL Curcumin and after 4 weeks of using the cream confirm that both fine lines and deep wrinkles, permanent furrows and laugh lines were clearly and noticeably minimised. The skin regained elasticity and firmness, and looked younger. Anti-aging action of curcumin is determined by strong antioxidant properties of this substance, which we had also confirmed in our in vitro tests.

\*Cream containing 3% of Vecticel Curcumin based on the following ingredients: Aqua, Glycerin, Black Currant Seed Oil/Olive Oil/Aminopropanediol Esters, Caprylic Capric Triglyceride, Glyceryl Stearate, Phosphatidylcholine, Hydrogenated Phosphatidylcholine, Butyrospermum Parkii Butter Unsaponifiables, Propylene Glycol, Polysorbate 80, Curcumin, Citric Acid, Disodium Edta, Acrylamide/Sodium Acrylate Copolymer, Paraffinum Liquidum, Trideceth-6, Dehydroacetic Acid, Benzyl Alcohol.

VECTICELL Curcumin improves skin tone

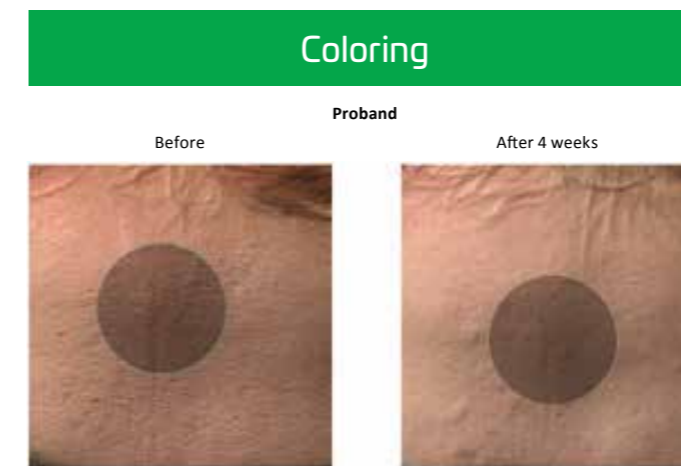


Figure 11: Skin tone change before and after applying cream with 3% VECTICELL Curcumin.

Results:

The instrumental test confirmed very good brightening properties of curcumin. It was observed that the skin tone was improved by 8% on average after 4 weeks of using cream with 3% of VECTICELL Curcumin. The regular application of the cream helped to reduce various types of discolorations, restoring the natural healthy skin tone and appearance.

VECTICELL Curcumin reduces pores



Figure 12: Pores reduction after applying cream with 3% VECTICELL Curcumin

Results:

The reduction of number and size of pores is an exceptional result. After using the cream for 4 weeks, the number of pores decreased by 25%, which shows that the skin's texture has been significantly improved, intensively moisturised and reconstructed by the VECTICELL Curcumin.

Summary

Numerous conducted in vitro and in vivo studies, including apparatus measurements and subjective feelings of probands, confirmed the effectiveness of VECTICELL Curcumin in smoothing the skin structure, significant wrinkles reduction, both mimic, static and gravitational, reducing the amount and size of skin pores and lightening its color. **VECTICELL Curcumin is an ideal solution for mature skin, requiring intensive smoothing, firming, toning the color and restoring natural glow and healthy appearance. It also works perfectly as a booster of protection against UV and blue light (HEV).**

## Product description

Viscous, opalescent solution.

## Appearance

Yellow to dark yellow opalescent solution.

## INCI

Aqua/Water, Phosphatidylcholine, Propylene Glycol, Polysorbate 80, Curcumin, Disodium EDTA, Citric Acid, Dehydroacetic Acid, Benzyl Alcohol.

## Storage

Keep in the original packaging. Store in a covered area at a maximum temperature of 5-20°C. Protect against direct sunlight.

## Shelf life

18 months from the date of manufacture

## Recommended formulation conditions

**Always shake before use.** Recommended adding to the final product during the final manufacturing stage at a maximum temperature of 35°C. Optimum formulation pH while adding the raw material: 4.0 – 7.0. Alkaline pH is not recommended.

**Soluble** in water.

Recommended **concentration**: 3% – 5%.



# VECTICELL

*delivery system*



Synthos CARE  
Synthos Dwory 2  
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odpowiedzialnością  
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