

Nanotechnology

Dr. Gabriele Blume, Sopharcos, Im Schloss 7 , 36396 Steinau, Germany

Nanotechnology-I: Sophi-Tops – two penetrating carrier systems

Sopharcos has developed two new carrier systems that penetrate into the skin and which are formed by an edible, plant-derived emulsifier based on sunflower. Thus these carrier systems can immediately be used in natural cosmetics.

Carrier systems with the ability to transport actives into the skin have long played an important role in cosmetics. The most well-known are the liposomes and nanosomes – vesicles that consist of purified phospholipids from the soy plant¹. Whilst with liposomes the vesicle is internally aqueous the core of nanosomes consists of oils and lipophilic actives. Thus liposomes are more suitable for the encapsulation of hydrophilic substances and nanosomes are best suited for use with lipophilic actives.

The soy plants, and thus the soy lipids, nevertheless still carry the stigma of “genetic modification” and cultivation that has “a negative impact on nature”. Rain forests and savannah in South America must vanish as the Neue Zürcher Zeitung newspaper recently wrote².

Sophi-Hydro-Tops and Sophi-Lipo-Tops, the two new penetrating carrier systems, are particularly suitable for use in natural cosmetics.

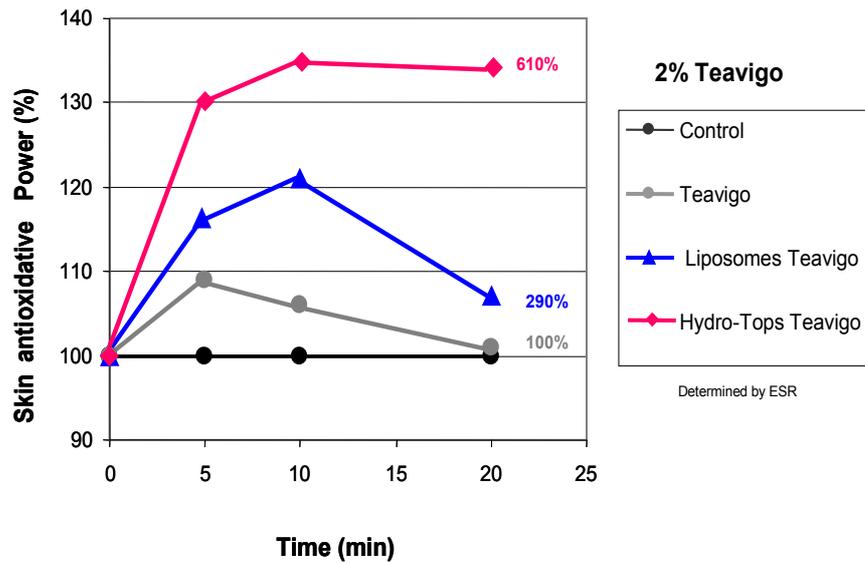
Carrier system alternative to liposomes

The Sophi-Hydro-Tops are a new carrier system which exhibits similar or better characteristics than the older, well-known liposome systems. With the tiny unilamellar vesicles, which have an unusually homogenous particle size distribution, both hydrophilic and amphiphilic actives can be encapsulated. In comparison with liposomes the Hydro-Tops have a greater encapsulation efficiency for certain substances. So, depending on the active, between 50 and 100 percent more of e.g. green tea extract (Teavigo) can be encapsulated in the Hydro-Tops.

The penetration and antioxidative efficacy of the green tea extract in the skin – epidermis and dermis - at a concentration of 2.0 percent was measured with the help of ESR³. The skin has its own natural protection against free radicals. A radical scavenging active applied onto the skin that has the ability to penetrate through the skin barrier (the stratum corneum) will

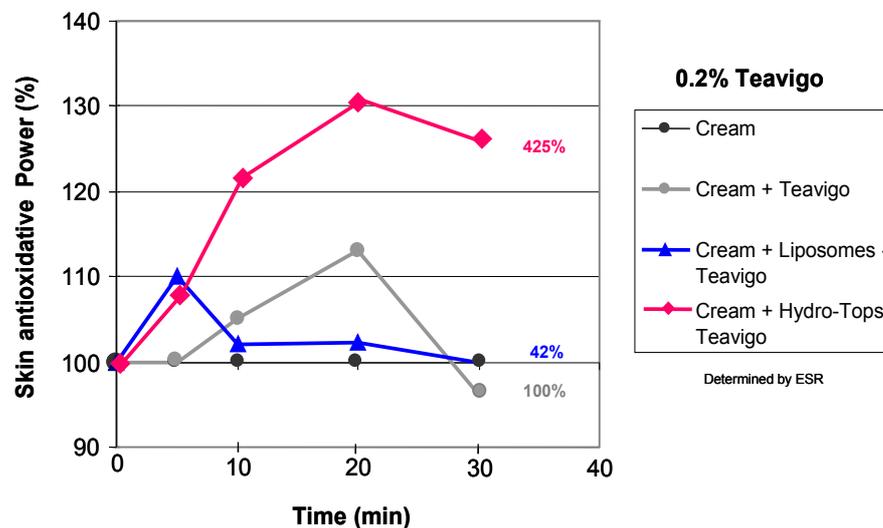
increase the antioxidative potential in the deeper viable skin layers. The percentage increase in skin protection against radicals is measured in the form of SAP values (Skin Antioxidative Power). Figure. 1 shows a significantly better penetration and the duration of efficacy of the antioxidants is prolonged by several times when the green tea is encapsulated into the Sophi-Hydro-Tops.

Fig. 1: Skin Antioxidative Power (SAP) of green tea extract



When the vesicles are incorporated into a cream with lamellar structures also an enhanced penetration and improved efficiency is observed (Fig.2). While the liposomes can not keep their membrane stabilities in the cream, the green tea extract is released from the vesicles. This can be observed by the decreased penetration and efficacy level.

Fig. 2: Skin Antioxidative Power (SAP) of green tea extract in a lamellar cream



Carrier system as an alternative to nanosomes

Sophi-Lipo-Tops are a new carrier system that exhibits similar or better characteristics than the long familiar nanosomes. In the colloidal carrier system with particle sizes between 100 and 180 nanometers oil droplets and/or lipophilic actives are encapsulated at a very high concentration level, for example 15 percent pure tocopherol.

The Sophi-Lipo-Tops with their encapsulated lipophilic actives are presented as an aqueous dispersion and so can be integrated without difficulty into water-based formulations, for example gels, serums and mousses. The encapsulated active also stabilizes well in formulations – over 30 percent after only 2 days storage at room temperature. In addition, using ESR (Electron Spin Resonance Spectroscopy) it was seen that the encapsulated lipophilic substance (here tocopherol) penetrates into the skin³. In comparison with the classic, phospholipid-based nanosomes the Sophi-Lipo-Tops encapsulated vitamins were more efficient and their antioxidant action continued for longer.

The AUC (Area under the Curve), used as a measure of bio-availability of a substance, is by the factor 3.5 more with nanosomes and by a factor of 8.1 more with the Lipo-Tops than with pure oil with the same amount of vitamin E.

Using the new system, which is not based on phospholipids, there is now a carrier system which exceeds the performance characteristics of the well-known liposomes and nanosomes.

Nanotechnology-II: Sophi-Caps – a non-penetrating carrier system

New nanocapsules –Sophi-Caps UV - were developed with the ability to encapsulate 50% of the organic UV- filters Octocrylene (UVB) together with Avobenzone (UVA) Octocrylene (UVB) in a ratio of 3.5 : 1. This combination offers a photostabilization of Avobenzone and prevents the UVA filter from crystallization.

The Sophi-Caps UV are dispersed in a water / ethanol solution and can be used directly after thickening for example with xanthan gum. Therefore they can be used in innovative oil-free sun care formulations like sprays or gels.

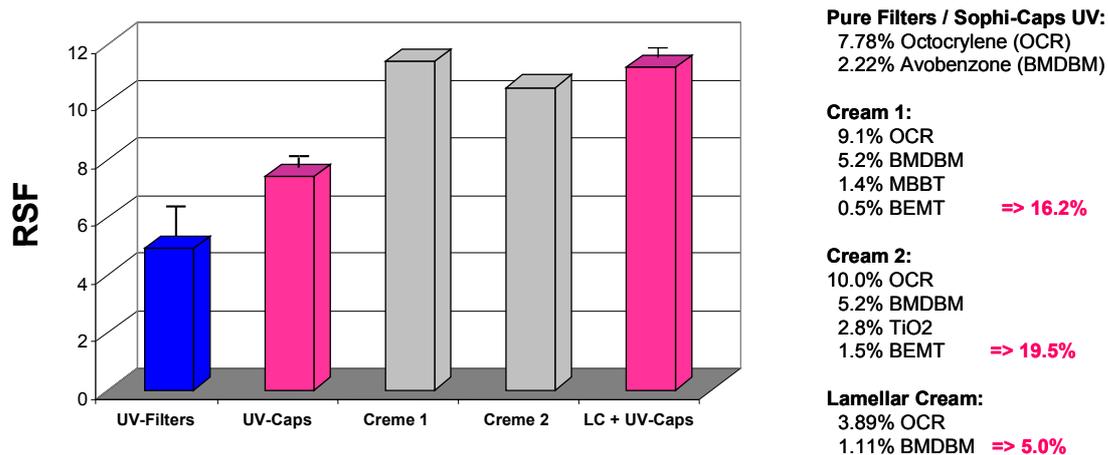
The size of the Caps is around 700 nm and they have a negatively charged surface. Due to the size these capsules are not able to enter the skin but form an uniform layer onto the skin surface. Therefore they permit preparing a formulation of safe and effective sun protection.

Exogenous influences like UV-radiation with a wave length smaller than 400 nm possess sufficient energy for damaging molecules directly in the skin or generating free radicals. These UV-induced free radicals (reactive oxygen species, ROS) can be measured ex vivo on irradiated skin explants by Electron Spin Resonance (ESR).

The RSF is an universal factor which characterizes the free radical status in the skin and also the protection effects of UV-filters or sunscreens ^{4,5}.

The Sophi-Caps UV were incorporated into the lamellar cream with very low filter concentrations and were significantly able to avoid the formation of free radicals by UV-radiation (Fig.3).

Fig. 3: Radical Protection Factor (RSF) of Sophi-Caps UV in a lamellar cream



All these described carrier systems are superior over the most common ones for their higher encapsulation efficiencies and better performance which lead to lower concentrations of actives in the final formulations.

¹G. Blume: “Flexible Liposomes for topical Applications in Cosmetics”, in: Skin delivery Systems 2008, 269–283, ed. Johann W. Wiechers, Allured Press

²Neue Zürcher Zeitung, 01.02.2011, Seite 11

³K. Jung et al.: “Antiaging Status of Skin characterized by Skin Antioxidative Protection (SAP) – Efficacy of topically applied Antioxidants”; SÖFW Journal 132 (2006) 38–44

⁴U. Osterwalder et al.: „Importance of UVA Sun Protection: A Comparative Analysis of Different Quality Control Methods“; SÖFW-Journal 135 (2009) 2-13

⁵T. Herrling et al.: “Penetration of Reactive Substances in the Skin characterized by its Radical Status Factor (RSF)”; Incosmetics 14. April 2010 Paris France; CSC Cosmetic Science Conference