

# High tech agents: new - improved - and more effective?

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In skin care products, the essential sales argument on the manufacturers' side and the decisive factor on the part of consumers to buy the product are the active agents contained. Accordingly, the cosmetic industry is continually researching for new and better agents. What are their specific features and what effects do we expect?

**C**omplex questions which require complex answers though! On the one hand new agents are expected to perform miracles and on the other hand, the European Cosmetic Decree only allows a quite limited room for manoeuvre as to their real efficacy.

## Already the base is highly effective

Typical cosmetic effects for example are the smoothing of the skin or an increased skin hydration. These effects, though, may already be achieved with base products containing specifically selected ingredients according to the individual skin - an experienced skin analysis however is required in this case. Further effects which can more or less be expected from reasonable base care products are the reduction of the transepidermal water loss or the protection against external substances.

## Active agents and their dosage

However, in order to preserve the skin elasticity, to prevent and treat minor wrinkles in combination with a skin tightening, specific agents are required. This also applies for an even look of the skin as well as the prevention and treatment of problem skin. In these cases the interaction of chemical structure, of concentration, transport and of the release of the agents is quite significant. The dosage though may be comparatively low. A high dosage frequently has adverse effects. Therefore, intelligent transport systems are required to pass the stratum corneum in low dosage and without any side effects in order to achieve the expected effects in the deeper skin layers.

This however cannot be taken for granted just to mention the application of vitamin A which has repeatedly been reported to cause irritations in higher dosage. The irritation threshold level is around 0.1 per cent for the Central European skin type. Vitamin C in high dosage has keratolytic effects just like AHA

acids and vitamin E in high dosage supports autoxidation which actually is the contrary effect of a radical scavenging activity.

In the cases described an effective solution is to firstly chemically modify (derivatize) and then secondly transport the substances using appropriate carrier systems.

## The appropriate transport

**Vitamin C** for example, used as palmitate (oil soluble) or phosphate (water soluble) and **vitamin A and E** as acetates (oil soluble) will be added to liposomes (water soluble agents) or nanoparticles (oil soluble agents). After passage of the stratum corneum the agents are hydrolyzed by enzyme reactions, a process in which only hydrolyzed physiological substances are formed. In this way, vitamins become high tech agents.

Due to their oil solubility, **vitamin K and coenzyme Q10** may be directly encapsulated in nanoparticles without any further modification.

However, the transport particles should not be visualized as a tool to directly permeate the stratum corneum, even on the contrary. The membranes of the transport particles merge with the barrier layers of the skin which increases their penetrability because of their modified composition. Or, in other words, the barrier is switched to passage way and thus allows the agents to permeate. In this connection it is not essential whether the liposome has a single or multiple shell structure. Also the size only has a minor influence whereas it rather is a criterion for its physical stability. In the end, only the specific type and the concentration of membrane components used will influence the permeability of the barrier layers.

Of course, not every one of the so called high tech agents also shows brilliant effects. Frequently there is only a very complicated manufacturing process and the change from the animal to a vegetable origin may play a significant role though. This however is seen

as an advantage as the specific properties and the quality are easier to reproduce.

This for example applies for the successful **hyaluronic acid** which formerly was produced from cockscombs and today is made from streptococcus zooepidemicus cultures.

### Wrinkles & Co

The **oligopeptides** "pentapeptide" and "hexapeptide" are an extrapolation of the well-known condensed collagen hydrolysates which are synthetically modified animal substances. Oligopeptides are synthetically produced in a relatively complicated process. Although they will not miraculously spirit away wrinkles similar to the botox effect as it is frequently claimed, they show a topically smoothing effect with a visible reduction of minor wrinkles due to their ability to interact with the keratin of the skin. They also positively influence the skin hydration.

**Ceramides** have similar effects. As a rule, it can be said that they cannot compensate the ceramide deficiency in the skin either. In this specific case, the physiology of the skin and especially of the ceramide family is far too complicated. However, from the cosmetic point of view and also concerning the surface of the skin they have excellent skin care properties and are safe for long-term usage.

### Long term effects

There are active agents with immediate effects (effective agent) and agents with long term effects. **Essential fatty acids** for example show long term effects as they interfere with the ceramide metabolism as for instance the linoleic acid and hence are able to modify the appearance of the skin. Agents with long term effects may be most adequately used for preventive purposes and among others may be categorized as "anti-aging" substances. The long term effects of **phytohormones** in this connection still have to be observed and evaluated. Up to date experiences with comparable substances do not allow expecting the effects of human hormones however without their specific side effects.

### Immediate effects

Hyaluronic acid, peptides (see above) and CM glucan, i.e. organic substances, definitely are effect agents with smoothing and tightening features. A very interesting group in this connection are **mineral substances** and among them the micronized and ultra fine titanium dioxide or zinc oxide particles.

Previously snow white, the particles today are colourless and provide an efficient protection against the UV containing sunlight. Unfortunately they are not compatible with all the different cream bases available.

**Pigments**, the components of decorative cosmetic products are of mineral origin as well. They can also be used in food quality and contain substances like silica, mica, titanium dioxide, iron oxide and magnesium stearate. Day creams with these components will not only add some colour onto the skin. They are even able to visually reduce wrinkles in a very effective way, not because of the filler effect though, but rather due to the structure of the particles used since several of the above mentioned substances are combined in a very complicated coating process. The result of it are particles which are able to fill in the wrinkle marks while causing an increased diffuse reflection of light. The contrast between wrinkles and smooth skin will visibly be softened. This however is an immediate effect which will only last up to skin cleansing. This concept allows avoiding talcum and additional colouring agents.

### Mixture of substances

An important factor here is not only the effect of a single substance but also the mixture of several substances. The different elements taken separately may appear as quite unspectacular whereas the mixture is the innovative point in this case.

It turned out for example that combinations of substances adapted to the chemical composition of the barrier layers may form structures which are physically similar and enable external "repair processes" of the barrier layers. Measurements in combination with occupational substances show that the skin becomes more resistant.

Barrier layers with increased penetrability caused by liposomes and nanoparticles (see above) can be restored to normal conditions. This is an interesting effect for dry skin as it reduces the initially increased transepidermal water loss to normal values after the penetration of agents. In case of oily skin this additional treatment however is not required.

### One substance: a broad therapeutic potential

Many of the high tech agents may be used for different applications: **liposomal vitamin C phosphate** in low dosage has radical scavenging properties, activates the collagen synthesis but may also be successfully applied

for hyperpigmentation (as e.g. after laser treatments). The liposomal base is effective against cornification disorders among others also against the specific type of acne caused by it. This list could be continued.

An important factor however is the knowledge of the molecular properties and the specific

effects of the substances in the skin. This is the only guarantee for the appropriate application and the adequate dosage.

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