

# Enzymes - the silent brownies

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Enzymes are substances of very special kind. They are the brownies in the metabolism of live organisms as they compose or degrade the substances involved. They take care of almost every single chemical transformation, silently, ecologically and without leaving any waste products. They can also be selectively used in the field of cosmetics.

**E**nzymes certainly are experts in their field and that is also the reason why they mostly take care of one single specific chemical transformation only. Hence, nature is provided with a multitude of different enzymes. They all contain protein components and have an extremely complicated structure. They are very sensitive, therefore and will easily be deactivated by higher temperatures or impacts of e.g. acids, bases, oxidizing agents and surface active substances. In this connection we also speak of denaturation.

## Composing or transforming substances

The alcoholic fermentation in the wine and beer production is a typically enzyme controlled process in which sugar is transformed into alcohol and carbon dioxide. In this process yeast serves as an enzyme supplier. Ptyalin which is also called  $\alpha$ -amylase, is an enzyme of the human saliva and transforms starch into malt sugar, a process which we can physically notice when bread becomes slightly sweeter in flavor the longer it is chewed. It is an interesting fact that there are parallels in the vegetable as well as the human sphere and among others also the skin is concerned here. UV radiation stimulates the enzyme tyrosinase in the skin which is responsible for the melanin formation and accordingly the skin tanning process. The very same enzyme also causes the brown colouring on cut fruits. In both the cases tyrosinase can be inactivated by vitamin C with the consequence that neither the skin will tan nor the fruit salad turns brown.

Tyrosinase inhibitors are selectively used in so called whitening products to prevent hyper pigmentation.

Conventional saps frequently contain proteases i.e. enzymes which are able to break down proteins. Papaine which can be found in the sap of the tropical melon tree and bromelaine gained from the sap and the stems of pineapples belong to this group. In the cosmetic field both the enzymes are used for enzyme peelings. They break down cell bonds and thus remove superficial horny cells. This

specific kind of exfoliation of the skin is consistent, gentle and can be done in form of a mask.

## Lipolytic enzymes

The effect of hydrolases which are able to break down lipids and release the respective fatty acids can easily be noticed by the rancid taste of stale lipid-containing food. Grating raw potatoes also releases hydrolases and some time ago when this procedure still was part of the everyday cooking routine the effects could be physically felt by rough skin as the triglycerides and diglycerides of the lipid layer of the skin were degraded. Related to the hydrolases are lipases which preferably degrade the lipids which e.g. are emulsified by cholic acids. They can also be found in the human digestive tract. Phospholipases, i.e. enzymes which specifically break down phospholipids also belong to this particular group.

Proteases and hydrolases can also be found in the stratum corneum and among other specific tasks they participate in the formation of free amino acids belonging to the NMF factor as well as in the adequate balance between triglycerides, diglycerides, monoglycerides, glycerin and fatty acids. Added to skin care products, physiological triglycerides are appropriate substances for the care of the acidic lipid barrier of the skin as they excellently integrate into the skin balance and subsequently are transformed into the required components. Enzymes resulting from the natural colonization of micro organisms on the skin also contribute to the adequate skin balance.

## Formation of collagen

Another very interesting group are enzymes which participate in the formation and degradation of collagen. As everybody knows, the collagen synthesis decreases with advancing years whereas the degradation of collagen will increase. The naturally present vitamin C activates the collagen forming

enzymes and increases the inhibitors of the collagenase which is responsible for the collagen degradation. The less vitamin C is found in the skin, the less collagen will be formed. Vitamin E also participates in this process. Therefore it is recommended to include both the vitamins to antiaging skin care products. It is also advisable to add the vitamins in form of derivatives which are integrated into appropriate carrier systems like liposomes or nanoparticles. After penetrating and permeating into the skin vitamin C is locally hydrolyzed by enzymatic reaction from vitamin C palmitate (nanoparticles) or vitamin C phosphate (liposomes) and released. Specific metalloproteinases which are activated by an overdose of UV radiation on the skin participate in the collagen degradation process, and this should be reason enough to avoid excessive sun exposure.

The expression of metalloproteinases is inhibited by olibanum extracts (*boswellia sacra*). The extract also inhibits the 5-lipoxygenase which is a key enzyme for inflammatory processes.

Olibanum extract which is encapsulated in nanoparticles is not only used for cosmetic applications but also for the treatment of inflammatory skin diseases.

Besides the vitamins C and E the enzyme superoxide dismutase is effective against free radicals in the skin. It destroys superoxide radicals and transforms them into hydrogen peroxide molecules which then are transformed into water.

### **Co-factors of enzymes**

The components of enzymes and their Co-factors as for example the vitamins B<sub>2</sub> (riboflavin), nicotinamide (niacin), pantothenic acid (component of coenzyme A), biotin and folic acid also are interesting substances. The preliminary stage of pantothenic acid i.e. D-panthenol is frequently used in cosmetics for the treatment of reddened skin as well as for increasing the skin hydration. Coenzym Q<sub>10</sub> (ubichinone) in company with phosphatidylcholine can be found in the mitochondria where it contributes to generate the energy required in cells and gained by oxidation of lipids.

### **In fruits and cream cheese**

There is just no life without enzymes. It is characteristic for enzymes that already minuscule quantities perform their specific tasks without wearing out. That is the reason why they are also called bio-catalysts.

For skin care purposes, isolated enzymes as well as enzyme containing extracts or saps can be used. In addition to that, inhibiting or activating the natural enzymes in the skin are major aspects. With regard to the enzymes contained, the well-known remedies from past times like treatments with cream cheese, fruits and co. which are only rarely applied today will become a topical issue again. And future will certainly have some surprising skin care information in store.

As you can see in the field of cosmetics there is a great variety of potential applications for enzymes. The present article could only focus on certain aspects of the topic.

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