L-Fucose
An anti-aging glyconutrient for sensitive skin
In the human skin, L-Fucose is found both in the epidermis and in the dermis. In the epidermis, L-Fucose is only found in special layers (in the stratum spinosum and stratum granulosum). It is assumed that the membrane sugars play a central role in the maturation process (also called the differentiation process) of skin cells. The fibroblasts in the dermis are able to absorb L-Fucose and convert the monosaccharide into glycoproteins. It has been found that the skin of psoriasis patients has a different distribution of glycoproteins containing L-Fucose than normal skin does.

L-Fucose
- is a rare, naturally occurring monosaccharide
- plays an important role in the skin as a membrane-associated sugar
- is one of the “eight essential sugars” that are vital for a proper functioning of human cells
- should not be confused with fructose, a common, widespread sugar, which is found in honey and many types of fruit

The biological effects of L-Fucose
The application of L-Fucose to skin cells achieves a variety of stimulatory effects with a positive impact on skin texture. In particular, L-Fucose is used in anti-aging creams, to promote the accelerated healing of wounds (regeneration), and to reduce allergic reactions (e.g. to lessen the symptoms of allergic contact dermatitis). Its properties qualify L-Fucose in particular for the use in anti-aging cosmetics designed for sensitive skin care.

L-Fucose from Jennewein Biotechnologie GmbH
L-Fucose is found in nature in marine algae. However, naturally available quantities are limited, and the extraction of L-Fucose from this natural source is harmful to the environment and expensive. The L-Fucose manufactured by fermentation by Jennewein Biotechnologie GmbH…

- has a high degree of purity ≥ 95% / HPLC (residual water and further sugars)
- is identical to the natural L-Fucose that is present in human-skin
- is a white crystalline powder completely soluble in water
- contains no preservatives
- is not irradiated
- is free of GMOs (production process comparable to processes used in food production, e.g. vitamins)
- uses an environmentally friendly production process (no toxic chemicals used)

Applications: anti-aging, sensitive skin, and skin regeneration.
Concentrations used: 0.1 - 1%
PRESERVING YOUR YOUTHFUL SKIN APPEARANCE

The anti-aging and sensitive skin treatment properties of L-Fucose

L-Fucose strengthens the skin by:
• inhibiting enzymes involved in age-related degradation processes, such as matrix-metalloproteinases (MMP-2 and MMP-9)
• stimulating elastin biosynthesis and glycosaminoglycan (GAG) synthesis
• protecting cells by lowering the oxidative stress
• reduction of allergic reactions
• Stimulating elastin biosynthesis

Moreover
• L-Fucose-rich oligo and polysaccharides protect in vitro against the AGE-induced (AGE = advanced glycation endproducts) formation of senescent cells (age marker: senescence-associated beta-galactosidase positive cells)
• L-Fucose-riche polysaccharide formulations protect against the AGE-induced inhibition of collagen synthesis

Reduction in wrinkles
A formulation with L-Fucose-rich oligo- and polysaccharides was tested on 20 female test persons for 4 weeks on the wrinkled area around the eyes. The formulation was applied twice a day. Evaluation was performed using skin replicas. The results were analysed with morphometry. After 4 weeks of application, there was a significant improvement in the state of wrinkles of the skin. It was found that a significant reduction in wrinkles occurred in 65% of all the cases studied.


Stimulation of elastin biosynthesis (in vitro tests on fibroblasts)
ATTENUATION OF WRINKLES BY L-FUCOSE

L-Fucose significantly reduces the depth of wrinkles

Evaluation of the skin before and after L-Fucose treatment
(Subject No. 5, 50 years)

Before treatment

After 4 weeks of treatment

Study involving 15 test persons. The numbers above or below the bar indicate the age in years. In comparison: right versus left eye. Positive percentage figures indicate an improvement in the wrinkles.
PROTECTION AGAINST SKIN AGING PROCESSES

L-Fucose protects the elastic fibres by the inhibition of degradative enzymes

Inhibition of elastase-type endopeptidase activity. The studies were carried out on dermal fibroblasts. L-Fucose, mannoose and the oligosaccharide formulation were admitted at a concentration of 10μg/ml. The mean values from six trials were calculated.

L-Fucose (10μg/ml) exhibited a 40% inhibition of elastase-type endopeptidase activity (p < 0.001). The oligosaccharide formulation was less active and exhibited an approximately 26% inhibition at the same concentration (p < 0.01). Mannose did not exhibit any inhibitory properties.

SPECIFICATION

**L-Fucose**

<table>
<thead>
<tr>
<th><strong>Structure</strong></th>
<th><img src="image" alt="Structure" /></th>
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<tbody>
<tr>
<td>Synonym</td>
<td>6-deoxy-L-galactose</td>
</tr>
<tr>
<td>Formula</td>
<td>C₆H₁₂O₅</td>
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<tr>
<td>Molecular mass</td>
<td>164.16</td>
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<tr>
<td>INCI</td>
<td>Fucose</td>
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<tr>
<td>CAS No.</td>
<td>2438-80-4</td>
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<table>
<thead>
<tr>
<th><strong>Properties</strong></th>
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<tbody>
<tr>
<td>Purity / assay</td>
<td>≥ 95% / HPLC</td>
</tr>
<tr>
<td>Appearance</td>
<td>Lyophilised off-white / ivory-coloured powder</td>
</tr>
<tr>
<td>Hazardous material</td>
<td>–</td>
</tr>
<tr>
<td>Package sizes</td>
<td>250g, 500g, 1kg, 2.5kg, 5kg, 10kg, 25kg</td>
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<tr>
<td>Shelf-life</td>
<td>1 year in the unopened original packaging at RT; 2 years at 4-8°C</td>
</tr>
<tr>
<td>Solubility</td>
<td>soluble in water</td>
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<tr>
<td>Storage</td>
<td>Well sealed and in a dry place</td>
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</table>
Sugars are vital for the wellbeing of humans. Moreover, sugars are not all the same. Nature provides a variety of sugars, ranging from a simple source of energy to complex molecules performing vital functions in the human organism. The sugar molecules which are key to effective cellular communication and proper cell function are called essential sugars. The rare sugar L-Fucose represents one out of eight essential sugars.

These sugar building blocks in combination with proteins and lipids form glycoconjugates which decorate the surface of every human cell. This unique structure of cell standing sugars plays a vital role in cell recognition and cell to cell communication. This process of „saccharification” of a cell is called glycosylation. A total of eight sugars, including L-Fucose, are involved in this process in the human body.

A sufficient supply of glyconutrients is vital. Nowadays only glucose and galactose of these essential sugars are present in sufficient amounts in our everyday food. L-Fucose, N-acetylgalactosamine and N-acetylneuraminic acid occur in mother’s milk and in some algae, for example. Our body can synthesize essential glyconutrients from glucose, though a large amount of energy is needed to do so. Thus 15 separate enzyme activities are needed to convert galactose into L-Fucose. Added, directly available glyconutrients lead to a better availability.

The small L-Fucose sugar molecule (monosaccharide) exhibits a great effect as a companion of proteins. This is especially apparent if the sugar is missing, as is the case (among other things) in leukocyte-adhesion deficiency (LAD II) patients. In this rare genetic disease, the cells are not capable of attaching L-Fucose molecules to proteins. The patients’ vital functions are impaired, and they are very poorly protected against infection.

L-Fucose is a glyconutrient, which plays an outstanding role in the healthy development of infants and can be found in the form of the human-milk-oligosaccharide Fucosyllactose in high concentration in the human mother’s milk. L-Fucose influences the development of the brain, above all the long-term memory. L-Fucose is also an immune modulator, prevents tumour growth, and plays an important role in the cell to cell communication. High L-Fucose concentrations can be found between nerve intersection points, in the kidney and in the outer layer of the skin. The L-Fucose metabolism is out of balance in patients with diabetes, cancer and skin diseases.

L-Fucose glycoconjugates (glycoproteins and glycolipids) are essential to reverse inflammatory processes and continue to play a major role in immune responses. In inflammatory diseases, L-Fucose is able to suppress allergic skin reactions such as contact dermatitis. L-Fucose also plays an important role in psoriasis. It has been established that the distribution of L-Fucose in the keratinocytes of the skin of psoriasis patients is completely different than in persons with healthy skin.
FORMULATION INFORMATION
L-Fucose

L-Fucose is easy to dissolve at an application concentration of 1%. With gentle stirring, a colourless transparent solution is quickly obtained in demineralized water. The pH of this solution is approximately 5.8.

A preliminary solution in a small amount of water is recommended for incorporation in the formulation. This „preliminary solution” is prepared while gently stirring and with an L-Fucose/water ratio of 1/2. The solution appears pale yellow.

L-Fucose leads to a slight degradation of viscosity. If the formulation is highly viscous, this slight reduction of viscosity has no particular effects. However, if a low viscosity base formulation is worked with, subsequent adjustment of the viscosity is required. L-Fucose does not cause destabilization.

A 1% solution in demineralized water is prepared as follows: 0.5 g of the product is added to 49.5 g of water in a glass beaker and stirred using a magnetic stirrer. The 50% „pre-solution” is prepared as follows: add 4 g of demineralized water to 2 g of product contained in a glass beaker and stir to homogeneity using a magnetic stirrer.

The basic gel formulation consists of the following constituents:

<table>
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<tr>
<th>Trade name</th>
<th>INCI</th>
<th>%</th>
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<tbody>
<tr>
<td>Demineralized water</td>
<td>qsp 100</td>
<td></td>
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<tr>
<td>Glycerine 4810</td>
<td>Glycerol</td>
<td>3,00</td>
</tr>
<tr>
<td>Edeta B powder</td>
<td>Tetrasodium EDTA</td>
<td>0,10</td>
</tr>
<tr>
<td>Gelinnov</td>
<td>Sodium Polyacrylate (and) C18-C21 alkanes (and) trideceth-6</td>
<td>1,60</td>
</tr>
<tr>
<td>Floramac 10</td>
<td>Ethyl Macadamiate</td>
<td>5,00</td>
</tr>
<tr>
<td>Cremophor CO 410</td>
<td>PEG-40 Hydrogenated Castor Oil</td>
<td>1,00</td>
</tr>
<tr>
<td>Glydant Plus Liquid</td>
<td>DMDM Hydantoin (and) Iodopropynyl Butylcarbamate</td>
<td>0,20</td>
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Viscosity J+1 (Brookfield RVDV-I+, RT, speed 5) = 79 500 cP
pH J+1 = 5.9

Centrifugation (4 x 15 min at 4000 rpm, Sigma 1-6): OK

After cooling, at the end of the formulation process, 1% L-Fucose, pre-dissolved in 2% demineralized water is included.
LITERATURE REFERENCES

L-Fucose


