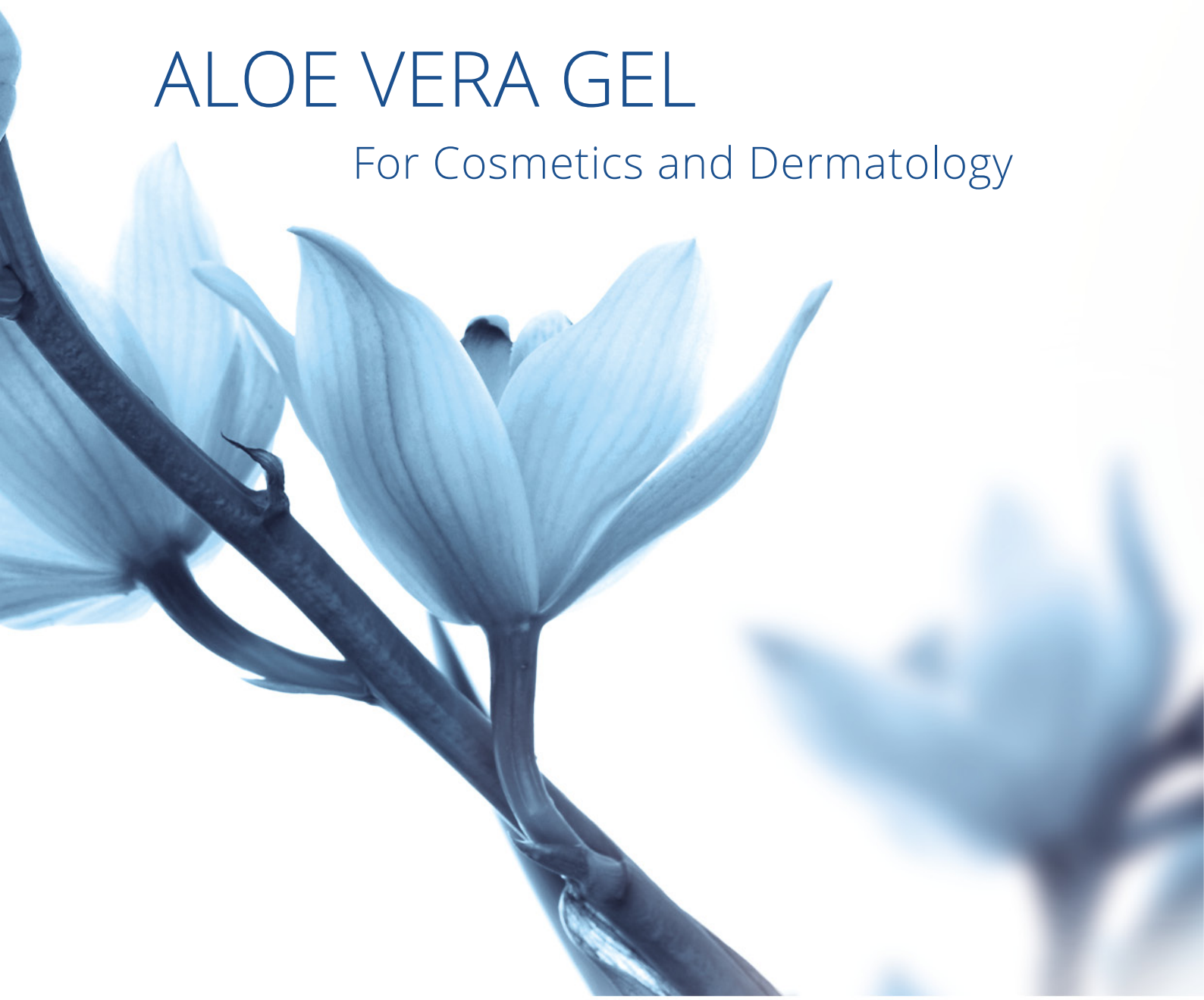
ALOE VERA GEL

For Cosmetics and Dermatology



TERRY LABORATORIES
QUALITY ALOE VERA EXTRACTS & CONCENTRATES

RAHN
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Content

Aloe Vera –
a desert plant

Aloe Vera is a member of the tree lily family, known as Aloe barbadensis . There are over 250 species of aloe grown around the world. However, only two species are grown today commercially, with Aloe barbadensis Miller and Aloe aborescens being the most popular.

The Aloe plant is grown in warm tropical areas and cannot survive freezing temperatures. The leaves of the Aloe plant grow from the base in the rosette pattern. Mature plants can grow as tall as 2 and a half feet to 4 feet with the average being around 28 to 36 inches in length. Each plant usually has 12-16 leaves that, when mature, may weigh up to three pounds. The plants can be harvested every 6 to 8 weeks by removing 3 to 4 leaves per plant.

Tradition and science

The semi-tropical plant, Aloe Vera, has a long and illustrious history dating back to 2200 BC where it was first documented in the Sumerian clay tablet, found in the city of Nippur. It has been mentioned throughout recorded history and given a high ranking as an all-purpose herbal plant. The same Aloe Vera Gel that was popularly recommended in the past as a holistic elixir of life or as a wound healing agent, on the basis of the outstanding experiences of its use. It is also proving an impressive measure in 20th century scientific studies.

Apart from the known moisturising and anti-inflammatory action, from the cosmetic standpoint, the cell-stimulating and wound healing-promoting effects are of particular interest.

Aloe Vera Gel helps
to heal skin damages

Skin damage can be brought about in a variety of ways and its extent can vary. It may be caused physically by solar radiation, mechanically by friction or chemically by environmental toxins. The complex repair mechanism of the skin usually includes also an increased cell division and is accompanied by an inflammatory process. Where skin damage is slight, this mechanism is normally restricted to the epidermis and is noticeable as a skin irritation. If, however, the dermis and consequently the connective tissue or even small blood vessels are affected, this is the classical picture of a wound.

The care of healthy or slightly irritated skin differs strongly from the treatment of a graze or a wound. From the legal standpoint, the difference lies in the skin zone that is primarily treated. Cosmetics may only care for the epidermis, whereas medical products usually act on the deeper skin layers or directly on open skin areas (wounds).

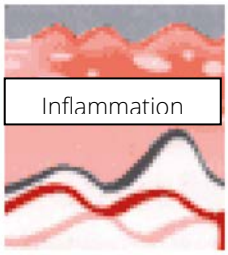
For the dermal field of application of Aloe Vera, the simplest distinction that can be made is between sterile and non-sterile damage. It is precisely here that the great difference in the mode of action of Aloe Vera Gel lies.

Sterile damage

The skin barrier is intact and foreign substances haven't penetrated the skin. Nevertheless, the skin is physically damaged, e.g. by strong solar radiation. An inflammatory reaction appears in the form of a warm skin reddening and dry small epidermal scales betray the fact that the skin has lost moisture.

What the skin now needs is:

- Skin moisturising
- Anti-inflammatory action
- Vital substances for optimising the repair processes



Non-sterile damage

The skin barrier is damaged and foreign substances such as bacteria have penetrated the skin. It may be that not only the epidermis, but also the dermis is opened and should actually be covered again as rapidly as possible. But first, the penetrating foreign substances must be eliminated and disposed of.

What the skin now needs is:

- Antibacterial effect
- Rapid wound healing
- Vital substances for optimising the repair processes

What makes Aloe Vera Gel so unique?

Its special quality is the complex interplay of many bio-active ingredients, which interact massively in concert and are thus able to develop their full effect. The saying, only together are we strong, is certainly applicable here! Over 200 active substances have already been discovered in Aloe Vera Gel. These belong, among other things, to such categories important to the skin as vitamins, minerals, amino acids, polysaccharides, enzymes and phytosterols. Despite the industry's intensive efforts, it has not so far proved possible to isolate an especially important and effective substance from Aloe Vera Gel, and to use it as a single substance, as is so often the case in modern pharmacy. Even today, Aloe Vera Gel still displays its true effectiveness only in its original and pure form.

The most important Aloe Vera Gel ingredients

The following list is not comprehensive, although it does give an overview of the most important Aloe Vera Gel ingredients.

Category	Typical examples
Amino acids	Lysine, histidine, arginine, aspartic acid, threonine, serine, hydroxyproline, proline, glycine, alanine, cystine, valine, methionine, isoleucine, leucine, glutamic acid, phenylalanine, tryptophane, tyrosine
Enzymes	Amylase, lipase, alkaline phosphatase, bradykinase, carboxypeptidase, catalase, oxidase
Minerals	Magnesium, calcium, potassium, sodium, phosphorous, zinc
Phytosterols	Beta-Sitosterol, campesterol, lupeol
Polysaccharides	Glucomannan, acemannan, pectin, cellulose
Vitamins	B_1, B_2, B_3, B_6, B_{12}, Folic acid
Growth factors	Auxins, gibberellins
Further active	Salicylic acid, malic acid

Mode of action of the Aloe Vera active substances

Although Aloe Vera Gel is known for cosmetic and medical application, the mode of action is not the same in both cases. Certain Aloe Vera active substances cannot penetrate the skin barrier and are therefore only effective when they come into direct contact with the cells of the dermis, as in the case of a wound, for instance. Other substances, however, penetrate readily into the intact skin and are able to care for the skin very well by a moisturising and soothing effect. Thus the effectiveness profile of the Aloe ingredients is divided into two categories, the cosmetic application field and the medical application field.

Active substance	Cosmetic effect	Medical effect
Amino acids	Skin moisturising	Components of protein synthesis and stimulators of collagenogenesis
Enzymes	Remain on the skin, possibly split biopolymers into their skin moisturising components	Are important for wound cleansing and support an anti- inflammatory effect
Minerals	Catalyse cell processes and accelerate the skin's own protective functions (such as neutralization of free radicals)	Catalyse cell processes and support the skin’s own protective functions
Phytosterols	Stimulate cell division and have an anti-inflammatory effect	Stimulate cell division and have an anti-microbial effect
Polysaccharides	Remain on the skin and can have a moisturising and soothing effect on the skin	Aloe Vera polysaccharides stimulate the immune system and promote wound healing
Vitamins	Support the cell processes and have a vitalising effect	Support the cell processes and therefore promote wound healing
Growth factors	Stimulate cell division and have an activating effect	Stimulate cell division and promote wound healing
Further: Salicylic acid	Has an anti-inflammatory effect	Has an anti-microbial and anti-inflammatory effect
Summary	Aloe Vera Gel has a moisturising, soothing (anti- inflammatory) and vitalising effect on the skin	Aloe Vera Gel stimulates the immune system, has an anti- microbial effect and promotes wound healing

Demonstrable effectiveness

Numerous studies with Aloe Vera Gel confirm its good effectiveness in various fields of application, such as skin moisturising, as an anti-inflammatory action or for wound healing. Based on the distinctive data situation, the WHO drew up a monograph on Aloe Vera Gel and confirmed the positive effects in various fields of application at a concentration for use of at least 10% Aloe Vera Gel. (Appendix 1)

Skin moisturising

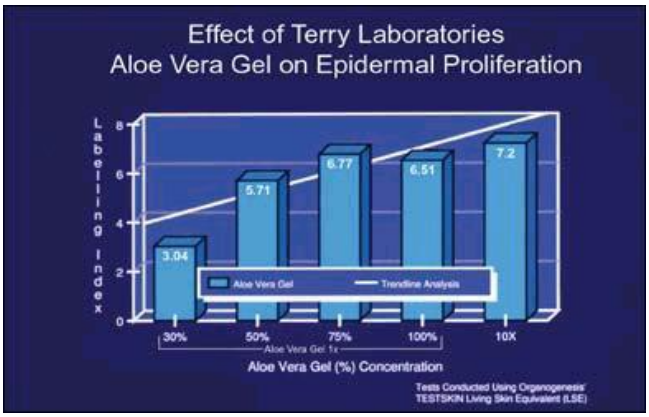
Various ingredients of Aloe Vera Gel cause it to have a skin moisturising effect. This action is brought about by a number of amino acids and sugar compounds and is enhanced indirectly by vitalising of the epidermis (by increased cell division and improved cell processes) and a polysaccharide film on the skin surface. [2]

Anti-inflammatory action

Aloe Vera Gel exerts a soothing effect on the skin through the action of various active substances in that the release of inflammatory mediators such as prostaglandins is inhibited. There are also indications that neutrophilic granulocytes are inhibited from migrating to the focus of inflammation, which prevents the release of further inflammatory mediators. Minerals can also optimise the skin's own protective functions and additional bring the skin back into balance. [2, 9, 10, 11, 12, 20]

Cell growth

The fact that Aloe Vera Gel stimulates cell division has been impressively demonstrated in a cell culture test. Basal keratinocytes occurring in the epidermis divide significantly more often when Aloe Vera is added. This method was originally used to test the cytotoxic potential of Aloe Vera Gel. It became apparent that Aloe Vera Gel did not have any toxic effect, but rather exerted a stimulating effect on basal keratinocytes. Following on from this, the same test model was used to evaluate the dose-dependency of cell stimulation. [17]



Extract from the in vitro study

The in vitro study by Terry Laboratories' Aloe Vera proved to be non-toxic to basal keratinocytes. In addition, Aloe Vera gel proved to accelerate basal keratinocyte growth. The results of the research indicate that the higher the concentration of Terry Laboratories' Aloe Vera gel the larger the increase in basal keratinocyte activity. The increased Aloe Vera Gel solid-matter content in the test led initially to an enhancement of cell growth, although this reached a plateau above a certain concentration. It is apparent from this that the action of Aloe Vera Gel is dose-dependent and that by increasing the Aloe Vera Gel concentration, a higher level of efficacy can be achieved.

Wound healing

The specialist literature contains numerous references to the fact that Aloe Vera Gel promotes wound healing and that a large number of Aloe active substances are bound into the complex regeneration process. The polysaccharide acemannan, for instance, is involved in the stimulation of the collagen and glycosaminoglycane synthesis, which is a role that is also attributed to the amino acid arginine. Increased macrophage activity is also brought about by several Aloe Vera active substances, and this is also an important process for rapid wound healing. In addition, plant growth factors such as gibberellins, and phytosterols such as lupeol support the overall repair mechanism, quite apart from the optimising of cell processes through the presence of minerals and vitamins. [2, 4, 5, 10, 11, 12, 18, 19, 20:

Wound healing can generally be divided into 3 stage:

Most important steps

1. Inflammation

- Clotting and complement system cascade; Release of growth hormones which, among other things, lead migrating cells to the wound

2. Proliferation – Formation of granulation tissue:

- Fibroblasts which form collagen and glycosaminoglycanes
- Inflammatory cells (granulocytes), to kill off bacteria
- Vascular cells, to generate the nutrient supply

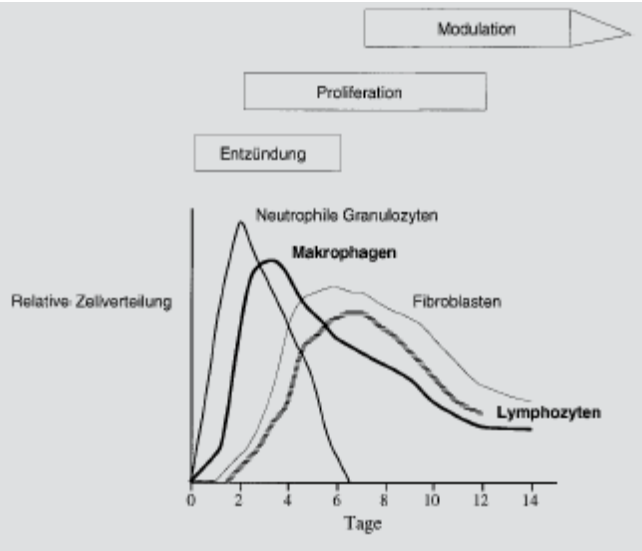
3. Wound modulation

The fine structuring of the extracellular matrix may take up to a year. The initial fibrin and fibronectin is replaced by type III collagen before finally type I collagen binds the skin structure together (as in intact skin).

Immunoregulation of wound healing

Sequence of events during wound healing. Neutrophilic granulocytes and macrophages represent the largest cell fraction during the inflammatory phase. Later, lymphocytes and matrix-forming fibroblasts dominate.

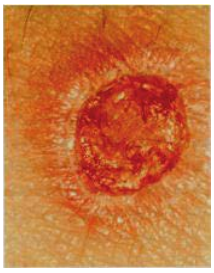
Source: M.Schäffer & H.-D. Becker



Aloe Vera Gel is ideally suited to support all the stages of wound healing thanks to its unique mixture of phytostimulants. Not only does it accelerate the healing phase, it also optimises the strength and evenness of the wound. The fact that this functions wonderfully well in practice is impressively demonstrated by the in vivo study discussed below.

Extract from the in vivo study

By means of a dermatological supervised study of wound healing in human skin has been able to demonstrate clearly that those wounds, which are treated with Aloe Vera Gel, show visibly more rapid and better wound healing.



ontaining 70% of
Aloe Vera Gel

Is Aloe Vera Gel still effective after being concentrated?

When the processing steps during the Aloe Vera Gel concentration procedure are performed with care, concentrated Aloe Vera Gel retains its effectiveness.

Evidence for this is provided by the in vitro cell growth study with Terry's Aloe Vera Gel concentrates (1x and 10x) mentioned two pages above, and the in vivo wound healing study using Terry's 10x Aloe Vera Gel also mentioned above.

These demonstrate clearly that Aloe Vera Gel retains its activity when gentle processing methods are used.

Cultivation
and processing

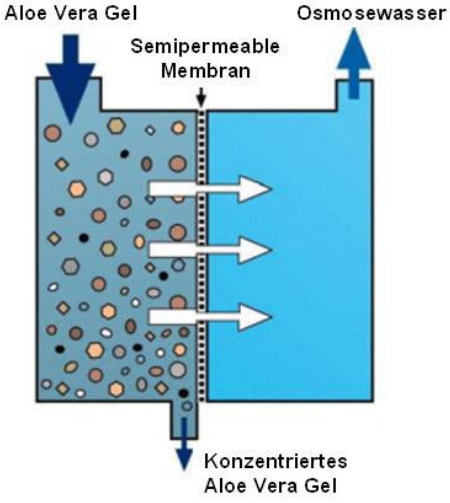
Terry Laboratories uses Aloe Vera plants from the southern Tamaulipas region of Mexico, which thrive under controlled organic conditions. For the subsequent processing, a differentiation is made as to whether the final Aloe Vera product can still be regarded as “certified organic” or not. A further distinction is made as to whether the leaf casing is removed by hand or mechanically when the Aloe Vera fillet is released. Hence in the more cost-effective mechanical treatment tiny quantities of the leaf casing are still detectable in the end product.

General processing

The Aloe Vera leaves are cut off separately and filleted, and the Aloe Vera gel is carefully separated from the leaf casing. The actual Aloe Vera juice is released from the fibrous material by means of filtration and immediately sterilized using pasteurization. The latter is especially important for reasons of effectiveness and safety: on the one hand important active ingredients of the Aloe Vera would quickly decompose, and on the other hand this prevents bacteria being deposited in or on the body.

A part of the natural water content is carefully removed from this germ-free, watery Aloe juice using reverse osmosis at a temperature of around 15°C. The concentrated gel can then be further processed as desired into 200-times powder concentrates by means of freeze drying or spray drying, or into liquid 1x, 10x or 40x versions.

Reverse osmosis equipment for gentle concentration of the Aloe Vera gel



The different concentrating methods

Freeze-drying
This process removes moisture from a product containing water without impairing its biological, chemical or structural properties. In the first step, the product is frozen, so that its water content is turned to ice. In a second step, the ice is removed from the product. By applying a vacuum to the drying chamber combined with gentle temperature control, the water is made to change from the solid state directly into the gaseous state and is thereby removed from the product. This process is known as sublimation. In order to make freeze-dried Aloe Vera powder, an already concentrated Aloe Vera Gel is used.

Spray-drying
In spray-drying, liquid products are atomised into fine droplets at the top of a drying tower. During their free fall through the tower, the droplets are dried by a hot air stream flowing within the tower, the product only being exposed to the hot air for between half a second and one second. After freeze-drying, spray-drying is second gentlest industrial method used.

New: The Cryo-Vera freeze-drying process

Through integration of the Cryo-Genics into the freeze-drying process, Terry Labs has launched a revolutionary product into the Aloe Vera World. Resulting in a more uniformed and stable finished product the new Cryo-Vera 200X Aloe Vera powder retains more of the natural ingredients of fresh Aloe Vera compared to a standard freeze-dry Aloe Vera.

- This new process allows a more efficient and shorter drying time
- In addition the already gentle freeze-drying process is optimised
- Yielding an even more high-quality product with homogeneous colour quality

Of decisive importance here is the first step of the process when, through instantaneous cooling under rotation, small Aloe Vera pearls are formed, from which the water can sublime much more rapidly during the drying stage.

Aloe Vera quality

Terry Laboratories forms part of the largest world-wide seller of Aloe Vera Gel, with particular reference to its true-to-nature cultivation and constant year-round quality of the Aloe Vera.

This is achieved because it is possible to obtain fresh Aloe Vera gel at any time from huge Aloe plantations where the climate is optimal all year round, following organic guidelines (without the use of pesticide and artificial fertiliser). The cultivation of the Aloe Vera plants on natural principles is continuously monitored and certified according to NOP/USDA and EEC 2092/91 standards. As a member of the Aloe Vera umbrella association (IASC = International Aloe Science Council), Terry has its Aloe Vera gels tested and certified according to the current I.A.S.C. guidelines and thus provides certified, high quality Aloe Vera. This is also noted on the analysis certificate for every batch. The fact that there is no use of enzymes during the entire production chain and the use of the gentle reverse osmosis technology lead to a particularly high content of long-chain polysaccharides in the products. The Kosher certificate, the extremely low aloin content (<0.1ppm in the 1x gel) and the approval for food use enable extensive use of Terry Aloe in the pharmacy, cosmetics and food sectors.

The certificate of controlled IASC quality applies to the correspondingly identified products.

The certificate of organic cultivation applies to all Aloe Vera gel products from Terry.

This organic Mayacert certificate Belongs to Terry's 200x powders

Investigation of samples

Terry Laboratories will test free of charge any competitive samples our customers are willing to send us. An analytical result will be available within 1 week each. The quality and purity of the Aloe Vera sample is determined using the HPLC analysis and a Böhringer-Ingelheim kit.

Individual Substances

Overview

Aloe Vera polysaccharides

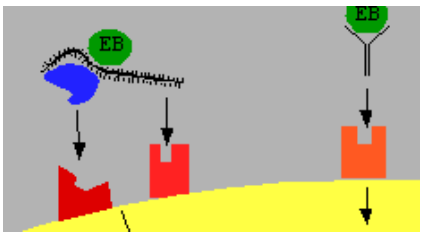
Polysaccharides are long-chain biopolymers which may be built up from different sugar units. The polysaccharides occurring in Aloe Vera Gel are biopolymers made primarily using the components glucose and mannose. Recent research results have shown that, above all, mannose and ist polymers play an interesting role in the human cell metabolism, since these are able to dock onto specific receptors on the cell surface and so exert an influence on cellular metabolism. [15, 16]

In Aloe Vera Gel, these polysaccharides occur mainly in the form of acetylated polymannans, which are better known as acemannans.

Acemannans are also involved in improving wound closure. It is assumed that a mannose-6-phosphate group on the acemannan stimulates a corresponding receptor on the fibroblast membrane, by means of which the new formation of collagen and glycosaminoglycans is stimulated. Since only specific groups, such as mannose-6-phosphate or IGF-II (insulin-like growth factor) are able to dock onto this receptor, very specific polysaccharides are required for the activation, such as those which occur naturally in Aloe Vera Gel.

Example of receptor docking on a cell surface

Sometimes, one specific structural form that fits to one membrane receptor is sufficient, though often several components have to fit for the receptor to trigger an action.



An action may, for instance, be the new formation of collagen

In a variety of investigations, it has been made clear that, alongside other Aloe Vera components, acemannan also exerts an activating influence on macrophages and so is able to support the body's own immune defence system. Since the polysaccharides are unable to pass through the barrier layer of the skin, in the case of topical application, this effect is only useful in the area of wound healing.

Polysaccharides with an immunostimulant effect are relatively rare, although they are known from other plants. An example is the polysaccharide lentinan from the Asian shiitake mushroom (Lentinus Edodes), although this has a somewhat different action mechanism than polyglucan.

Aloe Vera polysaccharides are therefore mainly involved in the wound-healing effects of Aloe Vera Gel, since due to their large molecular weight, they are not able to pass through the barrier layer of the skin. In cosmetic application, they support the skin moisturising and are able, if they are broken down on the skin surface into still smaller pieces, to have a slightly antimicrobial effect.

Aloin

Aloin, which belongs to the group of anthraquinones attracts attention, both for use in foodstuff and in cosmetics, due to its known laxative effect and its possible irritant potential. In foodstuffs, the aloin content is subject to statutory regulation by the European Commission. The maximum permissible aloin content is 0.1ppm in the finished product. In cosmetic products, also, a low aloin content is desirable.

In two different independent institutions in Germany, Aloe Vera Gel products from Terry Laboratories were investigated in respect of their aloin content. It became clear that the aloin content lies well below the allowable values:

Testing institution	Aloin – detection limit	Aloe Vera Product	Result
1	1.5 ppm (mit HPLC)	Powder TN003 200x	Not detectable
2	1 ppm (mit HPLC)	Powder TN033 200x Powder TN001 200x Gel AG014 10 x	Not detectable Not detectable Not detectable

A content of less than 2ppm of aloin in 200x Aloe Vera powder means that when re-diluted back to pure Aloe Vera Gel (1x), an aloin content of <0.01ppm results!

Based on the HPLC detection limit of 1ppm and the possible variations of ingredients in a natural product, Terry Laboratories has decided to guarantee an aloin content of <0.1ppm for all Aloe Vera gels and powders, related to pure Aloe Vera Gel (1x).

This meets not only the requirements of the food-related laws, but also the desire for a low aloin content for use in cosmetics.

Aloe Vera Gel &
INCI declaration

Aloe Vera gel has the INCI name Aloe Barbadensis Leaf Juice.

Difference between juice and extract

Aloe Barbadensis Gel is a plant juice (and not an extract) and consists of water and a proportion of solids. The natural proportion of aloe vera solids in Aloe Vera Gel is approx. 0.5%, the rest is water. Concentration of the Aloe Vera gel is achieved by proportionally removing some or all of the water. This produces concentrates (10x, 40x, 200x) that result in pure Aloe Vera gel (1x) when re-diluted correctly with water. In the INCI declaration the term 'Aloe Barbadensis Leaf Juice' makes it clear that the name 'Gel' refers to the proportion of aloe vera juice.

An Extract is gained using a solvent and a certain proportion is thus extracted from the plant. When talking about extracts we therefore differentiate between the proportion of solvent and the proportion of extract (dry residue). For Aloe Vera Oil Extract AO002, for example, it is soy oil that extracts the oil-soluble proportion from the Aloe Vera Gel. The INCI name is therefore Aloe Barbadensis Leaf Extract. In this case the INCI declaration must include the solvent and the extracted proportion.

Application of the difference between juice and extract in aloe vera products

1% of a 10x Aloe Vera Gel concentrate (e.g. Aloe Vera Gel 10x AG014) re-diluted with 9% water produces an original Aloe Vera Gel (1x).

This 10 times re-diluted Aloe Vera Gel (1x) can therefore be submitted in the INCI declaration 10% Aloe Barbadensis Leaf Juice. The water proportion (Aqua) is thereby reduced by 9%.

1% of an Aloe Vera Oil extract (e.g. Aloe Vera Oil Extract AO001), on the other hand, is split into solvent (soy oil = 99.97%) and aloe vera extract proportion (approx. 0.03%). For 1% Aloe Vera Oil Extract AO001, for example, the INCI declaration would be as follows: 0.9997% glycine soya and/or 0.0003% Aloe Barbadensis Leaf Extract.

Summary

Juice or Gel (Aloe Vera Gel)

A juice consists of a natural proportion of water and solids, the concentration of which is always approximately constant (defined). Water is thus a fixed constituent of the juice and is part of the name 'juice' independently of whether the juice was obtained directly or by re-diluting. In the INCI declaration it is logical that the quantity of gel is named and no differentiation is made between the proportion of water and solids as the INCI name is 'juice' and not 'dry matter of juice".

Extract

An extract consists of a solvent and an extracted quantity of a material. The relative proportion of material to solvent can be chosen at will and the quantity and composition of the extracted proportion of solids is highly variable (not defined). In the INCI declaration both the solvent and the extract are therefore given in the corresponding quantities.

Application information

Dosage recommendations

In order to be able to speak of an effective quantity of Aloe Vera Gel, Terry Laboratories recommends the use of at least 10% Aloe Vera Gel in a cosmetic product. The WHO confirms this by citing a concentration of 10-70% Aloe Vera Gel. The Aloe Vera umbrella organisation I.A.S.C. (International Aloe Science Council) cites a minimum content of 15% Aloe Vera Gel if the finished product is to be I.A.S.C.-certified. It has proved to be the case that as the Aloe Vera Gel concentration increases, the effectiveness also rises.

General recommendation: 10-100%

Calculation for concentrates

Pure Aloe Vera Gel (1x)	10x Aloe Vera Gel concentrate (10x liquid)	200x Aloe Vera Gel concentrate (powder)
10–100%	1–10%	0.05–0.5%

Manufacturing notes

Addition of the product to a preparation should preferably be done at a temperature of <45°C (113°F). As with all products having a raised electrolyte content, the high content of minerals and salts in Aloe Vera Gel can impair the stability of an emulsion or an acrylate gel.

Recommendations for application

Aloe Vera Gel is extremely versatile in use and new fields of application are constantly becoming apparent. These extend from body lotions and skin care tissues to deodorants, shower gels, face masks and after sun products. The recommendations for application are therefore based, in the following, on recommended fields of application:

Cosmetic application:

- for skin moisturising
- for skin care
- in case of skin irritations

Dermatological application:

- for wound healing
- in case of acne
- in case of burns

Application example

Soothing After Sun Balm with 30% Aloe Vera Gel

Slight, white emulsion, pH value approx. 6.5

- Aloe Vera moistens and soothes tired skin
- Cyclodextrin-encapsulated menthol provides a long-lasting cooling effect

Phase	Ingredients	INCI Name EU	% [w/w]
A	Water demin. Glycerin 86%	Aqua Glycerin	72.40 5.00
B	Carbopol Ultrez 10 Carbopol ETD 2050	Carbomer Carbomer	0.30 0.30
C	Cetiol SN Cegesoft C24 Cetiol OE Euxyl PE9010 Parfum Keltrol CG-SFT	Cetearyl Isononanoate Ethylhexyl Palmitate Dicaprylyl Ether Phenoxyethanol, Ethylhexylglycerin Parfum Xanthan Gum	3.00 7.00 2.00 1.00 0.40 0.40
D	NaOH solution 10%	Sodium Hydroxide, Aqua	2.00
E	Aloe Vera Gel 10x (AG014)	Aloe Barbadensis Leaf Juice	3.00
F	Water demin. CC Menthol 50%	Aqua Cyclodextrin, Menthol	3.00 0.20

Manufacturing process:

1. The manufacturing process does not require heating
2. Prepare water, add B while stirring
3. Mix substances of Phase C and stir until it is homogenous
4. Add C to A/B and homogenize shortly
5. Add D and homogenize strongly
6. Add E to the above mixture and stir until homogeneous
7. Add the pre-dispersed phase F and stir until homogeneous

Bibliography

01 Effect of Aloe Vera preparations on the human bioavailability of Vitamin C & E
02 WHO monographs on selected medicinal plants: Aloe Vera Gel
03 Internal uses of Aloe Vera
04 Wound healing, oral and topical activity of Aloe Vera
05 Aloe and other topical antibacterial agents in wound healing
06 Effect of orally consumed Aloe Vera Juice
07 Aloe Vera and Gibberellin anti-inflammatory activity in diabetes
08 The effects of lifelong Aloe ingestion on aging and pathology
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12 Aloe Vera: understanding it's proposed mechanism of action
13 Whole leaf Aloe Vera and the human immune system
14 Whole leaf Aloe Vera and the human digestive system
15 Biological activity of eight known dietary monosaccharide
16 The science of immunity
17 Aloe Vera Gel and its effect on cell growth
18 Wound healing assay
19 Immunregulation der Wundheilung
20 Mannose-6-Phosphate: anti-inflammatory and wound healing activity of a growth substance in Aloe Vera

Annex 1

Extract from the WHO monograph on Aloe Vera Gel

WHO monographs on selected medicinal plants

Aloe Vera Gel

Definition

Aloe Vera Gel is the colourless mucilaginous gel obtained from the parenchymatous cells in the fresh leaves of *Aloe vera* (L) Burm. f. (Liliaceae) (*1*, *2*).

Plant material of interest: liquid gel from the fresh leaf

Aloe Vera Gel is not to be confused with the juice, which is the bitter yellow exudate originating from the bundle sheath cells of the leaf. The drug Aloe consists of the dried juice, as defined on page 33.

General appearance

The gel is a viscous, colourless, transparent liquid.

Posology

Fresh gel or preparations containing 10–70% fresh gel.

Anti-inflammatory

The anti-inflammatory activity of Aloe Vera Gel has been revealed by a number of *in vitro* and *in vivo* studies (*14*, *17*, *24*, *25*). Fresh Aloe Vera Gel significantly reduced acute inflammation in rats (carrageenin-induced paw oedema), although no effect on chronic inflammation was observed (*25*). Aloe Vera Gel appears to exert its anti-inflammatory activity through bradykinase activity (*24*) and thromboxane B_2 and prostaglandin F_2 inhibition (*18*, *26*). Furthermore, three plant sterols in Aloe Vera Gel reduced inflammation by up to 37% in croton oil-induced oedema in mice (*15*). Lupeol, one of the sterol compounds found in *Aloe vera*, was the most active and reduced inflammation in a dose-dependent manner (*15*). These data suggest that specific plant sterols may also contribute to the anti-inflammatory activity of Aloe Vera Gel.

Wound healing

Clinical investigations suggest that Aloe Vera Gel preparations accelerate wound healing (*14*, *18*). *In vivo* studies have demonstrated that Aloe Vera Gel promotes wound healing by directly stimulating the activity of macrophages and fibroblasts (*14*). Fibroblast activation by Aloe Vera Gel has been reported to increase both collagen and proteoglycan synthesis, thereby promoting tissue repair (*14*). Some of the active principles appear to be polysaccharides composed of several monosaccharides, predominantly mannose. It has been suggested that mannose 6-phosphate, the principal sugar component of Aloe Vera Gel, may be partly responsible for the wound healing properties of the gel (*14*). Mannose 6-phosphate can bind to the growth factor receptors on the surface of the fibroblasts and thereby enhance their activity (*14*, *15*).

Furthermore, acemannan, a complex carbohydrate isolated from *Aloe* leaves, has been shown to accelerate wound healing and reduce radiation-induced skin reactions (*20*, *21*). The mechanism of action of acemannan appears to be twofold. First, acemannan is a potent macrophage-activating agent and therefore may stimulate the release of fibrogenic cytokines (*21*, *22*). Second, growth factors may directly bind to acemannan, promoting their stability and prolonging their stimulation of granulation tissue (*20*).

The therapeutic effects of Aloe Vera Gel also include prevention of progressive dermal ischaemia caused by burns, frostbite, electrical injury and intra-arterial drug abuse. *In vivo* analysis of these injuries demonstrates that Aloe Vera Gel acts as an inhibitor of thromboxane A_2, a mediator of progressive tissue damage (*14*, *17*). Several other mechanisms have been proposed to explain the activity of Aloe Vera Gel, including stimulation of the complement linked to polysaccharides, as well as the hydrating, insulating, and protective properties of the gel (*1*).

Burn treatment

Aloe Vera Gel has been used for the treatment of radiation burns (*27–30*). Healing of radiation ulcers was observed in two patients treated with *Aloe vera* cream (*27*), although the fresh gel was more effective than the cream (*29*, *30*). Complete healing was observed, after treatment with fresh Aloe Vera Gel, in two patients with radiation burns (*30*). Twenty-seven patients with partial-thickness burns were treated with Aloe Vera Gel in a placebo-controlled study (*31*). The Aloe Vera Gel-treated lesions healed faster (11.8 days) than the burns treated with petroleum jelly gauze (18.2 days), a difference that is statistically significant (*t*-test, $P < 0.002$).

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