

## STUDY OF THE CHEMICAL COMPOSITION OF ALOE VERA

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**Abstract.** This article discusses the chemical composition, uses and biological importance of the aloe vera plant, which has been widely used in the fields of pharmaceutical and cosmetology for centuries.

**Keywords.** Aloe vera, gel, latex, mannans, saccharides, anthraquinones, aloin.

**Introduction.** Aloe vera (*Aloe barbadensis miller*) is a succulent plant, originates from the Arabian Peninsula, which is widely distributed and is considered an invasive species in many world regions. The name aloe vera was derived from the Arabic word “Alloeh”, meaning a “shining bitter substance” and vera came from Latin word “vera”, meaning “true”. For years, aloe vera has been widely use in several cultures – Egypt, Greece, Mexico, India, China, and Japan. The plant belongs to the Asphodelaceae (Liliaceae) family that thrives in dry regions in Asia, Europe, America, and Africa.

The two substances from aloe vera – a clear gel and its yellow latex are widely used to manufacture commercial products. Aloe gel is typically used to make topical medications for skin conditions, such as burns, wounds, frostbite, rashes, psoriasis, cold sores, or dry skin. Aloe latex is used to be ingested for relief of constipation.

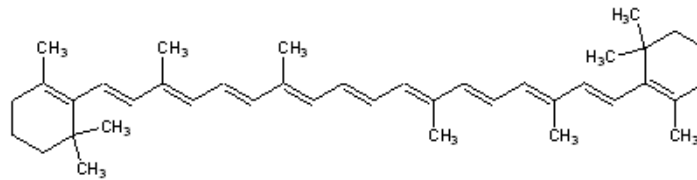
Orally ingested non-decolorized aloe vera leaf extract was listed among “chemicals known to the state to cause cancer or reproductive toxicity” by the California Office of Environmental Health Hazard Assessment. Since 2016, aloe

vera whole leaf extract is classified as a possible human carcinogen by the International Agency for Research on Cancer. Aloe skin contains aloin which is toxic. Oral ingestion of aloe vera is potentially toxic, and may cause abdominal cramps and diarrhea.

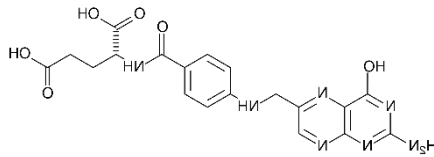
Cosmetic companies commonly add sap or other derivatives from aloe vera to products such as makeup, tissues, moisturizers, soaps, sunscreens, incense, shaving cream or shampoos. Reviews show that its inclusion in many hygienic products is due to its “moisturising emollient effect”.

In compositional studies on the structural components of leaf portions of the Aloe vera plant, the rind was found to compose 20-30% and the pulp 70-80% of the whole leaf weight. On a dry-weight basis, the rind and pulp contain 2.7% and 4.2% lipids, and 6.3% and 7.3% proteins respectively. The percentages of soluble sugars (11.2% and 16.5%), primarily as glucose, and the percentages of ash (13.5% and 15.4%), in particular calcium, were relatively high in the rind and pulp, respectively. Non-starch polysaccharides and lignin represented the bulk of each leaf fraction and were found to be 62.3% and 57.6% of dry weight of the rind and pulp, respectively. Acetylated mannan is the primary polysaccharide in aloe vera gel. Other chemical constituents of aloe vera include lectins such as aloctins A and B.

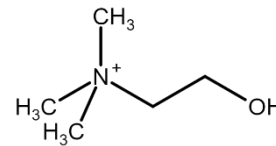
The inner leaf pulp of the Aloe vera plant contains large, thin-walled cells that produce gel. Aloe vera gel serves as the water and energy storage component of the plant. The main feature of the Aloe vera plant is its high water content, ranging from 99% to 99.5%, while the remaining 0.5-1.0% solid material is reported to contain over 200 different potentially active compounds, including vitamins, minerals, enzymes, simple and complex polysaccharides, phenolic compounds, and organic acids.



(a) Beta-carotene



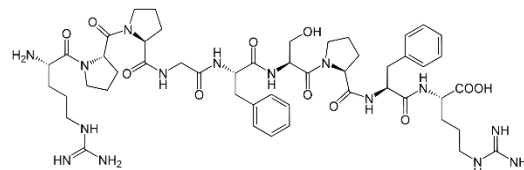
(b) Folic acid



(c) Choline

Aloe vera contains vitamins: beta-carotene; C and E, which are antioxidants. It also contains vitamin B12, folic acid, and choline.

Of the enzymes, there are 8 enzymes: alliasse, alkaline phosphatase, amylase, bradykinase, carboxypeptidase, catalase, cellulose, lipase and peroxidase.



(d) Bradykinin

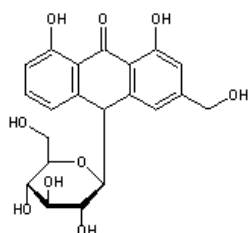
Bradykinase helps to reduce excessive inflammation when applied to skin topically, while others help in the breakdown of sugars and fats.

Minerals provides calcium, chromium, copper, selenium, magnesium, manganese, potassium, sodium, and zinc. They are essential for the proper functioning of various enzyme systems in different metabolic pathways and few are antioxidants.

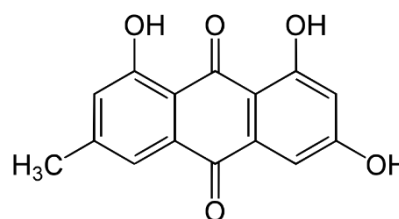
Saccharides provides monosaccharides (glucose and fructose) and polysaccharides (glucomannans, polymannose). These are derived from the mucilage layer of the plant and are known as mucopolysaccharides. The most prominent monosaccharide is mannose-6-phosphate, and the most common polysaccharides are called glucomannans [beta-(1,4)-acetylated mannan].

Acemannan, a prominent glucomannan has also been found. Recently, a glycoprotein with antiallergic properties, called alprogen and novel anti-inflammatory compound, C-glucosyl chromone, has been isolated from Aloe vera gel.

Anthraquinones provides 12 anthraquinones, which are phenolic compounds traditionally known as laxatives.



(e) Aloin



(f) Emodin

Aloin and emodin act as analgesics, antibacterials and antivirals. Lipids provides 4 plant steroids: cholesterol, campesterol,  $\beta$ -sitosterol and lupeol.

All these have anti-inflammatory action and lupeol also possesses antiseptic and analgesic properties.

Hormones like auxins and gibberellins help in wound healing and have anti-inflammatory action. It provides 20 of the 22 human required amino acids and 7 of the 8 essential amino acids. Salicylic acid possesses anti-inflammatory and antibacterial properties. Lignin, an inert substance, when included in topical preparations, enhances penetrative effect of the other ingredients into the skin. Saponins that are the soapy substances form about 3% of the gel and have cleansing and antiseptic properties.

Aloe vera latex contains four major C-glycosyl constituents: aloin A, aloin B, aloesin, and aloeresin A. Aloin A, a C-glycosyl anthrone, also referred to as barbaloin, is the major component of aloe latex. Aloin A and its epimer, aloin B, also referred to as isobarbaloin, have a 9-anthrone skeleton and a  $\beta$ -D-glucopyranosyl substituent. Aloesin, also known as aloeresin B, is a 5-methyl chromone with an 8- $\beta$ -D-glucopyranosyl substituent, and aloeresin A is a 5-

methyl chromone with an 8- $\beta$ -D-glucopyranosyl-2-O-*trans-p*-coumarol substituent. In addition, the latex from Aloe vera contains several aromatic compounds, such as aldehydes and ketones.

<b>Advantages of Aloe Vera</b>	<b>Disadvantages of Aloe Vera</b>
Soothing for skin irritations	Potential for allergic reaction
Wound healing properties	Excessive consumption may cause digestive discomfort (due to aloin)
Moisturising effects	Limited scientific evidence for some health claims
Sunburn relief	Not suitable for everyone
Antioxidant properties	

Aloe vera is an ancient succulent plant with green, fleshy leaves. The leaves contain two liquids: a yellow, bitter-tasting latex in the bark and a sticky gel inside. The product is made from recycled leaves. Aloe vera has been used for centuries and grown throughout the world for its medicinal properties, including anti-inflammatory and antibacterial properties. Aloe vera gel consists of water, amino acids, vitamins, lipids, sterols, tannins and enzymes. It also contains phenols, saponins and anthraquinones, which have antiviral, antibacterial and antifungal properties. Contains antrones, aloins, aldehydes and ketones. Aloe vera has immunomodulatory, moisturizing, wound healing, antioxidant, anti-inflammatory, antitumor, antibacterial and antifungal effects.

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