

# ***Aloe vera*** 162

## ***Properties and Value added Products***

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## What is *Aloe vera* ?

*Aloe vera*, locally known as *Guarpatha*, is a cactus-like plant that grows in hot, dry climates. As a result of its use as folk medicine, it is claimed that *Aloe vera* has wound and burn healing properties, anti-inflammatory and immunomodulatory effects. *A. vera* is used in a variety of commercial products because of these therapeutic properties. The plant is the source of two commonly used products that differ in their chemical composition as well as in therapeutic abilities - these two products are gel and the yellow sap. The gel or juice is a clear, viscous material that is separated from the parenchymal tissues in the leaves of the plant. The second product, yellow sap or latex, present in the pericyclic tubule cells, is an active cathartic pharmaceutical product known simply as the aloe. The species is originally from Southern Africa and the populations that occur elsewhere are the result of human cultivation. In India, it is found in Rajasthan, Andhra Pradesh, Gujarat, Maharashtra and Tamil Nadu.

*Aloe vera* (syn. *A. barbadensis* Miller) a perennial belonging to the Liliacea family, is a shrubby or arborescent, xerophytic short-stemmed succulent plant growing to 60–100 cm tall, spreading by offshoots. The plant has triangular thick and fleshy leaves with serrated edges. Leaves are green to grey-green, with some varieties showing white flecks on the upper and lower leaf surfaces. The flowers are produced in November on a spike up to 90 cm tall, each flower pendulous, with a yellow tubular corolla 2–3 cm long. Each leaf is composed of three layers: 1) an inner clear gel that contains polysaccharides, amino acids, lipids, sterols and vitamins, etc.; 2) the middle layer of latex which is the bitter yellow sap and contains anthraquinones and glycosides ; 3) the outer thick layer of 15-20 cells called rind which has protective function and synthesizes carbohydrates and proteins. Inside the rind are vascular bundles responsible for transportation of substances such as water (xylem) and starch (phloem).

## Major chemical constituents

*Aloe vera* contains more than 75 potential active constituents mainly present in the gel and in the yellow sap of the plant. The gel consists primarily of water (>98%) and polysaccharides. Active principles of yellow sap are hydroxyanthrone derivatives. The active constituents are:

1. Sugars : Aloe gel provides monosaccharides and polysaccharides. The most prominent monosaccharide is mannose-6-phosphate, and the most common polysaccharides are glucomannans and acemannan. Recently, a glycoprotein with antiallergic properties, called alprogen and novel anti-inflammatory compound, C-glucosyl chromone, has been isolated from *A. vera* gel.
2. Anthraquinones: Yellow sap provides 12 anthraquinones including aloin and emodin. These are phenolic compounds traditionally known as laxatives and act as analgesics, antibacterials and antivirals.
3. Sterols: Gel contains cholesterol, campesterol,  $\alpha$ -sisosterol and lupeol and they have anti-inflammatory, antiseptic and analgesic properties.
4. Enzymes: Aloe gel contains 8 enzymes which include alkaline phosphatase, amylase, bradykinase, carboxypeptidase, catalase, cellulase, lipase, and peroxidase. Bradykinase

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

5. **Minerals:** Calcium, chromium, copper, selenium, magnesium, manganese, potassium, sodium and zinc are the major minerals present in Aloe.
6. **Hormones:** The hormones auxins and gibberellins have been reported in Aloe. They help in wound healing and have anti-inflammatory action.
7. **Amino acids:** Aloe provides 20 of the 22 human required amino acids and 7 of the 8 essential amino acids.
8. **Vitamins :** Aloe contains vitamins A ( $\beta$ -carotene), C and E, which are antioxidants. It also contains vitamin B<sub>12</sub>, folic acid, and choline.
9. **Others:** Aloe also contains salicylic acid, lignin, saponins. 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 are the soapy substances and have cleansing and antiseptic properties.

### How it works ?

1. **Moisturizing and anti-aging effect:** Polysaccharides help in binding moisture into the skin. Aloe stimulates fibroblast which produces collagen and elastin fibers making the skin more elastic and less wrinkled. It also has cohesive effects on the superficial flaking epidermal cells by sticking them together, which softens the skin. The amino acids also soften hardened skin cells and zinc acts as an astringent to tighten pores.
2. **Laxative effects:** Anthraquinones present in latex increase intestinal water content, stimulate mucus secretion and increase intestinal peristalsis.
3. **Healing properties:** Increases collagen synthesis which accelerates wound contraction and increases the breaking strength of scar tissue.
4. **Stimulation of the immune system:** Alprogen inhibits calcium influx into mast cells, thereby inhibiting the antigen-antibody-mediated release of histamine and leukotriene from mast cells. Acemannan also stimulates the immune system.
5. **Anti-inflammatory action:** *Aloe vera* inhibits the cyclooxygenase pathway and reduces prostaglandin E<sub>2</sub> production from arachidonic acid due to the anti-inflammatory compound called C-glucosyl chromone present in the gel.
6. **Skin Protector :** Aloe gel has been reported to have a protective effect against radiation damage to the skin. On administration of aloe gel, an antioxidant protein, metallothionein, is generated in the skin, which scavenges hydroxyl radicals and prevents suppression of superoxide dismutase and glutathione peroxidase in the skin.
7. **Antiviral and antitumor activity:** These actions may be due to indirect or direct effects. Indirect effect is due to stimulation of the immune system and direct effect is due to anthraquinones.
8. **Antiseptic effect:** The ingredients like Lupeol, salicylic acid, urea nitrogen, cinnamonic acid, phenols and sulfur have inhibitory action on fungi, bacteria and viruses.

9. Antiburn effect : Fresh undiluted leaf gel applied externally is soothing and healing.
10. Hair care : Water extract of dried leaves applied externally on human adults at a concentration of 86.6% was found to make hair smooth. Fresh leaf gel applied externally to human adults has been found to reduce hair fall. There was improvement of hair in patients with alopecia areata.

## Uses

*Aloe vera* gel is used topically, and is often put on burns, skin infections, skin inflammation, wounds, and other skin conditions. Aloe gel for hair growth and for fighting acne, are also sold. Over the years, different people have used aloe gel in a variety of situations, and for different purposes. Some have claimed aloe gel health benefits, and conditions where it is suggested that gel from the plant can be useful, include the following:

Arthritis, Dandruff, Dry skin, Frostbite, Genital herpes (males), Hair loss, Human papilloma virus (HPV), Lichen planus (skin), Pruritus (itch), Psoriasis vulgaris, Rheumatoid arthritis, Seborrhea (seborrheic dermatitis), Severe facial pain, Skin bacterial infections, Skin burns, Skin fungal infections (yeast), Skin ulcers, Sunburn, Trigeminal neuralgia, Wound healing, Alzheimer's disease, Antifungal, Antimicrobial, Antioxidant, Antitumor, Antiviral, Arthritis, Asthma, Balding (or simple hair loss), Bladder stones, Blood vessel problems, Bowel disorders, Cancer (prevention), Chronic fatigue syndrome, Congestive heart failure, Constipation (as a laxative), Eye scratches, Facial pain (extreme), Gingivitis, Heartburn, Heart disease (prevention only), Hepatitis, High blood cholesterol levels, Inflammatory bowel disease (IBD), Irritable bowel syndrome (IBS), Kidney stones, Leukemia, Lichen planus, Parasites, Parkinson's disease, Periodontal rinse (surgery), Osteoarthritis, Reduction of stomach acid, Systemic lupus erythematosus (SLE), Tumors, Ulcerative colitis (UC) .

## Precautions

Although use of *Aloe vera* may have significant health benefits, it also has certain drawbacks and side effects and therefore, precaution should be taken against certain uses of *Aloe vera*, or using the herb in particular circumstances. Also, some side effects may come after prolonged use of *A. vera*.

**Topical:** Topical usage, such as *Aloe vera* gel or cream, is not typically associated with any major side effects. In sensitive individuals, it may cause redness, burning, stinging sensation. It is best to apply it to a small area first to test for possible allergic reaction.

**Oral:** Abdominal cramps, red urine, hepatitis, Decreased potassium blood levels, Diarrhoea (due to laxative effect), Lowered absorption of a variety of medications, Lowered blood glucose levels (blood sugar), Muscle weakness and abnormal heart rhythms (due to levels of potassium). Prolonged use has been reported to increase the risk of colorectal cancer. Laxative effect may cause electrolyte imbalances (low potassium levels).

**Contraindication:** Contraindicated in cases of known allergy to plants in the Liliaceae family.

**Pregnancy and breastfeeding:** Oral aloe is not recommended during pregnancy due to theoretical stimulation of uterine contractions, and in breastfeeding mothers, it may sometime causes gastrointestinal distress in the nursing infant.

**Interactions:** Application of aloe to skin may increase the absorption of steroid creams such as hydrocortisone. It reduces the effectiveness and may increase the adverse effects of digoxin and digitoxin, due to its potassium lowering effect. Combined use of *A. vera* and furosemide may increase the risk of potassium depletion. It decreases the blood sugar levels and thus may interact with oral hypoglycemic drugs and insulin.

### CAZRI's Contribution

Research on *Aloe vera* at Central Arid Zone Research Institute (CAZRI), Jodhpur, was initiated in 2002 to address various issues. Crude Aloe juice has less acceptability due to the presence of different anthraquinones and other impurities. Methodology was standardized to get relatively transparent, colourless and aloin free juice. Purified juice was further processed for making various products having long shelf life.

**Concentrated Aloe juice:** The new process is a simple, low cost technique. Juice of desired concentration can be prepared by this process. Quality of juice which has low concentration of active ingredient, can be improved.

**Extraction of aloin:** The process is simple and is carried out at ambient temperature. The organic solvent used in the process may be recovered and reused. The extracted compound has laxative and other pharmaceutical properties. Moreover, its several derivatives are of immense utility in different medications. Due to these properties, aloin has industrial utility and is in great demand in international market.

So far following products have been developed in CAZRI.

**Aloe Crack Cream:** The cream is highly effective for cracked feet, dry/dehydrated skin. It moisturizes and softens the skin and also helps in healing of skin lesions and skin cracks.

**Aloe Moisturizer:** It is most suitable for normal/ oily skin. It makes the skin smooth and glowing. It removes the black spots from the skin formed due to cold.

**Aloe Gel:** This is a moisturizer, suitable for summer; Regular use on scalp may help in growing new hair.

**Aloe Candy:** The product is edible in which the natural attributes are retained. AVPS (Aloe vera polysaccharides) is present in concentrated form (200 –300%).

**Aloe Jelly:** This is an edible product in which natural attributes including AVPS are intact.

**Aloe pickles:** has aqueous base. Natural attributes including AVPS are intact, has low salt content.

**Aloe Shampoo:** It makes the hair silky, shiny and dandruff free and reduces hair fall.

**Aloe Hair Nourishing Cream:** It prevents hair fall and makes hair strong.



Aloe Jelly



Aloe Candy



Aloe Crack Cream



Aloin



**Aloe Moisturizer**



**Aloe Hair Nourishing Cream**



**Aloe Shampoo**



**Aloe concentrated juice**



**Aloe Gel**



**Aloe pickles**

**Aloe vera products developed by CAZRI**

**Estimated production cost of CAZRI Aloe products (Rs/ 100 g)**

<b>Name of Aloe products</b>	<b>Production cost (Market price)</b>
Aloe Crack Cream*	50/- (60/- to 70/-)
Aloe Moisturizer*	15/- (50/- to 80/-)
Aloe Gel	9/- (40/- to 60/-)
Aloe Candy	62/- (New product)
Aloe Jelly	23/- (New product)
Aloe pickles	4/- (New product)
Aloe Shampoo*	17/- (30/- to 100/-)
Aloe Hair Nourishing Cream	22/- (New product)

\* Products are sold through ATIC.

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