



Definition, Testing and Application of Aloe Vera and Aloe Vera Gel

Definition

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

Nomenclature

Aloe barbadensis Mill., *Aloe chinensis* Bak., *A. elongata* Murray, *A. indica* Royle, *A. affinalis* Forsk., *A. perfoliata* L., *A. rubescens* DC, *A. vera* L. var. *littoralis* König ex Bak., *A. vera* L. var *chinesis* Berger, *A. vulgaris* Lam. (2-5). Most formularies and reference books regard *Aloe barbadensis* Mill. As the correct species name, and *Aloe vera* (L.) Burm. f. as a synonym. However, according to the International Rules of Botanical Nomenclature, *Aloe vera* (L.) Burm. f. is the legitimate name for this species (2-4). The genus *Aloe* has also been placed taxonomically in the family called *Aloeaceae*.

The Story of Aloe Vera

The plant Aloe Vera has a history dating back to biblical time.

Aloe vera plant is not a cactus, but a member of the tree lily family, know as *Aloe barbadensis*. It produces a tubular yellow flower in the spring that is typical of the lily family.

There are over 250 species of aloe grown around the world. Only two species are grown commercially: *Aloe barbadensis* Miller and *Aloe aborescens*. The Aloe plant is grown in warm tropical areas and cannot survive freezing temperatures. In the United States, most of the Aloe is grown in the Rio Grande Valley of South Texas, Florida and Southern California. Internationally, Aloe can be found in Mexico, the Pacific Rim countries, India, South America, Central America, the Caribbean, Australia and Africa.

The original use of the Aloe plant was in the production of Aloin, a yellow sap used for many years as a laxative ingredient by the pharmaceutical industry. Another main ingredient: Aloe Gel, a clear colorless semi-solid gel that was also stabilized and marketed. This Aloe Vera Gel, beginning in the 50's, has gained respect as a commodity used as a base for nutritional drinks, as a moisturizer, and a healing agent in cosmetics and OTC drugs. Chemical analysis has revealed that this clear gel contains amino acids, minerals, vitamins, enzymes, proteins, polysaccharides and biological stimulators. Public interest in Aloe has grown quickly, and now there is a considerable amount of research into the various components of Aloe to find out more about their properties and to characterize these components so that more specific research can provide clues to the "magic" that is attributed to Aloe Vera.

For more information go to the Aloe Research studies links.

Description

Succulent, almost sessile perennial herb; leaves 30-50 cm long and 10 cm broad at the base; colour pea-green (when young spotted with white); bright yellow tubular flowers 25-35 cm in length arranged in a slender loose spike; stamens frequently project beyond the perianth tube.

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.

General appearance

The gel is a viscous, colourless, transparent liquid.

Organoleptic properties

Viscous, colourless, odourless, taste slightly bitter.

Geographical

Probably native to North Africa along the upper Nile in the Sudan, and subsequently introduced and naturalized in the Mediterranean region, most of the tropics and warmer areas of the world, including Asia, the Bahamas, Central America, Mexico, the southern United States of America, south-east Asia, and the West Indies.

Identity Test

NMR

Microbiology

The test for *Samonella* spp. In Aloe Vera Gel should be negative. Acceptable maximum limits of the other microorganisms are as follows. For external use: aerobic bacteria –not more than 10^2 /ml; fungi-not more than 10^2 /ml; enterobacteria and certain Gram-negative bacteria- not more than 10^1 /ml; *Staphylococcus* spp. –0/ml. (Not used internally.)

Moisture

Contains 98.5% water

Pesticide residues

To be established in accordance with the national requirements. For guidance, see WHO guidelines on quality control methods for medicinal plants and guidelines on predicting dietary intake of pesticide residues.

Heavy metals

Recommended lead and cadmium levels are not more than 10 and 0.3 mg/kg, respectively, in the final dosage form.

Radioactive residues

For analysis of strontium-90, iodine-131, caesium-134, caesium-137, and plutonium-239, see WHO guidelines on quality control methods for medicinal plants.

Other Tests

Chemical test for Aloe Vera Gel and tests for total ash, acid-insoluble ash, alcohol-soluble residue, foreign organic matter, and water-soluble extracts to be established in accordance with the national requirements.

Chemical assays

Carbohydrates (0.3%), water (98.5%). Polysaccharide composition analysis by gas-liquid chromatography.

Major chemical constituents

Aloe Vera Gel consists primarily of water and polysaccharides (pectins, hemicelluloses, glucomannan, acemannan, and mannose derivatives). It also contains amino acids, lipids, sterols (lupeol, campesterol, and β -sitosterol), tannins, and enzymes.

Mannose 6-phosphate is a major sugar component.

Dosage forms

The clear mucilaginous gel. At present no commercial preparation has been proved to be stable. Because many of the active ingredients in the gel appear to deteriorate on stage, the use of fresh gel is recommended. Preparation of fresh gel: harvest leaves and wash them with water and a mild chlorine solution. Remove the outer layers of the leaf including the pericyclic cells, leaving a "fillet" of gel. Care should be taken not to tear the green rind, which can contaminate the fillet with leaf exudates. The gel may be stabilized by pasteurization at 75-80°C for less than 3 minutes. Higher temperatures held for longer times may alter the chemical composition of the gel.

Medical uses

Uses described in pharmacopoeias and in traditional systems of medicine.

Aloe Vera Gel is widely used for the external treatment of minor wounds and inflammatory skin disorders. The gel is used in the treatment of minor skin irritations, including burns, bruises, and abrasions. The gel is further used in the cosmetics industry as a hydrating ingredient in liquids, creams, sun lotions, shaving creams, lip balms, healing ointments, and face packs.

Aloe Vera Gel has been traditionally used as a natural remedy for burns. Aloe Vera Gel has been claimed to be effectively used in the treatment of first- and second-degree thermal burns and radiation burns. Both thermal and radiation burns healed faster with less necrosis when treated with preparations containing Aloe Vera Gel. In most cases the gel must be freshly prepared because of its sensitivity to enzymatic, oxidative, or microbial degradation. Aloe Vera Gel is not approved as an internal medication, and internal administration of the gel has not been shown to exert any consistent therapeutic effect.

Uses described in folk medicine, not supported by experimental or clinical data. The treatment of acne, hemorrhoids, psoriasis, anemia, glaucoma, petit ulcer, tuberculosis, blindness, seborrheic dermatitis, and fungal infections.

Pharmacology

Wound healing

Clinical investigations suggest that Aloe Vera Gel preparations accelerate wound healing. *In vivo* studies have demonstrated that Aloe Vera Gel promotes wound healing by directly stimulating the activity of macrophages and fibroblasts. Fibroblast activation by Aloe Vera Gel has been reported to increase both collagen and proteoglycan synthesis, thereby promoting tissue repair. 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 factor receptors on the surface of the fibroblasts and thereby enhance their activity.

Furthermore, acemannan, a complex carbohydrate isolated from Aloe leaves, has been shown to accelerate wound healing and reduce radiation-induced skin reactions. 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. Second, growth factors may directly bind to acemannan, promoting their stability and prolonging their stimulation of granulation tissue.

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 the injuries demonstrates that Aloe Vera Gel acts as an inhibitor of thromboxane A₂, a mediator of progressive tissue damage. 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.

Because many of the active ingredients appear to deteriorate on storage, the use of fresh gel is recommended. Studies of the growth of normal human cells *in vitro* demonstrated that cell growth and attachment were promoted by exposure to fresh Aloe Vera leaves, whereas a stabilized Aloe Vera Gel preparation was shown to be cytotoxic to both normal and tumour cells. The cytotoxic effects of the stabilized gel were thought to be due the addition of other substances to the gel during processing.

Anti-inflammatory

The anti-inflammatory activity of Aloe Vera Gel has been revealed by a number of *in vitro* and *in vivo* studies (See studies section). Fresh Aloe Vera Gel significantly reduced acute inflammation in rats (carrageenin-induced paw oedema), although no effect on chronic inflammation was observed. Aloe Vera Gel appears to exert its anti-inflammatory activity through bradykinase activity and thromboxane B₂ and prostaglandin F₂ inhibition. Furthermore, three plant sterols in Aloe Vera Gel reduced inflammation by up to 37% in croton oil-induced oedema in mice. Lupeol, one of the sterol compounds found in Aloe Vera, was the most active and reduced inflammation in a dose-dependent manner. These data suggest that specific plant sterols may also contribute to the anti-inflammatory activity of Aloe Vera Gel.

Burn treatment

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

Contraindications

Aloe Vera Gel is contraindicated in cases of known allergy to plants in the Liliaceae's family.

Precautions

No information available concerning general precautions, or precautions dealing with carcinogenesis, mutagenesis, impairment of fertility; drug and laboratory test interactions; drug interactions; nursing mothers; paediatric use; or teratogenic or non-teratogenic effects on pregnancy.

Adverse reactions

There have been very few reports of contact dermatitis and burning skin sensations following topical applications of Aloe Vera Gel to dermabraded skin.

Posology

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

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