

Need and Scope Of Development Of Aloe vera As Remedy medicine For Skin Diseases

Rupali A Mali¹; Shashikant R Pattan¹; R.Y.Patil²; Amruta M Vayakole³; Pallavi S Pedagonkar³
Utakarsha D Gharte¹; R S Jadhav³; D G Baheti⁴

1. Department of Pharmaceutical Chemistry, Pravara Rural College of Pharmacy, Pravaranagar, 413736, (MS) India.

2. S. U. College Kharadi, Pune, (MS) India

3. Department of Pharmacognocny, Pravara Rural College of Pharmacy, Pravaranagar, 413736, (MS) India.

4. Sitabai Thite College of Pharmacy Shirur Pune (MS) India

Adress for Correspondence*

Dr.Shashikant.Pattan

Principal,Pravara Rural college of Pharmacy,Loni,Maharashtra.

413736 India

shashipattan@yahoo.com

Summary

The number of factors such as over population, increased pollution, variety of micro-organisms, biological toxins, chemical and physical agents etc.. are responsible to produce various skin diseases. The various allopathic drugs are available in market which are used in different skin diseases but they cause various side effects. As compared to the allopathic drugs HERBAL DRUGS produces less or no side effects hence they have large demand in the treatment of various skin diseases.

The present review subject matter is related to the important uses of the “ALOE VERA” in various skin diseases including its complete pharmacognostic scheme.

Introduction

- Malnutrition, environmental pollution, over population, are various are factor which affects general health of people.
- A variety of micro-organisms, biological toxins, chemical agents, physical factors cause damage to skin.
- Variety of HERBAL DRUGS are used in treatment of skin diseases

COMMON SKIN DISEASES:

- Being exposed to the physical & chemical environment the skin subjected to injury by a variety of agents which may not affect the internal agents
- More than 300 diseases of skin have been reported.
- The conditions that cause skin disease are of generally 2 types
 - A) Predisposing cause
 - B) Immediate cause

DIFFERENT SKIN DISEASES:

1. Eczema
2. psoriasis
3. Dermatitis
4. Ringworm
5. Boils
6. Warts
7. Acne
8. Leprosy

PLANTS USED IN SKIN CARE

name of drugs	USES
1. Adhatoda vasica	Scabies
2. Allium sativum	pimples
3. Aloe barbadensis	In healing of chronic ulcer, dermatitis
3. Aloe vera	Psoriasis, protection against X-ray damage
4. Azadirachta indica	Leprosy & eczema
5. Carica papaya	Skin care
6. Curcuma longa	Various skin diseases
7. Ocimum sanctum	Ringworm, Leprosy

Information about the Aloe Vera**What is Aloe Vera?**

Aloe Vera is a species of Aloe, native to northern Africa. It is a stemless or very short-stemmed succulent plant growing to 80-100 cm tall, spreading by offsets and root sprouts. The leaves are lanceolate, thick and fleshy, green to grey-green, with a serrated margin. The flowers are produced on a spike up to 90 cm tall, each flower pendulous, with a yellow tubular corolla 2 to 3 cm long.

Aloe Vera has long been a popular houseplant. Often called the 'miracle plant' or the 'natural healer', Aloe Vera is a plant of many surprises. It flourishes in warm and dry climates, and to

many people it looks like a cactus with fleshy thorny leaves. In fact it is a member of the Lily family, staying moist where other plants wither and die by closing its pores to prevent moisture loss.

There are around 400 species of Aloe, but it is the Aloe Barbadensis Miller (Aloe Vera or "true aloe") plant which has been of most use to mankind because of the medicinal properties it displays.

The Aloe Vera Plant

Although there are many Aloe's the term Aloe Vera ("true Aloe") refers to the Aloe Barbadensis Miller. Fully grown the plant stands 60 to 90 cm high, and a mature leaf is 7 to 10 cm across at the base, weighing 1.5 to 2 kg.

The lower leaf of the plant is used for medicinal purpose. If the lower leaf is sliced open, the gel obtained can be applied on the affected area of the skin. Leaves and seeds are the two edible parts of Aloe Vera.

The Aloe leaf structure is made up of four layers:

Rind - the outer protective layer;

Sap - a layer of bitter fluid which helps protect the plant from animals;

Mucilage Gel - the inner part of the leaf that is filleted out to make Aloe Vera gel.

Aloe Vera (inner gel) contains the 8 essential Amino Acids that the human body needs but cannot manufacture.

Aloe Vera has a bitter taste which can be unpleasant in the raw state. It is possible to get used to the taste of plain Aloe Vera gel, but if you can't the addition of some fruit juice helps to make it more palatable.

There is much confusion between Aloe Vera Gel and Aloe Vera Juice with the two often being thought synonymous. The term Gel refers to the inner leaf only, whereas Juice refers to "Aloe Latex" a bitter substance found just under the skin of the leaf.

Leading authorities on Aloe Vera maintain that only Aloe Vera gel as fresh as preservation allows from the inner leaf has any remarkable properties.

Aloe Vera used Throughout History

Aloe Vera has been found described in writings in many different cultures and as far back as the Greek, Egyptians, and Roman eras. References have also been found in writings from the Indian and Chinese early cultures. Ancient records show that the benefits of Aloe Vera have been known for centuries, with its therapeutic advantages and healing properties surviving for over 4000 years. The earliest record of Aloe Vera is on a Sumerian tablet dating from 2100 BC.

Its antiquity was first discovered in 1862 in an Egyptian papyrus dated 1550 BC. Egyptian Queens associated its use with their physical beauty.

It was used to great effect by Greek and Roman physicians. Researchers have found that both the ancient Chinese and Indian used Aloe Vera.

In the Phillipines it is used with milk for kidney infections.

Aloes are referred to in the Bible, and legend suggests that Alexander the Great conquered the island of Socotra in the Indian Ocean to secure supplies of Aloes to treat the battle wounds of his soldiers.

Today in Japan Aloe Vera is commonly used as an ingredient in commercially available yogurt. There are also many companies which produce Aloe Vera beverages.

People in Tamil Nadu, a state of India, often prepare a curry using Aloe Vera which is taken along with Indian bread (nan bread) or rice.

Uses and Home Remedies using Aloe Vera

Aloe gel has been used for topical treatment for minor wounds and burns and skin irritations for centuries. Aloe Vera used to be known as the "burn plant". It is no longer necessary to keep an Aloe Vera plant handy for when you catch your hand on the oven door, these days Aloe Vera Gel comes in handy tubes.

A two year trial is underway at the Neath, Morriston and Singleton hospitals in Swansea for use of Aloe Vera in treating Irritable Bowel Syndrome (IBS). A clinical trial involving 44 patients suffering from Ulcerative Colitis has been completed at the Royal London Hospital and the John Radcliffe Hospital in Oxford. The trial was completed in January 2004 and an improvement found in 38% of Patients given Aloe Vera gel as opposed to 8% given a placebo.

One of the home remedies for asthma was to boil some Aloe Vera leaves in a pan of water and breathe in the vapor.

Others have reported benefits of Aloe Vera in treating Eczema and Psoriasis, and a product called Aloe Propolis Creme is favoured by many for these conditions.

For pharmaceutical use as a laxative, the aloe juice is taken from the tubules just beneath the outer skin of the leaves. It's a bitter yellow and dried to become aloe granules that are dark brown in color.

Made into a beverage and taken internally, it has been used to help many other conditions. Some of them are constipation, ulcers, diabetes, headaches, arthritis, and coughs. Taking aloe internally does have side effects, which can include pain, electrolyte imbalances, and diarrhea.

It has been determined that it can also help with treating minor vaginal irritations.

Aloe Vera is best used when used fresh from the plant. It doesn't store well but can be bought as a preserved product. Aloe Vera can be used topically as well as taken internally. It has been used for mouth sores, what we call stomach sores, or cold sores.

Aloe Vera has been especially helpful of patients with severe and various skin diseases. It acts as a rejuvenating action. It acts as a moisturizer and hydrates the skin. After being absorbed into the skin, it stimulates the fibroblasts cells and causes them to regenerate themselves faster. It's the cells that that produce the collagen and elastin so the skin will get smoother and look younger.

Because Aloe Vera is natural, it works gently within the intestinal tract to help break down food residues that have become impacted and help clean out the bowel. When the bowel is cleaned out, it greatly reduces bloating, discomfort, and helps ease stress, which only leads to more attacks of irritable bowel syndrome.

How to Grow Aloe Vera Plants at Home



Established Aloe vera plants are available at almost any garden supplies shop or plant nursery.

Aloe plants are not very frost tolerant. If they are grown outdoors in warmer climates they should be planted in full sunlight, or partial shade. Apply a balanced liquid feed during the growing season.

For growing Aloe Vera indoors its best to place it near a window that gets a lot of sun. During summer you can move the pot(s) outside.

Watering should be kept to a minimum during the winter months but during summer the plant will require a lot of water.

If planting from scratch or re-potting your Aloe plant the potting soil should be moderately fertile and fast draining with a couple of inches of gravel in the bottom of the pot

Aloe barbadensis, also known as Aloe vera is part of the Liliaceae plant family



General Information

Botanical Name: Aloe barbadensis

Common Name: Aloe vera, Curacao Aloe, Barbados Aloe, Lily of the Desert

Plant Family: Liliaceae

Medicinal Part used: The leaves, the fresh leaf gel and latex

Cultivation



Aloe vera has been widely grown as an ornamental plant. Large scale agricultural production of Aloe vera is undertaken in Australia, Cuba, the Dominican Republic, China, Mexico, India, Jamaica, Kenya and South Africa, along with the USA to supply the cosmetics industry with Aloe vera gel.

Plant Constituents of Aloe vera

Aloe vera leaf contains more than 200 different constituents. The juice contains, on average, more than 99% water. Aloe-emodin ,Aloins, Barbaloin and Isobarbaloin,amino acids amorphous Aloin ,approximately 96% water, enzymes , essential fatty acids, essential oil polysaccharides, resin, vitamin C, vitamin E, Zinc.

Aloe vera leaf contains more than 200 different constituents. The juice contains, on average, more than 99% water.

Some constituents are:

- Acemannan and other polysaccharides boost T-lymphocyte cells which help promote skin healing and neutralize many of the enzymes responsible for damaging the mucosal wall
- Aloe-emodin
- Aloins, Barbaloin and Isobarbaloin
- amino acids
- amorphous Aloin
- approximately 96% water
- enzymes
- essential fatty acids (anti-inflammatory).
- essential oil
- Galactomannans (long chain sugars derived from plants)
- glycoproteins (protein-carbohydrate compounds that speed the healing process by stopping pain and inflammation)
- minerals
- polysaccharides (a type of carbohydrate that stimulates skin growth and repair)
- resin
- vitamin C
- vitamin E
- Zinc

USES:

- Aloe vera used to heal skin wounds.
- Aloe vera plant is used to heal burn.
- Helps in speeding recovery time after surgery.
- Aloe vera gel is used on blisters.
- Aloe vera Plants are also helpful in healing insect bites.
- Aloe vera Plants are also helpful in healing rashes.
- Aloe vera Plants are also helpful in healing sores.
- Aloe vera Plants are also helpful in healing herpes.
- Aloe vera Plants are also helpful in healing urticaria.

- Aloe vera Plants are also helpful in healing fungus.
- Aloe vera Plants are also helpful in healing vaginal infections.
- Aloe vera Plants are also helpful in healing conjunctivitis.
- Aloe vera Plants are also helpful in healing allergic reactions.
- Aloe gels are applied on dry skins to give them glowing effect.
- Helps in reducing acne.
- Helps to reduce sunburn.
- Aloe vera helps to fight frostbite.
- Aloe vera uses includes fighting from shingles.
- It helps in screening out x-ray radiation.
- Aloe vera used to reduce psoriasis.
- Aloe vera used to reduce rosacea.
- Aloe vera used to reduce warts.
- Wrinkles from aging are reduced by applying Aloe vera.
- Aloe vera used to reduce eczema.
- Bacterial, Viral, Fungal and Parasitic Conditions
- Blood Conditions
- Cardiovascular Conditions
- Gastrointestinal Conditions
- Immune System Conditions
- Inflammatory Conditions
- Liver Conditions
- Respiratory Tract Condition

Bacterial, Viral, Fungal and Parasitic Conditions

- AIDS
- eliminates parasites (especially protozoan infections)
- relieves Herpes simplex & zoster
- relieves symptoms of Candida
- relieves symptoms of Epstein-Barr virus (chronic fatigue syndrome)
- relieves symptoms of fungal infections
- relieves symptoms of genital herpes
- relieves symptoms of yeast infections
- Staphylococcus infections
- vaginitis
- viral infections

Blood Conditions

- aids hyperglycemia
- aids in blood circulation
- hemorrhoids
- lowers blood sugar in people with type 2 (non-insulin-dependent) diabetes

Cardiovascular Conditions

- relieves hypertension

Female Conditions

- menstrual cramps and irregularity

Gastrointestinal Conditions

- acts mainly on the large intestine
- colic
- constipation
- dyspepsia
- facilitates digestion by aiding the immune system
- helps cleanse the digestive tract by exerting a soothing, balancing effect
- helpful to the stomach, small intestine and colon
- intestinal infection
- keeps the bowels functioning smoothly and helps when there is an impaction
- moves allergenic proteins from the small intestine into the colon
- aids in healing wounds by drawing out infection and preventing infection from starting
- naturally alkalizes digestive juices to prevent over-acidity
- promotes a favorable balance of gastrointestinal symbiotic bacteria and decreased yeast populations
- relieves nausea
- relieves symptoms of indigestion
- stimulates activity of the gastrointestinal tract
- stimulates intestinal motility

Immune System Conditions

- allergic reactions
- has immune-stimulating actions
- strengthens the body's natural resistance

Inflammatory Conditions

- relieves arthritis

Liver Conditions

- assists liver and gall bladder functions
- helps hypercholesterolemia

Respiratory Tract Conditions

- colds
- relieves symptoms of esophagal reflex
- relieves symptoms of gingivitis

Aloe is used for inflammatory bowel conditions

- Crohn's disease
- gastritis
- irritable bowel syndrome
- ulcerative colitis

Externally Aloe vera gel is helpful for:

- abrasions
- acne
- boils
- burns
- bursitis
- carbuncles
- chafed and cracked skin
- chafed nipples from breastfeeding
- contusions
- cuts and scratches
- dandruff
- denture (gum) sores
- dermatitis
- edema (swelling)
- hemorrhoids
- inflamed eyes
- insect bites
- post-treatment dental discomfort and pain
- radiation burns
- rashes
- psoriasis
- skin irritation
- skin rashes
- sprains
- stings
- sunburn

- tendonitis
- ulcers
- varicose veins
- warts
- wounds
- wrinkles
- X-ray burns

By placing a protective coating on the affected areas which:

- accelerates the rate of healing
- decreases swelling and redness
- increases the availability of oxygen to the skin
- increases the synthesis and strength of tissue
- prevents blisters
- reduces inflammation
- relieves pain

Externally it can also be used as :

- aid in keeping the skin supple
- draw out infection
- help control of acne and eczema
- have a moisturizing effect on the skin
- prevent infection
- relieve itching due to insect bites and allergies

Poisonous parts

Latex

Poisonous component

Aloe-emodin

Side effects-

- electrolyte loss
- can delay healing of major wounds
- can color urine pink when taken internally
- fluid imbalance
- intestinal cramps

Most of these side effects only occurring when a person overdoses or uses aloe vera for too long.

Products

Global Herbal Supplies has Aloe Vera available in the following forms:

- Aloe vera Extract
- Aloe vera Butter
- Dried Aloe Vera
- Aloe vera Juice - Lifestream, Morlife, Nature's Sunshine
- Aloe vera Gel - Lifestream, Nature's Sunshine

Usage of Aloe vera

The bitter yellow juice found between the gel and the outer skin of the leaf is dried and used as a laxative.

Medicinal Part used: The leaves, the fresh leaf gel and latex

- Aloe latex is the sticky residue left over after the liquid from cut Aloe leaves has evaporated
- Aloe vera extract is made by pulverizing the whole leaves of the plant
- Aloe juice and gel is made from the inner leaf (most commonly used for minor cuts and burns)

Definition, Testing and Application of Aloe Vera Gel

Definition

Aloe Vera is the colourless mucilaginous gel obtained from the parenchymatous cells in the fresh leaves of Aloe vera

Description

Succulent, almost sessile perennial herb; leaves 30-50 cm long and 10 cm broad at the base; colour peagreen(when young spotted with white); bright yellow tubular flowers 2.5-3.5cm 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 exudates 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, southeast 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 Gramnegative 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.

Other Tests

Chemical test for Aloe Vera Gel and tests fro 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 6phosphate 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 $75\text{--}80\text{ }^\circ\text{C}$ 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 firstand seconddegree 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, seborrhoeic 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 intraarterial 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 to 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 nonteratogenic 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.

Conclusion

The number of factors such as over population, increased pollution, variety of micro-organisms, biological toxins, chemical and physical agents etc. are responsible to produce various skin diseases. The various allopathic drugs are available in market which are used in different skin diseases but they cause various side effects. As compared to the allopathic drugs HERBAL DRUGS produces less or no side effects hence they have large demand in the treatment of various skin diseases.

Aloe vera is one of the most important herbal drug used in the treatment various cosmetic formulation as well as it is also used in various other health diseases and also in increases in immune power.

References

1. WHO monographs on selected medicinal plants.
2. Bruneton J. Pharmacognosy, phytochemistry, medicinal plants. Paris, Lavoisier, 1995.
3. Grindlay D, Reynolds T. The Aloe Vera phenomenon: a review of the properties and modern uses of the leaf parenchyma gel. *Journal of ethnopharmacology*, 1986, 16:17151.
4. Newton LE. In defense of the name Aloe Vera. *The cactus and succulent journal of Great Britain*, 1979, 41:2930.
5. Tucker AO, Duke JA, Foster S. Botanical nomenclature of medicinal plants. In: Cracker LE, Simon JE, eds. *Herbs, spices and medicinal plants*, Vol. 4. Phoenix, AR, Oryx Press, 1989:169242.
6. Hänsel R et al., eds. *Hagers Handbuch der Pharmazeutischen Praxis*, Vol. 6, 5 th ed. Berlin, Springer, 1994.
7. Youngken HW. *Textbook of pharmacognosy*, 6 th ed. Philadelphia, Blakiston, 1950.
8. *Quality control methods for medicinal plant materials*. Geneva, World Health Organization, 1998.
9. *Deutsches Arzneibuch 1996*. Vol. 2. *Methoden der Biologie*. Stuttgart, Deutscher Apotheker Verlag, 1996.
10. *European pharmacopoeia*, 3 rd ed. Strasbourg, Council of Europe, 1997.
11. Rowe TD, Park LM. Phytochemical study of Aloe Vera leaf. *Journal of the American Pharmaceutical Association*, 1941, 30:262266.
12. *Guidelines for predicting dietary intake of pesticide residues*, end rev. ed. Geneva, World Health organization, 1997 (unpublished document WHO/FSF/FOS/97.7; available from Food Safety, WHO, 1211 Geneva 27, Switzerland).
13. Pierce RF. Comparison between the nutritional contents of the aloe gel from conventional and hydroponically grown plants. *Erde international*, 1983, 1:3738.
14. Hart LA et al. An anticomplementary polysaccharide with immunological adjuvant activity from the leaf of Aloe Vera. *Planta medica*, 1989, 55:509511.
15. Davis RH et al. Antiinflammatory and wound healing of growth substance in Aloe Vera. *Journal of the American Pediatric Medical Association*, 1994, 84:7781.