Chemistry of Medicinally Important Xerophytic Plant Aloe Vera and its Vital Significance: A Review

Himanshu Sharma and S.C. Sharma

School of Applied Sciences, Chitkara University, Punjab, India

E-mail: himanshu.sharma@chitkara.edu.in; sc.sharma@chitkara.edu.in

Abstract Aloe vera is a natural product that is now a day frequently used in the medical field. It has several advantages for curing many diseases and is also used in cosmetology. Due to its various advantages in different purposes, we need to further studies. The Aloe vera’s properties, mechanism of action and medicinal uses are briefly reviewed in this article.

Keywords: Aloe Vera, Medicinal Plant, Disease Resistant

1. INTRODUCTION

There are so many xerophytic plants are known today. The plants which are present in dry and desert areas are called xerophytic plants. Aloe Vera is one of the best example of medicinally important xerophytic plant (Herbs). It is grown largely in South Texas, USA, Mexico, India, South America, Central America, Australia and Northern Africa Akinyele and Odiyi (2007). The Aloe gel or fillet, which is stored in the inner portion of leave, contain almost 99.5% water and 0.5% other ingredients. It is a Arabic word which means a shining bitter substance. It is a succulent and Perrineal plants and belonging to the Liliaceae family. The plant has stiff grey green lance shaped leaves containing clear gel in central mucilaginous pulp. Scientists has discovered over near about 150 nutritional ingredients in aloe vera. The true aloe vera plant is called Aloe barbadensis Miller, otherwise called Curacao aloe and is the most medicinally potent of the 300 varieties found around the world. The first written record about the Aloe vera were found over 6,000 years old clay tablets found in Mesopotamia. These tablets contained aloe as an active ingredient used in curing infections, treating skin problems Atherton (1998) and Robson etal. (1982). Today, Aloe vera is one of the most studied plants worldwide. It is also referred as a miracle plant and known as Wand of heaven by native Americans. It is also used as an antiseptic, anti-inflammatory and a cure of heart burns and relive the symptoms of illnesses like cancer, diabetes and kidney problems. Recently, Aloe Vera gel has been used as an active ingredient in hundreds of skin lotions, sun blocks and cosmetics. The
gels use in cosmetics Bland (1985), Kandil and Gobran (1979) has been increased by claims that it has anti-aging effect similar to Vitamin-A derivatives Crew (1939). It is believed to be effective in treating stomach ailments, gastrointestinal problems, skin diseases, constipation due to accumulation of heat Jeffrey (1985), for radiation injury, for its anti-inflammatory effect, for wound healing and burns as an anti ulcers and diabetes Kandil and Gobran (1979,1982), Borrelli and Izzo (2000), Parmer et al. (1986), Blitz et al. (1963). It is also known as lily of desert, the plant of immortality and medicine plant with qualities of serve as alternative medicine. In homeopathic medicine aloe is used for hemorrhoids. In India Aloe Vera is also referred to as, Dhrit Kumari, in Ayurvedic treatments.

2. CHEMISTRY OF ALOE VERA

The important chemical constituents of Aloe vera are: Amino acids, Anthraquinones, Enzymes, Minerals, Vitamins, lignins, Cabbohydrates (monosaccharide and polysaccharides), Salicylic acid, Saponins, and Sterols.

**Amino Acids** in Aloe vera are the building blocks of protein and influence our brain function. Humans require 22 amino acids and the body will make all of them except for eight essential amino acids which our body gets from the food/drinks that we take in. Every one of the essential amino acids are available in Aloe vera and they include Isoleucine, Leucine, Lysine, Methionine, Phenylalanine, Threonine, Valine and Tryptophan. Some of the other non-essential amino acids found in Aloe vera include Alanine, Arginine, Asparagine, Cysteine, Glutamic acid, Glycine, Histidine, Proline, Serine, Tyrosine, Glutamine, and Aspartic acid.

**Anthraquinones**, a phenolic compound that has stimulating effects on the bowels and have the antibiotic properties. Aloe vera provides 12 anthraquinones such as emodin, aloetic acid, aloin, anthracine, anthranon, barbaloin, chrysophanic acid, emodin, ethereal oil, ester of cinnemonic acid, ispbarbaloin and resistanol. The most important anthraquinones are aloin and emodin. They have antibacterial, anti-viral, and analgesic properties. The anthraquinones in Aloe vera breakup residue, pus and lifeless cells, bring blood to the region and flush out material from the wounds and ulcers. They help with absorption from the gastro intestinal tract and have Anti-microbial Lorenzetti et al. (1964) and Sims et al. (1971). Too many anthraquinones can produce pain and diarrhoea.

**Enzymes** found in Aloe vera include Amylase (breaks down sugars and starches), Bradykinase (stimulates immune system, analgesic, anti-inflammatory Obata (1993), Shelton (1992)), Catalase (prevents accumulation of water in the
body), Cellulase (aids digestion - cellulose), Lipase (aids digestion - fats),
Oxidase, Alkaline Phosphatase, Proteolytase (hydrolyses proteins into
their constituent elements), Creatine Phosphokinase (aids metabolism), and
Carboxypeptidase.”.

**Vitamines and Minerals**, Aloe vera, an anti-oxidant rich plant, contains
vitamins such as A, C, and E plus the minerals, zinc, and selenium. Anti-
oxidants help boost the immune system and combat free radicals in the
body. It also contains Vitamins B₁, B₂, B₃, B₅, B₆, and B₁₂ along with choline,
calcium (teeth and bone formation, muscle contractions and heart health),
magnesium (strengthens teeth and bones, maintains healthy muscles and
nervous system, activates enzymes), zinc (speeds up wound healing, mental
quickness assists with healthy teeth, bones, skin, immune system, and digestive
aid), manganese (activates enzymes, builds healthy bones, nerves and tissues),
chromium (assists with protein metabolism and balancing of blood sugars),
selenium which all influence our brain performance.

Additional minerals found in Aloe vera include copper (important for red
blood cells, skin and hair pigment), iron (involved in oxygen transportation
and making of hemoglobin in red blood cells), potassium (helps with fluid
balance), phosphorus (helps build bones and teeth, assists with metabolism
and body pH), and sodium (regulates body liquids, helps with nerve and
muscle performance, and helps deliver nutrients into body cells). Aloe vera
also contains the trace minerals of rhodium and iridium used in cancer and
tumor research experiments.

**Lignins**, a major structural material of cellulose content, that allows for
penetrative properties. Aloe vera can soak into the skin up to seven layers deep
Coats (1979). It penetrate into the toughened areas of the skin being beneficial
for skin problems such as eczema and psoriasis.

**Carbohydrates (Monosaccharides & Polysaccharides)** The next constituents
of Aloe Vera are monosaccharide and polysaccharides. Monosaccharides
contain the simple sugars which include glucose. The polysaccharides are
the more complex long-chain sugars involving glucose and mannose or the
Gluco-mannans. These sugars are ingested whole from the stomach. They
do not get broken down like other sugars, and appear in the blood stream in
exactly the same form. This process is known as pinocytosis. Once in the
blood stream, they exert their healing and immuno-regulating effect Wang
of these polysaccharides are not absorbed but stick to certain cells lining the
gut and form a barrier preventing absorption of unwanted material so helping
to prevent a leaking gut syndrome. The sugars are also used in moisturizing preparations Darokar et al. (2003), Treutlein et al. (2003).

One polysaccharide, **Acemannan** Linnaeus (1953), Newton (1979), McAnalley (1998) is known for its ability to restore and boost the immune system by stimulating the production of macrophages and improving the activity of T-Lymphocytes by up to 50%. It produces immune agents such as interferon and interleukin which help to destroy viruses, bacteria, and tumor cells. It also improves cellular metabolism by normalizing cellular function and regulating the flow of nutrients and wastes in and out of the cells. It knows how to destroy parasites and fungus. In some AIDS patients, it even protected the immune system from the toxic side effects of AZT. Carrington Laboratories in the United States have separated the acemannan from Aloe vera. The product is sold as “Carrisyn” and is being used for treatment of AIDS and Feline leukemia. Many sources stated that Aloe vera has mucopolysaccharides, nitrogen containing polysaccharides, found in animals and bacteria.

**Salicylic Acid**, is an aspirin-like compound Which has anti-inflammtory, analgesic, and anti-bacterial properties. It has anti-pyretic properties for reducing fevers. Other constituents of Aloe vera would include prostaglandins, tannins, magnesium lactate, resins, mannins, proteins such as lectins, monosulfonic acid and gibberlin.

**Saponins**, are soapy substances from the gel that is capable of cleansing and having antiseptic properties. The saponins perform strongly as anti-microbial against bacteria, viruses, fungi, and yeasts. The plant sterols or phyto-steroids in Aloe vera include Cholesterol, Campesterol, Lupeol, and B (Beta sign) Sitosterol. The plant steroids have fatty acids in them that have antiseptic, analgesic, and anti-inflammatory properties.

### 3. MEDICINAL USES OF ALOE VERA

Aloe Vera has been used externally to treat various skin conditions such as cuts, burns and eczema. It is alleged that sap from Aloe Vera eases pain and reduces inflammation. It has antiseptic and antibiotic properties which make it highly valuable in treating cuts and abrasions. It has also been commonly used to treat first and second degree burns, as well as sunburns and poison oak, poison ivy, and poison sumac infections and eczema. It can also be used as a hair styling gel and works especially well for curly or fuzzy hair. It is also used for making makeup, moisturisers, soaps, sunscreens, shampoos and lotions. Aloe Vera gel is useful for dry skin conditions, especially eczema around the
eyes and sensitive facial skin. Its juice may help some people with ulcerative colitis, an inflammatory bowel disease.

Aloe has been marketed as a remedy for coughs, wounds, ulcers, gastritis, Diabetes, Cancer, headaches, arthritis, immune-system deficiencies, and many other conditions when taken internally. However, the general internal use is as a laxative. 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. As a medicine it is used as:

**Protector of Human Immune System:** The whole leaf extract galvanizes the cells of immune system. The phagocytes increase their scavenging activities, thus cleansing the body and kicking off a whole cascade of protective actions which strengthen immunity.

**Improves Digestive System:** Aloe juice helps in digestive disorders. Constipation, diarrhea, indigestion, irritable bowel syndrome etc are cured by the flushing action. The deposits of toxins and unwanted substances in our diet which keep accumulating in intestines prevent the absorption of essential nutrients causing nutritional deficiency, lethargy, constipation, lower back ache. Aloe juice helps flush out these residues boosting the digestion and giving a greater feeling of well-being.

**In Arthritis:** Being a stimulant to the immune system, a powerful antiinflammatory, an analgesic and able to speed up cell growth, it repairs arthritis damaged tissue. While conventional allopathic treatment only relieves pain, Aloe helps in repair process by regenerating cells and detoxifying the affected area.

**In Cancer:** Aloe juice enables the body to heal itself from cancer and the damage done by radio and chemotherapy which destroy healthy immune cells crucial to the recovery.

**In Diabetes:** It lowers glucose and tri-glyceride levels in diabetic patients. Effects can be seen from the second week of the treatment. It may help to lower down the glucose level which is the main cause associated with the disease.

**In Hepatitis:** Extract of aloe juice has been shown to have beneficial effects on liver and alleviate symptoms considerably in chronic hepatitis patients.

**In Heart disease:** Addition of isabgol and Aloe Vera juice to the diet of patients of angina pectoris, results in marked reduction of serum cholesterol and tri-glycerides in level of HDL.
In AIDS: A daily dose of min. 1200mg. of active ingredients of aloe vera showed substantial improvement in AIDS symptoms. Says Dr. Pulse, Aloe is to an AIDS patient as insulin is to a diabetic.

In Piles: Aloe has been found useful in piles, mixed in small quantities with sulphur. It is applied by natives externally in the form of lep -pasta- in pleurisy A sweetmeat, halwa, is prepared from the pulp of the leaves and given in cases of piles, and apparently with very good effect.

In Wound and Skin diseases: Aloe Vera gel is excellent for easing first degree burns, relieves inflammation and accelerates healing. Aloe Vera gel has anti-fungal, anti-bacterial and anti-viral effects and helps heal minor wounds. It lessens painful effects of shingles, reduces symptoms of psoriasis and eases heartburns and ulcers.

Jaundice: few drops of aloe juice is installed in the nostrils to control jaundice.

Liver Disorders: Aloe juice with turmeric powder should be taken twice a day.

Difficult Urination: Continuous diluted aloe vera juice should be taken time to time to alleviate this condition.

In Wounds: Boil aloe leaves and take the fleshy part of the inside of the leaves to use as a poultice over wounds.

As a Cosmetic: Aloe is one of the best known moisturizers and used in creams and shampoos. Extracts of Aloe Vera is a proven skin healer. Aloe Vera help to soothe skin injuries affected by burning Maenthaisong etal. (2007), skin irritations, cuts and insect bites, and its bactericidal properties relieve itching and skin swellings. It is known to help slow down the appearance of wrinkles and actively repair the damaged skin cells that cause the visible signs of aging. Aloe is a powerful detoxifier, antiseptic and tonic for the nervous system. It also has immune-boosting and anti-viral properties. Research has proven that adding Aloe Vera to ones diet improves digestion. As a general health tonic.

4. HOW THE ALOE VERA WORKS

Aloe Vera contains nearly 100 named constituents, out of which, 75 are active healing compounds. It can survive harsh conditions, including drought and radiation and still do its’ healing work. It can treat a wide variety of internal
and external problems and can penetrate deeply into the skin and mucous membranes to soothe and fight infection. The chemical aspects of Aloe Vera are used for medicinal purposes. Bitter Aloes are made from the dried, purified sap obtained from the latex - the thin layer of tissue directly beneath the skin. This bitter yellow substance contains resins, anthraquinones and anthraglycosides, or aloins. It has a strongly purgative effect when taken internally and is usually used as a laxative. The latex is also used in after-sun products to soothe and moisturize. It is the inner pulp of Aloe Vera that provides the juice and gel, which are most used for both internal and external healing. Anthraquinones, found primarily in the latex but also in small quantities in the gel, are to some degree responsible for Aloe Vera’s anti-inflammatory and anaesthetizing effects when applied to swellings, stings, sprains and sunburn.

4.1 External Use

There are two theories to explain why Aloe Vera works externally. One is that it promotes rapid cell regeneration. The other is that Aloe Vera contains enzymes that cause chemical changes, thus intensifying healing. The high water content of the gel (96%) carries nutrients to the site of external injuries. Although mainly water, the gel has the ability to lower the surface tension of water. When Aloe Vera gel or products are applied to the skin, the amino acids, vitamins, minerals and other constituents are carried deep into the dermal layers to heal and soothe. Aloe Vera also eradicates dead skin cells, thus helping to regenerate cell growth and promote healthy tissue. Although many claim that commercial products are more potent than the raw gel because they have higher concentrations of Aloe Vera’s active ingredients, for most people the fresh gel gives excellent results. Aloe Vera gel appears to work best when applied from the leaf rather than removed and used alone.

4.2 Internal Use

Taken internally as a drink, Aloe Vera juice triggers a healing response for which a combination of constituents are responsible. The juice cleanses and detoxifies the digestive system and thus influences other organs and systems. It contains magnesium lactate, which seems to lower stomach acidity, thus reversing the effects of indigestion and heartburn. It has proved to be very effective in the treatment of stomach ulcers; instead of reducing production of excess hydrochloric acid in the stomach as most ulcer drugs do, it coats the stomach lining. Aloe Vera can also raise hydrochloric acid levels. It is known as ‘amphoteric’ because it can treat opposite conditions by raising or lowering levels of hydrochloric acid as needed (low hydrochloric acid levels
Aloe Vera restores balance in the digestive system in several ways. It acts as an alkalizing agent, it reduces yeast overgrowth, which destroys normal gut flora and it penetrates the walls of the digestive system to remove harmful bacteria. Once balance is restored and beneficial flora reinstated, inflammation is reduced and the body is able to absorb nutrients. Painful disorders such as irritable bowel syndrome (IBS), acid indigestion, colitis and candida benefit from Aloe Vera. By raising energy levels and promoting a sense of well-being, Aloe Vera reduces stress and tension.

5. CONCLUSION

It is clear from the above discussion that the Aloe Vera plant is very much significant for human being. Its trigger in so many diseases and there is no any side effect of the extract and juice of this plant. Due to its significant nature it is also called “Miracle Plant”. It is very much significant in skin diseases. It also control the Creatinine level in the blood, so it is helpfull for kidney patients.

REFERENCES


Maenthaïsong, Ratree; Chaiyakunapruk, Nathorn; Niruntraporn, Surachet (September 2007), “The efficacy of Aloe vera used for burn wound healing: A systematic review”, Burns 33 (6): 713.


