

**ALOE VERA: A PLANT OF VITAL SIGNIFICANCE**

M.A. Saeed*, Ishtiaq Ahmad**, Uzma Yaqub***, Shazia Akbar*, Amran Waheed*, M. Saleem****, and Nasir-ud-Din**

* PCSIR Laboratories Complex, Lahore. ** IMMBS, The University of Lahore, Lahore. *** Lady Willingdon Hospital, Lahore. **** Department of Botany, Govt. College, Lahore.

**ABSTRACT**

This research shows the vital significance and importance of Aloe Vera. It is a descriptive research. Aloe Vera is a vitally important plant that has been used for different ailments i.e. geotron testinal, gont boils, etc. It has several other properties or characteristics including antibacterial, anti-inflammatory and antiseptic attributes. Easy growth, maintenance and multiple uses of aloe plant’s constituents have promoted several elaborated investigations in public and private sector.

**Key words:** Aloe vera, Glycoproteins, Alolein, Aloe-gel, and Aloe-sap.

**INTRODUCTION**

Herbs have been used for different remedies in all cultures. In Asia, plant products and plant-derived drugs have been used therapeutically for centuries. More recently, people have become more interested and better informed about the use of herbs [1]. The use of herbal remedies reached its zenith in late 1800s and early 1900s [2]. In early part of 20th century a dramatic decline in use of herbal remedies began in USA, due to isolation and chemical synthesis of structural analogs and so herbal remedies disappeared from pharmacy shelves. Fifty years later, trend towards herbal remedies reverted and pharmacy shelves started to fill again. A survey in 1997 showed that nearly sixty million people were using herbs and a 75% increase in sales occurred over the past years [2]. In fact, herbal medicines played an important role in treating and preventing people from debilitating diseases since long. The role of plant-derived medicine in treating diseases will ever increase. Thousands of plants have been claimed to possess medicinal properties. Throughout the world, today, extensive investments have occurred for the therapeutic applications of herbal plant-resources, which are of unlimited abundance around us, to improve the quality of life. Aloe vera is a vitally important plant that has been used in folklore for different purposes, such as for healing boils, wounds, burns and treatment of different ailments. Ancient Egyptians papyrus, Mesopotamian clay tablets contained Aloe as an active ingredient used in curing infections, treating skin problems and as a laxative [3,4]. The word Aloe vera appears to be derived from Arabic word “Alloeh”, which means “a shining bitter substance.” We still refer to “bitter Aloes” describing the laxative drug still listed in U.S. pharmacopoeia today. There are many romantic tales about Aloe, suggesting that Egyptian queens, Nerfertiti and Cleopatra, used it as part of their regular beauty regimen [5]. Supposedly Alexander the Great in 333 B.C occupied the island of Socotra in the Indian ocean for its famed Aloe supplies, needed to treat his wounded soldiers [3,6]. Aloe was used by Hippocrates and Arab physicians, and was introduced to Western Hemisphere by Spanish explorers.

Aloe is also common in both traditional Chinese and Ayurvedic medicine. The Chinese describe Aloe’s skin and the inner lining of its leaves as a cold, bitter remedy which is downward draining and used to cure constipation due to accumulation of heat [7], the gel is considered cool and moist. In Ayurvedic medicine, the traditional medicine of India, Aloe has multiple uses inclusive of laxative, antihelminthic, hemorrhoid remedy, and uterine stimulant. It is used topically, often in combination with licorice root, to treat eczema or psoriasis. In Arabian medicine, the fresh gel is used on the forehead as a headache remedy or rubbed on the body to cool it in case of fever, as well as being used for wound-healing, conjunctivitis, and as a disinfectant and laxative [4]. The aloe gel has been extensively used in gastrointestinal disorders, including peptic ulcer, and its clinical efficacy has been documented [8-12].

In recent times, Aloe vera gel has been used as an active ingredient in hundreds of skin lotions, sun blocks and cosmetics [13]. The gel’s use in cosmetics has been increased by claims that it has anti-aging effects similar to vitamin A derivatives [13]. Aloe gained popularity in the United States in the 1930’s with reports of its success in treating X-ray burns [14]. Recently, Aloe extracts have been used to treat canker sores...
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#### Table - 1: Significant Clinical Developments in the Use of Aloe vera

<table>
<thead>
<tr>
<th>Date</th>
<th>Origin</th>
<th>Clinical Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 B.C.</td>
<td>Celsius, a Greek physician introduced Aloe into western medicine.</td>
<td>Sap as laxative [20].</td>
</tr>
<tr>
<td>41-68 A.D.</td>
<td><em>Aloe vera</em> plant described in the book &quot;Greek Herbal&quot; of Dioscorides.</td>
<td>Sap as healing agent. Additionally, induces sleep, cleanses stomach, treatment for boils, ulcervated genitals, stops hair loss, heals tonsil, diseases of mouth and eyes [20].</td>
</tr>
<tr>
<td>200 A.D.</td>
<td>Galen, Antyllus, Aretaces, and many other Southern European physicians used Aloe as medicine.</td>
<td>For different clinical purposes [20].</td>
</tr>
<tr>
<td>700-800 A.D.</td>
<td>For the first time Chinese used <em>Aloe vera</em>.</td>
<td>For the of treatment of sinus, fever and Convulsions in children by Aloe [20].</td>
</tr>
<tr>
<td>1300-1500 A.D.</td>
<td>Aloe (dried sap) was introduced to English medicine.</td>
<td>For the treatment of external wounds and diseases as purgative [20].</td>
</tr>
<tr>
<td>1700-1900 A.D.</td>
<td>Carl Von Linne, 1720, described the plant as Aloe Vera. In 1820 Aloe vera was officially listed in United States pharmacopoeia (U.S.P.) [20]. Aatin. The sap prepared as a purified product for commercial use.</td>
<td>As purgative and skin protectant [20]. For the treatment for radiation injuries, ulcers, burns, dermatitis and other skin injuries and diseases [20].</td>
</tr>
<tr>
<td>1950 A.D.</td>
<td>A Russian scientist discovered the utility of Aloe vera juice for various diseases.</td>
<td>For the treatment of parasitic diseases and several lung disorders.</td>
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<tr>
<td>1975 A.D.</td>
<td>Robert discovered that the plant has other multiple applications in animals [20].</td>
<td>For ringworm, skin allergies, abscess, hot spots, lacerations, inflamed cyst [20].</td>
</tr>
<tr>
<td>1979 A.D</td>
<td>Suzuki et al., (1979) isolated two lectins from leaves. of Aloe arborescence Miller [21].</td>
<td>Hemagglutinating and mitogenic activity [21].</td>
</tr>
<tr>
<td>1985 A.D.</td>
<td>Bland discovered <em>Aloe vera</em> juice as a clinical drink.</td>
<td>Helps digestive processes, controls infections and has no toxic effects [7].</td>
</tr>
<tr>
<td>1987 A.D.</td>
<td>Burns described that the disease shingles (Herpes Zoster) is caused by the same virus that also causes chicken pox and common herpess.</td>
<td><em>Aloe vera</em> as remedy for shingles [20].</td>
</tr>
<tr>
<td>1991 A.D.</td>
<td>Davis et al., reported in two different publications about inhibitory and stimulatory systems from Aloe vera.</td>
<td>The Aloe extract acts as modulator-system towards wounds, inflammation and is valuable for managing lower extremity conditions [22,23].</td>
</tr>
<tr>
<td>1994 A.D</td>
<td>Davis et al., described mannose 6-phosphate from Aloe gel.</td>
<td>It improves wound healing and inhibits inflammation [24].</td>
</tr>
<tr>
<td>1997 A.D</td>
<td>A glycoprotein was isolated from <em>Aloe Barbadensis Miller</em>.</td>
<td>The glycoprotein promoted cell growth [25] and proliferation of human normal dermal cells and baby hamster kidney cells.</td>
</tr>
<tr>
<td>2000 A.D.</td>
<td>Pecere and co-workers [27] reported Aloe emodin.</td>
<td>Emodin (hydroxyanthraquinones) from Aloe vera leaves has antineuroectodermal tumor activity both in vitro and vivo.</td>
</tr>
<tr>
<td>2001 A.D</td>
<td>A glycoprotein, G1G1M1DI2, was isolated from Aloe vera.</td>
<td>Wound-healing via cell proliferation and migration [28].</td>
</tr>
<tr>
<td>2002 A.D</td>
<td>Choi et al. [29] isolated beta-sitosterol from <em>Aloe Vera</em>.</td>
<td>Beta-sitosterol has an angiogenic effect in chorioallantoic membrane.</td>
</tr>
</tbody>
</table>
[15,16], stomach ulcers [10] etc. Many homes keep a plant handy in the kitchen where it readily thrives in bright sunlight with little care. In case of a minor burn, a fresh leaf can be cut and the gel of the inner leaf applied directly to the burn immediately after the injury. The inner leaf lining of the plant is often used as a natural laxative. In a quite recent survey (1990) of members of a health-maintenance organization, Aloe vera was used by 64%; of these, 91% believed it had been helpful [17]. Aloe is also an ingredient in Compound Benzoin tincture [18].

Although, Aloe has remained stalwart over the aeons of time since the Biblical era to the 20th century, but it has never achieved a true notoriety as other products i.e. foxglove, digitalis, cinchona (quinine), or willow bark (acetyl salicylic acid). This position of “poor relative” across the tracks has been the fate of Aloe, partially because of the failure of industry to fund scientific investigations and because of the slow progress of science in developing models to test Aloe. The first real investigation, which provided scientific enlightenment concerning Aloe’s therapeutic efficacy started early in twentieth century [19]. That was the age when the medicinal chemists traveled extensively and bought back plants, reputed for medical applications including cathartics, in order to isolate and characterize active substances using the chemistry of the day. The significant clinical developments in the applications of Aloe vera are listed in Table-1.

The precise and comprehensive isolation and analytical techniques have made it relatively easier to provide more information about the active principles of this wondrous and magical Aloe plant [30,31]. Thus a large number of chemical substances have been identified, which act as cathartic, emollients, accelerator of wound-healing [28] and modulator of immune response [32,33]. These include inorganic ions ( Na, K, Ca, Mg, Zn, etc.) [34] and small and large organic chemicals of quinone family [35-38], free sugars [39], carbohydrates (polysaccharides) [40-45], enzymes [46,47], lectins [48,49], proteins and the products of their breakdowns i.e. peptides and amino acids), vitamins [50] and many more.

THE ALOE PLANT AND ITS CONSTITUENTS

Aloe (urdu name ghigwar, local name kawar gandal), is genus of shrubby, scattered, succulent plant of the Lily family (Liliaceae). There are over 250 species of Aloe grown around the world and are native to Africa. Most of them have rosette of leaves at the stem, but no stem. Several species are cultivated as ornamentals due to their sharp pointed spiny leaves and colorful clusters of yellow or red flowers. Today two species are grown commercially, namely Aloe barbadensis Miller, also called Aloe vera, and Aloe arborescence [51]. Tubular yellow flowers are produced annually in the spring. The Aloe plant is grown in warm tropical areas and cannot survive freezing temperature. Mature plant grows as tall as two and a half inches to four feet, with the average being around 28-36 inches in length. Each plant has 12-16 leaves that, when mature, may weigh up to 3 pounds. The plant can be harvested every 6 to 8 weeks by removing 3 to 4 leaves per plant. The Aloe barbadensis and Aloe arborescence are grown in the United States in the Rio Grande valley of South Texas, Florida and Southern California. Internationally the plants can be found in Mexico, the Pacific rim countries, India, South America, the Caribbean, Australia and Africa.

Chemistry of Aloe

There are more than 200 compounds found in Aloe barbadensis, about 75 of which have biological activity [46, 47, 50, 52-58]. The prominent components are anthraquinones [35-38], Aloin [44], Aloe emodine polysaccharides [48-53], enzymes [46,47], reducing sugars [39], organic acids, metallic cations [34]. The Aloe gel or fillet, which is stored in the inner portion of the leave, contains 99.5% water and 0.5% solid matter. Table-2 shows the chemical constituents of Aloe vera with their activity.

Biochemistry

The solid ingredients in Aloe gel are divided into large molecules (0.1 %) and small molecules (0.4 %). Large molecules are polysaccharides and the minor constituents include a mixture of proteins (glycoproteins), and compounds of lower molecular weights, such as sterols, terpenes and other molecules.

Aloe vera: Potentially Active Chemical Constituents

• High molecular-weight constituents e.g.
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### Table 2: Constituents of Aloe vera and their Activity

<table>
<thead>
<tr>
<th>Constituents</th>
<th>Number Identified</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Amino Acids</strong></td>
<td>Twenty amino acids required by humans have been found, including 7 of the 8 essential ones, which the body cannot synthesise.</td>
<td>Component of proteins that are required for the functional proteins, such as muscle tissues, enzymes, hormones etc.</td>
</tr>
<tr>
<td><strong>Anthraquinones</strong></td>
<td>Aloe vera provides 12 Anthraquinones, including aloe emodin, aloetic acid, aloin, anthracine, antraron, barbaloin, chrysophanic acid, emodin, ethereal oil, ester of cinnemonic acid, isobarbaloin, and resistannol.</td>
<td>In small quantities, anthraquinones act as potent antimicrobial [59] and antiviral [60] agents. In high concentration, these compounds exert a powerful purgative effect. Topically they can absorb ultraviolet light, inhibit tyronase activity, reduce the formation of melanin [57, 61].</td>
</tr>
<tr>
<td><strong>Enzymes</strong></td>
<td>There are 8 Enzymes isolated from Aloe vera, including aliiase, alkaline phosphotase, amyrase, carboxypeptidase, catalase, cellulase, lipase, peroxidase.</td>
<td>Most of the enzymes help in the break-down of food-sugars and fats. Some of the enzymes may be involved in other functions, such as carboxypeptidase, inactivates bradykinins, produces anti-inflammatory effect [46, 47].</td>
</tr>
<tr>
<td><strong>Hormones</strong></td>
<td>Two Hormones are known from Aloe vera, which are auxins and gibberlins.</td>
<td>Both of these play an important role in wound-healing and anti-inflammatory effect.</td>
</tr>
<tr>
<td><strong>Lignin</strong></td>
<td>Cellulose-based substance.</td>
<td>This woody substance provides penetrating power in Aloe vera skin-penetrations, so having the ability to carry other active ingredients deep into the skin to nourish the dermis [62].</td>
</tr>
<tr>
<td><strong>Minerals</strong></td>
<td>Aloe Vera provides 9 minerals: Calcium, Chromium, Copper, Iron, Magnesium, Manganese, Potassium, Sodium and Zinc.</td>
<td>These are essential for good health and known to work in certain combination with each other, vitamins and other trace-elements. Magnesium lactate inhibits histidine decarboxylase and prevents the formation of histamine from amino acid, histadine [47]. Histamine is released in many allergic conditions and causes intense itching and pain.</td>
</tr>
<tr>
<td><strong>Salicylic Acid</strong></td>
<td>Aspirin-like compound.</td>
<td>Acts as analgesic.</td>
</tr>
<tr>
<td><strong>Saponins</strong></td>
<td>Glycosides</td>
<td>These soapy substances form 3% of the gel and are general cleansers, having antiseptic properties [63].</td>
</tr>
<tr>
<td><strong>Sterols</strong></td>
<td>The plant provides 4 main plant-steroids: Cholesterol, Campesterol, Lupeol, Beta Silosterol.</td>
<td>Sterols are anti-inflammatory agents, whereas lupeol also possesses antiseptic and analgesic properties.</td>
</tr>
<tr>
<td><strong>Sugars</strong></td>
<td>Aloe vera provides both monosaccharides, (glucose and fructose) and polysaccharides (glucomannans and polymanose).</td>
<td>Monosaccharides have anti-inflammatory action and polysaccharides posses antiviral, immune-modulating activity [64-67, 68] such as Acemannan [66-68].</td>
</tr>
<tr>
<td><strong>Vitamins</strong></td>
<td>Aloe vera contains many vitamins, except vitamin D. The vitamins found include vitamins A,C,E,B (the thiamine, Niacin, Riboflavin, B12), F, Choline and Folic acid.</td>
<td>Vitamin B’s and Choline are involved in amino-acid metabolism, B12 plays an important role in production of RBCs, Folic acid is involved in the development of red cells.</td>
</tr>
</tbody>
</table>
a) Polysaccharides: glucomannan [42,45] and acemannan [44]

b) Glycoproteins

c) Lectins

- Low molecular weight constituents e.g. anthraquinones, vitamins, saponins, sterols, etc.

(a) Polysaccharides: The polysaccharides make up approximately 20 percent of the solid content and comprise mostly a mixture of polysaccharides of a linear, highly acetylated \( \beta 1-4 \) Mannan, branched dextrans, pectic acids and other polysaccharides with negative charge. Polysaccharides hexose makes up 5 to < 10 % of the total solids. Associated closely with these polysaccharides are small molecules, primary charged ions. The gel or mucilage obtained from the leaf flesh contains quite different compounds from the bitter latex extracted from the leaf-lining. Aloe gel is 99% water with a pH of 4.5 and is a common ingredient in many non-prescriptional skin conditioners. The gel contains an emollient polysaccharide, glucomannan [42,45]. It is a good moisturizer, which accounts for its use in many cosmetics. Acemannan [44], the main carbohydrate in the gel, is a water-soluble long-chain mannose polymer, which accelerates wound-healing, modulates immune function (particularly macrophage activation and production of cytokines) and demonstrates antineoplastic and antiviral effects.

(b) Proteins: Proteins in the gel, on the other hand, make up 1 % of the solid content of the gel extract. The predominant proteins in gel-extracts are lower molecular-weight (11,000 and 14,000 kDa respectively, for the two peptide chains). They are probably associated with lectin and may account for the mitogenic activity [49].

c) Glycoproteins: Glycoproteins have been isolated from Aloe. The homogeneous glycoprotein [69] having 34% carbohydrates, of molecular weight 40 kDa, stimulates DNA synthesis in baby hamster kidney-cells and exhibits lectin properties by reacting with sheep cells. The glycoprotein fraction from Aloe vera gel exhibits proliferation-promoting activity in human and hamster cells and enhances wound-healing with significant cell- proliferation and migration. Another glycoprotein fraction (protein 82%, carbohydrate 11%) with a molecular weight 29 kD from Aloe vera gel was found to have a proliferation-promoting activity on human and hamster- cells in vitro [25].

(d) Lectins: Lectins [48,49,70,71] with different haemagglutinating activities have been isolated. Alocitin I and Alocitin II were isolated from leaf pulp [70]. The Alocitin II activity was inhibited by N-acetyl-D-galactosamine, whereas the Alocitin I was not inhibited by different sugars (twenty) tested for specificity. Two lectins [48] had also been isolated from leaves of Aloe arborescence, the P-2 with molecular weight 18000 and S-1 with molecular weight 24 kDa. The P-2 and S-1 contain more than 18% and 50% neutral carbohydrates by weight, respectively. Both of these exhibit haemagglutinating activity, whereas P-2 also exhibits mitogenic activity on lymphocytes. Interestingly, both of them contain a high proportion of acidic amino acids (i.e. Asp and Glu), and low proportion of Met and His. A lectin with a molecular weight 35 kDa was isolated from leaf-skin of Kidachi Aloe [71] that showed Haemagglunating and mitogenic activity. The sequence of this protein is highly homologous to that of mannose-binding lectin from snowdrop bulb.

(e) Anthraquinones: The leaf lining (latex, resin or sap) contains anthraquinone glycosides [35-38] (aloin, Aloe-emodin and barbaloin) that are potent stimulant laxatives. These water-soluble glycosides are split by intestinal bacteria into a glycones which effect the laxative action. The laxative effect from Aloe is stronger than from any other herb, including senna, cascara or rhubarb root; it also has more severe side-effects, such as cramping, diarrhea, and nausea [72]. For medicinal use, the leaf-lining is dried and the residue is used as herbal laxative. The products are usually taken at bedtime. They are poorly absorbed after oral administration, but moderately well-absorbed after bacterial hydrolysis. They are eliminated in the urine, bile, feces and breast milk. They turn alkaline urine red. Most of herbalists recommend that they should be avoided during pregnancy, due to the risk of stimulating uterine contractions and also avoided during lactation, due to the risk of excretion in breast milk. Aloe is seldom recommended as a first choice among laxative preparations, due to the severe cramping and nausea associated with its use.
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ALOE VERA IN HEALTH AND DISEASE

The Aloe had been used for the treatment of many ailments i.e. gastrointestinal, gout boils, etc. by folks of many nations since long. However, real scientific research into Aloe vera resulted in the isolation of Aloin in 1900s, which was used as laxative until World War II. In the 1930s research began focusing in Aloe’s benefits. Aloe has been used to cure X-ray dermatitis [73]. It was concluded that results as a whole had been satisfactory when the treatment of Aloe vera leaf was given to more than 50 cases of X-Ray dermatitis. Further research confirmed these findings for Aloe, helping to relieve eczema, thermal burns, scalding, sunburn, minor injuries, and certain allergies, including poison ivy.

Detailed studies explored Aloe’s several other characteristics, including that of antibacterial, anti-inflammatory, and antiseptic properties of Aloe vera. Aloe may penetrate injured tissue, relieve pain, dilate capillaries, and work as an anti-inflammatory agent. It has also been shown by Davis and co-workers [22,23,74-76] that certain amino acids, vitamins, RNA act as anti-inflammatory. These and other compounds are grouped together to form the inhibitory systems [22,74]. Glycoproteins (enzymes) form a part of this system [5]. Immune stimulators, growth-factors and muco-polysaccharides heal wounds and are grouped together to form stimulatory system [23,75,76]. Many active components in both systems synergize, so that the final total activity in each system is greater than the sum of the active compounds.

Diabetics exhibit poor wound-healing, due to poor collagen formation and reduced wound-healing and reduced wound-tensile strength. The diabetic fibroblast suffers from premature aging. Aloe vera reduced inflammation and improved wound-healing in both the normal and diabetic states, in a dose dependent-response fashion [77]. Aloe vera activates enzymes found in the pancreas; it helps the blood sugar-content in individuals suffering from hypoglycemia and diabetes [78,79].

A mixture of Aloe vera and Aloe arborescence was studied for its therapeutic effects on the cirrhosis patients by a Japanese research team [80]. The liver-function tests have shown that AST, ALT and total bilirubine values were significantly reduced and normal values were completely restored after six month. It is also suggested that the mucopolysaccharides, one of the ingredients in Aloe, play an important role, by acting as a growth factor. This growth-factor contributes to wound-healing by stimulating fibroblasts (connective-tissue cells) to produce more collagen, which in turn increases the remodeling of the wound and fills in the wound area. Acting synergistically, Aloe may keep the wound moist and at the same time allow oxygen to penetrate the wound, adding to regeneration. Grundlay and Reynolds [81] revealed that Aloe seems to promote healthy-cell growth: if a cell is cancerous, growth is not stimulated. Winters [82] found that fresh Aloe vera leaves contained lectin-like compound, which enhanced the growth of normal human cells in tissue-culture, but not tumor cells. This was further confirmed in case-reports of El Zawarhy et al., [83] in which it is pointed out that Aloe vera gel promotes the regeneration of normal tissue but does not have the similar growth-patterns in carcinogenic tissue. Jeffrey Bland [7] studied the effects of Aloe vera juice-consumption on urinary indican, stool specific-gravity, gastric and bowel motility. Urinary indican values decreased, indicating lowered conversion of tryptophan by bowel bacteria, an improved protein-digestion and absorption, as well as reduced bowel putrefaction. This change, by itself, could help in preventing colon cancer.

The biological and biochemical research has delineated various properties and mechanisms leading to clinical implications of Aloe. Attributes, such as moisturizing and penetrating properties, are well known, but its healing abilities and analgesic action as well as bacterial activity need to be further elaborated.

The research conducted during the last two decades contributes further to the useful effects of Aloe biochemicals that are miraculously effective and a summary of clinical applications of Aloe vera is described in Table-3.

COMMERCIAL SIGNIFICANCE OF ALOE

The original commercial use of the plant was to grow it for the production of a latex substance called Aloin [30], which is yellow and, possess bitter and lingering taste. The latex of Aloe contains the laxative anthraquinones that have been shown to possess substantial antimicrobial activity against a wide variety of microorganism [30].
Table 3: Clinical Applications of Aloe vera

1. Antimicrobial
   a. Antibacterial
      Aloe gel is bacteriostatic or bactericidal against a variety of common wound-infecting bacteria in vitro: *Staphylococcus aureus*, *Streptococcus pyogenes*, *Serratia marcescens*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *E. coli*, *Salmonella typhosa* and *Mycobacterium tuberculosis* [4,59]. Aloe-emodin also inhibits the growth of *Helicobacter pylori* in a dose-dependent fashion [84].
   b. Antiviral
      Acemannan acts alone and synergistically with azidothymidine (AZT) [64,65,85] and acemannan hydrogel is used as treatment for persons infected with HIV relevant to CD44 [66,67].
      *Aloe vera* extract (0.5%) in a hydrophilic cream had a significantly enhanced healed lesions [66].
   c. Antifungal
      Aloe extract treatment of guinea pig feet that had been infected with *Trichophyton mentagrophytes* resulted in a 70% growth inhibition compared with untreated animals [87].

2. Antineoplastic
   Aloe A and B, aloesin and aloeresin were devoid of antitumor activity effects on human K562 leukemia cell lines [66]. Acemannan has demonstrated activity against feline leukemia virus and solid [88-93], and malignant tumors 28 and inhibits hepatic tumor induction [94,95]. In preliminary studies it has been significantly enhanced neatly a year survival [96].

3. Endocrine
   Aloe gel has been shown to lower blood sugar in diabetic mice [97,98], as well as normal mice [99]. Nearly half of diabetic patients surveyed in Texas reported using *Aloe vera* or other herbal remedies as complementary therapies for their diabetes [100]. Aloe gel to enhance the hypoglycemic effect of glibenclamide when given orally to diabetic patients [99,101].

4. Gastrointestinal
   a. Laxative
      Stimulant laxative (leaf lining), gastric and duodenal ulcers (gel), inflammatory bowel disease.
      Barbaloin, or loin, derived from inner sheath cells of the leaves, is a bitter, yellow laxative. Affects the sodium/potassium pump and chloride channels at colonic membrane [102,103]. Aloe's Anthraquinones enhance intestinal propulsion and water secretion in mice [104]. The Anthraquinones present in latex stimulate chloride and water secretion in large intestine, inhibits its reabsorption and stimulate peristalsis [105,106], and acts as a cathartic in chronically constipated adults [107].
      Aloe-emodim inhibits growth *Helicobacter pylori* in a dose-dependent fashion [84]. *Aloe vera* extract reduced aspirin-induced gastric mucosal injury in experimental rats [109], and extracts also suppressed the ulcerogenic effects of stress in experimental rats [110].
   c. Inflammatory bowel disease.
      Acemannan is under consideration as an experimental remedy for inflammatory bowel disease [111,112].

5. Immune modulation
   Acemannan acts as immune stimulant and anti-inflammatory [113,114], increases monocyte and macrophage activity and cytotoxicity, stimulates killer T-cells and enhances macrophage candidacidal activity in vitro [115-117]. Acemannan enhances macrophage release of interleukin-1 (IL-1), interleukin-6 (IL-6), tumor necrosis factor alpha (TNF-α), and interferon gamma (INF-γ) in a dose dependent fashion [115,118]. Aloe extracts also blocks prostaglandin and thromboxane production from arachidonic acid , reducing inflammation [4,119,120]. Acetylated mannans from Aloe in mice stimulated an increase in white blood counts, splenic cellularity, and absolute numbers of neutrophils, lymphocytes and monocytes [121-126]. Aloe reduced the production of interleukin-10 following exposure to ultraviolet radiation, reduces the suppression of delayed type hypersensitivity [127-129]. and blocked mast cell inflammatory responses to antigen-antibody complexes [130,131].
The other main ingredient of Aloe is called gel, which covers inner portion of the leaves. It is clear, colourless, and tasteless. Aloe Vera gel, like most natural juices in both fruits and vegetables, is unstable and subject to discoloration and spoilage from contamination by microorganisms. It is, therefore, most important to stabilize and concentrate the gel in powder natural form, for commercial use in nutritional foods and cosmetics.

Today the Aloe industry in USA and Mexico has established high ethical standards for businesses and Aloe products. Through the International Aloe Science Council of America (IASC), the Aloe Industry in America and Mexico solidified its dedication to providing the world with highest quality Aloe and Aloe products. The wide acceptance of Aloe by society in so many consumer-products suggests that the IASC is moving in the right direction. The IASC has committed professionals to the further growth of Aloe products by quality-research and marketing.

CONCLUSIONS

The ease in growth and maintenance of Aloe plant and multiple uses of its constituents have prompted several elaborate investigations in the private and public sector. Aloe Vera research based on comprehensive biological, biochemical, chemical and clinical studies have opened up new areas, and many more effective uses are likely to be developed. There is a major scope in the promotion of recombinant-DNA based studies, targeting compounds of value to be isolated and produced in stable and realistic quantities. The procedures of isolation and maintenance of Aloe-products in stable form required special care and these have been established after painstaking efforts.

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