

## A Review on Wonder Plant Aloe Vera

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### Abstract

For millennia, people have utilized and appreciated the health, aesthetic, therapeutic, and skin-care benefits of aloe vera plants. Aloe is a plant that grows in dry regions of Africa, Asia, Europe, and America. It has approximately 300 species. *Aloe barbadensis miller* is the botanical name of aloe vera. It is a perennial, xerophytic, succulent, shrubby or arborescent plant with pea-green hue that is a member of the *Asphodelaceae* (*Liliaceae*) family. The plant features fruits that are filled with many seeds, yellow tubular blooms, and triangular, fleshy leaves with serrated edges. There are 75 potentially active ingredients in aloe vera, including vitamins, enzymes, minerals, carbohydrates, lignin, saponins, amino acids, and salicylic acids. Numerous investigations were conducted on aloe vera to assess various attributes, such as its antiulcer, antidiabetic, antihypercholestermic, antioxidant, antibacterial, antiviral, antifungal, antiacne, cardiac stimulant, nutraceutical, moisturizer, immune modulator, ability to protect skin from UVA and UVB rays, and ability to heal wounds. The current study reviews phytochemicals, analyzes restrictions, and discusses aloe vera's potential as a cornerstone for medication therapy. Today, aloe vera is a natural product that is widely used in the cosmetics industry. Even though it has a number of indications, controlled trials are necessary to ascertain its true effectiveness. This study provides a brief overview of the aloe vera plant, including its characteristics, mode of action, and therapeutic applications.

**Keywords:** Aloe vera, medicinal uses, bioactive compounds, taxonomic classification, health and beauty skin

### INTRODUCTION

Recently, there has been a surge in the use of natural products for the prevention and treatment of oral problems, which may be advantageous for groups with low socioeconomic status in both urban and rural areas [1]. The most well-known and currently attracting a lot of scientific attention among the

several currently accessible herbal compounds is aloe vera. The Arabic term "Alloeh", meaning "shining bitter substance", is the root of the Aloe vera moniker, while the Latin word "vera" means "true". 2,000 years ago, Greek scientists thought aloe vera was a panacea [1]. The Egyptians referred to aloe as "the plant of immortality". Aloe vera plants have been used since the time of the Bible. It is a perennial succulent xerophyte, which means it can live in dry environments by developing water-storing tissue in its leaves [2]. Over 250 different types of aloe are cultivated worldwide. *Aloe arborescens* and *Aloe barbadensis* Miller are the only species produced for commercial purposes. Aloe plants can only withstand warm, tropical climates; they cannot endure freezing conditions, such as those experienced during winter. Most aloe plants grown in the United States are farmed in the

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Rio Grande Valley in South Texas, Florida, and Southern California. Aloe is a plant that grows in the Caribbean, Australia, Africa, Mexico, South and Central America, India, and the Pacific Rim [3].

## **PLANT**

The scientific name of Aloe vera is *Aloe barbadensis* Miller. It is a shrubby or arborescent plant with pea green foliage that is perennial, xerophytic, and a member of the Liliaceae family. It grows well in arid areas like those in Europe and America. It is present in the Indian states of Tamil Nadu, Gujarat, Maharashtra, Rajasthan, and Andhra Pradesh. The aloe vera plant has two distinct portions, each of which produces chemicals with entirely different chemical makes-ups and medicinal benefits. Aloe vera gel (or mucilage), a transparent, thin, flavorless substance that resembles jelly, is produced by the parenchymal tissue, which makes up the interior portion of aloe leaves. This tissue can be removed from the leaf by separating the gel from the waste material inside the cells. The other portion of the plant is made up of a group of specialized cells [4].

## **ANATOMY**

- A transparent gel within that is made up of 99% water while the other components are vitamins, lipids, sterols, amino acids, and glucomannans.
- Anthraquinones and glycosides are found in the bitter yellow sap that makes up the middle layer of latex.
- The rind, a thick outer layer made up of 15–20 cells, is protective and is where proteins and carbohydrates are made. Vascular bundles found inside the rind are in charge of moving materials like starch and water (xylem and phloem).[5].

## **ACTIVE COMPONENTS WITH ITS PROPERTIES**

There are 75 components in aloe vera that may be active, including vitamins, minerals, sweetener, carbohydrates, enzymes, lignin, saponins, salicylic acids, and amino acids [6, 7].

### **Vitamins**

It contains the antioxidant vitamins C, E, and A (beta-carotene). There is also folic acid, vitamin B12, and choline. Antioxidants neutralize free radicals.

### **The Enzyme**

It contains eight different enzymes, including amylase, alkaline phosphatase, amylase, bradykinase, carboxypeptidase, catalase, cellulase, lipase, and peroxidase. Bradykinase, when applied topically to the skin, helps reduce excessive inflammation while other enzymes assist break down fats and sugars.

### **Mineral**

There is calcium, magnesium, potassium, sodium, zinc, copper, selenium, and chromium. While not all of them are antioxidants, they are all required for many different enzyme systems in various metabolic pathways to function properly.

### **Sweetener**

It provides both monosaccharides (glucose and fructose) and polysaccharides (glucomannans/polymannose). These come from the plant's mucilage layer and are known as mucopolysaccharides. The most prevalent monosaccharide is mannose-6-phosphate, while glucomannans, in polysaccharides, [beta-(1,4)-acetylated mannan] is the most common. The well-known glucomannan acemannan was also found. C-glucosyl chromone, a novel anti-inflammatory molecule, and glycoprotein with antiallergic properties were recently discovered using aloe vera gel called alprogen [8, 9].

### **The Anthraquinones**

It provides 12 anthraquinones, which are phenolic compounds commonly employed as laxatives. Aloin and emodin have antiviral, antibacterial, and analgesic properties.

### **Fatty Acids**

It provides the four plant steroids lupeol,  $\beta$ -sisosterol, campesterol, and cholesterol. Each of them has anti-inflammatory properties, while lupeol also possesses analgesic and antimicrobial properties.

### **Hormones**

Auxins and gibberellins, which have anti-inflammatory and wound-healing qualities.

### **Others**

It provides 20 of the 22 amino acids required by humans and 7 of the 8 essential amino acids. Additionally included is salicylic acid, which has antibacterial and anti-inflammatory properties. When applied to topical therapies, the inert chemical lignin facilitates better skin penetration of the other components.

## **STUDIES ON ALOE VERA TO EVALUATE DIFFERENT PROPERTIES**

### **Antiulcer Activity [10]**

Acid secretion is inhibited by aloe vera extract, which may be because the plant contains lectins. The ability of the extract to reduce stomach acid output may be due to direct interaction with the cells that produce the acid because it has been demonstrated that lectins prevent parietal cells from absorbing aminopyrine.

### **Antidiabetic, Antihypercholestermic and Antioxidative Effect [11]**

The study's findings suggested that the presence of hypoglycemic trace elements including Cr, Zn, and Mn, which enhance insulin action, may be responsible for the hypoglycemic impact of aloe vera gel extract. Additionally, the antioxidant properties of aloe vera gel extract, which reduced oxidative damage in the serum of rats with diabetes produced by alloxan, could be the reason of the glucose-lowering effect.

### **Antibacterial Activity [12]**

The polyherbal mixture known as BASANT was made with curcumin, refined extracts of *Embllica officinalis* (Amla), purified saponins from *Sapindus mukorossi*, aloe vera, and rose water. *Candida tropicalis*, *Candida glabrata*, *Candida albicans*, and *Neisseria gonorrhoeae* were all effectively suppressed by it.

### **Antiviral Activity [13]**

According to the study, *A. barbadensis* extracts prevented the proliferation of viruses in human cell lines. The technique for measuring MS2 plaque reduction was used to find antiviral activity.

### **Antifungal Activity [14]**

As *M. furfur*'s growth on Sabouraud's dextrose agar medium was gradually reduced, the study's antifungal properties became apparent. Other species investigated were found to be less effective than aloe vera.

### **Antiacne [15]**

The study's findings led to the conclusion that an aqueous extract of *Garcinia mangostana* and Aloe vera may be used to create a topical gel solution for the treatment of mild acne vulgaris.

### **Cardiac Stimulant [16]**

The active ingredient in aloe vera may act on the receptors or any other receptors that propranolol blocks, according to the study, but it was unable to pinpoint the ingredient that gave the isolated heart a favorable inotropic and chronotropic response.

### **In Polycystic Ovarian Syndrome [17]**

According to information from a "in vitro" study, AVG directly affects important enzymes like 3 HSD, lowering enzyme activity and modifying the flux toward estradiol production.

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**A Potent Nutraceutical [18]**

Body weight and hematological parameters significantly increased after using aloe vera gel, indicating that it has nutritional properties.

**Moisturizer [19]**

Aloe vera extract moisturized the skin. The occlusive layer generation on the skin caused by the formulations and the humectants was the predicted mechanism.

**Immunomodulator [20]**

As evidenced by an increase in overall white blood cells, the study demonstrated that the greater dose of Aloe vera gel extract encouraged the multiplication of stem cells.

**Protection of Skin from UV-A and UV-B Rays [21]**

Aloe vera, basil, green tea, almond, olive, jojoba, and other herbs were frequently used in herbal sunscreens, along with others like cucumber.

**Wound Healing [22]**

The incision wound model's tensile strength was observed to increase as a result of the study; however, the granulation phase of healing was unaffected. In models of excision wounds, these herbs have also been shown to encourage epithelization and wound contraction.

**PROCESSING OF ALOE VERA LEAVES****Washing**

Aloe vera leaves are cleaned and disinfected by being placed in a calcium hypochlorite solution pre-wash bath. After being properly washed in a calcium hypochlorite solution with filtered water, the leaves are allowed to dry.

**Filleting**

Each leaf's upper and lower skin is gently peeled off using a knife, and the mucilaginous mass, composed of parenchymatous tissue and gel, is then divided into minute pieces. Yellow sap is carefully avoided coming into contact with the fillet. During the mechanical filleting operation (Dimetrical mechanism), the leaf is brought into the machine's frame with its wide axis at a right angle to the ground.

**Intermediate Processing**

Juice from aloe vera plants ferments because it is a great nutritional medium for microbial growth. Juice discoloration is caused by a variety of enzymatic and non-enzymatic degradation events. Thus, keeping the juice fresh becomes crucial. Diatomaceous earth is added to the juice to help make it clearer. The juice is then filtered until it is clear. By comprehending bacteria and their environment, it is possible to control the growth of bacteria during intermediate processing. Since health drinks frequently include monosaccharides and disaccharides added as sweeteners, they provide a good environment for bacterial growth [23].

**ANALYSIS OF ALOE VERA**

Aloe pulp is a truly distinctive plant tissue. Identifying the pulp's fundamental chemical makeup is one component of the analysis. Another is to analyze the intricate structural relationships between diverse chemicals and biological function. The first aspect is obviously not yet fully developed. The adoption of standardized procedures and the lack of a consistent strategy for the initial pulp processing serve as proof of this. The elemental analysis, amino acid composition, ash content, moisture content, and heavy metal concentration are usually the main methods used to qualify the pulp. General analytical methods like gel permeation or gel filtration chromatography and HPLC are widely employed for fractionation, purification, and size determination [24].

### **Analysis of Pulp and its Components**

Processing of pulp is necessary for pulp analysis. The yellow liquid from fresh aloe vera leaves is typically allowed to drip off before the rind is cut off with a sharp blade. It homogenizes the transparent pulp. pH is 4.0 to 4.5. The filtrate or centrifuge supernatant is utilized for analysis after it has been filtered or centrifuged. Prior to further processing, it is frequently freeze dried at this point. The presence of active material within the allowed limits and the absence of heavy metals, aflatoxins, and pesticide residue are checked in the pulp [25].

### **Physical Appearance**

The preparation for liquid gel is a viscous liquid. Depending on the particle size of the filter being used for filtration, it may be clear or highly foggy. Anthraquinone from rind contamination is indicated by the presence of yellowish or brownish coloring [26]. Or the phenols have been oxidized because it was not handled quickly enough.

### **Anthraquinones Analysis**

Unfortunately, there is virtually no quality control in the aloe gel sector due to the drastic variations in anthraquinone molecule composition during charcoal filtration during standard aloe gel manufacturing. But because anthraquinone may be carcinogenic (rats exposed to it developed gastro intestinal cancer), it is crucial to measure its concentration in aloe gel. When applied topically, aloe emodin in ethanol solution combines with UV light to produce pigmented skin tumors [27.]

### **Carbohydrates Analysis**

It is crucially vital to analyze the polysaccharides in aloe vera in order to verify the false claims made about commercial aloe vera products. To keep track of the consistency of pulp or the goods made from it, analysis of the total sugar composition is frequently requested. The most used methods are the phenol-sulfuric acid assay for total carbohydrate content and the m-hydroxydiphenyl method for uronic acid level. Moreover, HPLC and high performance anion exchange pulsed amperometric detector analysis can be utilized to ascertain the overall amount of carbohydrates. The structure of the glycosidic bond of aloe polysaccharides, particularly the mannan, has been extensively determined by specific rotation [28]. Because it is quickly absorbed and easily digested, maltodextrin is an oligosaccharide that is added to aloe vera products. Dextrans (mostly glucose) is essentially what commercial maltodextrins are. Maltodextrin can be easily seen using <sup>1</sup>H NMR on 100X sample contains 50% weight of maltodextrin [29].

### **Identification of Proteins**

Protein identification techniques include N-terminal sequencing and amino acid composition. Antibodies against the protein might be made for more research based on the findings from the peptide sequencing, and the protein's gene could be cloned and sequenced [30].

### **Analysis of Lipid Component**

TLC analysis of lipids can be performed after they have been separated on a silica gel column. NMR spectroscopy and GC-MS are used to determine the identity or structural composition of substances. Aloe pulp has so far been found to include a number of lipid components, including as cholesterol, lupeol, and  $\beta$  sitosterol.

### **Analysis of Small Organic Compounds Acetic Acid**

Because it is a sign of freshness, malic acid is a desired analyte. In a native aloe vera gel, it is a significant organic acid. Acetylated mannan and malic acid, in particular, seem to be the most significant and specific for product identification. It is the material that most resembles aloe pulp out of all those found so far. In aloe, gram-negative bacteria create lactate and other organic acids by assimilating malic acid. According to the conditions under which the plant grows, the malic acid level of the pulp is thought to range from 5.4 to 8.7% [31].

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## MECHANISM OF ACTIONS

### Healing Properties

Glucomannan, a mannose-rich polysaccharide, and gibberellin, a growth hormone, interact with growth factor receptors on the fibroblast to promote its activity and proliferation in addition to enhancing collagen formation after topical and oral Aloe vera treatment [32]. [Aloe gel not only increased the amount of collagen in the wound but also altered the composition of the collagen (more type III) and the degree of cross-linking. This accelerated the closure of the incision and increased the breaking strength of the resulting scar tissue [33]. There has been evidence of increased hyaluronic acid and dermatan sulfate production in the granulation tissue of a healed lesion after oral or topically applied therapy [34].

### Impact of UV and Gamma Radiation on Skin

Aloe vera gel is said to be able to protect skin against radiation damage [35, 36]. The exact role of aloe vera gel administration is uncertain, although it induces the skin to create metallothionein, an antioxidant protein that scavenges hydroxyl radicals and prevents glutathione peroxidase and superoxide dismutase from being inhibited in the skin. Reduced production of immunosuppressive cytokines, such as interleukin-10 (IL-10), by skin keratinocytes stops UV-induced suppression of delayed type hypersensitivity [37].

### Inhibition of Inflammation

Aloe vera inhibits the cyclooxygenase pathway and reduces the quantity of prostaglandin E2 generated from arachidonic acid. Recently, a novel anti-inflammatory chemical called C-glucosyl chromone was discovered from gel extracts [9].

### Immune System Effects

Alphagen blocks mast cell entry of calcium, which stops mast cell production of histamine and leukotriene, which is mediated by antigen-antibody interactions.[8]. In mice, acemannan induces the production of interleukin-1 (IL-1) and tumor necrosis factor by macrophages. This, in turn, sets off an immunological response that causes the malignant cells to necrotize and recede. Mice that had previously had implants of murine sarcoma cells were employed in this study [38]. Reactive oxygen free radicals are another thing that a number of low-molecular-weight compounds can stop activated human neutrophils from releasing [39].

### Laxative Effects

Latex contains anthraquinones, which have potent laxative properties. It accelerates intestinal peristalsis, increases mucus production, and increases the amount of water in the intestines [40].

### Antitumor and Antiviral Properties

These actions may be the consequence of influences that are either direct or indirect. Anthraquinones affect the body directly, while immune system activation affects the body indirectly. The anthraquinone aloin renders inactive a number of enveloped viruses, including *Varicella-zoster*, influenza, and *Herpes simplex* [41]. The observed reduction of phorbol myristic acetate's tumor-promoting effects and the stimulation of glutathione S-transferase point to a potential benefit of using aloe gel in cancer chemotherapy [42, 43].

### Moisturizing and Anti-Aging Effect

Moisture is held in the skin by mucopolysaccharides. Aloe vera promotes the synthesis of collagen and elastin fibers, which give the skin its elasticity and reduce wrinkles. When used to treat dry skin caused by industrial exposure, aloe vera gel gloves have been reported to improve skin integrity, minimize the appearance of fine wrinkles, and lessen erythema [44].

### Antiseptic Properties

Aloe vera contains six antiseptics: phenols, sulfur, urea nitrogen, cinnamonic acid, luteol, and salicylic acid. Each of these inhibits the growth of fungi, viruses, and bacteria.

### **Clinical Uses**

Most anecdotal evidence supports the clinical usage of aloe vera. Although most of these uses seem promising, controlled studies are required to determine its usefulness in treating all of the illnesses [45].

### **SIDE EFFECTS**

#### **Topical**

It can cause burning, stinging, redness, and in rare cases, extensive dermatitis in sensitive individuals. The main causes of allergic reactions include anthraquinones, like barbaloin and aloin.

#### **Oral**

Worsening constipation, red urine, diarrhea, hepatitis, or stomach aches.

### **Contraindication**

Cases of documented sensitivities to Liliaceae family plants are contraindicated during pregnancy and lactation.

### **Interactions**

It reduces the effectiveness of digoxin and digitoxin and may intensify their harmful effects because of its potassium-lowering impact.

### **CONCLUSION**

Aloe vera's pharmacological qualities have been confirmed by numerous *in vivo* and *in vitro* studies in modern sciences. These scientific studies offer enough proof that a medicine has a huge potential for use as a dental therapy. Therefore, a proper diagnosis, knowledge of conventional medicine, and application of that knowledge to the treatment plan are essential to guaranteeing success with this dental therapeutic agent. As a side note, the authors feel that more clinical research should be conducted even though Aloe vera is a promising herb with its many clinical applications in medicine and dentistry, particularly to validate and explain the action demands analytical methods which are well standardized and calibrated. The international aloe scientific council has set guidelines for what constitutes and does not constitute aloe vera in final products, along with the European Union, China, and Korea. Aloe vera will likely become more widely used and eventually used in dosable amounts with confirmed active components.

### **REFERENCES**

1. Botelho MA, Nogueira NAP, Bastos GM, *et al.* Antimicrobial activity of the essential oil from *Lippia sidoides*, carvacrol and thymol against oral pathogens. *Braz J Med Biol Res.* 2007; 40(3): 349–356.
2. Matos FJA, Sousa MP, Craveiro AA, Matos MEO. *Constituintes Químicos Ativos e Propriedades Biológicas de Plantas Medicinais Brasileiras.* 2nd Edn. Editora da UFC, Fortaleza, Brazil. 2004.
3. Harrison J, DDS, FAGD. Aloe vera in dentistry, book aloe vera. In: *Nature's Medicine Chest. Reader's Digest.* 2001; 19.
4. Tyler VE. *The Honest Herbal: A Sensible Guide to the Use of Herbs and Related Remedies.* 3rd Edn. New York, NY, USA: Pharmaceutical Products Press; 1993.
5. Tyler V. *The honest herbal: A sensible guide to the use of herbs and related remedies.* 3rd Edn. Binghamton, New York: Pharmaceutical Products Press; 1993.
6. Atherton P. Aloe vera revisited. *Br Journal of Phytotherapy.* 1998; 4: 176–183.
7. Atherton P. *The essential Aloe vera: The actions and the evidence.* 2nd Edn. Mill Enterprises; North America, Europe, Oceania; 1997.
8. Ro JY, Lee B, Kim JY, Chung Y, Chung MH, Lee SK, *et al.* Inhibitory mechanism of aloe single component (Alprogen) on mediator release in guinea pig lung mast cells activated with specific antigen-antibody reactions. *J Pharmacol Exp Ther.* 2000; 292(1): 114–21.
9. Hutter JA, Salmon M, Stavinoha WB, Satsangi N, Williams RF, Streeper RT, *et al.* Anti-inflammatory C-glucosyl chromone from *Aloe barbadensis*. *J Nat Prod.* 1996; 59(5): 541–3.

10. Sai Krishna Borra, Radha Krishna Lagisetty, Gowrinath Reddy Mallela. Anti-ulcer effect of Aloe vera in non-steroidal anti-inflammatory drug induced peptic ulcers in rats. *Afr J Pharm Pharmacol*. 2011 Oct 29; 5(16): 1867–1871.
11. Enas Ali Kamel Mohamed. Antidiabetic, Antihypercholesteremic and Antioxidative Effect of Aloe Vera Gel Extract in Alloxan Induced Diabetic Rats. *Aust J Basic Appl Sci*. 2011; 5(11): 1321–1327.
12. Nandagopal B, Sankar S, Ramamurthy M, Sathish S, Sridharan G. Could the products of Indian medicinal plants be the next alternative for the treatment of infections? *Indian J Med Microbiol*. 2011; 29(2): 93–101.
13. Cock I, Kalt FR. A modified MS2 bacteriophage plaque reduction assay for the rapid screening of antiviral plant extracts. *Pharmacogn Res*. 2010; 2(4): 221–8.
14. Vijayakumar R, Muthukumar C, Kumar T, Saravanamuthu R. Characterization of *Malassezia Furfur* and Its control by using plant extracts. *Indian J Dermatol*. 2006; 51(2): 145–8.
15. Bhaskar G, Arshia S, Priyadarshini S. Formulation and evaluation of topical polyherbal antiacne gels Containing *Garcinia mangostana* and Aloe vera. *Pharmacogn Mag*. 2009; 5(19): 93–99.
16. Kumar P, Goyal M, Tewari S. Positive inotropic and chronotropic effect of aloe gel on isolated rat heart. *Indian J Pharmacol*. 2007; 39(5): 249–50.
17. Maharjan R, Nagar PS, Nampoothiri L. Effect of Aloe barbadensis Mill. Formulation on Letrozole Induced polycystic ovarian syndrome rat model. *J Ayurveda Integr Med*. 2010; 1(4): 273–9.
18. Ojha S, Sonker K, Pandey M, Saraf SA. Aloe vera gel: A potent nutraceutical. *J Nat Pharm*. 2011; 2(1): 36–9.
19. Saraf S, Sahu S, Kaur C, Saraf S. Comparative measurement of hydration effects of herbal moisturizers. *Pharmaogn Res*. 2010; 2(3): 146–51.
20. Madan J, Sharma AK, Inamdar N, Rao HS, Singh R. Immunomodulatory properties of aloe vera gel in Mice. *Int J Green Pharm*. 2008; 2(3): 152–4.
21. Kapoor S, Saraf S. Efficacy Study of Sunscreens Containing Various Herbs for Protecting Skin from UVA and UVB Sunrays. *Pharmacogn Mag*. 2009; 4(19): 238–48.
22. Gupta N, Jain UK. Prominent wound healing properties of indigenous medicines. *J Nat Pharm*. 2010; 1(1): 2–13.
23. Moon EJ, Lee YM. A novel angiogenic factor derived from Aloe vera gel B Sitosterol, a plant sterol. *Angiogenesis*. 1999; 3(2): 117–23.
24. Reyes Juan E, Guanoquiza Manuel I. Microbiological Stabilization of aloe vera (aloe barbadensis miller) gel by High hydrostatic pressure treatment. *Int J Food Microbiol*. 2012; 158(3): 218–224.
25. Xiu Lian Chang, Changhai Wang. Effects of heat Treatments on the stabilities of polysaccharides substances and barbaloin in gel juice from aloe vera miller. *J Food Eng*. 2006; 75(2): 245–251.
26. Roberto Mandrioli, Laura Mercalini. Determination of aloe Emodin in aloe vera extracts and commercial formulations By HPLC with tandem UV absorption and fluorescence Detection. *Food Chem*. 2011; 126(1): 387–393.
27. Annex to CAC/RCP 1-1996 Rev 3 (1997). Amended (1999). Hazard analysis and critical control point (HACCP) system and guidelines for its application.
28. Amar Surjushe, Resham Vasani. Aloe Vera: A short review. *Indian J Dermatol*. 2008; 53(4): 163–166.
29. Shao A, Broadmeadow A, *et al*. Safety of purified decolourised (low anthraquinone) whole leaf Aloe Vera(L) Burm. f. juice in a 3-month drinking water toxicity study in F344 rats. *Food Chem Toxicol*. 2013; 57: 21–31.
30. Chow JTN, Williamson DA, Yates KM, Goux WJ. Chemical characterization of Immunomodulating polysaccharide of aloe vera L. *Carbohydr Res*. 2005 May 2; 340(6): 1131–42.
31. Chithra R Sajithlal GB, Chandrakasan G. Influence of aloe vera on collagen characteristics in healing dermal wounds in rats. *Mol Cell Biochem*. 1998; 181(1–2): 71–6.
32. Hegggers J, Kucukcelebi A, Listengarten D, Stabenau J, Ko F, Broemeling LD, *et al*. Beneficial effect of aloe on wound healing in an excisional wound model. *J Altern Complement Med*. 1996; 2(2): 271–7.

33. Chithra P, Sajithlal G, Chandrakasan G. Influence of aloe vera on the glycosaminoglycans in the matrix of healing dermal wounds in rats. *J Ethnopharmacol.* 1998; 59(3): 179–86.
34. Roberts DB, Travis EL. Acemannan-containing wound dressing gel reduces radiation-induced skin reactions in C3H mice. *Int J Radiat Oncol Biol Phys.* 1995; 32(4): 1047–52.
35. Sato Y, Ohta S, Shinoda M. Studies on chemical protectors against radiation XXXI: Protective effects of *Aloe arborescens* on skin injury induced by x-irradiation. *Yakugaku Zasshi.* 1990; 110(11): 876–84.
36. Byeon S, Pelley R, Ullrich SE, Waller TA, Bucana CD, Strickland FM. *Aloe barbadensis* extracts reduce the production of interleukin-10 after exposure to ultraviolet radiation. *J Invest Dermatol.* 1988; 110(5): 811–7.
37. Peng SY, Norman J, Curtin G, Corrier D, McDaniel HR, Busbee D. Decreased mortality of Norman murine sarcoma in mice treated with the immunomodulator, acemannon. *Mol Biother.* 1991; 3(2): 79–87.
38. Hart LA, Nibbering PH, van den Barselaar MT, van Dijk H, van den Burg AJ, Labadie RP. Effects of low molecular constituents from aloe vera gel on oxidative metabolism and cytotoxic and bactericidal activities of human neutrophils. *Int J Immunopharmacol.* 1990; 12(4): 427–34.
39. Ishii Y, Tanizawa H, Takino Y. Studies of aloe. V: Mechanism of cathartic effect. *Biol Pharm Bull.* 1994; 17(4): 651–3.
40. Sydiskis RJ, Owen DG, Lohr JL, Rosler KH, Blomster RN. Inactivation of enveloped viruses by anthraquinones extracted from plants. *Antimicrob Agents Chemother.* 1991; 35(12): 2463–6.
41. Kim HS, Lee BM. Inhibition of benzo [a] pyrene-DNA adduct formation by *Aloe barbadensis* Miller. *Carcinogenesis.* 1997; 18(4): 771–6.
42. Kim HS, Kacew S, Lee BM. In vitro chemopreventive effects of plant polysaccharides (*Aloe barbadensis* Miller, *Lentinus edodes*, *Ganoderma lucidum*, and *Coriolus vesicolor*). *Carcinogenesis.* 1999; 20(8): 1637–40.
43. West DP, Zhu YF. Evaluation of aloe vera gel gloves in the treatment of dry skin associated with occupational exposure. *Am J Infect Control.* 2003; 31(1): 40–2.
44. Zawahry ME, Hegazy MR, Helal M. Use of aloe in treating leg ulcers and dermatoses. *Int J Dermatol.* 1973; 12(1): 68–73.
45. Ernst E, Fugh-Berman A. Methodological considerations in testing the efficacy of complementary/alternative treatments (CATs). *Int J Alt Comp Med.* 1998; 16: 8–10.