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Review Article

# A REVIEW ON ALOE VERA-THE WONDER MEDICINAL PLANT

Suseela Lanka\*

Department of Biotechnology Krishna University, Machilipatnam-521001, Andhra Pradesh, India

## ABSTRACT

*Aloe vera*, a succulent plant that grows in arid and subtropical climates is best known for its medicinal properties and is used in Ayurvedic, Homoeopathic and Allopathic streams of medicine. It has been in use for a long time by people of varied cultures and traditional uses include applications to reduce perspiration, oral dosing for diabetes and to get rid of a range of gastrointestinal ailments. It is also used to treat burn wounds, minor cuts, genital herpes, and seborrheic dermatitis. The leaves of this wonderful medicinal plant contain numerous vitamins, minerals, natural sugars, enzymes, amino acids, and as well rich in various bioactive compounds that exhibit emollient, purgative, anti-inflammatory, antioxidant, antimicrobial, anti-helmenthic, antifungal, aphrodisiac, antiseptic and cosmetic values. Many cosmetic industries widely use this plant owing to its healing and nourishing properties.

**Keywords:** *Aloe vera*, Medicinal Uses, bioactive compounds, Cosmetic industries

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### \*Address for Correspondence:

Dr. Suseela Lanka, Department of Biotechnology, Krishna University, Machilipatnam – 521001, A.P., India.

## INTRODUCTION

Medicinal plants are occupying prominent position in pharmacological sector owing to their rich wealth of bioactive compounds. Majority of the new antibiotics introduced in the market are obtained from natural sources<sup>1</sup>. Medicinal plants would be the best source for obtaining a variety of drugs according to WHO<sup>2</sup>. The succulent plant, *Aloe vera*, belonging to the family Alliaceae grows to a height of 60 - 100 cm (24-39 inches), matures in 4 - 6 years survives for a period of nearly 50 years under favorable conditions. Among more than 500 species of Aloe genus, *Aloe vera* (L.) Burm. f. syn. *Aloe barbadensis* Miller, is most biologically active<sup>3,4,5</sup>. They are native to southern and eastern Africa along the upper Nile in the Sudan. Subsequently these plants are introduced into North Africa and into many other countries across the globe. Many countries viz., India, South Africa, the United States of America, Venezuela Aruba, Bonaire, Haiti, etc. commercially cultivate this plant<sup>6,7</sup> but the Aloe grown in desert of Southern California is the finest quality. The plant can resist temperatures up to 104°F and as well can

with stand below freezing temperatures until root is not damaged.

The leaves of this wonderful medicinal plant are flooded with numerous vitamins, minerals, enzymes, natural sugars, amino acids etc. They are as well rich in various phytochemicals that exhibit emollient, purgative, antioxidant, anti-inflammatory, anti-helmenthic, antimicrobial, aphrodisiac, antiseptic and cosmetic values. The leaves of *Aloe vera* are succulent, erect, and form a dense rosette. The gel made from the leaves have innumerable applications and the plant is mainly cultivated worldwide, primarily as a crop for "*Aloe gel*". As per the report given by the Kew Gardens, England's royal botanical center of excellence, *Aloe vera* has been used for centuries and is currently more popular than ever. As per the Egyptians Aloe is "the plant of immortality." Now a day's, *Aloe vera* is widely used in Food. It is also approved by the FDA as a flavoring agent & as a food supplement. It is also a main ingredient in many herbal remedies. Even many cosmetic products that are prepared are based on Aloe products.

## HISTORY

The *Aloe vera* plant has been used for centuries & is well known for its health, medicinal, beauty, and skin care properties. The name *Aloe vera* is derived from the Arabic word 'Alloeh' meaning 'shining bitter substance' and 'vera' in Latin means 'true'. 2000 years ago only *Aloe vera* was considered as the universal panacea by the Greek scientists. The earliest recorded human use of *Aloe vera* comes from the Ebers Papyrus; an Egyptian medical record i.e. is from the 16th century BC. Ancient Egyptians considered *Aloe vera* as the plant of immortality (as per the literature published in the *Indian Journal of Dermatology*). There are also recorded evidences that the plant has been in use for many centuries in countries like China, Japan, India, Greece, Egypt, Mexico, and Japan<sup>8</sup>. Egyptian queens, Nefertiti and Cleopatra used the leaves of this plant as part of their regular beauty regimes. Alexander the Great and Christopher Columbus also used it to treat the wounds of their soldiers. The first reference to *Aloe vera* in English was a translation by John Goodyew in A.D. 1655 of Dioscorides' Medical treatise *De Materia Medica*<sup>9</sup>. *Aloe vera* was in use as a laxative since 1800s, in the United States. By mid 1930s, a turning point has occurred when it was successfully used to treat chronic and severe radiation dermatitis<sup>9</sup>.

## TAXONOMICAL CLASSIFICATION

The taxonomical classification of *Aloe vera* is given in Table 1.

## ETHNO-BOTANY OF ALOE VERA

As per Ayurveda, *Aloe* is known as Kumari or "Young Girl". It is because, *Aloe* is believed to bring back

youthful energy and femininity. *Aloe* is used as a tonic for the female reproductive system. According to Ayurveda, *Aloe* is said to have alliterative, tonic, rejuvenating, purgative, and vulnerary actions. *Aloe* is also believed to give good solution to all the three Ayurveda constitutions, Vatta, Pitta and Kapha. It is mainly used as a remedy for constipation, colic, skin diseases, worm infestations and infections in traditional Indian medicine. It is also used as a laxative, antihelminthic, for haemorrhoid treatment, and as a uterine stimulant (menstrual regulator). *Aloe* extract is also topically used to treat eczema or psoriasis, in combination with liquorice root. *Aloe* is also used as food. People in Tamil Nadu, India often prepare a curry using *A. vera* which is taken along with Indian bread (nan bread) or rice<sup>10,11</sup>.

**Table 1: Classification of *Aloe vera***

Kingdom	Plantae
Clade	Angiosperms
Clade	Monocots
Order	Asparagales
Family	Asphodelaceae
Subfamily	Asphodeloideae
Genus	<i>Aloe</i>
Species	<i>A. vera</i>

## ACTIVE COMPONENTS OF ALOE VERA WITH THEIR PROPERTIES

*Aloe vera* is known to contain around 75 potentially active constituents: vitamins, enzymes, minerals, sugars, lignin, saponins, salicylic acids and amino acids<sup>12,13,14</sup>. Table 2 shows the active components present in *Aloe vera*.

**Table 2: Active components present in *Aloe vera* with properties**

Name of the Active component	Active components present in <i>Aloe vera</i> with properties
Vitamins	Vitamin A (beta-carotene), C and E, - antioxidants. It also contains vitamin B1, B2, B6 & B12, folic acid, and choline. *Antioxidants protect the body by neutralizing free radicals.
Enzymes	Allylase, alkaline phosphatase, amylase, oxidase, bradykinase, carboxypeptidase, catalase, cellulase, lipase, cylooxygenase, and peroxidase. *Bradykinase helps to reduce excessive inflammation when applied to the skin topically, while the other enzymes help in the breakdown of sugars, proteins and fats.
Minerals	Calcium, chromium, copper, selenium, magnesium, manganese, potassium, sodium and zinc. *Some of the minerals are essential for the proper functioning of various enzyme systems in different metabolic pathways and few acts as antioxidants.
Sugars	Monosaccharides (glucose and fructose) and polysaccharides (glucomannans/polymannose). *The most prominent monosaccharide is mannose-6-phosphate, and the most common polysaccharides are called glucomannans [beta-(1,4)-acetylated mannan]. *Acemannan, a prominent glucomannan has also been found. Recently, a glycoprotein with anti allergic properties, called alprogen and novel anti-inflammatory compound, C-glucosyl chromone, has been isolated from <i>Aloe vera</i> gel <sup>15,16</sup> .
Organic acids	Sorbate, salicylic acid, uric acid *salicylic acid possesses anti-inflammatory and antibacterial properties.
Anthraquinones	Alloin, barbaloin, isobarbaloin, anthranol, aloetic acid, aloe-emodin, ester of cinnamic acid, resistannol, chrysophanic acid and emodin, * Acts as laxatives. *Alloin and emodin act as analgesics, antibacterials and antivirals.

Fatty acids and Steroids	Cholesterol, campesterol, $\beta$ -sitosterol and lupeol. Fattyacids like Arachidonic acid, $\gamma$ -linolenic acid. *All these have anti-inflammatory action and lupeol also possesses antiseptic and analgesic properties.
Non-essential aminoacids	Histidine, arginine, aspartic acid, glutamic acid, proline, glycine, tyrosine, alanine and hydroxyl proline.
Essential aminoacids	Methionine, phenylalanine, isoleucine, leucine, valine, threonine and lysine.
Hormones	Auxins and gibberellins *that help in wound healing and have anti-inflammatory action.
Others	*Lignin, an inert substance, when included in topical preparations, enhances penetrative effect of the other ingredients into the skin. *Saponins that are the soapy substances form about 3% of the gel and have cleansing and antiseptic properties.

## THERAPEUTIC ACTIONS OF ALOE VERA

### 1. Anti-inflammatory action:

*Aloe vera* by inhibiting the cyclooxygenase pathway reduces the production of prostaglandin E2 from arachidonic acid. A novel anti-inflammatory compound called C-glucosyl chromone was also isolated from *Aloe vera* gel extracts recently<sup>17</sup>. Langmead *et al.*<sup>18</sup> reported Anti inflammatory effects of *Aloe vera* gel in human colorectal mucosa in vitro. Reuter *et al.*<sup>19</sup> reported the anti inflammatory potential of *Aloe vera* gel (97.5%) in the ultraviolet erythema test. Lee *et al.*<sup>20</sup> reported anti-inflammatory activity of *Aloe vera* adventitious root extracts through the alteration of primary and secondary metabolites via salicylic acid elicitation.

### 2. Anti Ulcer effect of *Aloe vera*:

The anti-ulcer effect of *Aloe vera* in non-steroidal anti-inflammatory drug (NSAID) induced peptic ulcers in rats was reported by Borra *et al.*<sup>21</sup>

### 3. Effects on the immune system:

Alprogen, an anti-allergic compound of *Aloe vera* inhibits calcium influx into mast cells, thereby inhibiting the antigen-antibody-mediated release of various mediators like histamine, serotonin, SRSA, leukotrienes etc from mast cells<sup>22</sup>. Acemannan stimulates the synthesis and release of interleukin-1 (IL-1) and tumor necrosis factor from macrophages in mice that had previously been implanted with murine sarcoma cells, which in turn initiated an immune attack that resulted in necrosis and regression of the cancerous cells<sup>23</sup>. Several low molecular constituents from *Aloe vera* gel are also capable of inhibiting the release of reactive oxygen free radicals from activated human neutrophils<sup>24</sup>. Madan *et al.*<sup>25</sup> reported Immunomodulatory properties of *Aloe vera* gel in mice. Im *et al.*<sup>26</sup> reported optimal molecular size of modified *Aloe* polysaccharides with maximum immunomodulatory activity. Zhang *et al.*<sup>27</sup> reported antioxidative and immunomodulatory properties of two novel dihydrocoumarins from *Aloe vera*.

### 4. Laxative effects:

The Anthraquinones present in latex acts as potent laxatives. They do so by increasing intestinal water content, by stimulating mucus secretion and as well by increasing intestinal peristalsis<sup>28</sup>.

### 5. Antiviral activity:

The antiviral activities of *Aloe* extracts may be due to indirect or direct effects. Indirectly they show these effects by stimulating the immune system and directly by anthraquinones. The anthraquinone aloin inactivates various enveloped viruses such as *Herpes simplex*, *Varicella zoster* and *Influenza*<sup>29</sup>.

### 6. Antitumor activity:

In a study polysaccharide fraction of *Aloe* has shown to inhibit the binding of benzopyrene to primary rat hepatocytes, thereby preventing the formation of potentially cancer-initiating benzopyrene-DNA adduct. Another study reported the induction of glutathione S-transferase and as well inhibition of the tumor-promoting effects of phorbol myristic acetate suggesting the possible role of *Aloe* gel in cancer chemoprevention<sup>30,31</sup>. Saini *et al.*<sup>32</sup> reported anti-tumor activity of *Aloe vera* against DMBA/croton oil-induced skin papillomagenesis in Swiss albino mice. El-Shemy *et al.*<sup>33</sup> reported antitumor properties and modulation of antioxidant enzymes' activity by *Aloe vera* leaf active principles isolated via supercritical carbon dioxide extraction.

### 7. Anti bacterial and Anti fungal activities:

Extracts from *Aloe vera* were found to have anti bacterial and anti fungal activities<sup>34,35,36,37,38</sup>.

### 8. Moisturizing and anti-aging effect:

*Aloe* is rich in mucopolysaccharides which help in binding moisture to the skin. *Aloe* stimulates fibroblasts to produce collagen and elastin fibers thereby making the skin more elastic and less wrinkled. It also has cohesive effects on the superficial flaking epidermal cells by sticking them together, which softens the skin. The amino acids present in *Aloe* gel also soften hardened skin cells. Zinc present in the gel acts as an astringent & tightens the pores. *Aloe vera* gel gloves improved the skin integrity, decreased appearance of fine wrinkles and erythema in the treatment of dry skin associated with occupational exposure indicating its moisturizing effects<sup>4</sup>. The gel also has anti-acne effect.

### 9. Antiseptic effect:

The Antiseptic effect of *Aloe vera* is mainly due to the presence of 6 antiseptic agent's viz., Lupeol, salicylic

acid, urea nitrogen, cinnamonic acid, phenols and sulfur. They all exhibit inhibitory action against fungi, bacteria and viruses<sup>39</sup>.

#### 10. *Healing properties:*

Topical and oral *Aloe vera* administration stimulates the activity and proliferation of fibroblasts which in turn significantly increases collagen synthesis. This action is due to the presence of Glucomannan, a mannose-rich polysaccharide, and gibberellin, a growth hormone that interacts with growth factor receptors on the fibroblast thereby stimulating its activity and proliferation<sup>40</sup>. Studies also showed that Aloe gel not only increases collagen content of the wound but also changes collagen composition (more type III) and increases the degree of collagen cross linking. This accelerates wound contraction and increases the breaking strength of resulting scar tissue<sup>41</sup>. There were also reports that oral or topical treatment with Aloe extracts increases synthesis of hyaluronic acid and dermatan sulfate in the granulation tissue of a healing wound<sup>42</sup>. In rats with diabetes type-II, administration of oral dosage of *Aloe vera* mucilage accelerated the trend of healing of skin wounds indicating the role of *Aloe vera* treatment in accelerating expression of vascular endothelial growth factor (VEGF) and TGF  $\beta$ -1 (stimulates fibroblasts to better reconstruct the extracellular matrix at wound place) in the area of wound in skin of rats<sup>43,44</sup>. Rajput *et al.*<sup>45</sup> reported pharmacology and phytochemistry of saponin isolated from *Aloe vera* for wound healing activity.

#### 11. *Effects on skin exposure to UV and gamma radiation:*

*Aloe vera* gel has been reported to have a protective effect against radiation damage to the skin<sup>46,15</sup>. Though exact role is not known, but following the administration of *Aloe vera* gel, metallothionein, an antioxidant protein is generated in the skin, which scavenges free radicals

and prevents suppression of superoxide dismutase and glutathione peroxidase, the antioxidant enzymes in the skin. Studies reveal that administration of Aloe prevents UV-induced suppression of delayed type hypersensitivity by reducing the production and release of skin keratinocyte-derived immunosuppressive cytokines such as interleukin-10 (IL-10)<sup>16</sup>.

#### 12. *Role of Aloe vera in dentistry:*

*Aloe vera* extracts were found to be effective in the maintenance of oral hygiene<sup>47,48,49,50,51,52,53,54</sup>. Wynn<sup>55</sup> also reported application of *Aloe vera* gel in dentistry.

#### 13. *Anti diabetic effects of Aloe extracts:*

Rajasekaran *et al.*<sup>56</sup> reported hypoglycemic effect of *Aloe vera* gel on streptozotocin-induced diabetes in experimental rats. Beppu *et al.*<sup>57</sup> reported Antidiabetic effects of dietary administration of *Aloe arborescens* Miller components on multiple lowdose streptozotocin-induced diabetes in mice. Rajasekaran *et al.*<sup>58</sup> reported beneficial effects of *Aloe vera* leaf gel extract on lipid profile status in rats with streptozotocin diabetes.

#### 14. *Antioxidant effects:*

Aloe extracts were also found to have Antioxidant effects<sup>59</sup>.

#### 15. *Food applications of Aloe vera juice*

Ahlatwat and Khatkar<sup>60</sup> in their review reported processing, food applications and safety of *aloe vera* products. Eshun and He<sup>61</sup> reported *Aloe vera* as a valuable ingredient for the food.

### CONCLUSION

The wonder and miraculous herb, *Aloe vera*, has proven for its wide range of applications in the treatment of many ailments. Though the plant is well known for its medicinal values<sup>62-69</sup> but controlled clinical trials are required to prove and evaluate its real efficacy.

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