

# A Review on Wound Healing Property of Aloe Vera

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**Abstract:** *Aloe vera is one of the most commonly used medicinal plants because of its wide range of habitats. However, it is not typically included in modern medicine. The effectiveness of aloe vera products needs to be checked regularly, whether they are used by themselves or combined with other medicines. It is very difficult to correctly identify the right type of aloe and make a proper mixture. Even though there is a lot of research on its biological effects, there is not much information on how to properly make aloe products. This may be because it is hard to find and separate the active ingredients in enough amounts to be useful. Also, there is not much knowledge about this process. Some studies have also warned about possible allergic reactions in certain people. Because of these concerns, especially with products that may have very little or no real aloe, there is a need for clear quality and safety standards for internal use. This paper looks at the chemicals in aloe vera, explores its limitations, and discusses its potential, especially since it is widely used in the beauty and skincare industry. Even though there are many reasons to use it, more controlled studies are needed to fully understand how effective it really is. This article gives a short summary of the aloe vera plant, what it looks like, how it works, and the ways it has been used in medicine. Because it has anti-inflammatory, antibacterial, and healing properties, aloe vera has been used for a long time to help with stomach problems and skin issues like burns, wounds, insect bites, and eczema. The purpose of this review is to check if the old uses of this plant are still valid, learn how it actually works, and find out which chemicals are responsible for its effects.*

**Keywords:** Aloe-vera, Phytochemicals, Aloe latex, Pharmacological Activities

## I. INTRODUCTION

Aloe vera, also called Aloe vera Linn or Aloe vera barbadensis Mill, is a tropical plant that grows in hot and dry places, like Thailand. Inside the center of its leaves, there's a gel-like substance called aloe vera gel, which is used to make many beauty products and medicines. People have used aloe vera gel for a long time, possibly since the Roman times or even earlier, for various purposes. In many countries, it is mainly used to help heal burns.

Aloe vera gel was added to Thailand's list of basic public health herbs to treat burns.

Some studies suggest that aloe vera or its parts can help wounds heal in different animal studies. However, there is not enough strong evidence to confirm this in humans. A recent review of 10 clinical studies looked at how effective aloe vera is for different conditions. The results showed that taking aloe vera by mouth might help lower blood sugar or cholesterol levels. It might also help with genital herpes and psoriasis when applied on the skin, but it doesn't prevent damage from radiation.

The review did not include information about aloe vera's effectiveness for burns.

Another study was conducted specifically to examine how well aloe vera works for treating burns. Aloe vera is a type of plant from the xanthorrhoeaceae family and is one of the most commonly used aloe species, especially in beauty products. Aloe vera is also known as Aloe barbadensis (Mill) or Miller. Aloes are plants that can live in dry environments. They have thick, fleshy leaves that store water, which helps them survive in hot and dry climates. These plants are found in sub-Saharan Africa, the Arabian Peninsula, and some islands in the Indian Ocean. Most aloe plants



have big, thick leaves that hold a lot of water. The outer layer of the leaves is thick and covered with a waxy substance. This waxy surface has a special pattern of ridges and tiny bumps. Aloes grow in many different places. Aloe vera plant The Aloe vera plant is a type of succulent that comes from the Liliaceae family. It is grown all around the world because of its many health and beauty benefits. Some people even call it a natural doctor or a beauty expert. There are many different types of Aloe vera, with about 360 to 500 species. Among these, Aloe barbadensis Miller, Aloe arborescens Miller, Aloe ferox Miller, Aloe vera var. chinensis, and Aloe Saponaria are known for their strong health benefits. Aloe barbadensis Miller is especially important (Ali et al. 2014; Gong and Lu 2015). Other types like Alve greathadii var. davyana (Figure 1) and Aloe ferox Miller are commonly found in South Africa.

Growing Aloe vera is a major industry, and some of the top producers include Latin American countries, the USA, China, and Thailand (Radha and Laxmipriya 2015; Rodriguez-Gonzalez et al. 2011).

The most valuable part of the plant is its long, thick, fleshy leaves that are packed with active ingredients (Figure 1). Because of this, Aloe vera is considered a plant that has global significance. Each leaf has three layers: the inner, middle, and outer layers. Together, they make up about 99% water and 1% of active substances. The inner layer has a clear gel that is rich in important components. The middle layer has a yellow, bitter liquid that contains anthraquinones and glycosides. The outer layer is for protection and

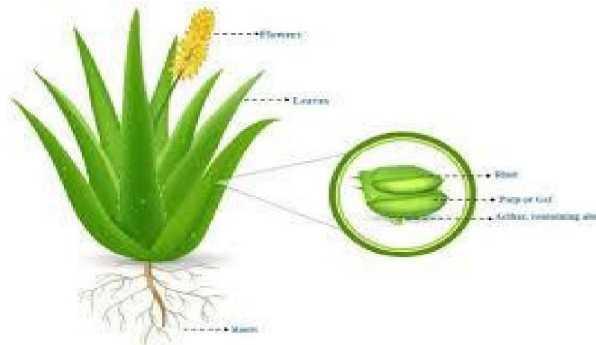


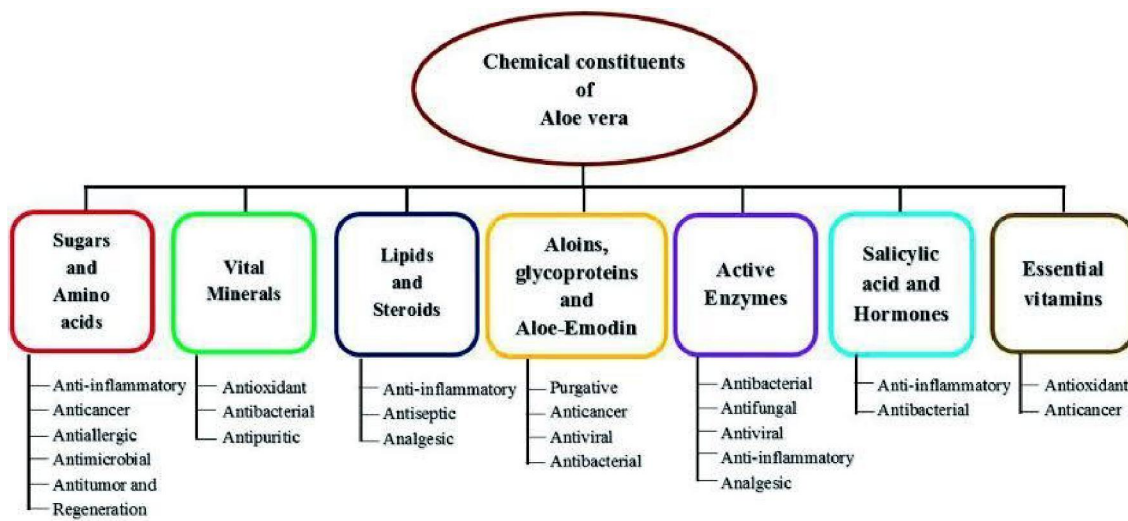
Fig. Aloe vera

enables it to survive in various extreme conditions (hot and dry areas with low rainfall). It can also survive in areas with low freezing temperatures (Ali et al. 2014; Baruah, Bordoloi, and Baruah 2016; Gong and Lu 2015; Nejatizadeh-Barandozi 2013; Radha and Laxmipriya 2015)

### Aloe vera compounds

Aloe vera contains a wide range of bioactive compounds. The chemical components of Aloe vera and their associated properties for different uses are presented in Figure 2 (Balaji et al., 2015). It contains approximately 20 minerals, 75 nutrients, 18 to 20 amino acids, 12 vitamins, and 75 to 200 active compounds, including aloesin, anthraquinones (such as aloesin and aloes-emodin), aloe-mannan, acemannan (gel poly-saccharides), mannose-6-phosphate, barbaloin, aloe ride, verectin, gibberellin-like substances, aloe resin, 5-methyl chromone, flavonoids, glycoprotein fraction, anthraglycosides, reducing sugars, cardiotoxic glycosides, saponins, naphthoquinones, sterols, and triterpenoids (Ali et al., 2014; Chauhan and Kumar, 2020; Mondal, Saha, and Rahman, 2021). The majority of these components include glycoproteins, barbaloin, emodin, mannose-6-phosphate, polysaccharides, acemannan, and aloesin (Ali et al., 2014; Mondal, Saha, and Rahman, 2021). Variations in the concentration of these compounds may be attributed to differences in climate, seasons, and geographical regions (Rodriguez-Gonzalez et al., 2011).





### Therapeutic and Pharmacological Effects

One can mention several pharmacological properties of the aloe vera plant, such as anti-inflammatory, anti-arthritis, antibacterial, antifungal, and hypoglycemic effects. Because of its antibacterial and antifungal characteristics, aloe vera helps in preventing the formation of dandruff on the scalp. Additionally, this plant is beneficial in managing fungal infections like alopecia [32]. Among other effects linked to the fresh gel of aloe vera, it is known for its ability to promote healing of wounds and minor skin injuries. Furthermore, taking this substance can lead to a reduction in pain at the site of injury [33]. The hydrating properties of aloe vera have also been shown in its topical formulations [34]. The application of aloe gel on the skin can enhance the absorption of topical drugs. A study examining the effect of aloe vera on the absorption of drugs such as caffeine, colchicine, mefenamic acid, oxybutynin, and kinin found that aloe vera can increase drug absorption, which may be due to the increased moisture content in the stratum corneum [35].

The aloe vera plant, also known as yellow aloe, resembles a cactus and is a succulent, watery plant. Its leaves contain a gel-like substance called mucilage. This mucilage is composed of certain glycoproteins that help reduce inflammation and pain while promoting healing. It also contains polysaccharides that aid in skin growth and repair. The mucilage from this plant can be utilized in the treatment of internal conditions.

## II. HISTORY

Greece, Egypt, India, Mexico, Japan, and China are among the many cultures that have used aloe vera for its healing properties for thousands of years. In ancient Egypt, princesses like Cleopatra and Nefertiti included aloe vera in their skincare routines. It was also used by Alexander the Great to treat injuries sustained by his soldiers and by Christopher Columbus during his voyages. The earliest known written reference to aloe vera in English appears in John Goodyew's translation of Dioscorides' medical text *\*De Materia Medica\**, published in 1655. By the early 1800s, aloe vera was already being used in America as a laxative. However, a significant development occurred in the mid-1930s when it was effectively applied to treat serious conditions like chronic and severe radiation dermatitis.

## III. MACROSCOPIC CHARACTERIZATION OF ALOE VERA

The plant produces fruits containing numerous seeds, along with yellow, tube-shaped flowers and triangular, fleshy leaves that have serrated edges. Each leaf consists of three distinct layers. The innermost layer is a clear gel that contains glucomannans, amino acids, lipids, sterols, and vitamins, with 99% of its composition being water. The middle layer contains the latex, which is a bitter yellow sap made up of anthraquinones and glycosides. The outermost layer,



known as the rind, is thick and composed of 15 to 20 cells. It acts as a protective covering and is responsible for producing proteins and carbohydrates. Within the rind, vascular bundles are present, and they function in transporting essential elements such as water.

#### **Plant**

The scientific name for Aloe vera is Aloe barbadensis miller. It is a member of the Asphodelaceae family, previously classified under Liliaceae. This plant is a shrub-like or tree-like, perennial, drought-tolerant, fleshy, and typically pea-green in color. It predominantly grows in arid areas across Africa, Asia, Europe, and the Americas. In India, it can be found in the states of Rajasthan, Andhra Pradesh, Gujarat, Maharashtra, and Tamil Nadu.

#### **Conditions:**

Alopecia, bacterial and fungal skin infections, chronic leg ulcers, parasitic infections, systemic lupus erythematosus, arthritis, and tic douloureux

Side effects: Topically, it may lead to redness, burning, stinging, and in rare cases, generalized dermatitis in individuals with sensitivity.

Allergic responses are commonly linked to anthraquinones, such as aloin and barbaloin. To check for potential allergic reactions, it is advisable to apply the product to a small area of skin first.

#### **Oral:**

Abdominal cramps, diarrhea, red urine, hepatitis, dependency, or worsening of constipation may occur. Long-term use has been linked to an increased risk of colorectal cancer. The laxative effect can lead to an imbalance of electrolytes, particularly a decrease in potassium levels.

#### **The Role of Growth Factors:**

Growth factors are proteins with a large molecular weight that are produced by most cells. When they are secreted, they initiate autocrine and paracrine signaling cascades that influence various cellular processes. Among the many effective growth factors involved in the healing of wounds, transforming growth factor-beta (TGF- $\beta$ ) plays a significant role. After tissue injury, TGF- $\beta$  is released at the wound site through the release of granules from platelets.

Atiba et al. (2011) demonstrated that oral administration of aloe vera mucilage can increase the production of basic fibroblast growth factor (bFGF) and TGF- $\beta$ 1 in the skin wounds of rats exposed to a specific type of radiation.

In another study from 2010, it was found that applying aloe vera mucilage topically to wounds in rats accelerated the healing process and also promoted blood clot formation and wound contraction. This study also noted that dermal treatment with aloe vera increased the formation of new blood vessels (angiogenesis), the development of granulated tissue, and improved collagen organization at the wound site [56]. Additionally, topical application of aloe vera mucilage was found to promote healing in shear wounds in both desert rats and rabbits.

### **Mechanism of Wound Healing by Aloe Vera**

#### **1. Anti-inflammatory Activity**

Aloe vera helps to decrease too much inflammation by blocking certain substances that cause inflammation, such as prostaglandins, bradykinin, and histamine. Additionally, it reduces the activity of the cyclooxygenase pathways, which in turn helps to lessen swelling, redness, and pain.

#### **2. Stimulation of Fibroblast Activity**

Fibroblasts play a key role in producing collagen and forming the extracellular matrix. Aloe vera promotes the growth of fibroblasts and enhances collagen synthesis, which helps improve three important aspects of wound healing: the tensile strength of the tissue, the process of wound contraction, and the development of granulation tissue.

#### **3. Enhanced Collagen Production**

Collagen is essential for tissue repair.

*Collagen synthesis*  $\uparrow \Rightarrow$  *Tissue repair and wound strength*  $\uparrow$

Glucomannan and gibberellin present in Aloe vera interact with fibroblast growth factor receptors, increasing collagen deposition and cross-linking.



#### **4. Moisturizing Effect**

Aloe vera gel helps keep a wound moist, which has several benefits. It prevents the tissue from drying out, supports the movement of skin cells to the wound site, and helps minimize the formation of scars. Wounds that remain moist tend to heal more quickly compared to those that are allowed to dry out.

#### **5. Antimicrobial Activity**

Aloe vera has the ability to fight against bacteria, viruses, and fungi, including organisms like *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Candida albicans*. This characteristic can help in lowering the chances of infection in wounds.

#### **6. Antioxidant Action**

During inflammation, reactive oxygen species (ROS) are produced, which can harm tissues. Aloe vera contains antioxidants that help neutralize free radicals, thereby supporting the protection and healing of tissues.

#### **7. Angiogenesis Promotion**

Aloe vera supports the development of new blood vessels, which helps to enhance:

- The supply of oxygen
- The transport of nutrients
- The process of tissue repair and regeneration.

#### **Modern Pharmaceutical Applications**

Current pharmaceutical research is concentrating on several advanced approaches, including aloe vera-loaded nanofibers, hydrocolloid dressings, bioengineered wound scaffolds, and combination therapies that use antibiotics along with silver nanoparticles. These innovative systems are designed to enhance the controlled release of drugs and promote better wound healing.

### **PHARMACOLOGICAL POTENTIALS OF ALOE VERA BURN AND WOUND HEALING PROPERTY**

Aloe vera is well recognized for its ability to provide comfort and aid in the healing of burns and other types of wounds. When applied to a wound, aloe vera helps speed up the process of wound closure and improves the strength of the healing tissue through the growth and multiplication of cells. It achieves this by promoting increased blood flow to the affected area. Aloe vera is considered one of the most effective wound dressings that has been discovered. The process by which this occurs is explained as follows: Aloe vera gel increases the amount of collagen in the wound and improves the cross-linking of collagen, which leads to better contraction of the wound and the breakdown of scar tissue. Research has also shown that the content of hyaluronic acid and dermatan sulphate in the new tissue formed during healing is increased. A 5.5 kDa glycoprotein extracted from *A. vera* has been found to enhance the migration of epithelial cells and support the healing process in human keratinocyte cells. Figure 5 illustrates how the application of aloe gel encourages the migration and proliferation of fibroblast cells to the wound site. The growth factors present in aloe vera are attracted to the wound and bind to the IGF receptors on fibroblasts. This leads to an increase in collagen content and cross-linking, thereby improving the tensile strength of the wound. (Sharma P. et al., 2015) Aloe vera gel not only increases the amount of collagen in wounds but also alters its composition and enhances cross-linking, which contributes to improved wound healing. Scientific research has demonstrated that the gel can enhance the flexibility of the skin and reduce its fragility, as 99% of the gel is composed of water. (V. Visuthikosol et al., 1995)

### **IV. CONCLUSION**

Aloe vera, a naturally occurring substance commonly used in the cosmetology sector, has been extensively researched for its anti-inflammatory, antibacterial, and wound-healing properties. It has been traditionally used to address various health issues, including digestive problems and skin conditions such as burns, wounds, insect bites, and eczema. The plant contains several active compounds, including acemannan, aloe-emodin, aloin, aloesin, and emodin. Recent studies have explored its historical uses, how it works, and its potential new applications. Aloe vera gel is most recognized for its ability to soothe and promote healing in burns and other types of wounds. It helps speed up the process of wound



healing by increasing collagen levels and promoting cross-linking, which leads to improved wound contraction and the breakdown of scar tissue. A glycoprotein extracted from *A. vera* has been found to promote the movement of epithelial cells and support the healing of wounds. However, more controlled studies are necessary to fully confirm the effectiveness of aloe vera.

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