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## Antimicrobial and Medicinal Properties of Aloe vera : A Review

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### ABSTRACT

The aim of this study is to show the medicinal properties and antimicrobial activity of aloe vera gel. Aloe vera gel has bioactive components that play an important role in the treatment of disease. It contains more than 200 bioactive components. Aloe vera includes 400 species in the genus aloe. Aloe vera is an evergreen succulent plant that consumes more oxygen into its leaves, it can also have antioxidants that help to reduce wrinkles from the skin. Aloe vera gel can also help to increase the HDL (High density lipoprotein) cholesterol and LDL (low density lipoprotein) cholesterol in the blood. LDL is known as bad cholesterol. This study includes the history, biological description, cultivation, medicinal properties and antimicrobial activity of aloe vera. During the time of cultivation there is no more need of water, it is able to grow in the air dry condition and high temperature. As a traditional, medicinal plant aloe vera has been used for thousands of years.

Keywords: aloe vera, gel, antimicrobial activity, bioactive components, medicinal use.

### 1. INTRODUCTION

Aloe vera is a medicinal plant and herb, that is succulent in nature. From all of the species of aloe vera, aloe barbadensis is the most common and easily available species in the world (Shende, V & Telrandhe, R. 2017). Latex of aloe vera contains the aloe vera gel that is medicinal in nature (Shende, V & Telrandhe, R. 2017). Aloe vera is commonly found in heated and dry places and there is no more need of water for plant growth. The word aloe vera derives from the arabic word 'Alloeh' that meaning is "Sparkle acrid substance" and the word vera derives from the latin word that's meaning is "Authentic" (Sanchez, M. et al., 2020). The mucilaginous tissue that is found in the center of aloe vera leaf is used in the production of cosmetics and medicines (Mawari, S.A., et al 2019). Aloe vera is a xerophytic plant, which consumes more water inside the leaf tissues. Aloe vera having the high water quantity around 99-99.5% and left 0.5 to 1.0% content are vitamins, minerals, enzymes, phenolic components, organic acids etc (Radha, M.P & Laximipriya, N. 2015).

Aloe barbadensis are used every but there are more species like aloe perryi baker, aloe andongensis and aloe ferox are also usable species (Guo, X. & Mei, N. 2016). Mesophyll of aloe vera leaves are known as aloe gel, which is used in the processing to obtain derivatives on the industrial basis. Within every next five years the market of succulent plant leaf tissues increases by 35 to 40% the annual estimation of this market is \$13 billion (Cristiano, G. et al., 2016). Flowers of aloe vera (commonly red, yellow and orange shades are found) are generally densely clustered at the apex of spikes and narrow bell shaped. The therapeutic uses including treatment for gastrointestinal condition and Chronic Inflammation (Cock, IE. 2015). There are many aloe species that are useful in the relief of pain and laxative agents (Amoo, S. et al., 2014). The plant belongs to the genus of aloe, having a long traditional use in the Islamic medicine (ITM). Aloe has been used as a folk treatment of many types of illnesses (Akberi, M., et al 2016). Opposed to the vehicle, A. vera concentration improved skin hydration, but in the transepidermal water loss (TEWL) on change was observed (Cassetti, F., et al 2011).

Traditionally we use aloe vera by extraction in hot water or we can also apply it fresh directly on the affected area and apply topically (Quave, CL. 2018). Liquid content of aloe vera was approved by drug and food administration as an aperient and laxative agent (Pereira, R.J & Bartolo, P. 2013). It is conducted by European commission (EC), aloe vera able to be used as a food additive, flavouring compound, to enhance palatability of food (

Christaki, E & Florou, P. - paneri. 2010). In the common language of Ayurveda it is known as kumari or young girl , because aloe vera gives back the spirit energy and feminine way (Pandey, A & Singh, S. 2016) . The aloe vera gel also helps the skin to improve dermal intake of the drug (Amoo, S. Aremu, 2015) .The native land of aloe vera is Africa , Madagascar , Arabian and Indian ocean Islands (Akev, N., et al 2015).

### **2. Common medicinal uses of aloe vera:**

Aloe vera leaf contains two main components , aloe gel and latex are usable in many as traditional medicine (Guo, X. & Mei, N. 2016).Aloe vera components play an important role in enhancement of estrogen level by enhancing the estrogen synthesis. It can also help to reduce the risk factor of metabolic syndrome like hyperglycemia , hyperlipidemia , hypertension , and obesity (Shakib, Z., et al 2019). Oral consumption of aloe vera gel and latex used in the Europe and united state for constipation condition and its gel extract also used as a food supplements in these conditions , glycemic control in diabetes , fever and bowel disease (Sadoya, S., et al 2020). Aloe vera contains aloe emodin, that is natural anthraquinone derivatives that shows its activity on neoplastic different tumor cells such as gastric, hepatic , lung melanoma colon and breast cancer cells (Dong, X., et al 2019). Emodine is extracted from the root of aloe vera ,is a derived from anthraquinone compounds also having the properties of anticancer , antiinflammatory , antioxidant , antibacterial , anti diabetes , antiviral and osteogenesis promotion activity (Guo, X. & Mei, N. 2020).

Aloe vera medicine is traditional Chinese medicines (TCM) and it is used as a mild laxative in the treatment of constipation conditions (Peng, C., et al 2019). When aloe vera gel is applied subgingivally , it relatively decreases plaque indices , pocket depth (Dhingra, K. 2013). It demonstrated that aloe vera have an important therapeutic use in the treatment of oral lesions such as oral lichen oral sub mucous fibrosis, xerostomia , recurrent aphthous ulcers , burning mouth syndrome (Naidu, GRS., et al 2016). In 1996 it is proofed by clinical trials , that aloe vera gel also having anti psoriasis properties . psoriasis is a common skin mediated condition that effect about 3-4% population in US . the symptoms includes , scaling , flaking , redness on skin , skin tightness , pain , ,bleeding on the affected area, pruritus , these condition shows negative effect on the patients mental and physical condition (Farahink, B., et al 2017) .

Aloe vera may have activity against IBD that is proved by its anti-inflammatory activities (Wan, P. et al ., 2014) . Aloe vera gel having magnesium lactate , prevents itching and irritation on skin that is caused by the reaction of histamine (Metin, ZG., et al 2020).

### **3. History:**

At the time of history animal and plant products use as the main source of drugs . Medicinal plants are the best source of drugs , according to the World Health organization (WHO) (Singab, NB., et al 2015). For the first time aloe vera showed its pharmaceutical role in a 'Mesopotamian' clay tablet at (1750 B.C.). Then it was used against skin infectious disease by egyptians at (550B.C.). Physicians of roman army, described that the aloe vera have the wounds healing properties ,in 74 C.E.

Mexico is a high yielding country as compared to other countries. (Singab, NB., et al 2018). In India, China and Japan aloe vera have been used as traditional medicine components for more than 2000 years (Radha, M.P & Laximipriya, N. 2015).Because of the ability to Increase the collagen synthesis, in 1930 aloe vera was used in the treatment of burned skin and in the healing of wounds (Pothuraj, R., et al 2015).

### **4. Synonyms of aloe vera :**

Aloe Chinensis Bak , Aloe barbadensis miller , aloe elongata murray , Aloe officinalis forsk , Aloe indica Royle , Aloe rubescens DC , Aloe perfoliata L. , Aloe vulgaris Lam , A. vera L. var .Chinensis Berger aer the synonym of aloe vera (Sahu, P., et al 2013) .

### **5. Botanical classification of aloe vera :**

Kingdom - Plantae  
 Subkingdom - Tracheobionta  
 Superdivision - Spermatophyta  
 Division -Magnoliophyta  
 Class - Liliopsida  
 Subclass - Liliidae  
 Order - Liliales  
 Family - Aloaceae  
 Genus - Aloe L.  
 Species - A . vera

### **6. cultivation of aloe vera:**

Aloe species are widely distributed in Africa, India, and other dry countries . 140 species, including aloe plants, occur in South Africa. The aloe species require the pH range about 7.0 to 8.5 for cultivation. But some species like Aloe plicatilis, Aloe haemanthifolia, and grass species require acidic pH of soil.

4 to 21 degree temperatures require the plant to grow. Flowering conditions occur in May and June . (Salehi, B. et al , 2018).

### **7. Medicinal properties:**

#### **7.1 Antioxidant activity of aloe vera:**

Aloe vera has some types of antioxidants which help to prevent some type of disorder. Some antioxidants are present in aloe vera are Tocopherol, Ascorbic acid, Carotenoids, Flavonoids and Tannins (Gulati, P., 2021).

### 7.2 Wound healing properties of aloe vera:

Aloe vera also plays an important role in the healing of skin wounds as a highly favorable medicine. Because skin is the largest organ of the body and plays an important role in the protection of the internal environment from the outer harmful environment (Hashemi, A. et al., 2015). The aloe vera gel increases the multiplication of cells, thus wound healing occurs at high rate, through increases the rate of collagen synthesis and increases the shrinkage of wounds. Some kind of component found in aloe vera gel like Glucomannan, a polysaccharide that increases the healing of wounds (Gulati, P., 2021). The process of healing of wounds is completed in three phases. In the first phase inflammation, hyperemia and leukocyte infiltration occur. In the second phase dead tissue is removed. And in the third phase multiplication and proliferation of cells occur which consist of fibrous tissue formation and epithelial cell regeneration (Maurya, R. et al., 2019).

### 7.3 Anti-inflammatory effect of aloe vera:

Phytochemicals of aloe vera prohibit the arachidonic acid pathway and cyclooxygenase pathway, That result in the small amount production of prostaglandin E2 through arachidonic acid which prevent the inflammation and inflammatory bowel disease. (Gulati, P., 2021).

### 7.4 Immunity Booster:

Aloe vera contains some types of phytochemicals, along with vitamins and protein that help the body to boost our immunity (Gulati, P., 2021).

### 7.5 Anti cancer:

Aloe vera contains some chemo preventive agents like glycoprotein and polysaccharides which helps the body fight against some type of cancer. These agents induce the immune system to fight against cancer (Adewole, J., 2019). Aloe vera contains aloin (an anthraquinone) is the main component of aloe vera gel that helps to reduce the secretion of VEGF (Vascular endothelial growth factor) in cancer cells. VEGF is the mediator of angiogenesis (development of new blood vessels) of cancer cells (Gulati, P., 2021).

### 7.6 In ear and nose infection:

Powder of aloe vera gel containing leaf can be used in the ear and nose infection along with the turmeric powder. Few drops of this contain can use 3 to 4 time in a day to reduce the infection (Maurya, R. et al., 2019)

### 8. Bioactive component of aloe vera:

Aloe vera contains bioactive components that have medicinal properties, most of the part of this layer made up of water (about 99% part) and other part made up of amino acids, lipids, sterols, vitamins and glucomannans. Aloe gel contains 55% polysaccharides, 17% sugar, 16% minerals, 7% proteins, 4% lipids and 1% phenolic compounds. The middle layer is made up of latex; it contains yellow fluid that is made up of anthraquinones and glycosides. The outer layer is made up of 15-20 cells, and some part of this layer is composed of xylem and phloem, vascular bundles. Xylem and phloem transport the water and minerals from the roots to the other parts of the plant (Rahman, S. et al., 2017)

Aloe vera contains more than 70 bioactive components. Some are as follows.

Serial number	Types	Compounds
1	Anthraquinones/Anthrones	Aloe emodin, aloetic acid, anthranol, Aloen A and B, ester of cinnamic acid
2	Carbohydrate	acetylated mannan, acetylated glucomannan, pectic substance, arabinogalactan, galactoglucoarbinomannan
3	Enzymes	Alkaline phosphate, amylase, carboxypeptidase, carboxylase, catalase, cyclooxygenase, lipase.
4	Inorganic compounds	Calcium, chlorine, phosphorous, chromium, copper, magnesium, iron, potassium, sodium, zinc.
5	Non essential and essential amino acid	Alanine, arginine, aspartic acid, glutamic acid, glutamic acid, listidine, hydroxyproline, isoleucin, leucin, methionine, proline, threonin, tyrosin, valine, phenylalanine.
6	Protein	Lectine, lectines like substances
7	Saccharides	Mannose, glucose, L-rhamnose, aldopentose

### 9. Antimicrobial activity of aloe vera:

Aloe vera has the anthraquinones which prohibit the protein synthesis in the bacteria by stopping the translation process. At the time there were many different types of studies conducted to show the antimicrobial activity of aloe vera and its components. But the main aim of these studies is to evaluate the antibacterial activity of aloe vera (Gulati, P., 2021).

The most common bacteria that are used for these studies are staphylococcus aureus and pseudomonas aeruginosa, because they are most commonly found on the upper surface of skin and sometimes cause skin infection when they come in contact with blood. Aloe vera contain aloe emodin which help to inhibit the growth of staphylococcus aureus by prohibit the formation of biofilm and extra cellular protein synthesis (Sanchez, M., et al 2020) . Commonly disk diffusion methods are used for the determination of antimicrobial activity of aloe vera gel. aloe vera can shows antimicrobial activity against skin infection causing bacteria , gram positive bacteria like staphylococcus aureus and staphylococcus epidermidis and some gram negative bacteria like E.coli, klebsiella pneumonia, pseudomonas vulgaris and pseudomonas aeruginosa. Some of these bacteria are antibiotic resistant but aloe vera gel can be used to inhibit the growth of these types of bacteria (Adewole, J., 2019) . High concentration of aloe vera gel can also inhibit the growth of oral pathogens or to destroy the oral pathogens high concentration of aloe vera gel are required. aloe vera gel can also be used as food preservatives, to preserve the food from microbial contamination (Adewole, J., 2019) .

Aloe vera contain bioactive components that make it alternative agents to control the fungal disease of row fruits and vegetables, aloe vera inhibit the 20% fungus that cause fruits and vegetable disease for eg; penicillium, alternaria, and botrytis spores. Aloe vera can also inhibit 38% growth of Fusarium , Colletotrichum and Rhizoctonia. aloe vera gel can also inhibit the plant disease causing fungus eg; Fusarium oxysporum, Colletotrichum gloeosporioides, Alternaria alternate, Bipolaris spicifera, Curvularia hawaiiensis but all of these aloe vera gel most effective against Fusarium oxysporum (Salehi, B., et al 2018).

Aloe vera gel contains components that have antiviral activities like lectin that inhibit the protein synthesis of cytomegalovirus. it is also inhibit the growth of herpes simplex type I and type II virus. It can also inhibit the growth of Influenza virus, varicella zoster and pseudoRabies virus by disturbing core envelopes of these viruses (Guo, X. & Mei, N., 2018).

### 10. Conclusion :

This review article shows the common properties of aloe vera , it's antimicrobial activity and medicinal properties of aloe vera . Aloe vera is a natural product with no side effects. It has been well documented that aloe vera contain proteins , vitamins, hormones , fatty acids , anthraquinones , and antioxidants, which medicinal have as well as therapeutic properties. So it is pre requisite to pay more attention towards the natural , easily available natural herbs , which have potential to cure the various illnesses . aloe vera is one of the most traditionally used herb , thus it is essential to explore the therapeutic value of its components which have main role in providing treatment against various seivour diseases.

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