

THE THERAPEUTIC PROPERTIES AND APPLICATIONS OF THE ALOE VERA PLANT

Note: This is a summary article on the following original article

Maan, A. A., Nazir, A., Khan, M. K. I., Ahmad, T., Zia, R., Murid, M., Abrar, M. (2018) The therapeutic properties and applications of Aloe vera: A review. Journal of Herbal Medicine 12, 1-10. <https://doi.org/10.1016/j.hermed.2018.01.002>

BIOINGENE.COM/PSJ

Article No. : D15MFY21R48

Article type: Summary

Received: 15 June 2021

Accepted: 10 July 2021

Online: 20 July 2021

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INTRODUCTION

Aloe vera is a short stem, perennial, and drought-resistant plant. More than 400 species of aloe vera are grown worldwide, especially in hot and dry areas.

A large number of therapeutic properties of *Aloe vera* have been reported, including antibacterial, antiviral, antifungal, anti-inflammatory, antioxidants, immunomodulatory, wound and sunburn healing, hypoglycemic, anticancer, anti-ulcer, antidiabetic, gastrointestinal, and protective properties. These beneficial therapeutic properties of *Aloe vera* are applied for several commercial applications.

Different parts of the plant contain approximately 75 types of different essential nutrients, and 200 active compounds including amino acids, enzymes, sugars, vitamins, saponins, minerals, lignin, anthraquinones, and salicylic acid. Volatile compounds and ascorbic acid are present in the flowers while polysaccharides, pectin, lignin, cellulose, and hemicellulose are present in the rind. Similarly, the leaves are the major source of different organic acids, enzymes, phenolic compounds, minerals, and vitamins.

BIOCHEMICAL COMPOSITION OF ALOE VERA

Aloe vera contains 99-99.5% water and 0.5-1% solid contents with high energy biomolecules like fat, vitamins, organic acids, phenolic compounds, simple and complex polysaccharides (Figure 1). *Aloe vera* leaves consist of three layers i.e. gel, latex, and rind. Gel is the inner layer containing transparent, soft, smooth, clear, moist, and lubricating jelly-like tissues having large parenchyma cells. It contains water (99%), glucomannans, amino acids, lipids, sterols, and vitamins. Latex is the middle layer having glycosides, bitter yellow sap, and anthraquinones. Rind is the outer thick layer consisting of (15-20) cells which give protection to the gel matrix and help in the synthesis of carbohydrates and proteins.

Gel and rind constitute the total major proportion of leaf weight (70-80% and 20-30% respectively). On a dry matter basis 55% polysaccharides, 17% sugars, 16% minerals, 7% proteins, 4% lipids, 1% phenolic compounds, and a variety of vitamins including vitamin (A, C, E, B1, B2, B12, niacin, choline, and folic acid). Carbohydrates consist of mono and polysaccharides including rhamnose, galactose, arabinose, glucomannans, and xylose. Enzymes present in *Aloe vera* gel include oxidase, cellulase, lipase, catalase, amylase, and carboxypeptidase. Chloride and Potassium are present in excessive amounts whereas sodium, calcium, chromium, magnesium, copper, zinc, and iron are present in fewer amounts. Anthraquinones and their derivative compounds in *Aloe Vera* have potential as antimicrobial and analgesic agents. Twenty amino acids are present in *Aloe vera* gel among which seven are essential amino acids.

components as well as their mutual interactions. It is especially applied in the cosmetic and pharmaceutical industry. The semi-viscous nature of *Aloe vera* gel also shows elastic behavior which can produce a network of polymeric fibrous chains. This semi-viscous material is essential for many formulations (e.g. creams, lotions, and foods) depending upon the combination of individual

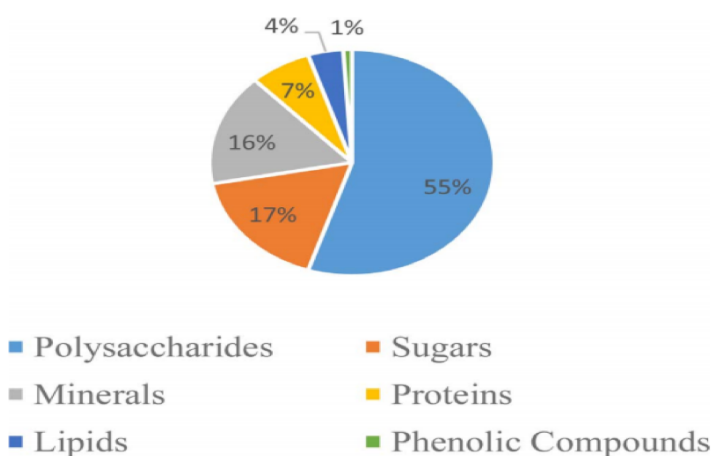


Figure 1. Chemical composition of *Aloe vera* gel on a dry matter basis

APPLICATIONS OF ALOE VERA IN PHARMACEUTICAL

Pharmaceutical applications increased the importance of *Aloe vera* due to its medicinal properties, and it has been used in the synthesis of pharmaceutical products including ointments, capsules, and tablets.

Aloe vera in wound healing

Different components of *Aloe vera* have been found effective in wound healing and in the integrity of injured tissues. Amino acids that are essential in the wound healing process are present in *Aloe vera*. It also contains many inorganic electrolytes like iron, potassium, magnesium, calcium, chromium, copper,

sodium, and zinc that play a key role in the wound healing process. They act as regulators for antibody production from the body and start wound healing by releasing growth factors. Many studies have shown fast healing of wounds with Aloe vera treatment.

Aloe vera as an anti-inflammatory and anti-ulcer

Aloe gel has anti-inflammatory and anti-ulcer properties, healing effects, mucus layer stimulation, and regulation of gastric secretion and helpful in decreasing ulcer size, erythema and exudation. An 80% concentration of Aloe vera can be successfully used for the treatment of skin ulcers including mouth ulcers, cold sores, and leg ulcers and effective against severe inflammation caused by prostaglandin synthesis, infiltration of leukocytes while less effective against inflammation caused by allergic agents. Intake of oral Aloe vera gel (2%) has been reported to be effective in reducing severe pain and wound size in patients with stomatitis.

Aloe vera as an anticancer

Glycoproteins and carbohydrates present in Aloe vera make it a valuable chemo-preventive agent that is useful against various types of cancers. These chemo-protective agents boost the immune system to fight against cancer. Barbaloin, aloe-sin, and aloe-emodin extracted from *Aloe vera* have shown cytotoxicity against acute myeloid leukemia and acute lymphocytic leukemia cancerous cells.

Aloe vera as an antidiabetic

Antidiabetic effects of Aloe vera gel is an effective antihyperglycemic agent against type 2 diabetes. It lowers blood glucose level without altering the normal blood lipid level and liver/kidney function. It has been identified that blood glucose level is lowered due to its increased metabolism.

Aloe vera as an antioxidant

Different antioxidants such as α -tocopherol, ascorbic acid, flavonoids, carotenoids, tannins, vitamin C and vitamin E are present in Aloe vera. It effectively reduced blood triglycerides level (25.2%), cholesterol level (15.4%), and LDL cholesterol (18.9%).

Aloe vera used as a laxative and viral disease protectant

Aloe vera gel has the potential to enhance the absorption of drugs with low bioavailability. It also has laxative compounds and is traditionally used for the treatment of constipation.

Aloe vera as an antimicrobial agent

Antimicrobial activity of *Aloe vera* substance having the ability to inhibit or delay the growth of microbes including bacteria, fungi, and viruses. Aloe gel can effectively inhibit the growth of food-borne spoilage and pathogenic microorganisms including *Salmonella*, *Streptococcus*, *Escherichia coli*, *Aspergillus Niger*, *Staphylococcus aureus*, and *Candida*, etc.

Aloe vera as an antiviral

Genital herpes (caused by Herpes Simplex Virus) and HIV infections (caused by Human immunodeficiency virus) are one of the most common sexually transmitted diseases and can be treated with aloe vera compounds. Polysaccharides and acemannans present in *Aloe vera* are effective against HIV viral infections.

ALOE VERA USE IN THE FOOD INDUSTRY

Aloe vera in the food industry is used as a dietary supplement and functional ingredient in many foods products including beverages, ice creams, yogurt, and milk, etc.

ALOE VERA USE IN THE COSMETIC INDUSTRY

Aloe gel is widely used in the cosmetic industry, where it has become an important selling ingredient. It is used as a base material for different formulations including moisturizers and sun protection face lotions. Aloe vera used as a humectant in skin care product preparations gives a moisturizing and soothing effects in shampoos, soaps, cleansers, moisturizing creams, and Ayurvedic medicines to heal chronic skin diseases like psoriasis, acne, and eczema.