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A Review: Synthesis, Characterization and Biological Activities of *Aloe Vera*

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ABSTRACT

Phytochemicals are the natural bioactive compounds found in different parts of a plant namely fruits, flower, stem, leaf, roots. For various medicines Aloe Vera plants are believed to be an important source and this medicine are effective in the therapy of various diseases and thus are commonly used as a therapy against illnesses. Its leaves have a characteristic bitter taste and are used as an alternative in gastritis, arthritis, eye disease, tumor, asthma, jaundice. Pharmacologically it is regarded as an immunity booster and works as a detoxifying agent. The gel extracted from the plant is used in medical, cosmetic and nutraceutical applications. This review paper makes an attempt to revisit the history, constituents and various medicinal application of Aloe Vera in recent studies and has revolutionized our understanding of it in industries.

Keywords: *Aloe Vera*; History; Polysaccharide; Mannan; Applications

INTRODUCTION

Aloe Vera is a member of family Asphodelaceae, a long-lasting plant with drought resistant property. Aloe, the name came from the Arabic word "alloeh" or "halal". Traditionally it has role in the traditional medicines like ayurveda, unani and homeopathy. *Aloe barbadensis* miller, is one of the species of the plant having semi tropical nature. The Sanskrit name of the plant is "Ghee Kunwar". The plant has blunted pointed and trimmed leaves and is found along the coastal areas of South India. They actually grow in variety of climates from dry to semi-arid and alpine vegetation as well. More than 200 compounds are found from this plant and about 75 of which have a high biological activity rate. The plant has a number of uses from food preservatives to medicine, ointments, lotions, jellies and creams. Studies have revealed that the plant possess various pharma activities such as anticancer, antioxidant, antidiabetic, immunomodulatory and many more other [1-3].

LITERATURE REVIEW

The *Aloe Vera* plant widely known as Barbados or Curaco Aloe has versatile uses in the field of medicines, health and beauty. It is regarded as one of the best products for skin care and suits all skin types. In Egypt, around 6,000 years ago first invention was done on this plant and they regarded it as a sacred plant. The juicy part of the plant was considered to have covert to beauty and immortality. In India during 16th century, people become familiar with healing power of the plant. It was known by various names in India such as Kunvar pathu, Ghrit Kumari and was the 16th holy plant. Made up of long and sharp leaves and every single part of the leaf is dividing into two regions, outer green and inner pulpy region. These plants belong to xerophytic category and have long water storage tissues. The uses and research on *Aloe Vera* is best defined by Grindlay and Reynolds in their paper The *Aloe Vera* phenomenon [4,5].

Cultivation

Aloe Vera can survive more than 7 years without water as it takes the water from the dew collected on the leaves surface. The plant grows up to height 1.5 to 2.5 in feet and its leaves are arranged in wheel like manner, long and thick. The two sides of the leaf are covered with thorny tip while the inner substance of the leaf is jelly like bitter in taste. The plant fully matures itself in 3 years and has usually 12-16 leaves on it. It usually flowers from October to January and contains pink flowers. Fruit development occurs during February to April. The market is dominated by USA (65%) while China and India share about 10% each which can further be increased by commercial cultivation.

- **Climate:** It is a cosmopolitan plant however it is preferred to grow on tropical and subtropical parts of the country. Due to its less water requirement, it can easily survive in arid and semi-arid areas.
- **Soil:** The soil should have approximately 60% sand and remaining clay or slit particles so the most ideal soil is sand-loam soil and has pH of around 8.5. The plant has narrow root system therefore it does not penetrate deeply into the soil.
- **Land preparation:** ploughing and laddering are done to make the soil free from weeds and the land is levelled. Along the slope, drainage system is made about 15 ft-20 ft apart.

A variety of products are synthesized with the plant extracts such as *Aloe Vera* gel, juice, cream, tea and sanitizer. Polysaccharides present in the plants pulp shows credits to many medical advantages. These organic molecules integrate progress in healing lesions, fungicide movement, antidiabetic impacts mitigating, anticancer, immune stimulatory and gastro protective properties [6,7].

Composition of plant

Partitioned aloe leaf into two significant parts, in particular the external green skin, including the phloem and xylem part and the inward parenchyma tissue. The leaf inner part is made up of parenchyma tissue or we can say it pulp, refers to the fleshy inner part consisting organelles and cells while the viscous liquid present in the cells is the 'mucilage' or 'gel'. *Aloe Vera* has three basic components which includes cell wall, the degenerate organelles and slimy fluid present inside the cells. The crude pulp has roughly 98.5% water and 99.5% water in adhesive component. Remaining is the mixture of solvent (water) and dissolved fat nutrients, chemicals, polysaccharides, phenols and natural acids. This heterogeneous organization of crude pulp adds to the different exercises related to medicinal uses noticed by the plant products (Figure 1) [8].

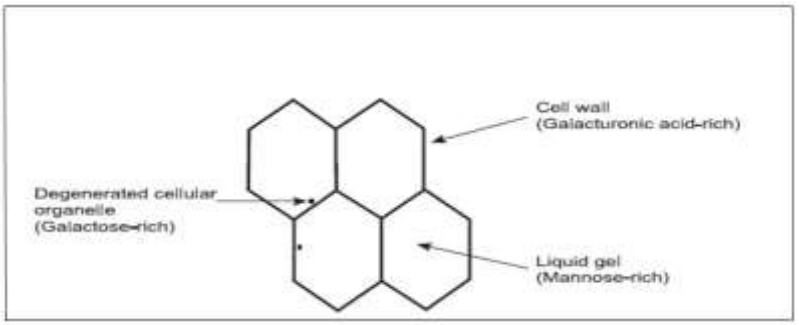

Figure 1: Internal microscopic view of *Aloe Vera*.

Various structures having different mixtures were isolated from the mid parenchymatic tissue part and the secretion coming from the adjacent cells. Exudates of the plant contains 1,8 dihydroxyanthraquinone along its glycosides, predominantly utilized in therapeutic. The pulp various organic molecules such as vitamins, proteins, lipids, enzymes, carbohydrates, amino acids along with inorganic compounds.

Polysaccharide composition

According to literature, the species of the plant which is analyzed decides the chemical composition of that plant. Mc.Analley in 1993 experimented that 60% of the plant is made up of the polysaccharides. Polysaccharides present in *Aloe Vera* are known as Aps which stands for Aloe polysaccharides. A discovery by Fagerheim, et al., showed glucose-mannose polysaccharides as the most important Ap in the year 1978. In 2013 Campestrini, et al., showed that acetyl groups on 4-linked-β-D-glucomannan constitute vital part of Aps which was located in the protoplast of parenchymatic cells as result of his experimental studies of *Aloe Vera*. Femmina, et al., experimented and detected that mannose and glucose present in cellulose were the two important polysaccharides present in the AIRs (lyophilized aloe fractions) [9].

Mannan composition

Mannan binds with hemicellulose and cellulose of the plant and plays a structural role in it. They also act as a storage organ to store non-starch carbohydrates in seed and vegetative tissues. Although many results are present in literature of polysaccharides of aloe plant, the consent among the authors is that the raw content of it which is due to acetylated glucomannan. According to Moreira, et al., acemannan present in the gel extract of plant has mannosyl aceylated resdiues in ratio 1:1(mannose: monomeric-acetyl) and are present as the side chains.

Applications

Aloe Vera being a plant of versatile uses have so many applications in the literature. In the ancient times it was used to cure constipation and to heal lesions in skin.

Anti-microbial activity: Some microorganisms are sensitive to various extracts of plants and a different component shows unique anti-microbial effects. The phytochemical constituent anthraquinones isolated the plant have shown great response to microbes. Methanolic extract produced by its leaf greatly inhibits the microbes like *Staphylococcus aureus* and *Escherichia coli*. Cellini L, et al., reported in his paper that *Aloe Vera* extract is useful against *Heliobacter pylori* infection.

Anti-viral activity: Lectin extracted from the leaves prevents the spread of Cytomegalovirus. Zandi K, et al., observed aloe-vera is effective towards the type I and type II Herpes Simplex virus as it somewhat interrupts the outer covering of the virus. He also mentioned in his studies the intake of the plant boosts the immunity by increasing glycoprotein present in immune cells and thus is beneficial to viral infections such as HIV.

Anti-cancer activity: The two components that have anticancer effects include glycoproteins and polysaccharides. Lin, et al. worked on the plants phytochemical constituents and concluded that they are responsible for the reduction in the production of carcinoma cells. Aloin is regarded as a unique anticancer agent in number of cancer cells. Aloe emodin inhibits the breast cancer and also retards the tumor cell such as hepatoma, lung carcinoma and leukemia cell by blocking signal transducers and transcription activators.

Anti-oxidant activity: Choi and Chung in 2003 discovered that *Aloe Vera* has many antioxidants like carotenoids, vitamin-C (ascorbic acid), alpha-tocopherol, tannins and flavonoids. Earlier in 1997 Borek has revealed that a great role in cancer formation is played by the reactive oxygen species.

Thus, these anti-oxidants contribute great to the regulation or neutralization of reactive oxygen species present in the body. Kang, et al., in 2014 explained the deaths of cell in zebrafish model and the effect of aloe polysaccharides against oxidative stress, as it reduces its level and there is decrease in the cell death.

Skin protection activity: The gel provides moisture to the parched skin and reduces skin redness (erythema) according to West and Zhu. The constituent responsible for this moisturizing effect in *Aloe Vera* gel is aloe mucopolysaccharides which binds water with the skin as a result hydrates it. Dal Belo, et al., had studied the nourishing nature of cosmetics with diverse amounts of *Aloe Vera*, it was proved that those products which have highest concentrations of the lyophilized gel increases the water content in stratum corneum by applying only once. Thus, it was proposed that these products improve the water holding capacity of skin and makes the skin moist.

Hepatoprotective activity: Histopathological studies explain the curative property of *A. vera* gel against liver damage. Chandan, et al., in 2007 stated that *A. vera* gel is having hepatoprotective property against the carbon tetrachloride. The water extract present in the *A. vera* gel has a great curative efficacy against the CCl_4. Kumar M, et al., stated in his paper the liver protection effects of the plant and various pharmacological roles [10].

CONCLUSION

Majority of the biological activity of the plant is due the polysaccharides composition found in the leaf. Gel content of the plant has versatile use as topical, dermatological, food, surgical wound applications, oral applications and many more. Recent studies have done a drastic change in the uses of *Aloe Vera*. Technological developments in analytical chemistry have made it lot easy to describe the chemical constituents present in the gel of the leaf and we expect more information regarding the plant in near future.

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