

Research Article

Processing, Food Applications and Safety of Aloe Vera Products

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Aloe vera is a well-known medicinal plant which thrives in varied agro-climates. The chemistry of the plant reveals the presence of diverse biologically active compounds associated with curing different ailments such as wound, inflammations, cancer, diabetes, ulcer, microbial diseases, skin diseases, acquired immune deficiency syndrome (AIDS), liver problems, dental problems, cardiovascular problems, hyperlipidemia and others. Aloe vera gel is extracted from its leaves and appropriate processing techniques are needed for stabilization as well as preparation of the end products. Unfortunately, because of improper processing procedures many of these so-called aloe products contain very little or virtually no active ingredients namely, mucopolysaccharides. In view of known wide spectrum of biological activities possessed by the leaves of aloe vera plant and its wide spread use, it has become imperative that the leaf must be processed with the aim of retaining essential bioactive components up to maximum possible limit or as much as contained in fresh leaf. The industries involved in processing of aloe vera need Government surveillance to ensure that the aloe vera products have beneficial bio-active chemicals as per claims of the manufacturers.

Regulatory bodies also need to look into the safety and toxicological aspects of aloe vera products for food applications. The claims made for medicinal value of aloe products should be supported by authentic and approved clinical trial data. However, approved clinical evidences are available only for lowering LDL, increasing HDL, decreasing blood glucose level, treating genital herpes and psoriasis.

Keywords: Aloe vera, Processing, Medicinal value, Food applications, Safety.

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Introduction

Traditional medicines are the integral part of human civilization to cure various ailments. According to the World Health Organization (WHO), up to 80% of the people of the world are dependent on herbs as traditional remedy to cure various ailments since the beginning of civilization. Natural products act as a leading source for the discovery of new drugs from the origin of Ayurveda. Among the reported medicinal plants, Aloe vera is used as a popular folk medicine throughout the world [1]. Aloe was originated in tropical Africa and it is now cultivated in warm climatic areas of Asia, Europe and America. Presently, the use of aloe vera has gained popularity because of herbal movement initiated by naturopaths, yog gurus, alternative medicine promoters and holistic healers. Most of the biological activities are contributed by the wide varieties of compounds present in the sap and gel of Aloe vera. Phytochemistry of aloe vera gel has revealed the presence of more than 200 bioactive chemicals.

The moisture content of raw aloe vera leaf is recorded to be around 98.5% - 99.5%. Of the residual dry matter consists of polysaccharides (55%), sugars (17%), minerals (16%), proteins (7%), lipids (4%) and phenolic compounds (1%) (**Figure 1**).

Processing of Aloe Vera

The general steps involved in the processing of aloe vera are explained in the following paragraphs.

Reception of raw material

The aloe vera leaves after harvesting must be transported in refrigerated vans from field to the processing plant. The leaves should be sound, undamaged, mold free and mature (3–4 years) in order to keep all the active ingredients in full concentration [2]. One important factor affecting the composition of final product is the handling of the leaves after its harvesting because the decomposition of the gel matrix starts just after its cutting due to natural enzymatic

reactions and the activity of bacteria normally present on the leaves. It can adversely affect the quality of the end product. Thus, the freshly removed leaves are refrigerated within 6 h or the leaves are directly fed to processing plant on the farm itself.

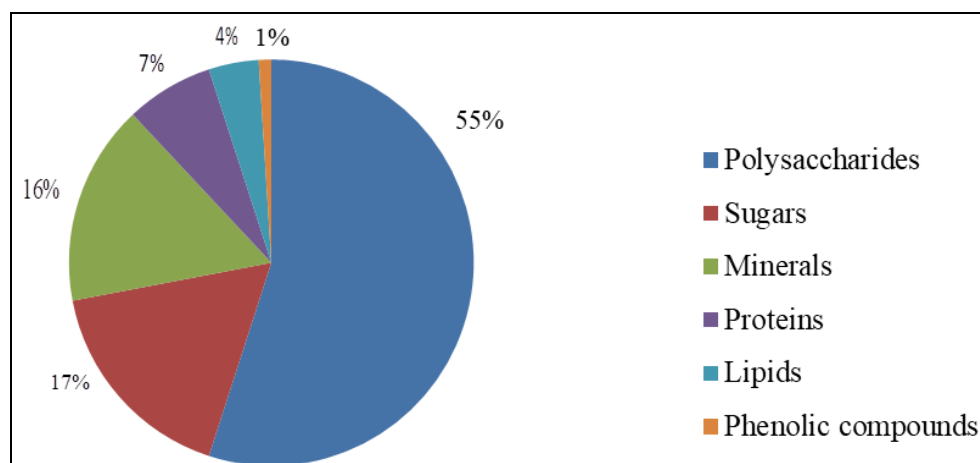


Figure 1. Composition of aloe vera

Filleting

In this process green rind of leaf is removed to extract the parenchymatous tissue called the gel fillet. It is reported that the aloe gel extracted from the leaf had greater stability than the gel left in the leaf. In order to avoid the loss of biological activity filleting operation must be completed within 36 h of harvesting the leaves. The presence of anthraquinones is an important factor leading to non-enzymatic browning in aloe products [3].

Homogenization and enzymatic treatment

It includes crushing or grinding of gel fillet at room temperature (25°C) in commercial high-speed grinder. The crushing or grinding should be completed within 10–20 min in order to avoid the enzymatic browning. Enzymatic treatment of aloe vera gel for a long duration prior to processing is detrimental to polysaccharides. It has been reported that the enzyme treatment at 50 °C and within 20 min did not cause loss of biological activity of polysaccharide in aloe vera gel.

Filtration and deaeration

Fibrous material is removed by this step. This operation influences the stability of aloe vera juice. Poor filtration results in sedimentation of aloe juice on storage. The unpasteurized aloe juice is fortified with vitamin C and citric acid to avoid browning reactions, improve flavor and stabilize the juice. Aim of deaeration is to prevent oxidation of ascorbic acid which eventually improves the flavors of aloe vera juice.

Hot processing and flash cooling

In hot processing, sterilization is achieved by treating the aloe liquid with the activated carbon at high temperature. This step may affect the taste, appearance and the biological activity of aloe gel products. Biological activity of aloe vera gel essentially remains intact when gel is heated at 65 °C for a period less than 15 min. Extended periods or higher temperatures greatly reduce activity levels. After heat treatment, the juice is flash cooled to 5°C or below within 15s to preserve biological activity. High temperature short time treatment (at 85–95 °C for 1–2 min) is an effective method to avoid the off flavor and the loss of biological activity of aloe vera gel. Physicochemical modification promoted by heat treatment at different temperature range from 30 to 80 °C on acemannan was evaluated [4].

Cold processing

In the cold processing technique, the entire processing steps are accomplished without the application of the heat. The use of enzymes, like glucose oxidase and catalase to inhibit the growth of aerobic organisms within aloe vera gel and

thereby sterilizing it was reported [5]. Other sterilization steps reported in the cold processing include exposing the gel to ultraviolet light followed by micron filtration.

Addition of preservatives and stabilizers

In all the processing techniques, preservation can be achieved by the addition of chemical preservatives and other additives. The use of sodium benzoate, potassium sorbate, citric acid and Vitamin E in synergism has been reported by some researchers. Stabilizing agent is added in aloe products to prevent sedimentation of juice upon storage. Some scientists proposed that algal polysaccharides or xanthan gum could stabilize the network structure of fresh aloe vera polysaccharide [6].

Storage

Aloe vera juice is packed in amber colored glass bottles to avoid the effect of light on the sensitive bioactive agents. Relative humidity and temperature are two most important environmental parameters that affect product quality.

Aloe juice and its food applications

The aloe vera juice finds wide application in food products like production of ready to serve drink, health drink, soft drink, laxative drink, aloe vera lemon juice, sherbet, aloe sports drink with electrolyte, diet drink with soluble fiber, hangover drink with B vitamin, amino acids and acetaminophen, healthy vegetable juice mix, tropical fruit juice with aloe vera, aloe vera yoghurts, aloe vera mix for whiskey and white bread, cucumber juice with aloe vera.

Aloe concentrate and its food applications

The aloe juice can be concentrated under vacuum without the loss of biological activity. The concentration operation must be conducted under 125 mm Hg vacuum at temperature below 50 °C and must not exceed 2 min as higher vacuum and temperature will cause loss of effectiveness of bioactive constituents. Concentration is carried out to get aloe vera concentrate of desired consistency to suit various food applications i.e. squash, jam and jellies. The concentrate of aloe can also be mixed with tea, water or juice.

Aloe powder and its food applications

In dehydration method the pure intact aloe vera gel fillets are first washed to remove traces of aloin. Then the fillets are placed into a humidity chamber where desired level of relative humidity and temperature are maintained. Here hot air is passed over the fillets to dry them. This material is then ground to powder and packed.

Qmatrix drying is a novel proprietary method of dehydration of aloe vera enabling the dehydration of aloe while maintaining its integrity with respect to flavor, colour and bioactivity [7]. Aloe vera powder can be used in curd, lassi, ice-creams, etc. Aloe powder has also been used in the preparation of yoghurts.

Safety aspects of aloe vera products

Scientific community is divided into two groups regarding safety of aloe vera products. One group advocates that the aloe vera is quite safe for human consumption. While the other group warns to use it with caution and utmost care to avoid contamination of aloin from the yellow exudates, as aloin is reported as DNA damaging and cancer causing [8]. On the contrary scientists have reported that anthraquinones present in aloe vera leaf, including aloin, are beneficial in a number of ways when used in small quantity, though the small quantity is not well defined.

It is reported that aloe vera gel is safe for external use, allergies are rare and adverse reactions with other medications have not been reported. Aloe should not be used internally during pregnancy, lactation or childhood and by persons suffering from abdominal pain, appendicitis or intestinal obstruction.

Conclusion

Processing of Aloe vera leaf gel has revealed that aloe vera as a highly potential functional and valuable ingredient that exhibits relatively impressive biological functions of great interest in cosmetic, pharmaceutical and food industries. However, it is recommended that aloe products should not be used internally during pregnancy or lactation period by women and by persons suffering from abdominal pain, appendicitis or intestinal obstruction. The aloe vera industry is flourishing worldwide and the gel is used in many products including fresh gel, juice and other

formulations. However, the fast-expanding aloe vera industry urgently needs reliable testing protocols to assess the quality and quantity of bioactive chemicals present in the final products. It also revealed the present processing technologies viz., gel stabilization technique, biological activity of aloe leaf gel and the effect of heat treatment on various constituents of gel. The process technologies like desiccant dehydration of aloe cubes, Qmatrix process, low temperature short time heat treatment process, active aloe process, Time Temperature and Sanitation Process, Total Process Aloe vera are the potential innovative process technologies.

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