

Aloe vera- Processing and Gel extraction techniques

PJ Nivethaa¹ and G. Sidhdharth²

^{1*}PG Scholar, Department of Vegetable science, College of Horticulture, Mudigere, UAHS - Karnataka

²PG Scholar, Department of Vegetable Science, Horticultural College and Research Institute, Periyakulam, TNAU – Tamilnadu

ARTICLE ID: 47

Abstract

Aloe vera gel is the mucilaginous jelly obtained from parenchyma cells of the Aloe vera plant. After harvesting of aloe vera leaves they are crushed, grinded, filtered and stabilised to get aloe gel. Green fillet is obtained by removing the rind and thus the fillet is homogenised by crushing and grinding. Homogenized green fillet is centrifuged at 10,000 rpm to extract the gel which is to be filtered and purified.

Introduction

Aloe vera is a plant species with several medicinal and nutritional values. The plant has green colored, gel-filled leaves. Many people use the gel to treat burns and wounds, and it is available as a juice. Aloe vera grows abundantly in tropical climates and has been used for centuries as a medicinal plant. Aloe vera leaves contain phytochemicals, under study for possible bioactivity, such as acetylated mannans, polymannans, anthraquinone C-glycosides, anthrones, and other anthraquinones, such as emodin and various lectins.

Aloe vera - Description of Leaves and Harvesting

Aloe vera is a stemless or very short-stemmed plant growing to 60 - 100 cm tall, spreading by offsets. The leaves are thick and fleshy, green to grey-green, with some varieties showing white flecks on their upper and lower stem surfaces. The margin of the leaf is serrated and has small white teeth.



Harvesting of leaves starts after 7 to 8 months of planting. Sharp knife is used for Aloe vera harvesting. Care has to be taken to decrease the loss of juice from the cut portion. If harvesting is done once in a year, October – November are the best stage for harvesting. The second year gives maximum yield and for about 4 to 5 years good yield could be harvested.

Aloe vera Gel

The production process of aloe products involve crushing, grinding or pressing of the entire leaf of the Aloe vera plant to produce an Aloe vera juice, followed by various steps of filtration and stabilization of the juice. The resulting solution is then incorporated in or mixed with other solutions or agents to produce a pharmaceutical, cosmetic or food product.

Potential use of aloe products often involves some type of processing, e.g. heating, dehydration and grinding. Processing may cause irreversible modifications to the polysaccharides, affecting their original structure which may promote important changes in the proposed physiological and pharmaceutical properties of these constituents.

Uses of Aloe vera Gel

The aloe vera plant is a succulent that stores water in its leaves in the form of a gel. This gel is highly moisturizing and great for sunburns, bug bites, minor cuts or wounds, and other skin problems. The gel contained in Aloe vera leaves reportedly comprises 75 nutrient, 200 active compounds, 20 minerals, 18 amino acids and 12 vitamins. It has been utilized as a resource of functional food, especially for the preparation of health drinks which contain Aloe vera gel and which have no laxative effects. It is also used in other food products, for example, milk, ice cream confectionery etc. Aloe vera gel is also used as flavoring component and preservative in some foods. (Kulveer Singh Ahlawat and Bhupender Singh Khatkar, 2011)

Storage of Aloe Gel

Prepared aloe vera gel without added vitamin C or E can be stored in the refrigerator in an airtight container for up to 1 week. However, adding one or both of the vitamins significantly increases the shelf life to up to 2 months in the refrigerator.

Processing parameters of Aloe vera

Time, temperature and sanitation (TTS) are necessary to preserve these biological activities. The TTS Aloe Process not only preserves the natural biological activities of Aloe vera but also enhances the physical stability of the finished products.

Methods of Aloe vera Leaf Processing

1. Leaf processing method

Aloe vera leaf juice is obtained by grinding or macerating the entire aloe vera leaf followed by purification to remove the phenolic compounds found in the latex. This purification step is usually accomplished via activated carbon filtration in a process known as decolorization.

2. Inner leaf processing method

Aloe vera leaf juice is obtained by stripping away the outer leaf rind, rinsing or washing away the latex, and processing the remaining inner leaf material. Decolorization is also sometimes employed with this method.



Basic methods of Aloe vera Leaf Processing

1. Traditional hand filleted Aloe processing
2. Whole leaf Aloe vera processing
3. Total process Aloe vera processing

1. Traditional hand filleted Aloe processing

In this process lower one inch of the leaf base, the tapering point (2–4 in.) of the leaf top, the short sharp spines located along the leaf edge as well as the top and bottom rind is removed with a sharp knife along with the rind parts to which several mucilages remains attached. The fillet and the mucilage are gathered from the aloe leaf for further processing. The highest concentrations of the potentially helpful aloe constituents are found in mucilage as this layer represents the place of synthesis of the beneficial constituents. The material of the mucilage layer, subsequent to their synthesis, is spreading to the storage cells (cellulose-reinforced hexagons) of the fillet. The Aloe vera gel fillet is washed with deionized water and move to the pulper. The pulper is fitted with a refrigerated system that keeps the temperature of the extracted juice lower to check decomposition. The aloe vera juice is conveyed to a holding tank and kept for 24 hours to decant. The holding tank is refrigerated for preserving the bioactivity of sensitive molecules of aloe vera.

2. Whole leaf Aloe vera processing

This whole leaf process employed in the making of aloe juice allows the cellulose (skin) to be dissolved, as well as measurable amounts of aloin is to be removed. This total procedure is done entirely by a cold process treatment. Maximum efficiency is thus assured, resulting in a product rich in polysaccharides. In this process, the base and tip are removed and then the leaf is cut into sections and ground into particulate slurry.

3. Total process Aloe vera processing

The Aloe leaves are hand filleted by the labour intensive method which is traditional. Then the green rinds and the mucilage layer from the tabletop are processed by a newly developed propriety methodology. A combination of the products produced by these two procedures produces an aloe product called Total Process Aloe, which contains an enviably high concentration of desirable constituents, which are virtually free from undesirable laxative anthraquinones. (Chandegara, V,K, and Varshney,A,K, 2013)

Processing of Aloe vera

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.

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. The freshly removed leaves are refrigerated within 6 h or the leaves are directly fed to processing plant on the farm itself.

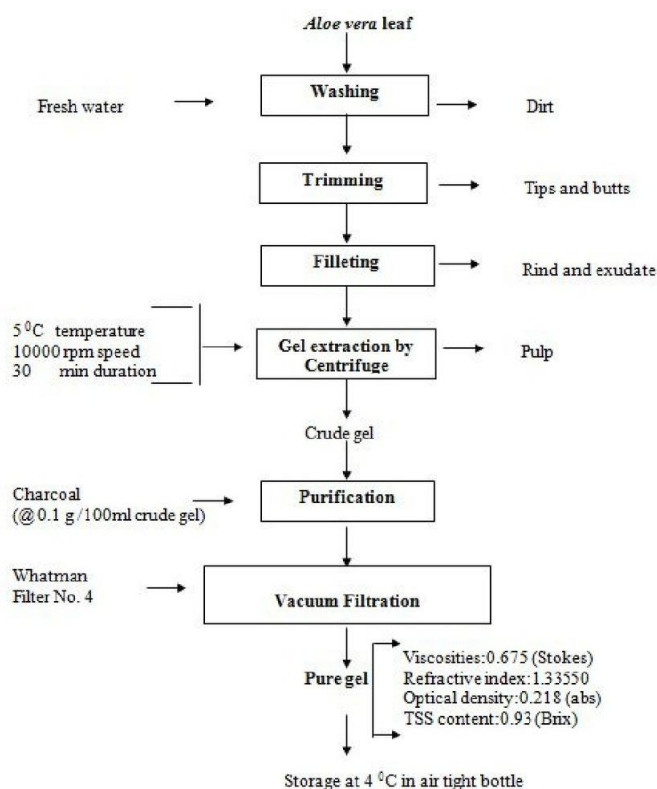
Filleting : Green rind of leaf is removed to extract the parenchymatous tissue called the gel fillet. Aloe gel extracted from the leaf had greater stability than the gel left in the leaf. The presence of anthraquinones is an important factor leading to non enzymatic browning in aloe products. Homogenization 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. Fibrous material is then removed. 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. Then it is processed either by Hot Processing or Cold Processing. (Ramachandra,C,T, and Srinivasa Rao,P, 2008)

Heat processing: Sterilization is achieved by subjecting the aloe liquid obtained from the activated carbon treatment to pasteurization at high temperature. The biological activity of Aloe vera gel essentially remains intact when the gel is heated at 65°C for periods less than 15 min.

Cold Processing: The entire processing steps are accomplished without the application of heat. The enzymes, like glucose oxidase and catalase were used to inhibit the growth of aerobic organisms within Aloe vera gel and, thereby, sterilize it. Other sterilization steps reported in the cold processing includes exposing the gel to ultraviolet light, followed by a micron filtration.

Preservatives like sodium benzoate, potassium sorbate, citric acid and Vitamin E are to be added. Stabilizing agent is added in aloe products to prevent sedimentation of juice upon storage. Aloe vera gel was mixed with sulphited polysaccharides isolated from the red micro algae, guar gum and xantham gum.

Gel extraction process from Aloe vera pulp



Gel stabilization

The gel extraction from Aloe vera leaves, had been carried out by removing of its exudates and its mucilage was scraped out with blunt edged knife. This mucilage was stirred vigorously in a blender to make it uniform. This solution was strained through a muslin cloth and filtered. This uniform solution was extracted for cold- extracted gel (CEG) and hot extracted gel (HEG).

Cold extracted gel (CEG): This solution was acidified with Hydro chloric acid (HCL) having pH 3.50 and the crude gel were precipitated out from the extract by adding slowly 95 % alcohol while stirring. The gel was obtained by centrifugation.

Hot extracted gel (HEG): Material left after passing the blended solution through muslin cloth, was treated repeatedly with hot water until the complete extractions of gel was affected.

Gel Stabilisation Technique

When exposed to air, the gel rapidly oxidizes, decomposes and loses much of its biological activities. The entire process involves washing the freshly harvested Aloe vera leaves in a suitable bactericide, followed by processing of the leaves to mechanically separate the gel matrix from the outer cortex. The separation of the gel from the leaf could be facilitated by the addition of cellulose dissolving compounds, e.g., cellulose. Thus, the aloe liquid obtained is treated with activated carbon to decolorize the liquid and remove aloin and anthraquinones, which have laxative effects. The resultant liquid is then subjected to various steps of filtration, sterilization and stabilization. The stabilized liquid, thus, obtained could be concentrated to reduce the amount of water or, alternatively, almost all of the water removed to yield a powder. In all these processing techniques, stabilization can be achieved by the addition of preservatives and other additives. Sodium benzoate, potassium sorbate, citric acid, vitamin E are to be used.

Conclusion

The global Aloe Vera product is estimated at \$ 125 million and the value of its finished products is over \$ 110 billion. Aloe Vera has been mentioned several times in the sacred scriptures. It is believed to have been used for the preservation of the body of the Jesus Christ. It is called as the plant of immortality. It is also mentioned in the holy book of Bible. It has been used by the tribal people as a medicine for the century

References

- Ramachandra C T and Srinivasa Rao P, 2008. Processing of Aloe Vera Leaf Gel. *American Journal of Agricultural and Biological Sciences* 3 (2): 502-510.
- Kulveer Singh Ahlawat, & Bhupender Singh Khatkar, 2011. Processing, food applications and safety of aloe vera products. *J Food Sci Technol* 48(5):525–533.
- Chandegara, V, K, and Varshney, A, K, 2013. Aloe vera L. processing and products. 3(4):492-506.