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## Application of *Aloe vera* for the development of functional foods

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### Abstract

In recent days health related problems are arises globally in all age groups due to bad life style and food habits. *Aloe vera* is recommended as herbal panacea for the management of different diseases. It is a rich source of vitamins, minerals, phytochemicals, and hormones which make it therapeutically important. It contain sugar like acemannan, glucose and polysaccharides of mannose. It is well introduced for its functional properties and is loaded with lots of health benefits like wound healing, anti-inflammatory, gastro protective, anti-microbial etc. Foods are the most common source by which the bioactive components of *Aloe vera* can rich inside the body and stimulate immunity. Therefore in present it has high demand in the formulation of dairy and confectionary products to take benefit of its functional properties. The unique properties of *Aloe vera* gel i. e. color less and watery jelly like texture makes it easy to blend in different formulations. All these beneficial properties of *Aloe vera* increase its industrial importance in pharma, cosmetics and food. However, aloin and aloe in Aloe gel gives bitter test and responsible for health issues. The bitter after taste make it unsuitable for raw consumption. Therefore it required proper processing and value addition to make it suitable for consumption by all age groups. Hence are converted into the form of *Aloe vera* gel, dairy and fruit based products. These are the most commonly consumable food products through which the functional properties of *Aloe vera* can reach all age groups.

**Keywords:** *Aloe vera*, functional food, Jam and jelly, yoghurt

### 1. Introduction

*Aloe vera* is a herbal plant, belong to family *Aloeaceae* (Farnsworth *et al.* 1999) [1]. It is important in herbal medicine and has been used in traditional medicines from thousands years ago in the treatment of the various diseases. The term *Aloe vera* is come from the Arabic word "Alloeh" which means "shining bitter substance" and "vera" means "true" in the Latin. 2000 years back the Greek scientists observed *Aloe vera* as the universal solution, and the peoples of Egypt called aloe as "the plant of endurance" (Farnsworth *et al.* 1999; Ahlawat and Khatkar, 2011; Atherton, 1998) [1, 2]. It grows mostly in the dry regions of Asia, Europe, and America. Although the plant of *Aloe vera* is an inhabitant to Africa's native Northern part, but it has spread more rapidly across the whole world because of its only easy cultivation process. In India this plant is found habitually in all regions such as Rajasthan, Gujarat, and Maharashtra etc. It is best known for two diverse preparations, the clear mucilaginous gel largely used for the minor burns treatment, particularly sunburns, and the bulky sap of the aloevera leaves which has strong laxative effects (Marshall, 1990) [3]. The clear gel of *Aloe Vera* is used for the management of diabetes and a range of gastrointestinal diseases (Ghannam *et al.*, 1986) [20]. It is a natural product widely used in the cosmetic industries for making of different product with a wide application such as face gel, night cream, sun cream, lotions etc. (Shelton, 1991) [28]. It is important to process the aloevera leaf in such a manner by which maximum of the bioactive components can be preserved to take advantages of their health benefits (Chandegara and Varshney, 2013) [5].

### 2. *Aloe vera* gel

The *Aloe vera* is luscious plant usually grow in tropical, warm climatic areas. The aloe gel is flavorless, odorless and clear mucilaginous substances extracted from the fleshy, thick, ragged, green color leaves of *Aloe vera* plant. The freshly harvested, undamaged matured leaves of *Aloe vera* were passed through filleting process to obtain gel fillets within 36 hours of harvesting to preserve its bioactive components (Grindlay and Reynolds, 1986; Robert, 1997; Lawless and Allen 2000) [8, 9, 7]. The fillets obtained are then homogenized and treated with

enzyme to improve its stability (Ahlawat and Khatkar, 2011) [2]. Aloe gel is presently used for manufacturing of different milk and fruit based functional foods like ice cream, yoghurt, probiotic dahi, jam, jelly, candy, ready to serve beverage etc. (Panesar, and Shinde, 2012; Sasi *et al.*, 2013; Manoharan and Ramasamy, 2013; Palve *et al.*, 2013; Rahman *et al.*, 2015; Tiwari *et al.*, 2015; Hussain *et al.*, 2016) [14, 41, 21, 13, 11, 44, 10, 12, 15]. *Aloe vera* gel can be used as natural preservative and flavoring agent in some foods (Christaki and Florou-Paneri, 2010) [16]. *Aloe vera* plant is used in large scale production of many medicine related to skin and it is highly recommended by the dermatologist as this is effective in treatment of all acne problem, some kind of skin infections most probably used to repair burns and used as a moisturizer for hydrating skin (Richardson *et al.*, 2005; Dal' Belo *et al.*, 2006) [17, 18]. The extracted Aloe gel shouldn't contain any other parts except gel such as leaf, skin and the yellow portion which may enhance its bitter taste. The latex of aloe causes many health issues like stomach pain and cramps, vomiting, nausea, electrolyte imbalances, diarrhea, kidney problems, hepatitis, muscle weakness and heart problem (Bottenberg *et al.*, 2007) [19].

### 3. Composition of *Aloe vera* and their properties

*Aloe vera* consists of 75 components which are potentially active that are vitamins, minerals, amino acid, lignin, saponins, salicylic acids, sugars etc. *Aloevera* is rich in more than 200 bioactive phytonutrients (Davis, 1997) [24]. The bioactive components of *Aloe vera* and their therapeutic value are well described previously by different authors (Vera, 1989; Shelton, 1991; Eshun and He, 2004) [23, 27, 28, 29]. *Aloe vera* gel contains vitamins such as vitamin A, C, E and vitamin B1, B2 choline and folic acid are also present (Lawless and Allen, 2000) [7]. Presence of vitamins E, C and minerals like, copper, selenium, zinc make it antioxidant rich and helps in management of different chronic diseases. Hormones auxins and gibberellins shows wound healing properties by inducing the cell propagation and provide anti-inflammatory action along with enzyme bradykinase, fatty acids and sugar. Mannose-6-phosphate, and glucomannans are the most abundant monosaccharide and polysaccharides in *Aloe vera* respectively. It contains different essential and non-essential amino acids. The constituent's like saponin and salicylic acid is responsible for antiseptic and antibacterial activity of *Aloe vera*. *Aloe vera* consist of 12 anthraquinones phenolic component. The emodine and aloin act as antivirals and also used as antibacterial and analgesics agent (Hutter and Salman, 1996; Surjushe *et al.*, 2008; Narayanan and Prabhu, 2017) [22, 25, 26]. *Aloe vera* extract reduce blood glucose level by enhancing its metabolism rate and due to its antioxidant effects (Boudreau and Beland, 2006) [30]. The alcohol insoluble extract of *Aloe vera* gel reduce the fasting blood glucose and increase plasma insulin levels (Rajasekaran *et al.* 2006) [31].

**Table 1:** Composition of *Aloe vera* gel

Components	Composition(%db)
Water	98
Total solid content	0.66
Soluble solid	0.56
Phenolic compound	1
Protein	7
Minerals	16
Sugar	17
Lipids	4
Polysaccharides	55

(Luta and McAnalley, 2005) [6]

### 4. Aloe juice concentrate and its food applications

Without the loss of biological activity aloe juice can be concentrated under 125 mm Hg vacuum at temperature below 50°C for  $\geq 2$ min. (Ramachandra and Rao, 2008) [34]. Aloe juice can be concentrated like other fruit juices to increase its storage life and for future industrial application in food and pharmacy (Swami *et al.*, 2014) [33]. *Aloe vera* juice concentrate can be used in making of powder (Qian, 2002), squash, jam, jellies, as well as can be used to blend with water and fruit juice for preparation of Aloe juice or blended fruit juice respectively.

#### Aloe gel powder and its food applications

Aloe gel powder can be prepared by lyophilization of *Aloe vera* gel fillets or concentrate, by tray drying of pulp or by dehydration of gel fillets in a controlled humid chamber (Ramachandra and Rao, 2008; Qian, 2002; Gautam and Awasthi, 2007) [34, 35, 36]. *Aloe vera* powder can be used in manufacturing of ice-creams, curd, lassi etc. Yoghurts was prepared by using aloe powder (Lee and Choi 1994; Seoshin *et al.*, 1995). Gel fillets of *Aloe vera* are washed to remove traces of aloin and then placed into a chamber where hot air at a controlled humidity and temperature is applied. The dried fillets are then ground to obtained *Aloe vera* gel powdered (Ramachandra and Rao, 2008) [34].

Qmatrix and freeze drying are best method of dehydration of *Aloe vera* to maintain its bioactivity along with flavor and color. In freeze drying, aloe gel fillet is lyophilized at  $-88$  °C and 0.01 mm Hg pressure for 65 h to get dried gel fillet, which are later on ground to obtain aloe powder with moisture content less than 4%. Freeze dried powder was prepared from *Aloe vera* gel concentrate prepared by ultra-filtration and reverse osmosis process (Qian, 2002) [35]. *Aloe vera* leaf powder was prepared by drying the grinded pulp of leaves in a tray drier at 50 °C for 12 h. The dried material is then ground into powder (Gautam and Awasthi, 2007) [36].

### 5. *Aloe vera* in dairy industry

Now a days aloe vera gel or juice are used in different dairy products such as ice cream, dahi, yoghurt, lassi and also food products like RTS and edible coatings etc (Keerthi *et al.*, 2016) [37].

### 6. Fortification of yoghurt and Sandesh with *Aloe vera*

Yoghurts is prepared from buffalo or cow milk by using inoculum *Lactobacillus bulgaricus* and *Streptococcus thermophilus* with or without any additional food ingredients and permitted food additives (Tamime and Robinson, 1994). The supernatant of fermented *Aloe vera* with probiotic *Lactobacillus plantarum* HM218749 shows a very strong free radical scavenging ability. The aloe fermentation supernatant can be used as functional beverage or cosmetic ingredients to guard human intestinal health, delaying senescence, and prevent chronic diseases (Jiang *et al.*, 2016) [39]. Cultured buttermilk, prepared by fortification of *Aloe vera* juice (5-20%) does not show significant changes in acidity and pH of the beverage. Addition of *Aloe vera* juice increases the viscosity and reduced the phase separation of the *Aloe vera* fortified buttermilk. Butter milk prepared with fortification of 10% *Aloe vera* juice give highest sensory acceptability (Mudgil *et al.*, 2016) [40]. *Aloe vera* fortified probiotic yoghurt on storage gives a reduced pH and count for *Lactobacillus acidophilus* and *Bifidobacterium bifidum* with an increased

synergies effect with storage time. However it shows a good viability for the above probiotic culture (Panesar and Shinde, 2012) [14, 41].

**7. *Aloe vera* dessert**

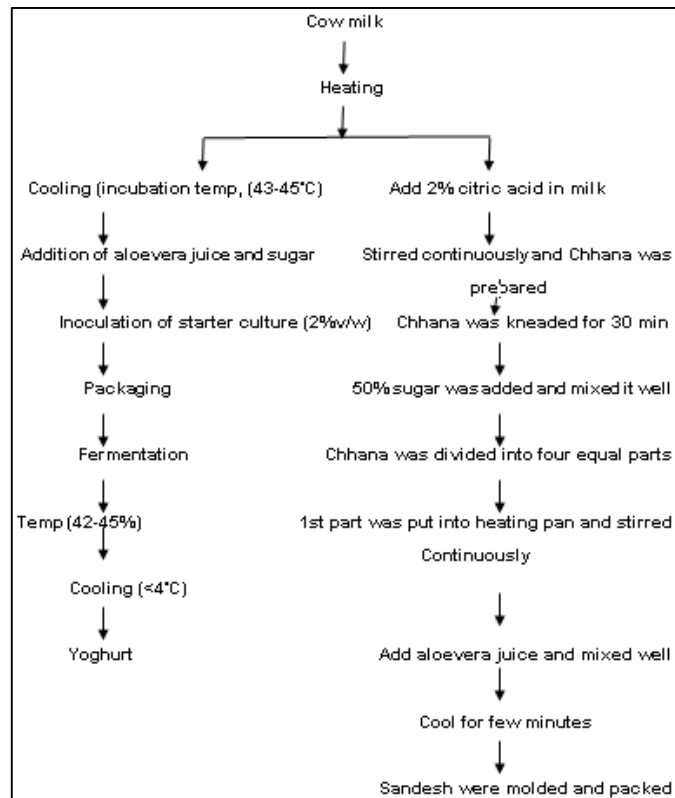
It is a very simple process which involves sorting, grinding, washing, peeling, cutting, cooking in syrup, adding flavor followed by packing and Pasteurization (Herlina, 2001) [43].

**8. *Aloe vera* in confectionary product**

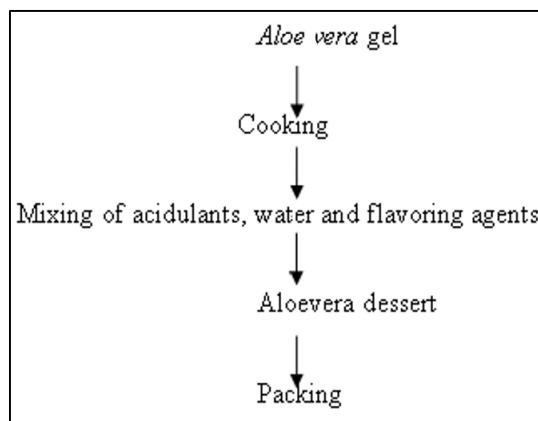
*Aloe vera* is used in confectionary products. It includes candies, jellies, chocolates and other confections which are made of sugar. Different fruit juices are added to get flavor in the products such as in jelly; orange juice is used to give orange flavor to the jelly (Anonymous, 2008) [42]. *Aloe vera* gel with Pineapple fruits juice at a ratio 40:60 gives good quality of jelly with high nutritional value (Palve *et al.*, 2013) [11, 44]. All the ingredients for the production of *Aloe vera* jam were optimized by response surface methodology (Jayabalan and Karthikeyan 2013) [45].

**9. *Aloe vera* in beverages**

*Aloe vera* juice contains various vitamins and minerals essential for the human body and is help in curing of bowel disorders, reducing inflammation in the body such as rheumatism, inflammation of ears, and arthritis due to which its consumption by consumes rises across the world. The global market of *Aloe vera*-based drinks grow at a CAGR of 9.6% during the period 2016-2020 (Wood, 2016). *Aloe vera* is used to make many fruit drinks with addition to other fruits such as orange, amla juice etc. *Aloe vera* juice can be used for the preparation of blended ready to serve (RTS) beverages with different fruit juices. Papaya and *Aloevera* based blended RTS beverage was prepared by and studied for it sensory and storage quality. *Aloe vera* in a ratio of 5 and 10 % gives a highest hedonic rating scale and can be successfully stored for a duration of 3month in refrigerated condition without significant changes in sensory and chemical quality (Boghani *et al.*, 2012).



**Fig 1:** Process flow chart for the preparation of *Aloe vera* fortified Yoghurt and Sandesh



**Fig 2:** Flowchart for the preparation *Aloe vera* dessert

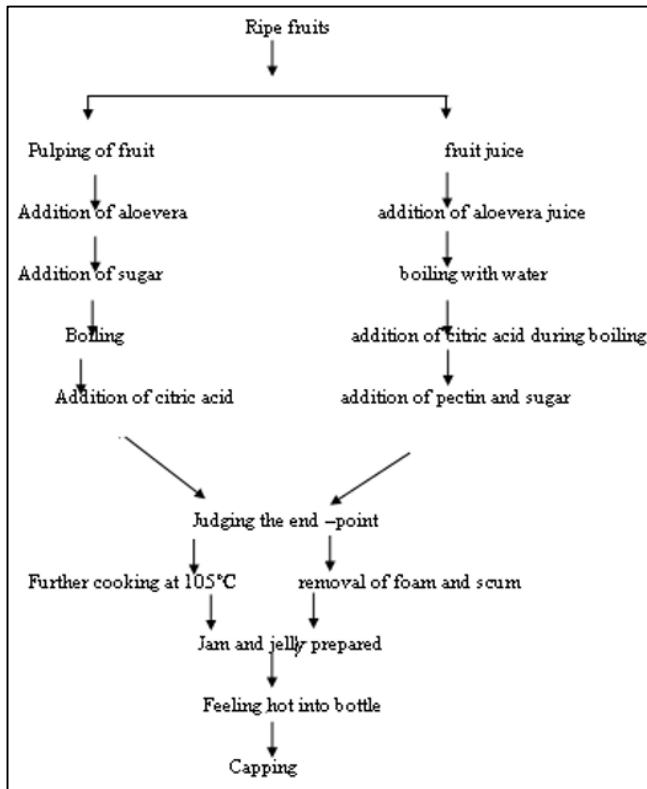


Fig 3: Process flow chart for preparation Aloe vera fortified jam and jelly

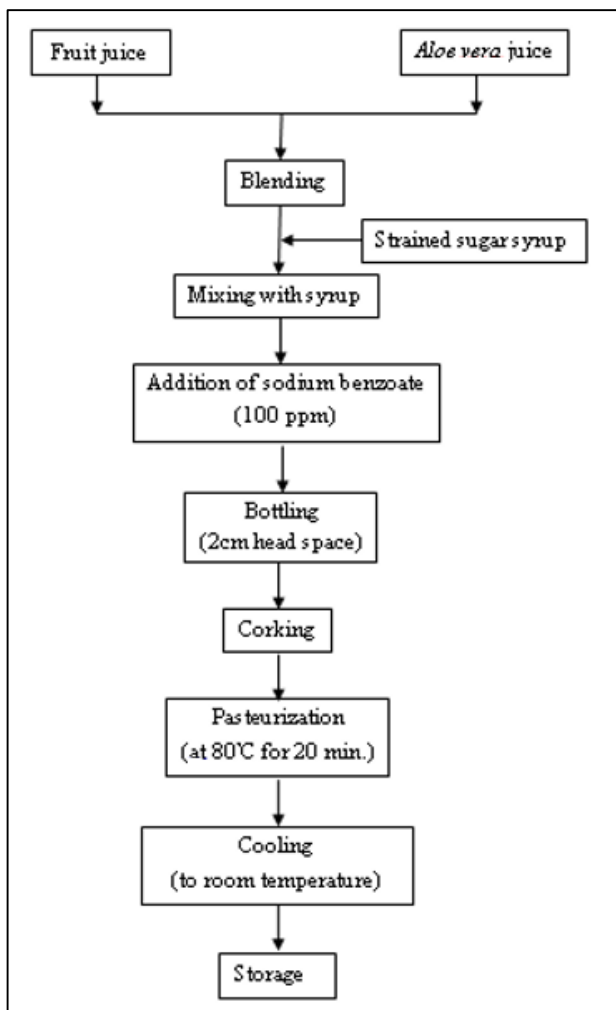


Fig 4: Flow diagram for preparation of blended Aloe vera and fruit beverage

## 10. Conclusion

As an important part of the herbal medicine, *Aloe vera* has various health benefits such as help in wound healing, protection against skin damage and it is also approved clinical trial data supports its all effective effects for lowering LDL, increasing HDL, decreasing blood glucose level etc. scientific evidences proves that *Aloe vera* gel is also safe for external use, the leaf of *Aloe vera* contain biological active materials which need careful handling and harvesting. The temperature is the important factor for the processing of *Aloe vera* and mainly in gel extraction process. It is concluded that we can infused *aloe vera* with various other nutrient to enhance the nutritive quality of the food product such as jelly, dessert, fruit juices, curd etc.

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