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Development and quality evaluation of aloe vera gel ice cube

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Abstract
Three formulae of aloe vera gel ice cubes were developed in this study. Aloe vera gel ice cubes were incorporated in the form of simple aloe vera gel ice cubes, aloe vera gel ice cubes using a sweetener (vanilla flavour) and aloe vera gel ice cubes coated with sugar. Sensory attributes were evaluated using 9-point Hedonic Scale method. Aloe vera gel ice cubes made by using simply aloe vera gel served with ice cream obtained the overall acceptability score of 5.66("neither like nor dislike" to "like slightly"). 7.20 for aloe vera cubes coated with sugar served with ice cream and in Paan ("like slightly" to "like moderately") and the overall acceptability score was 7.9 for aloe vera gel ice cubes made by using the sweetener served with ice cream. Which was much higher than that of other two formulae. The sweetener was of vanilla flavour which was much liked. Storage study revealed that aloe vera gel ice cubes containing sweetener was acceptable even after the three weeks storage period at -10 and -20°C.

Keywords: aloe vera, development, quality evaluation

Introduction
Aloe vera (*Aloe barbadensis* Miller), largely used in food and cosmetic industry, is a semi tropical perennial plant. The etymology of Aloe comes from “alloeh (k)” (Arabic) or “allal” (Hebrew) or “alsos” (Greek); which means ‘bitter’ “vera” means, true veritable. It is comprised of inner fleshy, colourless gel and outer dark green parenchyma.

Aloe vera is a short-stemmed juicy plant with green pointed and fleshy leaves entrapping a clear viscous gel. It can achieve a stature of 10-20 m with a stem girth up to 3 m. The annually produced flowers are orange in colour with the spikes reaching up to 90 cm tall.

The homeland of aloe is Africa, the Arabian Peninsula, Madagascar and Indian Ocean Islands. Aloe species are also found in the Mediterranean region, Canary Islands, Mexico, India, and the Caraibes. The genus Aloe contains over 400 different species among which; *Aloe barbadensis*, *Aloe arborescens*, and *Aloechinensis* are the most popular among them. However, *Aloe barbadensis* Miller is considered the most biologically active species. In the present work *Aloe barbadensis* Miller is used for further experimentation.

In India, the major areas under aloe vera cultivation are Alwar in Rajasthan, Satnapalli in Andhra Pradesh and Rajpipla in Gujarat. It is also found in the dry areas of states of Maharashtra and Tamil Nadu. Total production in India is estimated to be about 1,00,000 tonnes. The annual consumption of aloe vera extract by the Indian pharmaceutical industries is 200 tonnes which is met from the wild sources from the states of Maharashtra and Tamil Nadu. Ayurvedic pharmacies are using only 1% of the total production from India. The price of dried aloe vera leaves in India ranges from Rs 600-1000 per kg depending upon the aloin content and colour of the dried aloe vera. However, the rate of fresh aloe vera leaves varies from Rs 4-5 per kg.

Aloe vera has been used for its medicinal value for several thousand years. Its applications have been recorded in ancient cultures of India, Egypt, Greece, Rome and China. In biblical times the Egyptians hailed aloe vera as the plant of immortality. The Chinese called it their elixir of youth. The aloe vera has many common names and often referred to as burn plant, first aid plant or medicine plant. Its name is most likely derived from the Arabic word “Alloeh” meaning shining bitter substance. The use of aloe vera in the pharmaceutical industry is significant as far as the manufacturing of tropical ointments, gel preparation, tablets and capsules are concerned. It has been used for treating gastrointestinal problems because of its properties of soothing, cleansing and helping the body to maintain healthy tissues.

Aloe gel is known for assisting digestion and increasing blood and lymphatic circulation. It also improves kidney, liver and gall bladder functions and reduces the burning sensation of burns and blisters. Aloe vera juice is used to reduce warts, psoriasis and eczema. It also finds its usefulness in treating hair loss and dandruff problem as the enzyme present in aloe vera prevents hair loss by protecting the scalp against any diseases. Presently, the use of aloe vera has gained recognition because of herbal movement initiated by naturopaths, yoga gurus, alternative medicine promoters and holistic healers. Except in the pharmaceutical industries, the original commercial use of the aloe plant was in the production of a latex substance called ‘aloin’ (a yellow sap).In the food industry, it has the potential to be used as a food preservative (substitute of sulphur dioxide in preserving fruit and vegetables). It is also increasingly used as a natural coating because of its anti oxidative properties. The leaf powder is used in a number of ayurvedic medicines as it contains antioxidants, dietary fibre, iron, etc.

Materials and Methods

The experimental set-up, methods and techniques followed for development of aloe vera gel ice cubes and its quality analysis. The preliminary experiment was planned for developing aloe vera ice gel cubes. The aloe vera was analyzed on the basis of different quality aspects, which was also discussed in this chapter.

Collection of Raw Material

Fresh, healthy and matured aloe vera leaves were selected for conducting the experiment. The leaves were obtained from the Horticulture field of SHUATS campus. The leaves were cut in the early morning every day for experimentation to avoid moisture loss and spoilage. Each leaf was cut manually with a stainless steel knife and pulled carefully from the mother plant so as not to break the rind. The leaves were transported to the working place in a covered polyethylene bag to avoid oxidation or contamination and were kept in upright position in order to drain out the 'aloin' (yellow sap) present in it.

Preparation of Aloe Vera gel ice Cube

The procured aloe vera leaves were washed under tap water to remove sticking materials and dirt. The spikes, placed along the margins, were removed before slicing the leaves. The thick dark green outer skin was peeled out manually from the thick colour less parenchyma (or gel fillet) using a stainless steel knife. The gel was obtained with the help of sharp spoon and was blended in the grinder to form the juicy product. The juice was poured in the ice trays for refrigeration.

Cutting: Aloe Vera Gel was procured from aloe vera leaves with the help of knife.

Grinding: The gel was blended in grinder to form a smooth juice.

Freezing: The grinded juice was freezed in ice trays to form cubes.

Storage: The freezed cubes were stored in a container.

Process Flow Chart

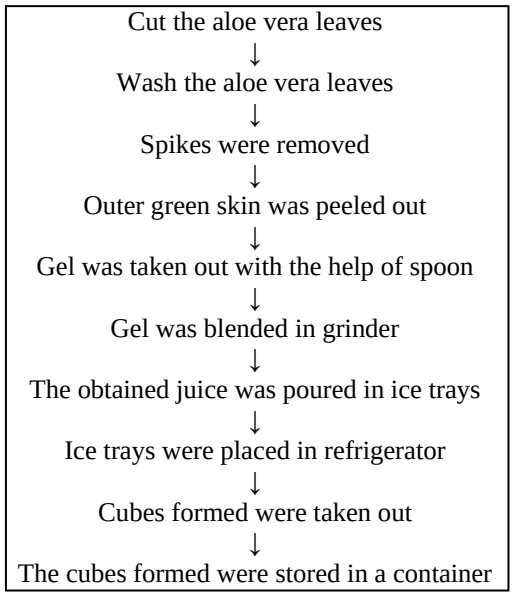

Fig 1: Flow sheet for preparation of Ice Gel Cubes

Experimental Plan

Based on the literature, the experimental plan is devised. Aloe Vera leaves were cleaned by washing it from the tap water. The upper layer was peeled out and the gel was removed by the sharp spoon. Grinder was used for making the gel in a foamy juicy product. After getting the desired product (juice of aloe vera) it was poured in the ice cube trays and was stored in the refrigerator. The desired outcome was the aloe vera gel ice cubes. This process was used two more times but with minute changes, in other process the sweetener (vanilla flavour) was mixed when we were grinding the aloe vera gel and another process was the coating of aloe vera gel ice cubes with fine sugar. The physicochemical and sensory qualities were evaluated just after the preparation of aloe vera ice gel cubes. Experimental variables/parameters and their levels and description were given in the following table.

Table 1: Experimental plan

Variables/ Parameters	Levels	Description
Product	1	Aloe Vera Ice Gel Cube
Replication	3	3
Storage Condition	1	Below 0℃
Physicochemical Characteristics	5	Moisture Content, Melting Time, Size of the Cube PH Value, Weight of the Ice Cube.
Sensory Analysis	1	9 point Hedonic Scale
Sample	9	3*3

Result and Discussion

The present investigation, development and various analysis of the Aloe Vera ice gel cubes were carried out in the Department of Food Process Engineering, SHUATS, Allahabad. The results were reported under following heads.

The proximate analysis includes moisture content, melting time, size, weight, distortion of the aloe vera ice gel cube. These were carried out in the Department of Food Process Engineering, SHUATS, Allahabad. The tabulated data and visualization in graphs were given below.

1. Apparent volume

The average value of length, width and thickness can be used to determine the apparent volume of aloe gel ice cube. The volume of the cube was determined using mathematical expression as described in section 3.4.2. The apparent volume was found to be in the range of 19.29 to 25.82 cm (Table 2). The average apparent volume of aloe vera gel ice cube for sample T1, T2, T3 was found to be 25.82, 26.99, 19.29 cm respectively.

Table 2: Apparent volume

S. NO.	Sample	Length(cm)	Breadth(cm)	Height(cm)	Volume
1.	T1	3.96	3.27	2.14	25.82
2.	T2	3.98	2.54	2.67	26.99
3.	T3	2.99	2.96	2.18	19.29

2. Moisture Content

The moisture content of the Aloe vera gel ice cube was measured by hot oven drying method as described in Chapter 3. The measurement of moisture content was replicated 3 times and their average moisture content is presented in Table

4.1. The moisture content of the three samples T1, T2, T3 were found to be 99.80, 98.88 % respectively.

Table 3: Moisture content of Aloe Vera Ice Gel Cube

S. No.	Sample No.	Initial Weight (gm)	Final Weight(gm)	Moisture Content %
1.	T1	10	0.12	99.80
2.	T2	10	0.15	98.88
3.	T3	10	0.20	99.50

3. pH value of Aloe Vera ice gel cubes

From the table it is evaluated that the pH value of the three samples T1, T2, T3 ranges from 4.9, 5.1, and 5.2, respectively, which is closer to the findings of Wang *et al*., (1993).

Table 4: pH value of Aloe Vera ice gel cubes

S. No	Sample No.	pH value
1.	T1	4.9
2.	T2	5.1
3.	T3	5.2

4. Effect of different treatment on sensory attributes of Aloe Vera Ice Gel Cube

Sensory evaluation of any consumable product is the best method of judging the acceptability of the product by the consumers. The assessment was done by studying the characteristics like colour, texture, taste and flavour and overall acceptability of the product by the panel of judges.

The survey showed that the sensory attributes of Aloe Vera ice gel cubes was high in $T_3$and sensory evaluation was lowest in sample T1 as the gel cube has bad taste as there is no flavour or sweetener added to this sample.

Table 5: Effect of different treatment on sensory attributes of Aloe Vera Ice Gel Cube

Sample No.	Taste	Flavour	Aroma	Colour	Texture
T1	4.5	4.7	5.1	7.0	7.0
T2	7.1	7.5	6.9	7.9	7.9
T3	8.0	7.9	7.3	7.9	8.1

Table 6: ANOVA

Source	D.F.	SS	MSS	Cal. F	Results	TAB F (%)
Treatment	2	13.561	6.781	17.506	S	4.459
Replication	4	4.297	1.074	2.774	NS	8.649
Error	8	3.099	0.387			
TOTAL	14	20.957				
S.EM=	0.278	CD (5%)=	0.908			
SE.d=	0.394	CD (1%)=	1.321			

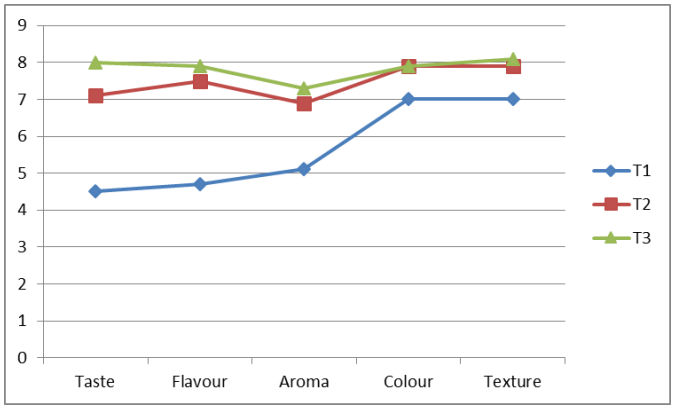

Fig 2: Effect of different treatment on sensory attributes of Aloe Vera Ice Gel Cube

Score for overall acceptability of different samples of Aloe Vera Ice Gel Cubes

The Aloe Vera gel Ice cubes were analyzed for overall acceptability as a sensory parameter. The data presented in table 4.3 indicates that the average rating for overall acceptability of different samples of aloe vera ice gel cubes for the attributes colour, texture, taste and flavour for sample T1 were found to be 4.5, 4.7,5.1,7.0,7.0 respectively. Whereas, for sample T2 it was 7.1, 7.5, 6.9, 7.9, 7.9 respectively. Similarly, for sample T3 it was found to be 8.0, 7.9, 7.3, 7.9, 8.1 respectively. It shows that the rating for overall acceptability of sample T3 was highest.

Table 7: Score for overall acceptability of different samples of Aloe Vera Ice Gel Cubes

S. No.	Treatment	Mean
1	T_1	5.66
2	T_2	7.20
3	T_3	7.9

Summary and Conclusion

Studies were conducted to analyze the sensory and physicochemical characteristics of Aloe Vera gel ice cubes of different sizes as well as Aloe Vera gel ice cubes using different bases for its better taste, prepared from Aloe Vera leaves. It's an attempt made for the development of Aloe Vera ice gel cubes so that it could be used on daily bases and can be prove as a potential food supplement. These experiments were conducted in Food Processing laboratory of Vaugh Institute of Agriculture Engineering and Technology, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad. Quality of Aloe Vera gel Ice cube was evaluated.

On the basis of study following inferences were drawn.

Summary

- Aloe Vera Gel is successfully utilized in producing the Aloe Vera gel ice cubes.
- Aloe Vera Gel was grinded to form the desired juicy product and refrigerated in 3 different trays at below 0ºc, after that the desired product was taken out and using electronic weighing machine different weights were obtained by different size of the cubes. Which is of 3.98*3.27*2.54, 3.98*2.67*2.54, 2.18*2.98*2.98 in cms, was refrigerated for 4 to 5 hours. The modest temperature was -10ºc to -20ºc.
- Total 9 (3*3) samples were made, each size of ice cube was made by using 3 different methods.
- Samples were evaluated immediately after preparation for physicochemical, sensory, which included taste, color, flavor, aroma, moisture, sliminess and the results were found to be within the range of acceptance.
- After sensory and physicochemical evaluation, it is found that sample with the smallest size of Aloe Vera gel ice cube (which is of 2.18*2.98*2.98 in cm's) consisting sweetener in it, had the best consistency and flavor and had a shelf life of maximum days (approx 3weeks).
- Highest Moisture Content Ratio was found in the largest ice cube compared to others (3.98*3.27*2.54) which was made by the Aloe vera gel simply grinded and the juice was refrigerated.
- Melting Time was approximately similar of every cube, after 18 seconds the ice cubes started to melt at the room temperature and it took 3 to 5minutes (depending upon the temperature of the particular room).
- Most weighted cube was one with the sugar coated as compared to the other cube (14.5 in grams).
- Most liked Aloe Vera gel ice cube was the sample no.3 (T1), the one in which we have added sweetener (vanilla flavor). The least liked was sample no.1 (T1), the one in which the aloe vera gel was grinded normally without adding anything.

Conclusion

Aloe Vera gel ice cube can be use immediately to soothe burns or to make a smoothie, or add to homemade shampoo. Aloe Vera gel ice cubes can also be effectively utilized in commercial level by using Ice Cream as a carrier. The frozen cubes can be directly put in the Ice Cream as a ready to serve product. Different Sizes for Aloe Vera gel ice cubes were used to know the best fit as well as the cubes were made by the different methods to consume it easily on the daily basis. During different physicochemical and sensory evaluation which included taste, colour, flavour, aroma, texture, the results were in the acceptance range. The quality of the Aloe Vera gel ice cube was best checked one with the added sweetener in it. It can be used on daily basis as a potential food supplement.

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