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A study on the changes of different physical parameters of aseptically packed white guava pulp at different storage condition

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Abstract
Guava is a common tropical fruit cultivated in many tropical and subtropical regions. *Psidium guajava* (common guava, lemon guava) is a small tree in the myrtle family (Myrtaceae), native to Mexico, Central America, the Caribbean and northern South America. Although related species may also be called guavas, they belong to other species or genera, such as the pineapple guava, *Acca sellowiana*. In 2016, India was the largest producer of guavas, with 41% of the world total. During storage condition there are changes in different physical characteristics of aseptic white guava pulp like Brix, pH, consistency & viscosity at Ambient (29-37 degree C) and refrigerated (4-10 degree C) storage condition. The result shows that Brix, pH, consistency & viscosity were changed in both conditions. But more in Ambient condition. It determines the quality of white guava pulp is decreased slightly in Ambient (29-37 degree C) and refrigerated (4-10 degree C) condition but not affected the sample s per this Industry's quality parameter in 4 months.

Keywords: Guava, ambient condition, refrigerated condition, aseptic packaging, pH, brix, viscosity, consistency, TSS

Introduction
Guavas are tropical fruits with yellowish-green skin, and they grow on trees in Central America. The Latin name for the common guava tree is *Psidium guajava*. Guava fruit is known for its pleasant flavour, refreshing taste and nutritional value. It is successfully grown all over India and contributes 0.4% of total fruit production with estimated production of 1.75 million tons from 0.25 million hectares. There is tremendous demand of fruit for fresh and processing purpose in both domestic and international markets. The share of guava in fresh fruit export from India is merely 0.65% which can be further boosted, if fruit is properly handled after harvest. Guava is a climacteric fruit, ripens rapidly after harvest and has short-shelf life. Therefore, guava cannot be sent to distant markets under normal conditions. Storage of fruits at low temperatures for a definite period is a common practice in developed countries such as North America and Northern Europe. Low temperature may delay or retard ripening and may reduce spoilage. But the problem with guava fruit is its high chilling sensitivity. Relatively little is known with respect to the sensitivity and the response of guava fruit to chilling temperatures. The effect of low temperature (0-3 °C) on storage life of guava fruits had been examined and a storage life of 2-3 weeks has been reported. Such low temperature storage causes fruit to lose consumer appeal and economic value. In the present investigation an attempt was made to optimize the storage temperature for guava fruit and storage behaviour of guava fruit has been studied at the optimum temperature.
Ambient temperature is the air temperature of any object or environment where equipment is stored. The adjective *ambient* means "relating to the immediate surroundings". Also sometimes referred to as the ordinary temperature or the baseline temperature, this value is important for system design and thermal analysis and Refrigerator temperature at or below 40° F (4 °C). The freezer temperature should be 0° F (-18 °C).
The main objectives of this study are to study the changes in different physical parameters of aseptically packed white guava pulp at different storage condition.

Materials & methods

Procurement of raw material

- Aseptic packed White Guava Pulp.
- Viscometer, pH meter, Refractometer, consistometer etc.
- Refrigeration unit (5-10 °C) and Ambient chamber (29-37 °C).
- Weighing Machine, Petri plates, beaker and Glassware's etc.
- Chemical such as 0.1 N NaOH; Phenolphthalein indicator; Ethylene, Dye etc.

Aseptic processing of white guava pulp

- The matured raw White guava fruit after arrival was allowed to ripen in Ethylene Control ripening Chamber and in Natural ripening sheds.
- After ripening the White Guava was issued for production. The ripened Guava was fed into belt conveyor where sorting of semi ripened, un-ripened and damaged fruits were carried out.
- The ripened fruit was washed with turbulence in fruit washer tank maintaining Hypochloride solution (20-50 ppm) followed by nozzle spraying when carried through conveyor to second washing stage.
- Second washing was done with potable water and it was conveyed to belt conveyor. The stem cutting was carried out and was fed into fruit miller for crushing of the Guava.
- The Coarse and Fine pulping was done by passing through pulper to the holding tank.
- The pulp was heated around 65° C and passed through Decanter.
- The filtration of pulp was carried out using 0.8 mm filter and passed through online metal detector.
- The de-aeration of pulp was done using Deaerator and was passed through Sterilizer followed by subsequent cooling of the pulp.
- The pulp was aseptically filled through filler head in Pre-sterilized bag.

Collection of sample

The aseptically packed White Guava Pulp was collected on the same date of Production. The Colour analysis and other physiochemical analysis were done for that samples same day. The collected samples were kept in Cold Storage and Ambient Chamber condition. The samples were analyzed for every 1 month intervals and were studied for 4 months.

Determination of total soluble solids (T.S.S) or ^{0}Brix

Brix of the White Guava Pulp was measured by using Refractometer. Zero setting of the Refractometer was done before using it for measuring the Brix of the product. Distilled water was placed on the base plate and zero of the Refractometer was adjusted by bringing the line dividing the bright and dark zone to zero using the zero setting screw. The water was removed and was wiped at the base plate and prism using clean cloth or tissue paper to remove the traces of water.

Drop of sample was placed on the base plate and the reading of Brix was noted as shown on the Refractometer scale.

Determination of the consistency using Bostwick consistometer

Bostwick Consistometer determines the consistency of viscous products by measuring the distance that the product flows under its own weight in a given time interval. The process of determination involves into 2 following steps-

- **Setting up of the instrument**

The Consistency meter was placed on a level surface and was adjusted using leveling screws until the bubble in the circular level was centered. The level was checked by placing another spirit level. Then, the pointed vertical lip of the Consistency meter was bending slightly until the two levels agree. Do not bend the horizontal part of the lip as this may prevent the proper leveling of the instrument. The gate was closed and hooked the trigger release over the top.

- **Operation**

The reservoir was filled with the material to be tested and level off the top with a spatula or other straight-edge. Press down on the trigger was pressed down to open the gate and at the same time was stop-watch was started. At the end of the time-period of 30 seconds, the material that had flown along the trough was determined. The maximum reading at the center of the trough and the minimum reading at the edge of the trough was taken, and was averages the values.

Determination of pH

The electrode was connected to the pH meter. The electrode was dipped in 7.0 pH buffer solution and the temperature knob was set as per the temperature of the solution. The pH mode function was selected and observed the reading. The pH meter was set exactly at 7.0 and was held the electrode with distilled water. The electrode dipped in pH 4.0 solution and the instrument was set at 4.0 pH. Then once again the electrode was dipped in pH 7.0 solution and the reading was verified for reading. Otherwise adjusted and replace in 4.0 pH buffer solution continue till it gave the desired readings at both buffer solution. The electrode was washed and immersed in test sample and pH value reading was noted down.

Determination of acidity

- Weigh 2-3g of Fruit pulp/Concentrate in a conical flask and add required quantity of Distilled Water.
- Add 2 drops of Phenolphthalein Indicator to the sample in the conical flask.
- Shake well to get a uniform solution.
- Titrate the above mixture against 0.1 N Sodium Hydroxide solution taken in the burette.
- Note down the burette reading when a pale pink colour is obtained.

Formulae

$$\% \text{ Citric acid} = \frac{0.1 \text{ x Burette Reading x } 64}{\text{Weight of sample taken} * 1000} * 100$$

This formula to be used for calculating the acidity of Fruit pulps/Concentrates is

$$\% \text{ Acidity} = \frac{\text{Burette reading x } 0.64}{\text{Weight of sample taken}}$$

Where Normality of Sodium hydroxide (N1) = 0.1 N
Volume of Sodium hydroxide = Burette Reading
Weight of Sample to be taken = 2-3 g
Equivalent Weight of Anhydrous Citric acid = 64.

Determination of viscosity using brook field viscometer:
The sample was taken into the beaker and the spindle of viscometer was immersed in the beaker. The viscometer was on and two round dial was taken and the dial reading was noted.

Calculation: Viscosity in cps = Dial reading x Spindle factor

Result & discussion

Table1: Physiochemical analysis of aseptic white guava pulp

Batch code: WGP/030216/201					
Date of Production: 03.02.2016					
Date of Analysis: 08.02.2016					
Sample	**Brix**	**Acidity**	**pH**	**Consistency**	**Viscosity**
Sample 1	9.4	0.44	3.82	4.5	20400
Sample 2	9.6	0.46	3.75	4.5	20800
Sample 3	9.4	0.52	3.78	5.0	20400
Sample 4	9.4	0.48	4.0	5.5	20000
Sample 5	9.2	0.54	3.91	4.8	20400
Average	9.4	0.48	3.85	4.8	20400

Effect of brix due to storage
The Brix of aseptically packed White Guava Pulp was determined by using hand refractometer for both the condition i.e. ambient temperature and refrigerated temperature.
The results gives minor changes in ambient storage condition and slightly changes in refrigerated temperature.

Effect of acidity due to storage
The Acidity of aseptically packed White Guava Pulp was determined for both the condition i.e. ambient temperature and refrigerated temperature.
The results gives minor changes in ambient storage condition and slightly changes in refrigerated temperature.

Effect of pH due to storage
The pH of aseptically packed White Guava Pulp was determined for both the condition i.e. ambient temperature and refrigerated temperature.
The results gives minor changes in ambient storage condition and slightly changes in refrigerated temperature.

Effect of consistency due to storage
The consistency of aseptically packed White Guava Pulp was determined for both the condition i.e. ambient temperature and refrigerated temperature.
The results give some time slightly changes in ambient storage condition and in refrigerated temperature because the presence of some residual enzymes.

Effect of viscosity due to storage
The Viscosity of aseptically packed White Guava Pulp was determined for both the condition i.e. ambient temperature and refrigerated temperature.
The results gives minor changes in ambient storage condition and slightly changes in refrigerated temperature.

Table2: Physiochemical Analysis of AWGP in ambient & refrigerated condition

Batch code: WGP/030216/201										
Date of Production: 03.02.2016										
Date of Analysis: 08.03.2016										
Sample	**Ambient (29-37 °C)**					**Refrigerated (4-10 °C)**				
	Brix	**Acidity**	**pH**	**Consistency**	**Viscosity**	**Brix**	**Acidity**	**pH**	**Consistency**	**Viscosity**
Sample1	9.2	0.46	3.75	4.8	20800	9.4	0.42	3.7	4.8	20800
Sample2	9.2	0.50	3.72	5.0	20600	9.6	0.40	3.77	4.6	20000
Sample3	9.4	0.48	3.88	5.2	20400	9.8	0.44	3.62	4.4	20600
Sample4	9.2	0.52	3.68	5.0	20600	9.4	0.46	3.7	5.0	20400
Sample5	9.4	0.46	3.44	5.0	20400	9.6	0.46	3.82	5.2	20000
Average	9.28	0.48	3.69	5.0	20560	9.56	0.43	3.72	4.8	20060

Table3: Physiochemical analysis of AWGP in ambient & refrigerated condition

Batch code: WGP/030216/201										
Date of Production: 03.02.2016										
Date of Analysis: 09.04.2016										
Sample	**Ambient (29-37 °C)**					**Refrigerated (4-10 °C)**				
	Brix	**Acidity**	**pH**	**Consistency**	**Viscosity**	**Brix**	**Acidity**	**pH**	**Consistency**	**Viscosity**
Sample1	9.4	0.48	3.6	4.2	20000	9.6	0.5	3.71	4.8	20200
Sample2	9.2	0.57	3.72	4.4	20000	9.6	0.44	3.45	5.0	20800
Sample3	9.0	0.53	3.68	4.5	20400	9.4	0.4	3.66	5.0	20000
Sample4	9.0	0.52	3.81	5.0	20480	9.6	0.42	3.72	4.8	20600
Sample5	9.2	0.42	3.74	4.2	20200	9.4	0.48	3.8	5.2	20400
Average	9.16	0.5	3.71	4.46	20216	9.52	0.44	3.66	4.96	20400

Table 4: Physiochemical analysis of AWGP in ambient & refrigerated condition

Batch code: WGP/030216/201										
Date of Production: 03.02.2016										
Date of Analysis: 08.05.2016										
Sample	**Ambient (29-37 °C)**					**Refrigerated (4-10 °C)**				
	Brix	**Acidity**	**pH**	**Consistency**	**Viscosity**	**Brix**	**Acidity**	**pH**	**Consistency**	**Viscosity**
Sample1	9.2	0.58	3.8	5.0	20200	9.2	0.51	3.62	4.8	20400
Sample2	9.0	0.55	3.76	5.4	20400	9.4	0.48	3.7	4.6	20600
Sample3	9.0	0.49	3.72	5.2	20400	9.6	0.41	3.72	4.8	20360
Sample4	9.2	0.50	3.69	5.4	20000	9.4	0.46	3.68	4.8	20480
Sample5	9.0	0.52	3.83	5.6	20600	9.4	0.42	3.68	4.8	20400
Average	9.08	0.52	3.76	5.32	20320	9.4	0.45	3.68	4.76	20420

Table 5: Physiochemical analysis of AWGP in ambient & refrigerated condition

Batch code: WGP/030216/201										
Date of Production: 03.02.2016										
Date of Analysis: 06.06.2016										
Sample	**Ambient (29-37 °C)**					**Refrigerated (4-10 °C)**				
	Brix	**Acidity**	**pH**	**Consistency**	**Viscosity**	**Brix**	**Acidity**	**pH**	**Consistency**	**Viscosity**
Sample1	9.0	0.60	3.66	5.2	20400	9.2	0.48	3.92	5.0	20000
Sample2	9.0	0.58	3.7	5.2	20000	9.4	0.46	3.76	4.5	20200
Sample3	9.2	0.54	3.72	5.8	20000	9.4	0.50	3.72	5.0	20200
Sample4	9.0	0.52	3.68	5.4	20200	9.2	0.46	3.7	5.2	20400
Sample5	9.0	0.50	3.67	5.2	20000	9.4	0.48	3.82	5.0	20800
Average	9.04	0.54	3.68	5.36	20120	9.36	0.47	3.78	4.94	20320

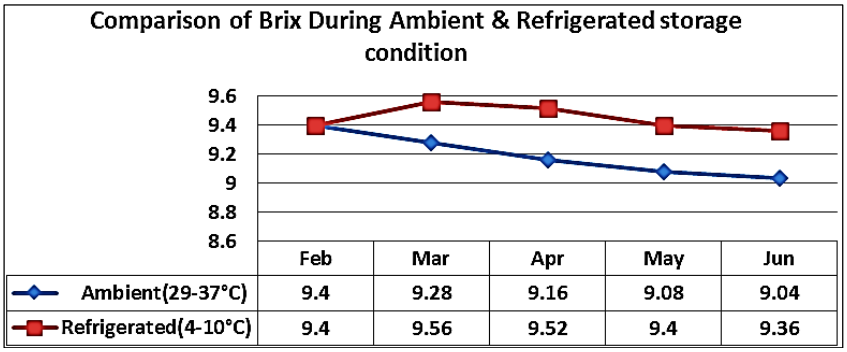

Fig 1: Comparison of brix during ambient and refrigerated storage condition.

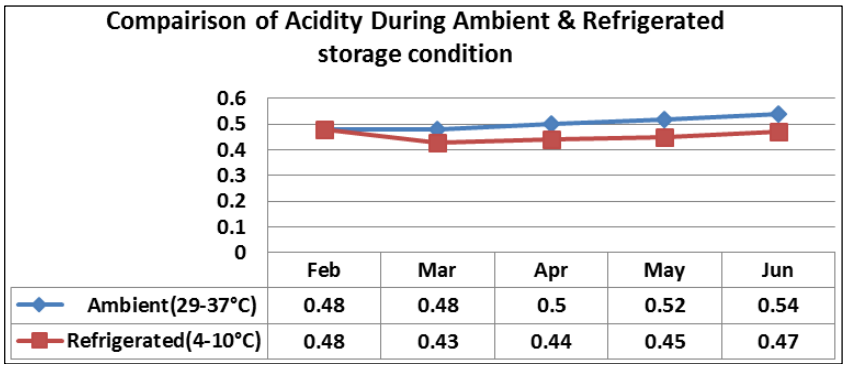

Fig 2: Comparison of Acidity during Ambient and Refrigerated Storage condition.

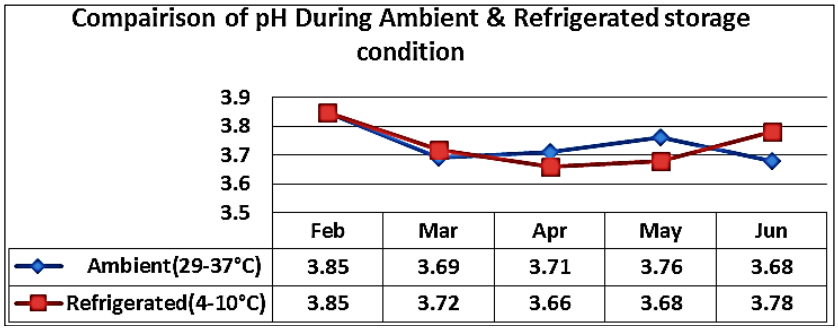

Fig 3: Comparison of pH during Ambient and Refrigerated Storage condition.

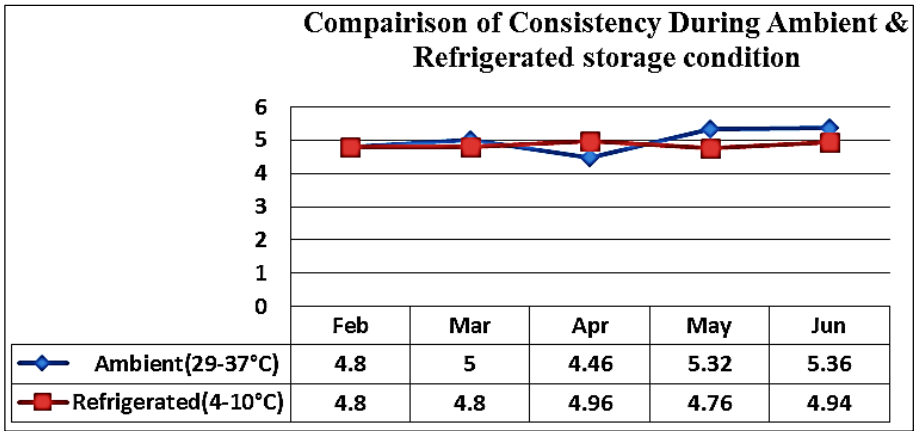

Fig 4: Comparison of consistency during ambient and refrigerated storage condition.

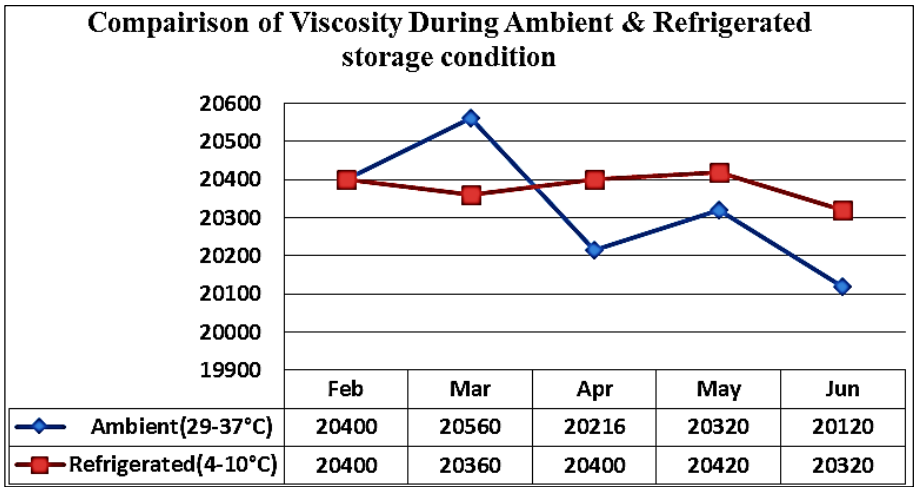

Fig 5: Comparison of viscosity during ambient and refrigerated storage condition.

Conclusion

During storage condition there are changes in different physical characteristics of aseptic white guava pulp like Brix, pH, consistency & viscosity at Ambient (29-37 degree C) and refrigerated (4-10 degree C) storage condition. The result shows that Brix, pH, consistency & viscosity were changed in both condition. But more in Ambient condition. It determines the quality of white guava pulp is decreased slightly in Ambient (29-37 degree C) and refrigerated (4-10 degree C) condition but not affected the sample s per this Industry's quality parameter in 4 months.

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