THINK INDIA JOURNAL

ISSN: 0971-1260

Vol-22-Issue-10-November-2019

A study on Color deterioration of white guava pulp subjected to different storage condition

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Abstract:

Colour is an important quality attribute in the food and bioprocess industries, and it influences consumer's choice and performances. Food colour is governed by the chemical, biochemical, microbial and physical changes which colour during growth, maturation, postharvest handling and processing. Colour measurement of food products has been used as an indirect measure of other quality attributes such as flavor and contents of pigments because it is simpler, faster and correlates well with other physiochemical properties. The chromameter is a tool for precise and objective assessment of surface colour. The (*psidium guajava* L.) which belongs to the family Myrtaceae is considered as one of the most important tropical fruit trees in the world, enriching the diet of hundreds of millions of people with its special characteristic odour and high nutritive value. The colour is the most important factor and also changed more in Ambient (29-37 degree C) condition than the Refrigerated (4-10 degree C) condition. 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 and to compare the changes in colour attributes of the white guava pulp during the storage condition.

Keywords: Guava, colour deterioration, ambient condition, refrigerated condition, aseptic packaging.

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Introduction:

Guava is the common name for any of the various tropical shrubs and small trees comprising the New World genus *Psidium* of the myrtle family (Myrtaceae), characterized by tough, dark, opposite leaves and an edible fruit. The term guava also is used for the fruit, which is a true berry. Members of the genus Psidium, the guavas, are typical Myrtoideae, with tough dark leaves that are opposite, simple, elliptic to ovate, and 5-15 centimeters long. The branches are very strong and highly tolerant to high winds. The flowers are white, with five petals and numerous stamens. Members of the genera *Accara* and *Feijoa* (= *Acca*, pineapple guava) were formerly included in this genus as well.

Guavas that were pink in colour had a more pigment content as polyphone, carotenoid and pro-vitamin A, than the white pulped variant. In India the pink Guava was primarily cultivated in Karnataka, Maharashtra and Uttar Pradesh. This Super Fruit was greatly recommended to deal with health problems such as high blood pressure and cholesterol, in the treatment of constipation and in treating, congested lungs. It was also believed to strengthen the heart and improve the blood circulation.

Colour of the food is the first parameter of quality evaluated by consumers. It is important for the acceptance of the product even before being consumed. Inspection of food products is done using vision machine, particularly analyzing and processing the images, where the parameters of each pixel on the surface of the recorded product must be known. Colour is an important quality attribute in the food and bioprocess industries, and it influences consumer's choice and preferences. Food colour is governed by the chemical, biochemical, microbial and physical changes which occur during growth, maturation, postharvest handling and processing. Colour measurement of food products has been used as an indirect measure of other quality attributes such as flavour and contents of pigments because it is simpler, faster and correlates well with other physicochemical properties. This review discusses the techniques and procedures for the

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measurement and analysis of colour in food and other biomaterial materials. It focuses on the instrumental (objective) and visual (subjective) measurements for quantifying colour attributes and highlights the range of primary and derived objective colour indices used to characterise the maturity and quality of a wide range of food products and beverages. Colour is one of the most widely measured product quality attributes in postharvest handling and in the food processing research and industry. (Pankaj B. Pathare *et al*., 2012)

Apart from differences in instrumentation, colour measurements are often reported based on different colour indices even for the same product, making it difficult to compare results in the literature. There is a need for standardisation to improve the traceability and transferability of measurements. The correlation between colour and other sensory quality attributes is well established, but future prospects exist in the application of objective non-destructive colour measurement in predictive modelling of the nutritional quality of fresh and processed food products.

A number of methods are available for measuring food colour objectively. Pigment may be extracted from the sample with a solvent and the absorbance of the solution measured at a selected wavelength on a spectrophotometer. Colour can also be measured by matching (with the eye) a liquid system containing the desired constituent in unknown amount with a similar system containing the desired constituent in known amounts.

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 and to compare the changes in colour attributes of the white guava pulp during the storage condition.

Materials and Methods:

Procurement of raw material:

- Aseptic packed White Guava Pulp.
- Chromameter Konica Minolta (CR-400).

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- Refrigeration unit (5-10°C) and Ambient chamber (29-37°C).
- Chemical such as 0.1 N NaOH; Phenolphthalein indicator; Ethylene, Dye etc.

Methods:

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

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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.

Colour Analysis using Chromameter:

The colour analysis of aseptically packed White Guava Pulp was performed. The Chromameter CR-400 model was used in colour analysis. Chromameter was connected with the computer cable and software was used.

Chromameter operating procedure involved 2 steps-

1) White calibration and

2) Absolute measurement

1) White measurement:

After connecting with the software, the calibration key was pressed in the measurement screen. The white calibration plate was kept at the centre of the measuring head. The measurement button was pressed and made sure that the ready lamp was on. Calibration was completed after lamp flashes 3 times.

2) Absolute measurement:

The samples were kept in clean and white transparent Petri plates. The sample was kept above the measuring head. The measuring button was pressed after making sure the ready lamp was on. The value of L* a* and b* were noted down and the Chromameter power was off before disconnecting with the computer.

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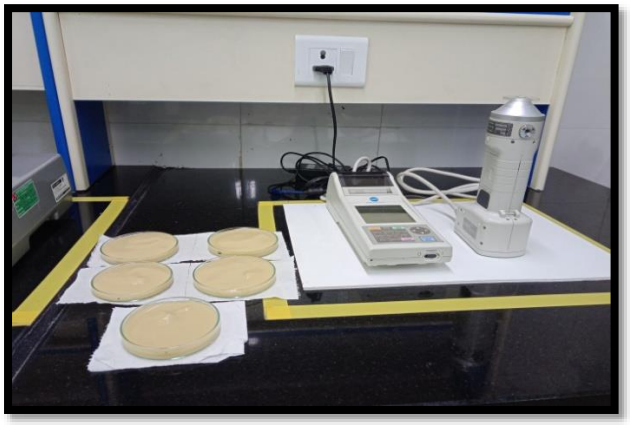

Fig: 1 Colour Measurement of Aseptic White Guava Pulp by using Konica Minolta Chromameter CR-400.

Result and discussion:

The analysis of physical parameters on White Guava Pulp (aseptically packed), i.e. Brix, pH, acidity, consistency, viscosity and colour were performed using hand refractometer, pH meter, Bostwick consistometer, Brookfield viscometer and Konica Minolta Chromameter CR-400 respectively.

Colour measurement in White Guava Pulp during storage condition:

The colour analyses were performed using Konica Minolta Chromameter CR-400. The colour analysis was performed in Hunter scale and CIE Lab scale .The colour analysis in Hunter scale were in the value of L, a and b. The colour analysis was performed in CIE scale in value of L*, a* and b*. The L* represents the level of brightness between black and white, a* represents balance between green and red and b* represents balance between blue and yellow.

Effect of Storage on colour deterioration of aseptically packed White Guava pulp The storage time and temperature are the factor which causes colour deterioration to great extent. The colour analysis was performed using Konica Minolta CR-400 in Hunter scale and CIE scale.

The aseptic White Guava pulp was kept at two conditions:

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1) Ambient Temperature (29-37°C)
2) Refrigerated Temperature (4-10°C)

In ambient temperature (29-37°C), the colour deterioration was more as compared to one which kept in refrigerated temp (5-10°C). The L, a & b value was deteriorated from 60.58, -1.86 and 15.32 to 58.67, -2.63 and 13.87 respectively. Similarly the L*, a* & b* value deteriorated from 63.86, -1.27 and 43.04 to 61.84, -2.0 and 41.81.

In refrigerated temperature (4-10°C), the colour deterioration had shown minimal colour deterioration in comparison with one kept in ambient temperature. The L, a & b has deteriorated from 60.58, -1.86 and 15.32 to 59.60, -2.13 and 14.69 where as L*, a* & b* value deteriorated from 63.86, -1.27 and 43.04 to 62.57, -1.79 and 42.05 respectively. Thus the study indicates that storing at cold atmosphere (4-10°C) retain brightness and colour to better extent than storing in ambient condition (29-37°C).

Colour Analysis using Konica Minolta Chromameter CR-400

Date of analysis : 08.02.2018

Batch code : WGP/061217/201

Date of Production : 06.02.2018

Table: 1 Colour Analysis of Aseptic White Guava Pulp

Description	Hunter Scale			CIE Scale		
	L	**a**	**b**	**L***	**a***	**b***
Sample 1	**60.83**	**-1.94**	**15.2**	**63.94**	**-1.2**	**42.78**
Sample 2	**60.62**	**-1.84**	**15.0**	**63.85**	**-1.32**	**43.74**
Sample 3	**60.45**	**-1.76**	**15.4**	**63.91**	**-1.25**	**42.85**
Sample 4	**60.78**	**-1.94**	**15.6**	**63.85**	**-1.28**	**42.96**
Sample 5	**60.25**	**-1.82**	**15.4**	**63.78**	**-1.3**	**42.88**

Average	**60.58**	**-1.86**	**15.32**	**63.86**	**-1.27**	**43.04**

Colour Analysis using Konica Minolta Chromameter CR-400

Date of analysis : 08.03.2018

Batch code : WGP/061217/201

Date of Production : 06.02.2018

Table : 2 Colour Analysis of Aseptic White Guava Pulp at ambient condition (29-37°C)

Description	Hunter Scale			CIE Scale		
	L	**a**	**b**	**L***	**a***	**b***
Sample 1	**60.62**	**-1.96**	**15.0**	**63.78**	**-1.28**	**42.70**
Sample 2	**60.45**	**-1.94**	**15.2**	**63.80**	**-1.40**	**42.20**
Sample 3	**60.45**	**-1.96**	**15.0**	**63.78**	**-1.40**	**42.80**
Sample 4	**60.22**	**-1.98**	**15.0**	**63.76**	**-1.30**	**42.72**
Sample 5	**60.10**	**-1.94**	**15.0**	**63.80**	**-1.25**	**42.60**
Average	**60.36**	**-1.95**	**15.0**	**63.78**	**-1.32**	**42.60**

Colour Analysis using Konica Minolta Chromameter CR-400

Date of analysis : 08.03.2018

Batch code : WGP/061217/201

Date of Production : 06.02.2018

Table: 3 Colour Analysis of Aseptic White Guava Pulp at Refrigerated condition (4-10°C)

Description	**Hunter Scale**			**CIE Scale**		
	L	**a**	**b**	**L***	**a***	**b***
Sample 1	**60.82**	**-1.94**	**15.0**	**63.78**	**-1.20**	**42.70**
Sample 2	**60.45**	**-1.92**	**15.2**	**63.80**	**-1.40**	**42.88**

Sample 3	**60.78**	**-1.82**	**15.4**	**63.78**	**-1.30**	**42.80**
Sample 4	**60.25**	**-1.88**	**15.0**	**63.86**	**-1.32**	**42.82**
Sample 5	**60.58**	**-1.86**	**15.4**	**63.80**	**-1.28**	**42.88**
Average	**60.57**	**-1.88**	**15.2**	**63.80**	**-1.30**	**42.81**

Colour Analysis using Konica Minolta Chromameter CR-400

Date of analysis : 09.04.2018

Batch code : WGP/061217/201

Date of Production : 06.02.2018

Table: 4 Colour Analysis of Aseptic White Guava Pulp at ambient condition (29-37°C)

Description	Hunter Scale			CIE Scale		
	L	**a**	**b**	**L***	**a***	**b***
Sample 1	**59.89**	**-1.98**	**14.92**	**63.2**	**-1.4**	**42.40**
Sample 2	**60.22**	**-2.06**	**15.0**	**62.68**	**-1.35**	**42.44**
Sample 3	**60.08**	**-1.98**	**14.94**	**62.20**	**-1.68**	**42.38**
Sample 4	**60.0**	**-2.08**	**14.98**	**62.45**	**-1.70**	**42.20**
Sample 5	**59.9**	**-1.98**	**14.86**	**62.0**	**-1.68**	**42.40**
Average	**60.01**	**-2.01**	**14.94**	**62.50**	**-1.56**	**42.36**

Colour Analysis using Konica Minolta Chromameter CR-400

Date of analysis : 09.04.2018

Batch code : WGP/061217/201

Date of Production : 06.02.2018

Table: 5 Colour Analysis of Aseptic White Guava Pulp at Refrigerated condition (4-10°C)

Description	**Hunter Scale**			**CIE Scale**		
	L	**a**	**b**	**L***	**a***	**b***
Sample 1	**59.89**	**-1.98**	**15.0**	**63.2**	**-1.4**	**42.64**

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Sample 2	**60.22**	**-1.92**	**15.2**	**62.68**	**-1.35**	**42.64**
Sample 3	**60.08**	**-1.96**	**14.98**	**63.20**	**-1.58**	**42.58**
Sample 4	**60.0**	**-1.90**	**14.98**	**62.45**	**-1.60**	**42.60**
Sample 5	**60.20**	**-1.88**	**15.18**	**63.26**	**-1.62**	**42.58**
Average	**60.07**	**-1.92**	**15.06**	**62.95**	**-1.51**	**42.60**

Colour Analysis using Konica Minolta Chromameter CR-400

Date of analysis : 08.05.2018

Batch code : WGP/061217/201

Date of Production : 06.02.2018

Table: 6 Colour Analysis of Aseptic White Guava Pulp at ambient condition (29-37°C)

Description	**Hunter Scale**			**CIE Scale**		
	L	**a**	**B**	**L***	**a***	**b***
Sample 1	**59.48**	**-2.22**	**14.44**	**62.02**	**-1.78**	**42.08**
Sample 2	**59.45**	**-2.20**	**14.50**	**62.06**	**-1.69**	**42.02**
Sample 3	**59.44**	**-2.18**	**14.46**	**62.09**	**-1.75**	**41.94**
Sample 4	**59.50**	**-2.18**	**14.46**	**62.02**	**-1.71**	**41.96**
Sample 5	**59.45**	**-2.16**	**14.42**	**62.01**	**-1.74**	**42.02**
Average	**59.46**	**-2.18**	**14.45**	**62.04**	**-1.73**	**42.0**

Colour Analysis using Konica Minolta Chromameter CR-400

Date of analysis : 08.05.2018

Batch code : WGP/061217/201

Date of Production : 06.02.2018

Table: 7 Colour Analysis of Aseptic White Guava Pulp at Refrigerated condition (4-10°C)

Description	**Hunter Scale**			**CIE Scale**		
	L	**a**	**b**	**L***	**a***	**b***

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Sample 1	**59.76**	**-2.02**	**14.88**	**62.85**	**-1.62**	**42.50**
Sample 2	**59.72**	**-2.02**	**14.86**	**62.78**	**-1.64**	**42.48**
Sample 3	**59.68**	**-2.04**	**14.86**	**62.76**	**-1.64**	**42.48**
Sample 4	**59.68**	**-1.99**	**14.80**	**62.78**	**-1.66**	**42.44**
Sample 5	**59.66**	**-2.06**	**14.78**	**62.72**	**-1.70**	**42.40**
Average	**59.7**	**-2.02**	**14.83**	**62.77**	**-1.65**	**42.46**

Colour Analysis using Konica Minolta Chromameter CR-400

Date of analysis : 06.06.2018

Batch code : WGP/061217/201

Date of Production : 06.02.2018

Table: 8 Colour Analysis of Aseptic White Guava Pulp at ambient condition (29-37°C)

Description	**Hunter Scale**			**CIE Scale**		
	L	**a**	**b**	**L***	**a***	**b***
Sample 1	**58.72**	**-2.58**	**13.88**	**61.82**	**-1.96**	**41.86**
Sample 2	**58.68**	**-2.64**	**13.88**	**61.90**	**-2.02**	**41.80**
Sample 3	**58.66**	**-2.66**	**13.90**	**61.86**	**-1.98**	**41.80**
Sample 4	**58.68**	**-2.64**	**13.86**	**61.80**	**-2.04**	**41.78**
Sample 5	**58.62**	**-2.66**	**13.84**	**61.84**	**-2.04**	**41.84**
Average	**58.67**	**-2.63**	**13.87**	**61.84**	**-2.0**	**41.81**

Colour Analysis using Konica Minolta Chromameter CR-400

Date of analysis : 06.06.2018

Batch code : WGP/061217/201

Date of Production : 06.02.2018

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Table: 9 Colour Analysis of Aseptic White Guava Pulp at Refrigerated condition (4-10°C)

Description	Hunter Scale			CIE Scale		
	L	a	b	L*	a*	b*
Sample 1	59.62	-2.12	14.72	62.58	-1.80	42.08
Sample 2	59.64	-2.10	14.70	62.60	-1.82	42.06
Sample 3	59.58	-2.12	14.68	62.56	-1.78	42.10
Sample 4	59.60	-2.16	14.72	62.58	-1.80	42.02
Sample 5	59.58	-2.16	14.66	62.54	-1.78	42.02
Average	59.60	-2.13	14.69	62.57	-1.79	42.05

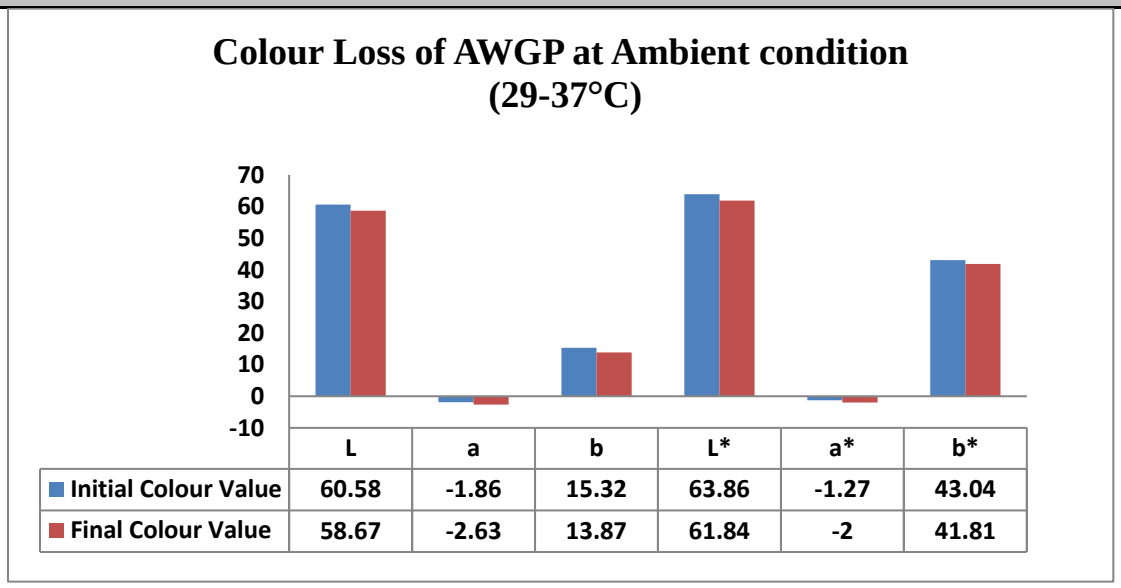

Fig: 2 Colour loss of Aseptic White Guava pulp kept at Ambient condition (29-37°C).

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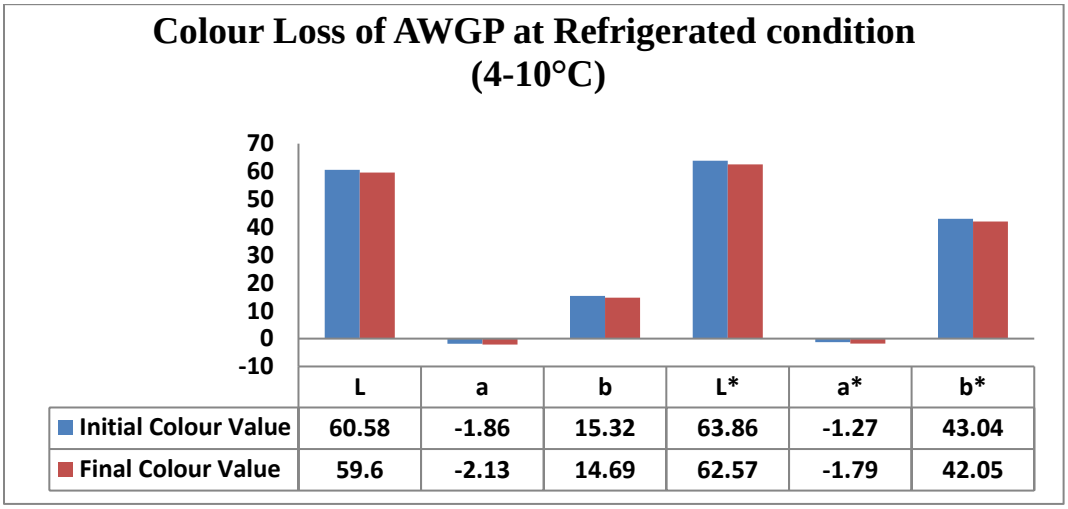

Fig: 3 Colour loss of Aseptic White Guava pulp kept at Refrigerated condition (4-10°C).

Table: 10 Monitoring of Temperature & Humidity of Ambient & Refrigerated Conditions

S.No	Date	Ambient condition		Refrigerated condition	
		Temp (°C)	R.H (%)	Temp (°C)	R.H (%)
1	08.02.2018	29	75	5.8	87
2	23.02.2018	31	67	5.2	88
3	08.03.2018	32	68	9.8	83
4	24.03.2018	34	63	4.6	91
5	09.04.2018	36	62	5.8	87
6	24.04.2018	37	61	8.4	87
7	08.05.2018	37	60	5.2	87
8	23.05.2018	36	62	6.5	89
9	06.06.2018	37	60	5.8	82

Temperature Range at Ambient Condition: 29-37°C

Temperature Range at Refrigerated Condition: 4.6-9.8°C

Relative Humidity Range at Ambient Condition: 60-75%

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Relative Humidity Range at Refrigerated Condition: 82-91%.

Conclusion:

The colour is the most important factor and also changed more in Ambient (29-37 degree C) condition than the Refrigerated (4-10 degree C) condition. The temperature has a major role in colour deterioration during subsequent storage. According to Arrhenius equation, the rate of reaction become double when there is increase in temperature. Packaging material also contribute in the colour deterioration to great extent but here Aseptic packet not causes more effect because of that bag comprising of 7 layers of pack, but due to oxygen permeability the colour was deteriorated. The study indicates that the Aseptically packed white guava pulp storing in cold storage (4-10 degree C) retains brightness and colour to better extent than storing in Ambient condition (29-37 degree C).

Reference:

- Abdullah, M.Z., Guan, L.C., Lim, K.C. & Karim, A.A. (2004). The applications of computer vision and tomographic radar imaging for assessing physical properties of food. Journal of food engineering 61: 125-135.

- Brosnan, T. & Sun, D. (2004). Improving quality inspection of food products by computer vision – a review-. Journal of Food Engineering 61: 3-16.

- Du, C. & Sun, D. (2004). Recent developments in the applications of image processing techniques for food quality evaluation. Trends in Food Science & Technology 15: 230-249.

- Finlayson, G.; Hordley, S.D. ; Hubel, P.M. (2001): Color by Correlation: A Simple, Unifying Framework for Color Constancy. Transaction on Pattern Analysis and Machine Intelligence, 23(11):1209-1221.

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- Ahmed, J., Shivhare, U., & Sandhu, K. (2002c). Thermal degradation kinetics of carotenoids and visual color of papaya puree. *Journal of Food Science, 67*(7), 2692–2695.

- Almela, L., Javaloy, S., Fernández-López, J. A., & Lôpez-Roca, J. M. (1995). Comparison between the tristimulus measurements *Yxy* and *L* a* b** to evaluate the colour of young red wines. *Food Chemistry, 53*(3), 321–327.

- Khan SH, Khan A, Litaf U, Shah AS, Khan MA, et al. (2015) Effect of Different Concentration of Guava Pulp, Apple Pulp and Sugar Solution on the Shelf Stability of Blend Leather Storage at Ambient Temperature.

- Augustin, M. A., Osman, A. and Osman, A. 1988. Post-harvest storage of guava (Psidium guajava L., cultivar Taiwan).

- Pertanika, 11(1): 45-50. Combrink, J. C., Kock, S. D., CJ-Van, E., De-kock, S. L. and Van-Eden, C. J. 1990. Effect of postharvest treatment and packing on the keeping quality of fresh guava fruit. Acta Hort., 275: 639-645.

- Aishah, B., 2 Hannah, K. and 2 Zati Alyani, O. 2016. Quality degradation Pink guava juice Kinetic Activation energy Q10.

- Tarlak, F., Ozdemir, M., & Melikoglu, M. (2016). Computer vision system approach in colour measurements of foods: Part I. development of methodology. Food Science and Technology, 36(2), In press. http:// dx.doi.org/10.1590/1678-457X.11615.

- Hutchings, J. B. (1999). Food colour and appearance (2nd ed.). New York: Springer.

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- Gohil, S. N., Garad B. V., Shirsath H. K. and Desai U. T., 2006, Study on physic-chemical constituents in guava (Psidium guajava) under sub-arid zone of Maharashtra. Scientific Hort., 10: 139-147.

- Singh, M., 1988, Performance of some cultivars of guava (Psidium guajava L.) with special reference to their commercial significance in the central gangetic plains. Punjab Hort. J., 28 (3-4): 50-55.

- Pandey, D., Shukla, S. K., Yadav, R. C. and Nagar, A. K., 2007, Promising guava (Psidium guajava L.) cultivars for North Indian conditions. Acta Hort., 735: 91- 94.

- Paschos, G. (2001): Perceptually uniform color spaces for color texture analysis: An empirical evaluation. IEEE Transactions on Image Processing 10 (6): 932-937.

- Yam, K.L. & Papadakis, S. (2004). A simple digital imaging method for measuring and analyzing color of food surfaces. Journal of Food Engineering 61: 137-142.

- Nutrition Data (ND). 2008b. Guavas, common, raw. *Nutritiondata.com*. Retrieved April 22, 2008.

- Isabella, M.B., Geraldo, A.M. and Raimundo, W.F. Physical-chemical changes during extraction and clarification of guava juice. *Food Chemistry*, 54(4). 383-386. 1995.

- León, K. (2004): Diseño de un sistema de medición de color en unidades L*a*b* a partir de imágenes adquiridas con cámara digital RGB. Memoria de Ingeniería Civil en Informática. Departamento de Ingeniería Informática, Universidad de Santiago de Chile.

- Baardseth, P., Skrede, G., Naes, T., Thomassen, M. S., Iversen, A., & Kaaber, L. (1988). A comparison of CIE (1976) L* a* b* values obtained from two different instruments on several food commodities. Journal of Food Science, 53(6), 1737-1742. http://dx.doi.org/10.1111/j.1365-2621.1988.tb07830.x.

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- Francis, F. J. (1995). Quality as influenced by color. Food Quality and Preference, 6(3), 149-155. http://dx.doi.org/10.1016/0950- 3293(94)00026-R.

- Radha,. and T.Mathew, L., 2007, Fruit crops. Horticulture Sciences series New India publishing agency, 3: 59-72.