

EFFECT OF MODIFIED ATMOSPHERE ON BIO-CHEMICAL PARAMETERS AND SHELF LIFE OF GUAVA (*Psidium guajava* L.) CV. HISAR SAFEDA AND L-49

Chetak Bishnoi^{1*}, R.K. Sharma¹ and S. Siddiqui²

¹Department of Horticulture. ²Dept. of Food Science & Technology
CCS Haryana Agricultural University, Hisar 1250-04, Haryana, India

*E-mail: chetak29@gmail.com

ABSTRACT: An experiment was conducted to study the effect of different durations of modified atmosphere on bio-chemical parameters and shelf life of guava under ambient conditions. Fruits were packed in perforated polyethylene bags (LDPE) of thickness 300 gauge and then stored at 8°C in BOD incubator for the periods 1, 2, 3 and 4 days. After respective durations of storage under MA at 8°C, fruits were removed from MA and packed in CFB and stored at ambient temperature. Fruits were sampled at every day for various bio-chemical pigments of guava. Among different durations of MA storage, the maximum total sugars and reducing sugars was recorded in the fruits stored for 0, 1 and 2 days and minimum in the fruits stored in MA for 4 days. The fruits stored in MA for different durations maintained high phenol contents and recorded maximum phenol in the fruit stored in MA for 4 days and minimum in control fruits. Higher retention of chlorophyll was recorded in the fruits stored in MA for 4 days while lesser carotenoids were recorded in fruit stored in MA for 4 days. Carotenoids content increased and chlorophyll content decreased with the increase in storage period in both the cvs Hisar Safeda and L-49 (Sardar).

Keywords : Guava, modified atmosphere, shelf life, phenol, chlorophyll, carotenoid.

Guava 'Apple of tropics' [*Psidium guajava* L.] is a popular fruit, grown successfully throughout tropical and sub-tropical regions. Guava is the fourth most important fruit crop after mango, banana, and citrus in India and occupies the area of 24.4 lakh ha and production 33.18 lakh MT with average productivity of 11.1 MT/ha (Indian Horticulture Database, 4). It is considered as one of the exquisite, nutritionally valuable, and remunerative crop. Guava is one of the most common fruits which are liked by both the rich and the poor because of its high nutritive value, availability at moderate price. It is a rich source of vitamin C and pectin (Patel *et al.*, 7). Guava is normally consumed as fresh as desert fruit but it is also processed into several products in fruit processing industry. A number of delicious products like jam, jelly, cheese, and RTS beverages are being prepared from guava fruits. Guava fruit is a climacteric fruit. It exhibits a climacteric pattern of respiration and ethylene production. Usually the fruits are harvested at different stage of maturity depending on the situation. After reaching the physiological maturity it ripens fast within 1 or 2 days resulting in early senescence of the fruit (Chundawat *et al.*, 1). The ripening of the fruits corresponds to a series of physiological, biochemical, and structural changes, which make the fruit attractive for consumption, so bio-chemical changes during ripening of fruit is also the

most important attribute because in addition to defining the quality of the fruit for consumption. Being highly perishable and very short post-harvest shelf life, a result of the loss of all quality attributes, which limits transportation and storage period. Packing of fruits in sealed polybags is the simplest way to attain MA (Neeraj *et al.*, 6), however, it may not always enhance the shelf life (Mahadeviah, 5). Thus there is a need to find out the suitable MA storage condition to enhance the shelf life and reduces the huge post harvest losses. Therefore, the present studies were carried out to find out the effect of various durations of MA on the subsequent shelf life quality and ripening behaviour of guava fruit cv. L-49 and Hisar Safeda.

MATERIALS AND METHODS

The fruits of rainy season crop were harvested at green mature stage. The fully green matured and healthy fruits cv. Hisar Safeda and L-49 were procured from the orchard of the Department of Horticulture, CCS HAU, Hisar, Haryana. The fruits were packed in imperforated polyethylene bags of thickness 300 gauge and stored at 8°C for 1, 2, 3 and 4 days. After respective durations of storage under MA at 8°C, fruits were removed from MA and packed in corrugated fiber board (CFB) and stored at ambient temperature. Control fruits packed directly in CFB boxes with

newspaper lining and stored at ambient conditions until they become unmarketable. Each treatment was comprised of four replications under complete randomized design. Fruits were sampled at every day for various bio-chemical parameters. Sugars were estimated by the method of Hulme and Narain (3). Total phenolic content was estimated by the method of Van Buren (8). The chlorophyll and carotenoids were estimated by the method given by Wellburn (9).

RESULTS AND DISCUSSION

From the results obtained from the present investigation it can be concluded that exposure of fruits for < 2 days to MA resulted in enhanced shelf life of fruits up to 8 days whereas fruits exposure to MA more than 3 days, fruits remained high phenol, high Chlorophyll and low carotenoid contents and still remained green, hard and did not ripen when further stored under ambient conditions. Gupta and jawandha (2) and Mahadeviah (5) have also reported similar findings in their respective study.

Table 1 : Effect of modified atmosphere on total sugars (%) of different cvs. of guava fruits during storage.

MA (Days)*	Period of storage (days)									Mean
	0	1	2	3	4	5	6	7	8	
	Hisar Safeda									
0	5.44	6.20	7.13	7.54	7.65	6.53	6.10	5.53	4.92	6.33
1	5.44	5.40	6.05	6.91	7.22	7.53	6.74	5.94	5.75	6.33
2	5.44	5.40	5.37	6.07	6.71	7.14	7.58	6.91	6.33	6.33
3	5.44	5.40	5.37	5.57	5.88	6.02	6.11	5.79	5.15	5.63
4	5.44	5.40	5.37	5.57	5.16	5.33	5.46	5.53	5.40	5.40
Mean	5.44	5.56	5.85	6.33	6.52	6.51	6.40	5.94	5.51	

CD (P=0.05) Treatments = 0.08 Storage = 0.11 Treatments × Storage = 0.24

Lucknow-49										
0	5.99	6.97	8.18	8.18	6.85	6.28	5.64	5.26	4.96	6.48
1	5.99	5.83	6.72	7.98	8.20	6.95	5.91	5.77	5.51	6.54
2	5.99	5.83	5.86	6.74	7.58	7.62	7.50	6.46	6.32	6.66
3	5.99	5.83	5.86	5.43	5.88	6.28	5.48	5.54	5.02	5.70
4	5.99	5.83	5.86	5.43	4.95	5.36	5.83	5.26	4.79	5.48
Mean	5.99	6.06	6.49	6.75	6.69	6.50	6.07	5.66	5.32	

CD (P=0.05) Treatments = 0.11 Storage = 0.14 Treatments × Storage = 0.32

*Bold figures indicate assumed values, which are similar to the values of fruits from bags opened on that day * at 8°C

Table 2 : Effect of modified atmosphere on reducing sugar (%) of different cvs. of guava fruits during storage.

MA (Days)*	Period of storage (days)									Mean
	0	1	2	3	4	5	6	7	8	
	Hisar Safeda									
0	3.69	3.79	3.95	4.11	4.53	3.73	3.17	3.05	2.95	3.66
1	3.69	3.71	3.82	3.98	4.04	4.37	3.61	3.06	2.59	3.65
2	3.69	3.71	3.70	3.78	3.82	3.71	3.73	3.27	3.39	3.64
3	3.69	3.71	3.70	3.72	3.76	3.78	3.36	3.41	2.93	3.56
4	3.69	3.71	3.70	3.72	3.72	3.73	3.20	3.04	2.76	3.47
Mean	3.69	3.73	3.77	3.86	3.97	3.86	3.41	3.16	2.92	

CD (P=0.05) Treatments = 0.09 Storage = 0.12 Treatments x Storage = 0.26

Lucknow-49										
0	3.81	4.21	5.06	5.62	4.82	3.97	3.66	3.09	3.02	4.28
1	3.81	3.76	4.07	5.12	5.30	5.12	4.03	3.61	2.93	4.25
2	3.81	3.76	3.59	3.97	4.48	5.16	5.48	4.31	3.57	4.24
3	3.81	3.76	3.59	3.07	3.52	3.81	3.98	4.23	3.78	3.73
4	3.81	3.76	3.59	3.07	3.10	2.93	2.97	3.08	2.58	3.21
Mean	3.81	3.85	3.98	4.17	4.24	4.20	4.02	3.66	3.17	

CD (P=0.05) Treatments = 0.09 Storage = 0.12 Treatments x Storage = 0.26

*Bold figures indicate assumed values, which are similar to the values of fruits from bags opened on that day * at 8°C

Table 3 : Effect of modified atmosphere on total phenols (g/100g fruit pulp) of different cvs. of guava fruits during storage.

MA (Days)*	Period of storage (days)									Mean
	0	1	2	3	4	5	6	7	8	
Hisar Safeda										
0	0.79	0.74	0.64	0.60	0.55	0.49	0.43	0.40	0.34	0.55
1	0.79	0.76	0.70	0.62	0.58	0.54	0.49	0.44	0.39	0.59
2	0.79	0.76	0.76	0.71	0.66	0.61	0.56	0.50	0.43	0.64
3	0.79	0.76	0.76	0.75	0.71	0.68	0.64	0.59	0.57	0.69
4	0.79	0.76	0.76	0.75	0.71	0.68	0.67	0.63	0.61	0.70
Mean	0.79	0.76	0.72	0.68	0.64	0.60	0.56	0.51	0.47	

CD (P=0.05) Treatments = 0.01 Storage = 0.01 Treatments × Storage = 0.02

Lucknow-49										
0	0.69	0.67	0.62	0.58	0.55	0.51	0.48	0.45	0.42	0.55
1	0.69	0.67	0.65	0.62	0.60	0.57	0.53	0.50	0.46	0.59
2	0.69	0.67	0.65	0.64	0.59	0.58	0.55	0.53	0.48	0.60
3	0.69	0.67	0.65	0.66	0.64	0.61	0.58	0.54	0.49	0.61
4	0.69	0.67	0.65	0.66	0.62	0.62	0.61	0.59	0.57	0.63
Mean	0.69	0.67	0.65	0.63	0.60	0.58	0.55	0.52	0.48	

CD (P=0.05) Treatments = 0.01 Storage = 0.01 Treatments × Storage = 0.02

Bold figures indicate assumed values, which are similar to the values of fruits from bags opened on that day * at 8°C

Table 4 : Effect of modified atmosphere Chlorophyll (mg/g of peel) of different cvs. of guava fruits during storage.

MA (Days)*	Period of storage (days)									Mean
	0	1	2	3	4	5	6	7	8	
Hisar Safeda										
0	1.32	1.21	1.11	1.04	0.92	0.65	0.51	0.39	0.33	0.83
1	1.32	1.32	1.18	1.05	0.86	0.67	0.50	0.36	0.34	0.84
2	1.32	1.32	1.33	1.19	1.07	0.82	0.67	0.49	0.43	0.96
3	1.32	1.32	1.33	1.34	1.28	1.20	1.06	1.06	1.01	1.21
4	1.32	1.32	1.33	1.34	1.34	1.28	1.28	1.24	1.18	1.29
Mean	1.32	1.29	1.26	1.19	1.09	0.92	0.80	0.70	0.66	

CD (P=0.05) Treatments = 0.02 Storage = 0.02 Treatments × Storage = 0.05

Lucknow-49										
0	1.50	1.22	1.02	0.87	0.67	0.56	0.44	0.34	0.32	0.77
1	1.50	1.35	1.25	1.14	0.94	0.68	0.56	0.46	0.37	0.91
2	1.50	1.35	1.44	1.28	1.10	1.02	0.78	0.59	0.46	1.06
3	1.50	1.35	1.44	1.46	1.37	1.27	1.21	1.15	1.11	1.32
4	1.50	1.35	1.44	1.46	1.42	1.40	1.35	1.33	1.24	1.39
Mean	1.50	1.32	1.32	1.24	1.10	0.99	0.87	0.77	0.70	

CD (P=0.05) Treatments = 0.02 Storage = 0.04 Treatments × Storage = 0.08

Bold figures indicate assumed values, which are similar to the values of fruits from bags opened on that day * at 8°C

Table 5 : Effect of modified atmosphere on total carotenoids (mg/g of peel) of different cvs. of guava fruits during storage

MA (Days)*	Period of storage (days)									Mean
	0	1	2	3	4	5	6	7	8	
Hisar Safeda										
0	0.72	0.79	0.83	0.91	0.99	1.13	1.25	1.40	1.48	1.05
1	0.72	0.69	0.80	0.85	0.92	1.00	1.11	1.26	1.45	0.98
2	0.72	0.69	0.71	0.79	0.86	0.94	1.05	1.16	1.22	0.90
3	0.72	0.69	0.71	0.69	0.72	0.76	0.80	0.83	0.85	0.75
4	0.72	0.69	0.71	0.69	0.66	0.70	0.72	0.75	0.80	0.71
Mean	0.72	0.71	0.75	0.78	0.83	0.90	0.99	1.08	1.16	

CD (P=0.05) Treatments = 0.01 Storage = 0.02 Treatments × Storage = 0.04

Lucknow-49										
0	0.80	0.98	1.07	1.20	1.37	1.41	1.49	1.56	1.66	1.28
1	0.80	0.79	1.01	1.11	1.16	1.33	1.39	1.46	1.59	1.18
2	0.80	0.79	0.78	0.97	1.08	1.14	1.26	1.36	1.50	1.08
3	0.80	0.79	0.78	0.76	0.79	0.80	0.82	0.84	0.87	0.81
4	0.80	0.79	0.78	0.76	0.75	0.76	0.77	0.79	0.81	0.78
Mean	0.80	0.83	0.89	0.96	1.03	1.08	1.15	1.20	1.29	

CD (P=0.05) Treatments = 0.01 Storage = 0.02 Treatments × Storage = 0.04

Bold figures indicate assumed values, which are similar to the values of fruits from bags opened on that day* at 8°C

REFERENCES

- Chundawat, B.S.; Singh, J.P.; Kainsa, R. and Gupta, O.P. (1976). Post harvest studies on guava fruits: Effect of packing and storage period on quality of fruits. *Haryana J. Hort. Sci.*, **5** : 130-136.
- Gupta, N. and Jawandha, S.K. (2012). Effect of different packagings on quality of peaches during storage. *HortFlora Res. Spectrum*, **1**(2) : 117-121.
- Hulme, A.C. and Narain, R. (1993). The ferricyanide method for determination of reducing sugars. A modification of Hegedorn-Jenson Hanes Technique. *Biochem. J.*, **25** : 1051-1061.
- Indian Horticulture Database (2013). National Horticulture Board. Ministry of Agriculture, Govt. of India. Gurgaon. <http://nbv.gov.in/online/information-bulletin.html>.
- Mahadeviah, M. (2002). Importance of packaging and recent developments in packaging materials and systems. *Indian Fd. Packer*, 173-176.
- Neeraj; Joon, M.S. and Bhatia, S.K. (2003). Use of plastic in fruit packaging a review. *Haryana J. Hort. Sci.*, **32** (1-2) : 1-7.
- Patel, R.M.; Pandey, A.; Dwivedi, S.K. and Sharma, G. (2005). Studies on physicochemical properties of guava (*Psidium guajava*). *Plant Arch.*, **5** (2) : 597-600.
- Van Buren, J. (1970). Fruit phenolics In : *The Biochemistry of fruits and their products*. A.C. Hulme vol. I. Academic press, London pp. 269-304.
- Wellburn, A.R. (1994). The spectral determination of chlorophylls a and b as well as total carotenoids by using various solvents with spectrophotometers of different resolutions. *J. Plant Physiol.*, **144** : 307-313.
- Yongjoon, Y.; Kim, S.J.; Yang, Y.J. and Kim, S.J. (1995). Changes in carotenoid pigments in the peel of "Fuji" apple fruit during Cold and CA storage. *J. Korean Soc. Hort. Sci.*, **36** (5) : 662-668.



Citation : Bishnoi C., Sharma R.K. and Siddiqui S. (2014). Effect of modified atmosphere on bio-chemical parameters and shelf life of guava (*Psidium guajava* L.) cv. Hisar Safeda and L-49. *HortFlora Res. Spectrum*, **3**(4) : 369-372