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Short communication

Effect of different polymeric films on shelf-life and quality of pear fruits under supermarket conditions

B.V.C. Mahajan*, Dinesh Kumar and W.S. Dhillon
Punjab Horticultural Postharvest Technology Centre, Punjab Agricultural University, Ludhiana 141004, Punjab

ABSTRACT

Pear fruits cv. 'Patharnakh' were harvested at physiological maturity, packed in paper moulded tray and tightly wrapped with different packaging films, *viz*., low density polyethylene (LDPE), high density polyethylene (HDPE), shrink and cling films. The film-packed fruits and control (without film packaging) were stored under super-market conditions, *i.e.*, 20-21°C and 90-95% RH and analysed for various physico-chemical parameters at weekly interval. Shrink film proved to be most effective in extending the storage-life of pear fruits up to three weeks and maintained superior quality as indicated by lower weight loss, desirable fruit firmness, total soluble solids, total sugars, acidity, and higher organoleptic score.

Key words: Pear, polymeric films, shelf-life, quality.

In India pear is grown in warm humid sub-tropical plains and cold dry temperate regions occupying an area of 38,600 ha with an annual production of 1.76 lakh MT (Anon, 2). 'Patharnakh' is the leading cultivar of pear, which is predominantly grown in Punjab state. The harvesting of Patharnakh pear starts in the third weak of July and continues up to the end of August. Generally, this period coincides with heavy rainfall and high temperature, which interferes with post-harvest quality and marketability of the fruits, resulting in huge post harvest losses. The role of packaging for horticultural produce seems to be still underestimated. Packaging of fresh fruits is essential in the whole distribution cycle, starting from producer to the final user. The basic principal of packaging technology is that once produce is placed in a package and sealed with polymeric films, an environment different from ambient conditions will be established inside the package such as high CO_2 and low oxygen which helps in maintaining the quality and increase the shelf life (Singh *et al*., 11). Hence, the present investigation was planned to study the effect of polymeric films on the storage life and quality of pear fruits under super market conditions, *i.e.*, at 20-21°C temperature and 90-95% RH.

The fruits of pear cv. Patharnakh were harvested at physiological mature stage. The bruised and diseased fruits were sorted out, and only healthy and uniform sized fruits were selected for the study. Four types of packaging films, *viz.*, low density polyethylene film (LDPE 25 µ), high density polyethylene film (HDPE 20 µ), shrink film (10 µ) and cling film (20 µ) were used for packaging of pear fruits in paper moulded trays (22 cm × 13 cm). Pear fruits were packed in trays and tightly sealed with different packaging films. After packing, four pin holes were made in all the packs to prevent condensation of water vapour inside the packages. Thereafter, the packed fruits as well as control (non-packed) fruits were stored at 20-21°C and 90-95% RH (super-market conditions). The experiment consisted of 5 treatments and 5 storage intervals and laid out in completely randomized design with three replications for each treatment and each storage interval. The various physico-chemical parameters were recorded at weekly interval for four weeks. The physiological loss in weight (PLW) after each interval of storage was calculated by subtracting final weight from the initial weight of the fruits and expressed in per cent. The fruit firmness was measured with the help of a penetrometer (Model FT- 327, USA) using 8 mm stainless steel probe and expressed in terms of kilogram force pressure (kg force).The overall organoleptic rating of the fruits was done by a panel of five judges on the basis of external appearance of fruits, texture, taste, and flavour, making use of a 9-point Hedonic scale (Amerine *et al.*, 1). The total soluble solids (TSS) of the fruit juice were determined using a hand refractometer and expressed as percent TSS after making the temperature correction at 20°C. The total sugars and titratable acidity were estimated as per standard procedure (AOAC, 3).

The shrink film packed fruits recorded the lowest mean PLW (3.37%), followed by cling film (Table 1). The unpacked fruits showed the highest PLW (6.05%). The PLW of fruits packed in shrink film ranged between 1.15 to 6.02 percent from 7 to 28 days of

*Corresponding author's E-mail: bvc_mahajan@rediffmail.com

Table 1. Effect of different polymeric films on physiological loss in weight (PLW) and firmness of pear fruits during storage under supermarket conditions.

Treatment	PLW (%)						Firmness (kg force)					
	Storage interval (days)						Storage interval (days)					
	0	7	14	21	28	Mean	0	7	14	21	28	Mean
LDPE film	0.00	1.65	2.85	4.75	6.86	4.03	6.95	6.22	5.85	4.92	4.15	5.29
HDPE film	0.00	1.94	3.10	5.04	7.23	4.33	6.95	6.01	5.70	4.75	3.95	5.10
Shrink film	0.00	1.15	2.20	4.10	6.02	3.37	6.95	6.80	6.39	5.50	4.99	5.92
Cling film	0.00	1.34	2.55	4.42	6.57	3.72	6.95	6.51	6.13	5.25	4.31	5.55
Control	0.00	2.93	4.78	6.72	9.75	6.05	6.95	5.93	5.05	4.14	3.45	4.64
Mean	0.00	1.80	3.10	5.01	7.29		6.95	6.29	5.82	4.91	4.17	
$CD_{0.05}$	Treatment (T) = 0.04						0.03					
	Storage interval (S) = 0.03						0.02					
	T × S = 0.08						0.07					

storage as compared to control where PLW ranged between 2.93 to 9.75 percent during four weeks of storage. The fruits packed in shrink or cling films recorded lower weight loss, which is obvious due to role of films in checking rate of transpiration/ respiration and maintaining higher humidity inside the wrappers (Sonkar and Ladaniya, 9).

The fruit firmness, in general followed a declining trend commensurate with advancement in storage period (Table 1). The fruits packed in shrink film maintained the highest average firmness (5.92 kg force) closely followed by cling film (5.55 kg force). The control fruits registered the lowest mean firmness (4.64 kg force). Softening of fruits is caused either by breakdown of insoluble protopectins into soluble pectin or by hydrolysis of starch (Mattoo *et al.*, 6). The shrink wrapping of fruits resulted in higher fruit firmness, which might be due to reduced transpiration loss and respiration activity and thus retained more turgidity of the cells as observed in pomegranate fruits (Nanda *et al.*, 7).

The maximum sensory score was shown by fruits packed in shrink film (7.87) followed by cling film packed fruits (Table 2). On the other hand, control fruits registered the minimum sensory score (6.30). The shrink film and cling film packed fruits were rated as very much desirable to moderately desirable after 3 and 4 weeks of storage as compared to control which were found acceptable up to 2 weeks of storage. The development of better sensory score in the shrink packs could be possibly due to creation of favourable gaseous atmosphere under congenial temperature (Heaton *et al.*, 4). Kader *et al.* (5) envisaged that a film resulting in a favourable atmosphere at low temperature may result in harmful atmosphere at higher temperature, thus make the quality of fruit acceptable in former case and unacceptable in latter case.

The fruits packed in shrink film recorded maximum TSS content (12.11%) followed by cling film (Table 2). The control fruits recorded the lowest average TSS content (11.23%). It was further observed that in shrink film packed fruits, the TSS content increased slowly and steadily up to 21 days (13.25%) and thereafter gradually declined after 28 days storage (10.95%). On the other hand, control fruits recorded a faster rise in TSS content up to 14 days (13.23%) and thereafter declined at a faster rate at the end of 4 weeks of storage. The fruits packed in shrink film recorded maximum total sugars content (8.70%) followed by cling film (Table 3). The control fruits recorded the lowest average total sugar content (7.98%). It was further observed that in shrink film packed fruits the total sugar content increase d slowly and steadily up to 21 days (9.68%) and thereafter gradually declined after 28 days storage (7.66%). On the other hand, control fruits recorded a faster rise in total sugar content up to 14 days (9.52%) and thereafter declined at a faster rate and recorded 6.20% total sugars at the end of 4 weeks of storage. The increase in TSS/sugars during storage may possibly due to breakdown of starch into sugars, as on complete hydrolysis of starch no further increase in sugars occurs and subsequently a decline in these parameters is predictable as they along with other organic acids are primary substrate for respiration (Wills *et al.*, 10). The data revealed that acidity of pear fruits experienced a linear decline as the storage period advanced (Table 3). In shrink film packed fruits, the acidity ranged from 0.35 to 0.19 per cent, followed by cling film (0.33 to 0.17 per cent) and in control fruits, it ranged from 0.30 to 0.12 per cent from 7 to 28 days of storage. The decrease in

Table 2. Effect of different polymeric films on sensory quality and TSS content of pear fruits during storage under supermarket conditions.

Treatment	Sensory quality						TSS (%)					
	Storage interval (days)						Storage interval (days)					
	0	7	14	21	28	Mean	0	7	14	21	28	Mean
LDPE film	7.00	7.35	7.55	7.70	6.32	7.23	11.00	11.46	11.76	12.85	10.24	11.58
HDPE film	7.00	7.20	7.35	7.35	6.25	7.04	11.00	11.25	11.53	12.50	9.85	11.28
Shrink film	7.00	7.68	8.05	8.25	7.48	7.87	11.00	11.95	12.30	13.25	10.95	12.11
Cling film	7.00	7.50	7.75	8.02	6.60	7.47	11.00	11.62	12.05	13.10	10.72	11.87
Control	7.00	8.00	8.15	5.54	3.50	6.30	11.00	12.30	13.23	10.23	9.15	11.23
Mean	7.00	7.55	7.77	7.37	5.77		11.00	11.72	12.17	12.39	10.18	
$CD_{0.05}$	Treatment (T) = 0.03						0.03					
	Storage interval (S) = 0.02						0.02					
	T × S = 0.05						0.06					

Table 3. Effect of different polymeric films on total sugars and titratable acidity of pear fruits during storage under supermarket conditions.

Treatment	Total sugars (%)						Acidity (%)					
	Storage interval (days)						Storage interval (days)					
	0	7	14	21	28	Mean	0	7	14	21	28	Mean
LDPE film	7.64	8.25	8.47	9.25	7.37	8.34	0.39	0.32	0.28	0.24	0.15	0.25
HDPE film	7.64	8.10	8.30	9.00	7.09	8.12	0.39	0.31	0.27	0.23	0.14	0.24
Shrink film	7.64	8.60	8.85	9.68	7.66	8.70	0.39	0.35	0.34	0.32	0.19	0.30
Cling film	7.64	8.36	8.67	9.30	7.50	8.46	0.39	0.33	0.30	0.26	0.17	0.27
Control	7.64	8.85	9.52	7.36	6.20	7.98	0.39	0.30	0.26	0.22	0.12	0.23
Mean	7.64	8.43	8.76	8.92	7.16		0.39	0.32	0.29	0.25	0.15	
$CD_{0.05}$	Treatment (T) = 0.03						0.01					
	Storage interval (S) = 0.02						0.02					
	T × S = 0.05						NS					

titratable acids during storage may be attributed to utilization of organic acid in pyruvate decarboxylation reaction occuring during the ripening process of fruits (Pool *et al.,* 8).

From the present study, it can by concluded that pear fruits packed in paper moulded tray and wrapped with shrink or cling film can be marketed for 21 days with highly acceptable quality attributes under super market conditions (20-21ºC and 90-95% RH).

REFERENCES

1. Amerine, M.A, Pangborn, R.M. and Roessler, E.B. 1965. *Principles of Sensory Evaluation of Food*. Academic Press, London.
2. Anonymous, 2010. *Area and Production of different Fruits in Punjab State*. Directorate of Horticulture, Punjab, Chandigarh.
3. A.O.A.C. 1990. *Official Methods of Analysis* (14th Edn.), Association of Official Analytical Chemists, Washington, D.C.
4. Heaton, E.K., Dobson, J.W., Lane, R.P. and Beuchat, L.R. 1990. Evaluation of shrink wraps packaging for maintaining quality of apples. *J. Food Prot.* **53**: 598-99.
5. Kader, A.A., Zagory, D. and Kerbel, E.L. 1989. Modified atmosphere packaging of fruits and vegetables. *Food Sci. Nutri.* **28**: 1-30.
6. Mattoo, A.K., Murata, T., Pantastico, E.B., Chachiss, K., Ogata, K. and Phan, C.T. 1975. Chemical changes during ripening and senescence. **In**: *Post-harvest Physiology, Handling and Utilization of Tropical and*

Subtropical Fruits and Vegetables, Pantastico, E.B. (Ed.), The AVI Pub. Co. Inc., pp. 103-27.

7. Nanda, S., Sudhakar Rao, D.V. and Krishnamurthy, S. 2001. Effects of shrink film wrapping and storage temperature on the shelf-life and quality of pomegranate fruit cv. Ganesh. *Postharvest Biol. Tech.* **22**: 61-69.

8. Pool, K.M., Weaver, R.J. and Kliewer, K.M. 1972. The effect of growth regulators on the changes in fruit fruits of Thompson Seedless during cold storage. *J. American Soc. Hort. Sci.* **97**: 67-70.

9. Sonkar, R.K. and Ladaniya, M.S. 1998. Effect of tray over wrapping by heat shrinkable and stretchable films on Nagpur mandarin fruits. *Indian Fd. Packe*r, **52**: 22-26.

10. Wills, R.B.H., Cambridge, P.A. and Scott, K.J. 1980. Use of flesh firmness and other objective tests to determine consumer acceptability of delicious apples. *Australian J. Exp. Agri. Anim. Husb.* **20**: 252-56.

11. Singh, Zora, Janes, J., Tan, S.C., Subhadrabandhu, S. and Pichakum, A. 2002. Effects of different surfactants on calcium uptake and its effects on fruit ripening, quality and postharvest storage of mango under modified atmosphere packaging. *Acta Hort.* **509**: 113-17.

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