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Effect of Individual Shrink Wrapping on Spoilage and Quality of Peaches during Storage

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ABSTRACT

Effect of individual heat shrink wrapping of peaches (*Prunus persica* (L.) Batsch.) were studied using heat shrinkable 50 µ LDPE and 20 µ LLDPE film to enhance the shelf life in cool chamber (5 ± 1°C, 90 – 95% RH). The minimum physiological loss in weight (PLW) was 0.65% in 50µ LDPE and 0.7% in 20µ LLDPE. The PLW drastically reduced as compared to control (45.26%) after 42 days of storage. The spoilage of fruits was 7% in 20µ LLDPE wrapped fruits. No fruit decay was found in unwrapped samples, but all the fruits shrivelled after 14 days of storage. The firmness of the fruits was better in 20µ LLDPE as compared to control. The colour of the fruits changed from greenish-yellow to yellowish–red, with corresponding rise of a, b and Yi value, and decreased L value. The total soluble solids increased and the titrable acidity decreased in all the treatments during storage. It may be concluded that the shelf life of the fruits in cool chamber may be extended up to 42 days by individual heat shrink wrapping with 20µ LLDPE film after post harvest treatment with carbendazim (500 ppm).

Peaches (*Prunus persica* (L.) Batsch.) are highly perishable fruits and have very short shelf life. These are generally available for consumption between April to June in subtropical plains of India, when the temperature usually rises to more than 40°C and relative humidity falls less than 50% leading to accelerated weight loss and considerable reduced shelf life. Besides the environmental factors, the omission of wax treatment also results in excessive weight loss, shrivelling and reduction in the quality of fruits. Polyethylene films appear to be more effective than waxes in reducing transpiration rate and do not to have any deleterious effect on the internal quality. Shrink wrapping of fruits reduce weight loss, minimize fruit deformation and also checks spoilage by preventing secondary infection of fruits packed in the same box, and thus successively enhance the shelf life (Ladaniya *et al*., 1997). To retain the quality and to extend the shelf life of fruits, various techniques such as wax coating, packaging in corrugated fibre boxes and polyethylene bags for different fruits are used (Singh and Mondal, 2006). Packaging of fruits is done as bulk packaging, tray or individual fruit packaging. However, individual packing of fruits is better than tray packing because if one fruit get damaged in a tray or box, it may become a source of inoculum and can cause infection to another healthy adjoining fruits. In individual packing, the infection is not transmitted to other fruits, and the infected fruits can be easily removed from the lots or secondary packaging (Golomb *et al*., 1984). Hence, an experiment was conducted to study the effect of different type of polyethylene packaging materials on spoilage and quality of peach fruits during storage under low temperature and high humidity.

MATERIALS AND METHODS

Raw Material

Fruits of peach cv. *Shan–e–Punjab* were sampled from 10 years old trees from a private orchard at Abohar, Punjab. The fruits were picked up from random locations of the orchard in the last week of April 2005. The fruits were sorted out for experimentation to maintain uniformity in size and colour. The fruits were washed with tap water and subsequently treated with carbendazim (500 ppm) to protect microbial contaminant, and dried at room temperature.

Shrink Wrapping and Storage Condition

Based on best results found in preliminary experiment conducted on different level of thickness, both types of polyethylene (i) linear low density polyethylene (LLDPE, 20µ thick), and (ii) low density polyethylene (LDPE, 50µ thick) were selected for the study. Individual fruit was loosely enclosed in heat shrinkable LLDPE and LDPE using sealing machine (Zimer International, 240 AC) before passing it through a heat tunnel (Sevana, Model QS 3520 STV) at 135°C for 15 seconds. This time-temperature combination was most suitable with no heat

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injury to the fruit. The unwrapped fruits were considered as control. Individually wrapped and unwrapped fruits were kept in high density polyethylene (HDPE) tray and stored in a cool chamber (5±1°C, 90–95% RH) for 42 days. Each treatment consisted of 50 individual wrapped fruits with 3 replications.

Fruit Quality Parameters

Fruits were evaluated for firmness with texture analyzer (*TA-XTi*, Stable Microsystems, UK). Each fruit was compressed at three places (tip, middle and stem end point) with 2 mm diameter probe up to a depth of 6 mm at test speed 0.5 mm/s. TSS of the fruits was measured with refractometer (range 0-32%). Titrable acidity was determined by titrating 5 ml of peach juice against 0.1N NaOH solution using phenolphthelien as indicator (Ranganna, 2000). The colour of a fruit was measured using Hunterlab miniScan XE plus colourimeter before and after storage. The fruit loss and decay during storage was expressed as per cent. Occurrence of mycoflora was identified on the basis of symptoms and microscopic study. Three fruits were taken randomly from each treatment for analysis and the data was subjected to analysis for variance using CRD design.

RESULTS AND DISCUSSION

The effects of shrink wrapping and storage period on PLW, spoilage, stone content and total soluble solids, acidity, firmness, colour and shelf life of fruits were evaluated and presented hereunder.

Physiological Loss in Weight (PLW)

At the end of 42 days of storage in cool chamber, PLW was 0.65 and 0.7% in LDPE (50µ) and LLDPE (20 µ), respectively (Fig. 1). No significant variation in PLW was recorded within shrink wrapped fruits at low temperature because of very low weight loss (0.65-0.7%) in both types of polyethylene films after 42 days of storage; whereas in unwrapped fruits (control) the PLW was quite high (10.4%) even on the 7th day of storage. Shrivelling appeared on unwrapped fruits because of excessive moisture loss from fruits. The weight loss significantly increased over the period of storage. The shrink-wrapped fruits did not show shrivelling, and shelf life of the fruits extended up to 42 days under cool chamber. PLW increased with an increase in the period of storage. It might be due to evapo-transpiration and respiration loss as reported for sapota and peach fruits by Joshua and Sathiamoorthy (1993) and Singh and Mondal (2006), respectively. In peach fruits, Singh and

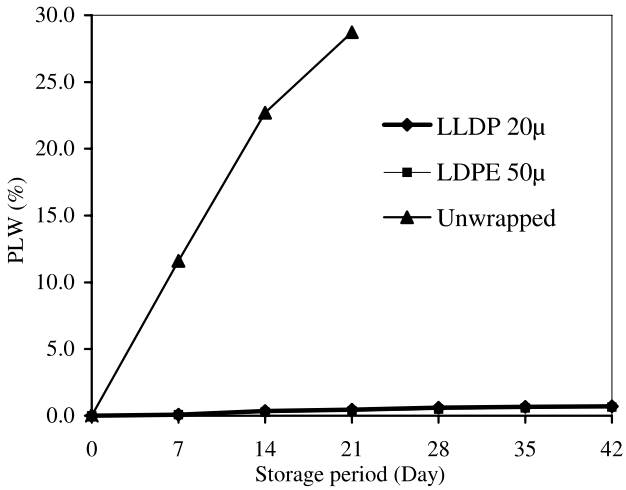

Fig. 1: PLW of shrink wrapped peach fruits during storage in cool chamber

Mondal (2006) reported 1.35% PLW in polyethylene packing after 40 days of storage in cool chamber.

Fruit Spoilage

The fruit spoilage in 20µ LLDPE and 50µ LDPE film was 7 and 10% respectively after 42 days of storage. *Alternaria alternata* and *Rhizopus macrosporus* spoiled 10% of fruits in 50µ LDPE wrapped, whereas in 20µ LLDPE packed fruits *A. alternata* only infected the fruits and spoiled 7% of them. The unwrapped fruits were not spoiled by microbes, but all the fruits were shrivelled. It may be because of excessive reduction of water content during storage, which reduces the turgidity of the fruit and its dry surface also did not favour the microbial infection as well as proliferation (Joshua and Sathiamoorthy, 1993; Singh and Mondal, 2006).

Stone Content and Total Soluble Solids

Stone content of the fruit was not significantly affected by shrink wrapping (Table 1). The total soluble solids (TSS) content of the fruit increased significantly in all the treatments, but no significant variation was found within the treatments. The TSS varied from 12 – 13% after 42 days of storage. No variation in TSS content was at all found in the fruits stored in different types of polyethylene used for shrink wrapping. The increase in TSS in control fruits may be attributed to moisture loss from the fruits. The moisture loss resulted in concentration of the soluble solids in the fruits. These results are in conformity with the previous results of increasing TSS during storage in kinnow (Singhrot *et*

Table 1. Effect of shrink-wrapping of peach fruit on physico-chemical characters after 42 days of storage in cool chamber

Treatment	Physico – chemical characters*					
	Stone (%)		TSS (%)		Acidity (%)	
	14 DAS	42 DAS	14 DAS	42 DAS	14 DAS	42 DAS
Shrink wrapped (LLDPE, 20 m)	12.98	15.11	8.0	12.5	0.685	0.520
Shrink wrapped (LDPE, 50 m)	9.20	12.95	8.0	12.0	0.720	0.525
Unwrapped	12.68	10.76	8.5	13.0	0.665	0.475
CD (0.05)	NS		NS		NS	

*Initial value: Stone (%) = 9.1; TSS content (%) = 7.8; Acidity (%) = 0.89
** DAS = Days after storage

al., 1987; Kumar *et al.,* 1990), and in mango (Chauhan *et al.,* 1987).

Acidity

The maximum acidity (0.52%) was recorded in shrink wrapped fruits with 50µ LDPE and 20µ LLDPE at the end of 42 days storage. Acidity declined significantly over period of storage in all the treatments. It might be due to metabolic activities of the fruits. Similar results have been reported for Nagpur mandarin by Sonkar and Ladaniya (1999) and for kinnow by Raghav and Gupta (2000).

Fruit Firmness

The shrink wrapped fruits were firmer than the unwrapped ones. For instance, fruits wrapped in 20µ LLDPE had higher peel hardness (1.72 N), pulping energy (3.65 N.mm), and firmness force (0.90 N) than unwrapped fruits (Table 2). The results clearly indicate that the firmness of fruit decreased during storage. This decrease was because of the conversion of insoluble fraction into soluble as well as the degradation process in fruits due to respiration, as also due to change in the cell wall polysaccharides and uronic acid. Similar results have been reported for many other fruits such as apple (Joshi and Seth, 1985) and banana (Ramana *et al*., 1989).

Fruit Colour

The comparative colour value before and after storage indicated that the fruit colour changed from greenish to yellowish and reddish at tip with corresponding rise in a, b, and Yi values and decrease in L value in all the treatments. The 20µ LLDPE slightly checked the colour change during storage as compared to the other treatments (Table 3). It may be due to the level of gas permeability in polyethylene, which affects the gas accumulation surrounding the fruits in individual packing.

Fruit Shelf Life

The shelf life of individual shrink-wrapped peaches increased with retention of fresh fruit quality for 42 days as compared to unwrapped (7 days) fruits during storage under cool chamber. The physiological weight loss during storage of the fruits reduced by less than 1% by shrink-wrapping with 20µ LLDPE and 50µ LDPE films as against unwrapped fruits under control conditions, where it was 45% after 42 days of storage. The wrapped fruits in 20µ LLDPE were firmer than unwrapped fruits. Similarly, there was no deformation in shrink-wrapped fruits, while in control the fruits had shrivelled.

Table 2. Effects of shrink-wrappi ng of peach fruit on firmness after 42 days of storage in cool chamber

Treatment	Firmness of fruit		
	Skin hardness (N)	Pulping energy (N.mm)	Firmness force (N)
Shrink wrapped (LLDPE, 20)	1.72	3.65	0.90
Shrink wrapped (LDPE, 50)	1.10	0.66	0.50
Unwrapped	1.31	1.36	0.61
CD (0.05)	NS	1.47	0.25

Initial value: Skin hardness = 4.06N; Pulping energy = 7.46; Firmness force = 3.14

Table 3. Effect of shrink-wrapping of peach on colour of fruit after 42 days of storage in cool chamber

Treatment	Colour of fruit			
	L	a	b	Yi
Shrink wrapped (LLDPE, 20)	49.6	10.5	21.2	91.7
Shrink wrapped (LDPE, 50)	54.7	15.5	23.0	94.2
Unwrapped	57.3	15.5	23.4	93.0
CD (0.05)	Treatment: 2.99; Location : 3.46; T x L : NS			

Initial value: L : 78.04; a : 7.12; b: 8.76; Yi: 74.00

CONCLUSION

Individual heat shrink wrapping of peaches with 20µ LLDPE after post harvest treatment with carbendazim (500 ppm) was found to be quite useful for extending the shelf life in cool chamber up to 42 days with better quality retention.

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