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Wax coating and padding materials influence quality and shelf-life of purple passion fruit during storage

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ABSTRACT

Weight loss, decay loss and the chemical changes associated with ripening were monitored in waxed and non-waxed purple passion fruit with different padding materials during storage at ambient temperature (26.5°C and 65.7% relative humidity). Shelf-life of paraffin (m.p. 60-62°C) waxed fruits was 25 days when packed in CFB boxes using high-density polyethylene (0.03 mm) pad. Rate of decrease in weight loss, decay loss and juice content was also slowed down with paraffin waxing however; juice density was higher in fruits coated with paraffin liquid (light) and padded with newspaper. Total soluble solids, acidity and ascorbic acid decreased during storage in all the treatments but decrease being least in fruits packed in perforated low density polypropylene (0.025 mm) that have maximum total soluble solids (13.0°B) and ascorbic acid (23.17 mg/100 ml juice) even at 25 days of storage. Reducing sugar first increase and then it started decline but total sugars were decrease during storage in all the cases. Irrespective of treatments maximum sugars were found in fruits packed with polyethylene padding, coated with paraffin solid wax.

Key words: Passion fruit, waxing, padding, shelf-life, fruit quality.

INTRODUCTION

Passion fruit (*Passiflora edulis* Sims) with its unique and delicate flavour is widely used in beverages, squash and cordials. The fruits are a good source of vitamin C and they find a ready market as fresh fruit and also when processed in to juice. Fruits begin to loss moisture as soon as they harvested and quickly become quite wrinkled if held under hot, dry conditions. Passion fruit liable for rapid deterioration immediately after harvest and loose consumer's appeal within a short span of storage period.

This necessitates the development of special packaging techniques to extend their post harvest life and quality. By protecting against moisture loss, bruising, mould growth and contamination, wax coating help in longer freshness of fruits. Waxing does not improve the quality of fruit, rather along with proper packaging and handling contributes to maintaining a healthful product. A number of skin coatings, *viz.* liquid paraffin, paraffin solid wax, castor oil and shellac of light orange color were used to enhance the shelf-life of different fruits, although promising results were obtained with waxes and have been accepted commercially (Sindhu *et al.*, 9; Meena *et al.,* 6). Present investigation was under taken to find the effectiveness of waxing and packaging methods in extending the shelf-life of purple passion fruits at ambient conditions. The changes in some physico-chemical composition during storage have also been observed.

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MATERIALS AND METHODS

The studies were conducted in the Post Harvest Laboratory, Division of Horticulture, ICAR Research Complex for NEH Region, Umiam (Meghalaya). The uniform and well ripe fruits of purple passion fruit were harvested and dipped in 500 ppm carbendazim, dried under fan drier for 30 min. before wax coating. Forty five fruits were selected in each treatment and following treatments were imposed, *viz*., T1 - Fruits coated with paraffin liquid (light) and padding with newspaper, T2 - Fruits coated with paraffin liquid (light) and padding with sterilized paddy straw, T3 - Fruits coated with paraffin liquid (light) and padding with high-density polythene (0.03 mm), T4 - Fruits coated with paraffin solid (m.p. 60-62°C) and padding with newspaper, T5 - Fruits coated with paraffin solid (m.p. 60-62°C) and padding with sterilized paddy straw, T6 - Fruits coated with paraffin solid (m.p. 60-62°C) and padding with high density polythene (0.03 mm), T7 - Sealed packing with perforated low density polypropylene (0.025 mm), T8 - Padding with newspaper, T9 - Padding with sterilized paddy straw, T10 - Padding with high density polythene (0.03 mm), and T11 - Control.

In sealed packing treatment non-waxed fruits were kept in each polypropylene bag (30 cm x 15 cm) with 6 perforations of 3 mm dia. In rest of the treatments, fruits were packed in perforated (6 perforations, 10 mm

dia) corrugated fibre board boxes (40 x 30 x 20 cm) in two rows and three layers. CFB boxes were sealed and kept at ambient condition (26.5°C temperature and 65.7% relative humidity). Fruits in control were packed in CFB boxes without any padding and wax application. The experiment was carried out in completely randomized design and each treatment was replicated thrice. Ten fruits per treatment were used for estimation and observations were recorded up to 25 days.

The cumulative physiological loss in weight of the fruit was determined, and expressed in per cent. The fruit from different sample were weighed and cut, juice was extracted from the pulp by squeezing and straining through muslin cloth, under aseptic conditions. The juice per cent was measured and expressed in per cent (%) as fresh weight basis. The juice obtained was weighed and then measured with measuring cylinder and the density of the juice was determined from the weight divided by volume of the juice and is expressed in g/cc. The total soluble solids content was determined with Erma hand refractometer (0-32°Brix). The tritratable acidity was determined by method as suggested in AOAC (1). Five ml of filtered juice was titrated against N/10 NaOH solution using phenolphthalein as an indicator. The sugar content and ascorbic acid were determined by volumetric method suggested by AOAC (1).

RESULTS AND DISCUSSION

The physico-chemical composion of passion fruit as affected during storage with the above different treatments was followed up. It has been seen in Figs. 1 and 2 that up to storage period of 25 days, there was a gradual increase in physiological weight loss with a corresponding decrease in the marketable fruits. Control fruit started shriveling; rendered unattractive at the initial days of storage and lost 52.35 per cent weight in comparison to the fruits coated with paraffin solid wax and padded with high density polythene which lost only 6.25 per cent weight at the end of 25 days of storage period. Fruits resembled fresh after 20 days storage period thereby indicating the role of wax coating in controlling the moisture loss from the fruits surface. Fig. 2 shows that percent decay loss increased with progressing storage period, irrespective of treatments. Decay of fruits was noticed after 10th day of storage in all treatments except paraffin solid padded with polyethylene, but the difference from the control was found statistically non significant. On 25th day of storage, treatment of wax with different padding material significantly influenced the per cent decay loss of passion fruit. The minimum decay (18.16%) was noticed in fruit treated with paraffin solid wax

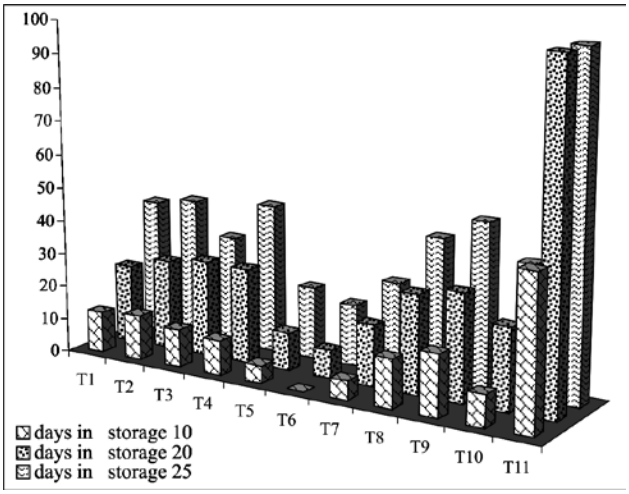

Fig. 1. Effect of wax coating and pading on PLW (%).

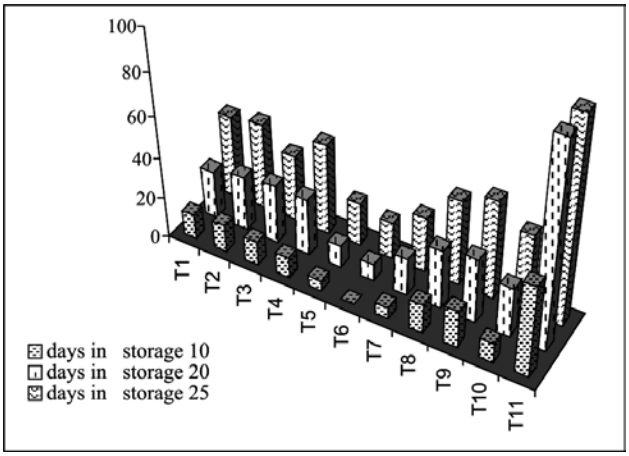

Fig. 2. Effect of wax coating and padding on decay loss (%) in passion fruit.

and padded with polyethylene followed by sealed packing of fruits in LDPE (0.025 mm), whereas, it was highest in control (72.13%). Result further revealed that in control, 100 per cent fruit was unmarketable even after 10th day of storage. The check in physiological weight loss and decay loss by paraffin wax coating and lining with polyethylene might be due to retardation of processes of transpiration and respiration. Reduction in losses of fruit weight and decay by wax coating and packaging has already been reported in different fruit crops (Sharma and Singh, 8; Sharma *et al*., 7).

Juice content and juice density did not change significantly in all the treatments up to 10th day of storage except in control where it was minimum (25.73%) and then showed a decreasing trend by 25th day of storage. Even up to 25 days of storage, there

was not much deterioration in juice content (31.21 to 28.67%) in fruit coated with solid paraffin wax and padded with polyethylene. Higher juice content in this treatment may be due to restricted evaporation and transpiration, which also reflected as decreased fruit weight loss. Less deterioration of juice with solid wax and polyethylene padding might be associated with the better moisture retention in fruits with this treatment (Venkatesha and Reddy, 12; Ben-Yehoshua *et al.*, 3). Data presented in Table 1 further revealed that there was non-significant effect of different treatments on juice density up to 20th day of storage. However, in contrast juice density was found highest (1.02 g/cc) in fruits treated with liquid wax, lining with newspaper up to 25 days of storage. TSS, acidity, total sugars and ascorbic acid increased during storage up to 10 days and thereafter, a slight decline was noticed in all the treatments. The TSS and ascorbic acid content did not differ significantly, irrespective of treatments and storage period. The maximum TSS (13.0 ^{0}Brix) and ascorbic acid (23.17 mg/100 ml juice) content were recorded in sealed packing with LDPE (0.025 mm) which was at par with paraffin wax (solid) coating + polyethylene padding. However, acidity was found maximum (2.17%) in fruits treated with parafin liquid wax padded with newspaper. The increase in TSS followed by slight decline might be due to rapid conversion of reserved starch and other polysaccharides to soluble form of sugar in sealed packing fruit during storage. Whereas, the pattern of acid conversion into their salts may be the reason of higher acidity in liquid wax treatment. These findings are in close conformity with the findings of Singh and Narayan (11), and Singh *et al.* (10). Higher ascorbic acid content in sealed packing followed by paraffin solid wax might be attributed to low rate of physiological process accompanied by lower respiration rate and transpiration loss compare to other treatments. These findings are also in accordance with the findings of Kumar *et al.* (5), and Koksal *et al.* (4).

Further, reducing sugar increases during storage up to 20 days followed by slight decline at 25 days of storage. Various post harvest treatment had non-significant effect irrespective of storage period on reducing sugar. Fruits treated with paraffin wax and padded by polyethylene have the maximum reducing sugar (3.62%) and total sugars (7.34%), which were at par with sealed packing in LDPE (0.025 mm) even at 25 days of storage period. This pattern of sugar conversion may be due to metabolic transformation in soluble compounds and more conversion of organic acid into sugars (Baviskar *et al.*, 2). These results are in agreement with the findings of Sindhu *et al.* (9), and Meena *et al.* (6).

Based on results, it may be concluded that coating of passion fruit with paraffin wax (solid, m.p. 62^{0}C) along with polyethylene padding may be considered as an economic and alternative method of fresh passion fruits storage at ambient conditions. This treatment reduced the physiological loss in weight; decay loss and kept fruit juice with good flavour and colour. They also effectively retained freshness and nutrient loss of fruits during storage. This treatment can be used satisfactorily in order to extend the shelf-life of purple passion fruit up to 25 days, by maintaining the quality parameters close to those of fresh fruits.

Table 1. Effect of wax coating and padding materials on chemical composition of passion fruit during storage.

Treatment	Juice (%)			Juice density (g/cc)			TSS (°Brix)			Acidity (%)		
Days in storage	10	20	25	10	20	25	10	20	25	10	20	25
Liquid wax with newspaper	30.20	29.51	26.12	1.08	1.02	1.02	13.2	12.4	11.2	2.38	2.30	2.17
Liquid wax with paddy straw	30.18	29.74	26.69	1.10	0.99	1.01	13.2	12.8	11.2	2.31	2.05	1.92
Liquid wax with polyethylene	30.40	29.35	26.49	1.08	1.01	0.97	13.4	12.2	12.0	2.48	2.05	1.92
Paraffin solid wax with newspaper	30.72	30.04	26.44	1.06	1.00	0.99	13.2	12.4	12.2	2.26	1.98	1.54
Paraffin solid wax with paddy straw	31.21	29.79	28.67	1.10	1.02	0.97	13.4	12.8	12.0	2.42	1.66	1.56
Paraffin solid wax with polyethylene	31.60	30.05	29.77	1.11	1.00	0.98	13.8	13.4	12.8	2.43	1.92	1.87
Sealed packing with HDPP (0.03 mm)	31.86	29.40	28.38	1.06	0.98	0.86	13.8	13.6	13.0	2.40	1.86	1.73
Padding with newspaper	29.58	26.54	23.60	1.08	1.02	0.94	12.8	12.4	12.4	2.48	1.54	1.44
Padding with paddy straw	29.80	26.78	24.15	1.06	1.02	0.94	13.6	13.2	11.8	2.39	2.30	2.11
Padding with polyethylene	29.86	27.31	24.44	1.08	1.01	0.89	13.8	12.8	11.2	2.45	2.37	1.72
Control	25.73	-	-	0.94	-	-	10.9	-	-	1.40	-	-
CD at 5%	1.34	2.13	1.94	NS	NS	0.04	NS	0.89	0.63	0.03	0.04	0.03

Table 2. Effect of wax coating and padding materials on chemical composition of passion fruit during storage.

Treatment	Reducing sugar (%)			Total sugar (%)			Ascorbic acid (mg/100 ml juice)		
Days in storage	10	20	25	10	20	25	10	20	25
Liquid wax with newspaper	3.24	3.61	3.03	8.54	7.80	7.14	24.65	20.52	19.41
Liquid wax with paddy straw	3.18	3.23	3.29	8.56	7.71	7.17	26.47	21.27	17.63
Liquid wax with polyethylene	3.21	3.65	2.62	8.52	7.28	7.19	26.44	22.14	19.64
Paraffin solid wax with newspaper	3.28	3.40	3.45	8.56	7.20	6.85	28.29	23.20	20.44
Paraffin solid wax with paddy straw	3.12	3.27	2.87	8.58	7.38	6.30	28.20	21.83	20.68
Paraffin solid wax with polyethylene	3.42	3.91	3.62	8.64	7.48	7.34	28.38	24.12	21.93
Sealed packing with HDPP (0.03 mm)	3.39	3.73	3.45	8.72	8.40	7.29	27.01	21.74	23.17
Padding with newspaper	3.12	3.14	3.02	8.28	7.21	6.95	23.44	17.74	19.39
Padding with paddy straw	3.10	3.11	3.09	8.19	7.16	6.97	21.15	17.85	16.44
Padding with polyethylene	3.16	3.19	3.10	8.26	7.22	6.88	24.40	18.53	19.36
Control	3.07	-	-	7.90	-	-	19.20	-	-
CD at 5%	0.21	0.24	0.19	0.25	0.21	0.39	3.17	2.96	3.25

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