Effect of chemicals and packaging on quality of mango fruits under cold storage

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**ABSTRACT**: Mango is a climacteric fruit and highly perishable in nature. To maintain the post-harvest quality in mango cv. Langra, fruits were treated with calcium chloride (2.0, 4.0 %) and gibberellic acid (100, 200 ppm) or combined with LDPE packaging. Treated fruits were placed in CFB boxes and subsequently stored at 13±1°C with 90-95% RH for 34 days. The effectiveness of treatments in extending fruit shelf life was evaluated by determining fruit firmness, TSS, acidity and vitamin C content. All LDPE packed fruits maintained higher fruit firmness as compared to non LDPE treatments and control. TSS contents improved throughout storage in LDPE treatments while in others these increased sharply up to 27 days and then a decline was noticed. Various treatments delayed reduction of acid and vitamin C contents during storage over the control. Results indicated that calcium chloride @ 2% + LDPE treatment were found significantly effective in maintaining firmness, total soluble solids, titratable acidity and retaining more ascorbic acid at the end of the storage.

**KEY WORDS**: Mango, CaCl₂, LDPE packaging, Low temperature storage, Fruit quality

Fresh, physiologically mature and uniform in size mango fruits cv. Langra were picked from College Orchard, Department of Fruit Science, Punjab Agricultural University, Ludhiana during the year 2012. The harvested fruits were immediately shifted to the Post Harvest Laboratory of the Department. The bruised and diseased fruits were sorted out and healthy fruits were washed and air dried at room temperature. A total of nine treatments were given comprising three replications in each treatment. T₁ (CaCl₂ 2%), T₂ (CaCl₂ 4%), T₃ (GA₃ 100 ppm), T₄ (GA₃ 200 ppm), T₅ (CaCl₂ 2% + LDPE packaging), T₆ (CaCl₂ 4% + LDPE packaging), T₇ (GA₃ 200 ppm + LDPE packaging).
100 ppm + LDPE packaging), T₂ (GA₃ 200 ppm + LDPE packaging), T₃ (Control). The experiment was laid out in a Completely Randomized Design. The fruits were given dip in aqueous solutions of CaCl₂ and GA₃ for five minutes. The treated fruits were air dried under shade before LDPE (40 micron with 0.1% perforation) packaging. The fruits were placed in CFB boxes and subsequently stored at 13±1°C with 90-95% RH for 34 days. The physico-chemical characteristics of fruit samples were analyzed on the day of harvesting and after 10, 20, 27 and 34 days of storage. Firmness of randomly selected fruits (three from each replication) was measured with the help of fruit pressure tester (Model FT- 327, USA). About one square centimeter of the skin in each fruit from the shoulder end on both sides was removed with the help of peeler and firmness of pulp was recorded and expressed in terms of kg/cm². Total soluble solids (TSS) were determined from the juice at room temperature with the help of hand refractometer (Model Atago, Japan) and expressed in per cent. The readings were corrected with the help of temperature correction chart at 20°C temperature. Acidity was estimated by titrating 2 ml of strained juice of fruits against 0.1 N NaOH solution using phenolphthalein as an indicator. The appearance of light pink colour marked the end point of titration. The percentage of titratable acidity was calculated and expressed in terms of anhydrous maleic acid. Ascorbic acid was determined by the 2, 6-dichlorophenol indole titration method (AOAC, 1995).

**RESEARCH FINDINGS AND DISCUSSION**

The texture is a critical quality attribute in the consumer acceptability of fresh fruits. The fruit firmness decreased with progressive increase in storage period in all the treatments (Fig. 1). The fruit firmness decreased at faster rate after 27 days of storage, especially in non-LDPE treatments. The CaCl₂ @ 2% + LDPE packaging treatment was best in maintaining fruit firmness throughout the storage period which was followed by GA₃ 200 ppm + LDPE packaging treatment while the minimum fruit firmness was recorded in control fruits. All LDPE packaging treatments registered higher fruit firmness as compared to respective non LDPE treatments. These results corroborate the earlier findings of Ben-Yehoshua (1985) who reported that sealing individual climacteric fruit in low-density polyethylene bags delayed ripening and softening of fruits and hence, improved marketability. CaCl₂ (2%) dips treatments improved maintenance of fruit firmness followed by GA₃ 200 ppm compared to control treatment, but these were less effective than with combination of LDPE treatments. The CaCl₂ treatments avoided softening and maintained the structures of cell walls through cross-linking the pectic acid in the cell wall (Gunes et al., 2001). Similar response was also reported by Hojo et al. (2009) who found that calcium is known to delay senescence resulting in firmer mango fruits.

Changes in total soluble solids as effected by various post harvest treatments are shown in Fig. 2. LDPE packed fruit recorded significantly lesser total soluble solids content than fruits given chemical treatments only. However, TSS contents in all LDPE treatments improved with storage time whilst in other treatments it increased up to 27th day followed by decline at the end of storage. This change was more apparent in untreated control fruits. Though, the control fruits recorded highest total soluble solids content after 27 days of storage. The excessive increase in TSS of mangoes during storage is an indication of quality deterioration (Pal and Roy, 1988). Kader et al. (1989) reported that the role of packaging was primarily to reduce the respiration rate of fruit and vegetables by retarding their metabolic activities. Reduced respiration also retards softening and slows down various compositional changes such as TSS, which are associated with ripening. After 34 days of storage, maximum TSS contents were retained in CaCl₂ (4%) + LDPE packed fruits and minimum in control fruits. Present results are in
line with that obtained by Singh et al. (1967) who reported a delayed and sustained increase in the total soluble solids in polythene packed fruits of ‘Dusehri’ mango.

In general the acid content of fruits declined with storage in all the treatments but it was sharper after 10th day of storage (Fig. 3). Comparatively, more acid content was noticed in fruits under LDPE packaging treatments. Highest acid content was recorded in CaCl₂ (2%) + LDPE packaging followed by 200 ppm GA₃ with LDPE packaging while the minimum level of juice acids were found in control. Higher acidity in CaCl₂ (2%) + LDPE packaging fruits may be attributed to slower utilization of organic acids in oxidative process because of slow rate of respiration. The delay in the reduction of acidity in film wrapped mango fruits as found in the present study confirms the earlier findings of Kalra et al. (1986) in ‘Dusehri’ mango. Post harvest dips of mango fruits in aqueous solutions of CaCl₂ and GA₃ solutions were also effective in retaining juice acidity over control. Similar results were reported by Jain and Mukherjee (2011) and (Sudhavani and Sankar, 2002) in mango.

The effect of post harvest calcium chloride and GA₃ with or without LDPE packaging treatments on ascorbic acid content of mango fruits is shown in Fig. 4. Ascorbic acid content decreased gradually with advancement of storage period. However, the retention of ascorbic acid was significantly higher in treated fruits as compared to untreated fruits throughout the storage period. At the end of the storage period maximum ascorbic acid was found in fruits treated with CaCl₂ (2%) + LDPE followed by GA₃ 200 ppm with LDPE packaging treatment and the control fruit recorded lowest ascorbic acid content. This could be due to retardation of oxidation process and consequent slow rate of conversion of L- ascorbic acid in to dehydroascorbic acid (Jain and Mukherjee, 2011). These results are in line with the findings of Tefer et al., 2007 in mango. Hence, based upon the present studies, it can be concluded that CaCl₂ @ 2% + LDPE packaging treatment markedly improved storage life of mango by maintaining fruit firmness and inhibiting senescent changes.

REFERENCES


