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Physico-chemical changes in peach fruit during storage

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SUMMARY :

Peach undergoes various ripening changes after harvest and the magnitude of post-harvest losses in fresh fruits is extraordinarily high resulting in proportionately higher economic losses than that of pre-harvest losses. An attempt was made to reduce these losses in which physiologically mature, uniform and healthy fruits of peach cv. SHAN-I-PUNJAB were harvested and treated for 5-minutes in aqueous solutions of spermidine, spermine and putrescine at three different concentrations *viz.,* 1.0, 2.0 and 3.0 mmol L^{-1} and treated fruits were packed in CFB boxes before storage at 0 to 1°C and 90-95 per cent RH for 32 days. Results revealed that post-harvest treatments of spermidine, spermine and putrescine were effective in delaying ripening and extending the post-harvest life of peach fruits under cold storage conditions. Putrescine @ 3 mmol L^{-1} treatment was found most effective in decreasing physiological loss in weight (PLW) and spoilage and maintaining the high palatability, TSS: acid and total sugars at the end storage period.

KEY WORDS : Peach, Storage, PLW, Sugar, Quality, Spermidine, Spermine, Putrescine

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In India peach is grown in the mid hills of the Himalayan range in the states of Jammu and Kashmir, Himachal Pradesh and also in limited scale in the hills of south India and north eastern parts of the country. In Punjab, its cultivation is mainly concentrated in Amritsar, Jalandhar, Hoshiarpur and Ludhiana districts and is becoming popular now a days because of higher returns on a unit area basis and availability of fruits when other fruits are scarce in the market. But, heavy post-harvest losses and a short post-harvest life are the major constrains in its cultivation. To boost its cultivation it is necessary to develop a profitable technology to extend its post-harvest life with minimum post-harvest losses. Different chemicals *viz.*, fungicides, disinfectants, nutrients and growth regulators are used in various fruits to extend their post-harvest life. Polyamines comes under the new class of growth regulators and they regulate the various physiological processes in plants. Polyamines are designated as anti-senescence agents and their level usually decreases during the ripening in most of the fruits (Kumar *et al.*, 1997). Exogenous application of polyamines influences the post-harvest life of fruits. Infiltration of polyamines in lemons harvested at colour break stage, delayed the colour change to yellow, reduced the weight loss during storage and increased fruit firmness through the maintenance of higher endogenous putrescine and spermidine levels than those found in control (Valero *et al.,* 1998). Post-harvest application of putrescine resulted in retardation of plum fruit softening during low temperature storage through suppressed ethylene biosynthesis and reduced activities of fruit softening enzymes (Khan *et al.,* 2007). Keeping the above facts in view an investigation was planned to study the effect of post-harvest applications of putrescine, spermidine and spermine on the storage life and quality of peach fruits.

EXPERIMENTAL METHODS

The present study was conducted in the post-harvest laboratory, Department of Fruit Science, Punjab Agricultural University, Ludhiana during the year 2012. Healthy and uniform fruits of peach cv. SHAN-I-PUNJAB were harvested, from the PAU Seed Farm, Ladhowal and treated in aqueous solutions of spermidine, spermine and putrescine at three different concentrations *viz.,* 1.0, 2.0 and 3.0 mmol L^{-1}, respectively for 5-minutes. Experiment comprised ten treatments with three replications in each treatment. T_1 [Spermidine (1.0 mmol L^{-1})], T_2 [Spermidine (2.0 mmol L^{-1})], T_3 [Spermidine (3.0 mmol L^{-1})], T_4 [Spermine (1.0 mmol L^{-1})], T_5 [Spermine (2.0 mmol L^{-1})], T_6 [Spermine (3.0 mmol L^{-1})], T_7 [(Putrescine 1.0 mmol L^{-1})], T_8 [Putrescine (2.0 mmol L^{-1})], T_9 [Putrescine (3.0 mmol L^{-1})] and T_{10} [Control (Water dip)]. Treated fruits were air dried under shade before packaging in CFB boxes. Packed fruit were kept at low temperature conditions (0 -1° C and 90-95% RH) for 32-days. Fruit samples were analysed after 8, 16, 24 and 32 days of storage for various physico-chemical characterstatics. The PLW of fruits was calculated on initial weight basis. The per cent loss in weight after each storage interval was calculated by subtracting final weight from the initial weight of the fruits and then converted into percentage value. Peach fruits were rated for palatability by a panel of five judges on the basis of external appearance, texture, taste and flavour. A nine point 'Hedonic Scale' described by Amerine *et al.* (1965) was used for its inference, as: 9 (Extremely desirable), 8 (Very much desirable), 7 (Moderately desirable), 6 (Slightly desirable), 5 (Neither desirable nor undesirable), 4 (Slightly undesirable), 3 (Moderately undesirable), 2 (Very much undesirable), 1 (Extremely undesirable). The spoilage percentage of fruits was calculated on number basis by counting the spoiled fruits in each replication and total number of fruits per replication. TSS: acid ratio was calculated by dividing the values of TSS with the corresponding values of titratable acidity. Total sugars were estimated by following the AOAC (1990) method. The data were statistically analyzed by Factorial Completely Randomized Block Design (CRD) as described by Singh *et al.* (1998).

EXPERIMENTAL FINDINGS AND ANALYSIS

The per cent loss in weight increased with the storage period irrespective of the treatments (Fig. 1). All the treatments showed a significant difference in physiological loss in weight as compared to the control fruits. After 8 days, the minimum physiological loss in weight (2.08%) was noticed in fruits treated with putrescine @ 3 mmol L^{-1}, which was followed by putrescine @ 2 mmol L^{-1} treatments, but the maximum physiological loss in weight (3.97%) was noticed in control fruits. Similar trend in physiological loss in weight was noticed after 2^{nd}, 3^{rd} and 4^{th} interval of storage. The lower weight loss in polyamines treated fruits could be attributed to stabilization or consolidation of both cell integrity and the permeability of the tissues, ameliorating chilling injury, the latter induces tissue disruption and connection between the skin and the external atmosphere allowing the transference of water vapour (Woods, 1990). Kaur (2011) reported that physiological loss in weight of peach fruits during storage can be reduced by pre-harvest spray of putrescine @ 3 mmol L^{-1}. Putrescine treated lemon fruit showed lower weight loss than non-treated fruit during storage (Valero *et al.*, 1998). Martinez-Romero *et al.* (2002) also reported a less physiological loss in weight in apricot fruits treated with putrescine than control. Zheng and Zhang (2004) showed a reduced fruit

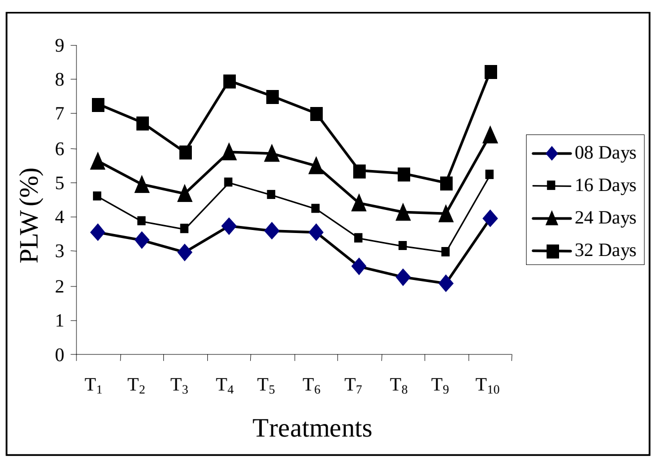

Fig. 1 : Effect of post-harvest treatments of polyamines on physiological loss in weight

weight loss in 'Ponkan' mandarin treated with different polyamines.

It is perusal from the data presented in Fig. 2, that the palatability rating of fruits increased continuously up to 16 days of storage in all the treatments. Fruits treated with putrescine @ 1, 2 and 3 mmol L^{-1} and spermidine @ 3 mmol L^{-1} showed a gradual increase in palatability rating up to 24 days of storage and afterward decline was observed, whereas the fruits treated with spermidine @ 1 and 2 mmol L^{-1}, spermine @ 1, 2 and 3 mmol L^{-1} and control fruits showed an increase in palatability rating only up to 16 days of storage, after that it declined, but this diminution was more steep in untreated fruits. After 8 and 16 days of storage, the maximum palatability rating was found in control fruits and minimum was recorded in putrescine @ 3 mmol L^{-1} treated fruits. But, on the 24th day of cold storage, the fruits treated with putrescine @ 3 mmol L^{-1} recorded maximum (7.96) palatability rating and minimum (5.35) palatability rating was observed in control fruits. Similar trend was followed at 4th interval *i.e.* after 32 days of storage. The higher palatability rating of putrescine treated fruits at the end of storage might be due to the delayed ripening and retardation of softening process of fruit that led to the development of better juiciness, texture, flavour and sweetness. Similar results were also obtained by Kaur (2011) during cold storage studies of peach fruits. Malik and Singh (2005) recorded that putrescine treatments significantly improved the fruit quality with higher palatability rating as compared to control. Serrano *et al.* (2003) also observed a higher palatability rating in plum fruits treated with putrescine.

Results showed that the spoilage percentage increased with the progression of storage period (Fig. 3). No spoilage was observed in any treatment up to 8 days of cold storage. After 16 days of cold storage only untreated peach fruits showed the rotting to the tune of 1.70 per cent. On the 24th day of cold storage only control, putrescine @ 1 mmol L^{-1}; spermine @ 1, 2 and 3 mmol L^{-1}; spermidine @ 1 and 2 mmol L^{-1} treated fruits showed spoilage. At the end of storage, maximum spoilage (8.87%) was recorded in untreated fruits followed by fruits treated with spermine @ 1 and 2 mmol L^{-1}, spermidine @ 1 and 2 mmol L^{-1}, putrescine @ 1 mmol L^{-1}. The maximum fruit spoilage was recorded in control fruits ranging from 1.70 to 8.87 per cent during 16-32 days of storage. Fruits treated with putrescine (1, 2 and 3 mmol L^{-1}) and spermidine (2 and 3 mmol L^{-1}) significantly reduced the spoilage percentage in fruits during storage. Peach fruits treated with putrescine @ 3 mmol L^{-1} and 2 mmol L^{-1} did not show any spoilage during the cold storage period of 32 days. Post-harvest treatments of putrescine were found effective in checking the spoilage of fruits during cold storage. Zheng and Zhang (2004) also recorded a reduced decay with post-harvest treatments of polyamines *viz.*, putrescine, spermine, spermidine and salicylic acid in 'Ponkan' mandarin as compared to control. These results are also in agreement with the findings of Smilanick and Sorenson (2001) in lemons. Post-harvest treatment of pomegranate fruits with 2 per cent calcium chloride in combination with 2 mmol L^{-1} spermidine can enhance chilling tolerance by increasing the activity of several antioxidant enzymes (Ramezanian *et al.*, 2010).

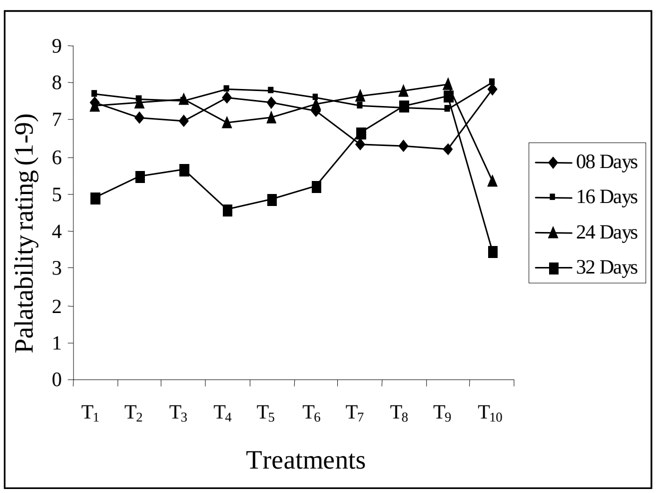

Fig. 2 : Palatability rating of stored peach fruits

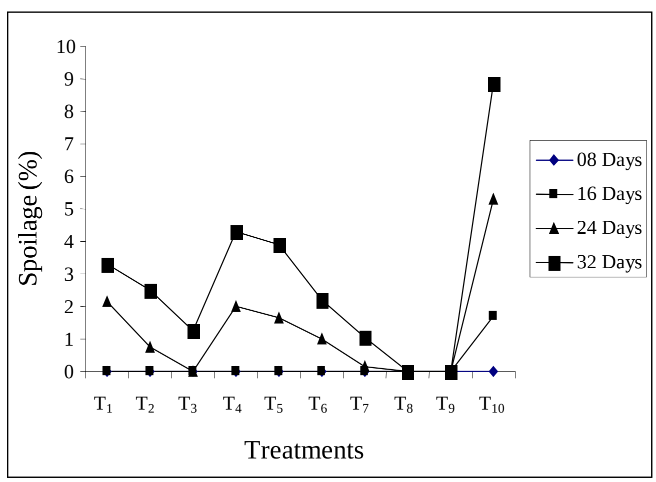

Fig. 3 : Effect of post-harvest treatments of polyamines on spoilage

Data presented in Fig. 4, revealed that with the advancement of storage period, an increase in TSS: acid ratio was observed up to 24 days of storage, afterwards a decline was recorded in all the treatments except putrescine @ 2 and 3 mmol L^{-1} treatments. Post-harvest treatments of polyamines significantly lowered the TSS: acid ratio of cold stored peach fruits as compared to control. After 8 days of storage, the maximum TSS: acid ratio (17.52) was recorded in control fruits, followed by spermine @ 1, 2 mmol L^{-1} and spermidine @ 1 mmol L^{-1} treatments. The minimum TSS: acid ratio (12.28) was observed in putrescine @ 3 mmol L^{-1} treated fruits, followed by putrescine @ 2, 1 mmol L^{-1} and spermidine @ 3 mmol L^{-1} treatments. Similarly, after 16, 24 and 32 days of storage, minimum TSS: acid ratio was maintained by putrescine @ 3 mmol L^{-1} treated fruits, while the maximum was recorded in the reference fruits. An increase in TSS: acid ratio with the advancement of storage period might be attributed to the increase in total soluble solids and reduction in acidity of fruits with the increase in storage period. Similar results were also reported by Gupta and Jawandha (2010) in peach cv. EARLY-GRADE. The higher TSS: acid ratio in control fruits might be due to the increase in TSS and decrease in acidity at faster rates. The present results are in agreement with Khan *et al.* (2008) who reported delayed changes in SSC: acid ratio of 'Angelino' plum fruits, when treated with putrescine. Khosroshahi and Ashari (2007) and Ramezanian *et al*. (2010) found that exogenous application of putrescine and spermidine on apricot and pomegranate fruits resulted in less TSS content as compared to control fruits. Malik *et al*. (2006) also reported that post-harvest application of polyamines reduced the TSS: acid ratio as compared to the control in 'Kensington Pride' mango.

Total sugars showed a progressive increase up to 24 days of storage and, thereafter, a decline in total sugars was recorded in all the treatments except putrescine @ 2 and 3 mmol L^{-1} treatments (Fig. 5). After 8, 16 and 24 days of storage, fruits under control showed maximum total sugars, followed by fruits treated with spermine (1 and 2 mmol L^{-1}) and spermidine (1 mmol L^{-1}), the minimum total sugars were estimated in putrescine @ 3 mmol L^{-1} treated fruits, followed by putrescine @ 2 and 1 mmol L^{-1} treatments. However, after 32 days of storage, the total sugars declined in all the treatments except putrescine @ 2 and 3 mmol L^{-1} treatments. The maximum total sugars were recorded in putrescine @ 3 mmol L^{-1} treated fruits, followed by putrescine @ 2 and 1 mmol L^{-1} treatments and the minimum total sugars were found in control fruits. Among all the treatments minimum total sugars were estimated in fruits treated with putrescine @ 3 mmol L^{-1} and the maximum total sugars were recorded in untreated fruits. The increase in sugars during storage may possibly be due to the breakdown of complex organic metabolites into simple molecules or due to the hydrolysis of starch into sugars. The decline in sugar content at the later stages of storage may be attributed to the fact that after the completion of hydrolysis of starch, no further increase in sugars occur and subsequently a decline in sugars is predictable as they along with other organic acids are primary substrate for respiration (Wills *et al*., 1980; Prashant and Masoodi 2009). Malik *et al*. (2003) also reported a slow increase

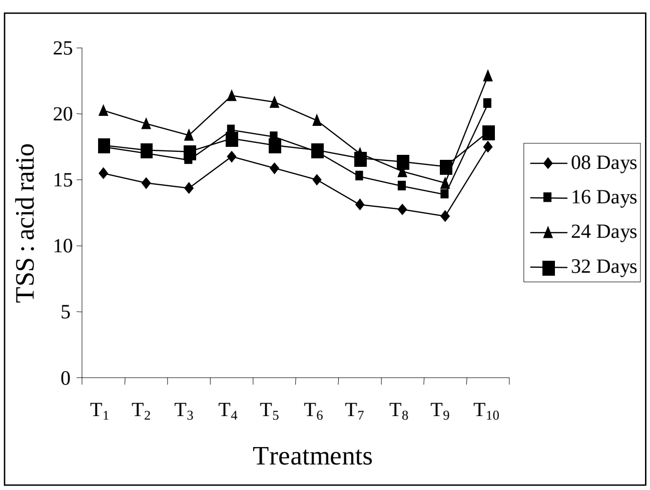

Fig. 4 : TSS: acid ratio of stored peach fruits

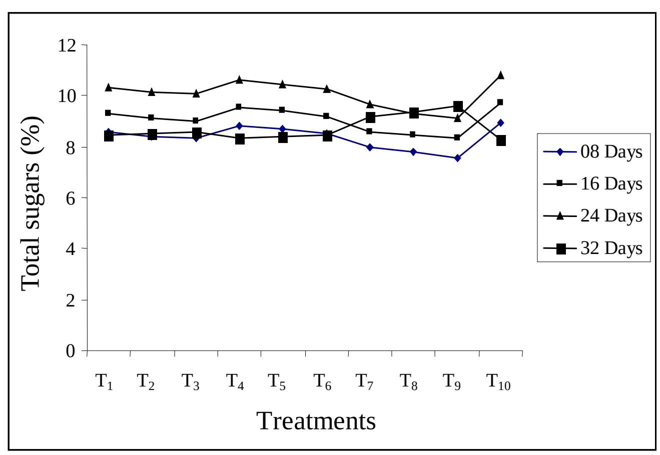

Fig. 5 : Effect of post-harvest treatments of polyamines on total sugars of stored peach fruits

in sugars in 'Kensington pride' mango fruits treated with pre and post-harvest application of putrescine as compared to the control fruits.

It can be concluded from the study that post-harvest treatment of putrescine @ 3 mmol L^{-1} is effective to safely extend the storage life of peach fruits.

LITERATURE CITED

Amerine, M.A., Pangborn, R.M. and Roessler, E.B. (1965). Principle of sensory evaluation of food. Academic Press, 5p. London, UNITED KINGDOM.

AOAC (1990). *Official and tentative methods of analysis*, Association of Official Agric Chemists, 15th Ed. Washington, DC, USA.

Gupta, N. and Jawandha, S.K. (2010). Influence of maturity stage on fruit quality during storage of 'Earli- Grande' peaches. *Notulae Scientia Biologicae*, **2**:96-99.

Kaur, B. (2011). Effect of pre-harvest application of putrescine and calcium nitrate on storage life of peach (*Prunus persica* L. Batsch), cv. SHAN-I-PUNJAB. M.Sc. Thesis, Punjab Agricultural University, Ludhiana, PUNJAB (INDIA).

Khan, A.S., Singh, Z. and Abbasi, N.A. (2007). Pre-storage putrescine application suppresses ethylene biosynthesis and retards fruit softening during low temperature storage in 'Angelino' plum. *Postharvest Biol. & Technol.*, **46**:36-46.

Khan, A.S., Singh, Z., Abbasi N.A. and Swinny, E.E. (2008). Pre- or post-harvest applications of putrescine and low temperature storage affect fruit ripening and quality of 'Angelino' plum. *J. Science Food & Agric.*, **88** : 1686-1695.

Khosroshahi, M.R.Z. and Ashari, M.E. (2007). Post-harvest putrescine treatments extend the storage-life of apricot (*Prunus armentiaca* L.) 'Tokhm-sefid'. *J. Hort. Sci. & Biotechnol.*, **82**: 986-990.

Kumar, A., Altabellu, T., Taylor, M.A. and Tiburao, A.F. (1997). Recent advances in polyamines research. *Trends Plant Sci.*, **2**:124-130.

Malik, A.U., Singh, Z. and Dhaliwal, S. (2003). Exogenous application of putrescine affects mango fruit quality and shelf life. *Acta Hort.*, **628**: 121-127.

Malik, A.U. and Singh, Z. (2005). Pre-storage application of polyamines improves shelf life and fruit quality of mango. *J. Hort. Sci. & Biotechnol.*, **80**: 363-369.

Malik, A.U., Singh, Z. and Tan, S.C. (2006). Exogenous application of polyamines improves shelf-life and fruit quality of mango. *Acta Hort.* (ISHS) **699**:291-296.

Martinez-Romero, D., Serrano, M., Carbonell, A., Burgos, L., Riquelme, F. and Valero, D. (2002). Effects of post-harvest putrescine treatment on extending shelf life and reducing mechanical damage in apricot. *J. Food Sci.*, **67** : 1706-1712.

Prashant, B. and Masoodi, F.A. (2009). Effect of various storage conditions on chemical characteristics and processing of peach cv. 'FLORD ASUN'. *J. Food Sci. & Technol.*, **46** : 271-274.

Ramezanian, A., Rahemi, M., Maftoun, M., Bahman, K., Eshghi, S., safizadeh, M.R. and Tavallali, V. (2010). The ameliorative effects of spermidine and calcium chloride on chilling injury in pomegranate fruits after long-term storage. *Fruits*, **65**:169-178.

Serrano, M., Martinez-Romero, D., Guillen, F. and Valero, D. (2003). Effects of exogenous putrescine on improving shelf- life of four plum cultivars. *Postharvest Biol.& Technol.*, **30** : 259-271.

Singh, S., Bansal, M.L., Singh, T.P. and Kumar, R. (1998). *Statistical methods for research workers.* Kalyani Publishers, NEW DELHI, INDIA.

Smilanick, J.L. and Sorenson, D. (2001). Control of post-harvest decay of citrus fruit with calcium polysulphide. *Postharvest Biol. & Technol.*, **21**:157-168.

Valero, D., Martinez-Romero, D., Serrano, M. and Riquelme, F. (1998). Influence of post-harvest treatment with putrescine and calcium on endogenous polyamines, firmness and abscisic acid in lemon (*Citrus lemon* L. Burm cv. VERNA). *J. Agric. & Food Chem.*, **46**: 2102-2109.

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. Agric. & Anim. Husbandry*, **20**:252-256.

Woods, J.L. (1990). Moisture loss from fruits and vegetables. *Postharvest News & Inform.* **1**: 195-199.

Zheng, Y. and Zhang, Q. (2004). Effects of polyamines and salicylic acid on post-harvest storage of 'Ponkan' mandarin. *Acta Hort.*, **632** : 317-320.