



Studies on chemical coating of kinnow (*citrus nobillis x citrus deliciosa tenora*) on post harvest shelf life.

KaranKumar Perumal , Azhagu Thirunavukkarasu. S, Meka Venkata Markande Swamy

**Department of horticulture, School of agriculture, Lovely Professional University,
Phagwara, Punjab (India)-144411**

Abstract

Kinnow is spring ripening, sweet juicy fruit with seeds, attractive upright growth habit. The fruit is medium and have more of a yellow or orange color .The fruit is fairly easy to peel, rich flavored, very juicy. The large, frost, tolerant columnar tree has dense foliage and is a good ornamental but has a strong tendency towards alternate bearing. Study was carried out on Kinnow mandarin to explore the effects of chemical coated with glycerin (2.5%),NaoH (2%),calcium lactate (3%),gum Arabic (10%),calcium chloride (1%),CMC (1%),with untreated fruits as a control on post-harvest shelf life of the fruit. The experiment was performed for 30 days in studying the physical and chemical parameters of the fruits and the readings were recorded at the intervals of 3 days. The obtained results showed that significant enhancement in fruit physical characteristics, as well as fruit chemical characteristics. Using gum Arabic (10%), CMC (1%) we are the best, which gave minimal damage and more shelf life to the mandarin fruit.

Introduction

Kinnow mandarin is the first generation hybrid of (*King * Willow leaf*) is the most common citrus fruit grown. Kinnow is stress tolerant first hardy, heavy fruit bearer, easy to establish and can be successfully grown with micro irrigation and mulch application. It is an interspecific hybrid which has been emerged as an important fruit. The fruit can be grown well at altitude ranging from 500-1500 mts in the wide range of light and degraded lands with proper drainage. It prefers subtropical climate, with warm summers and moderate winters which is the best suited for growth and development of fruit. The fruits has high nutritive value, refreshing juice, vitamin C, excellent flavor, attractive appearance and is quiet popular. The trees start fruit bearing from third year onwards and fruits are traditionally raised on gravelly lands under rainfed conditions leading to poor fruit yields and early mortality, making the practice economically unviable. Trees are planted in pits spaced 5-6m part, this allows an opportunity to utilize the interstate for giving inter crops in the initial two years. The suitable varieties of mandarin for cultivation in the region on degraded lands are kinnow, Srinagar, Hill Santara, Khasi Santara, Koor Santara, Darjeeling Santara.

Kinnow is the leading fruit industries. Although, these industries differ in geographic and socio-economic aspects. The kinnow industry is concentrated in central to upper Punjab Province, with smaller production units. The value chain development in Kimmie industry has been mainly led by the private sector and has become a unique example for other prospective horticultural industries. A feature of the industry is migrant skilled labour for harvesting, grading, packing. Kinnow has better shipping life and comparatively stable market, export marketing remains a challenging requirement and market access issues.

The postharvest losses can be reduced by extending shelf life through checking the rate of transpiration, respiration, microbial infection and protecting membranes from disorganization (Sahu, 2016). Among the different methods used to prolong the shelf life, is the application of the edible coatings like oil, wax, chemical to fruit has gained attention worldwide as these coatings maintained the quality even under ordinary storage condition (Bisen *et al.* 2012). The use of edible coating on fruits may result in creation of a modified atmosphere due to blockage of the pores within the fruits, minimizing respiration rate and increasing post harvest quality (Kader, 2005). It is reported that the use of coatings forms a protective layer around the fruit and can be used for consumption along with the coated product. These coatings make good oxygen and lipid barrier at low to intermediate relative humidity because the chemicals can effectively make hydrogen bond.

Some work has reported on the transportation losses due to infection of microbes. To govern this problem it can be governed by certain factors like perishable nature, method of harvesting, packaging, transportation etc. As Kinnow is a commercial fruit crop, the post-harvest losses are significant in terms of quantity and economic value. It is noted that estimation of post-harvest losses in several fruits studies are conducted Gajanana, 2002; Sreenivasa Murthy *et al.* 2002; and Kishore Kumar *et al.* 2006).

Review on literature

Ahmad *et al.* (2008). In the experiment the effect of coating with irradiated chitosan and unirradiated chitosan on the preservation of Kinnow fruits to maintain its quality produce. The fruits were coated with above chemicals, stored at 4 degrees Celsius in 80% relative humidity for 12 weeks. The observations were recorded. All the coated fruits has minimal weight loss and respiration rate during the period of storage, also delayed and minimized the changes in ascorbic acid content, titrable acidity, and maintained eating quality of fruits till 3 months as compared to untreated fruits.

Dhillon et al. (2013), experimented on the effect of surface coatings on the shelf life and quality of Kinnow fruits during storage. He took the fruits which were sorted, washed with chlorine solution (100ppm). The fruits were coated with Nipro Fresh SS 40T and SS 50 formulations. The fruits were air dried and packed in corrugated fibre board boxes. The fruits were stored under cold storage at 5-7 degree Celsius and under ambient conditions at 11-19 degree Celsius. The experiment revealed that in this conditions the Kinnow which was coated with these formulations can be stored for 45 days under cold storage and for 10 days under at room temperature. The control fruits can be stored for 30 days in cold storage and 5 days at ambient conditions.

Shah et al. (2015), experimented on storage stability of Kinnow fruit as affected by CMC and guar gum based silver nano particle coatings. The experiment was carried out for 120 days at 4 degree Celsius and 10 degrees Celsius. The physiochemical qualities were monitored after every 15 days of storage. The overall results showed that the fruits can be kept in good quality after coating for 4 months at 4 degree Celsius and for 2 months at 10 degree Celsius

Sharma et al. (2015), made investigation on the effect of surface coatings on postharvest quality of Kinnow mandarin. The study was carried out to know the effect of lac based wax, citrashine, P-104 and niprofresh TM on Kinnow mandarin to extend its shelf life. Results suggested that allows the surface coatings used could retain the quality attributes, titrable acidity and ascorbic acid of the fruits without any adverse effect, storing for 60 days under cold storage. The control fruits, can be stored for 45 days in cold storage

Baral et al. (2016) experimented on effect of post-harvest treatments on quality and shelf life of mandarin. He used wax emulsion (10%), bavistin (0.1%), wax (10%) with bavistin at 0.1%, calcium chloride at 1 %, with invested fruits as control. The fruits were stored for four weeks at ambient condition in Nepal. The result findings were showed that the fruit can be stored up-to four weeks when treated with wax and wax with bavistin in the condition with 14 degree to 18 degree Celsius temperature and 45%- 73% relative humidity.

Hosseini et al. (2017) reported on effect of different edible coatings on post-harvest quality of Kinnow mandarin .The effective method in the post-harvest industry in order to replace natural waxes which are removed is replaced by the edible coatings on fruits. So different coating materials of CMC (1%), Gum Arabic (5%), Persian gum (1%), beeswax (0.5%) ,carnauba wax (1%) and commercial wax were applied. Then the fruits were stored at 5 degree Celsius for 3 weeks. The results showed that CMC and PG coatings had minimal losses of physiochemical attributes.

Ahlawat et al. (2018) studied the effect of different chemical treatments on shelf life of kinnow fruits. Present investigation was carried out to know about the coating which accomplish its application on the fruits which is most effective for the preserving the physiological properties of the fruits. Among the coatings used, Gum Arabic 10% coating was the most effective to minimize the physiological loss in weight and maintained the quality parameters at all period of storage

Jitendra Kumar et al. (2018) made investigation on effect of different chemical treatments on ascorbic acid content of Kinnow fruits. As Kinnow is easily perishable fruit and decayed within 10-15 days at ambient condition. So to prevent the entry of microbes there is necessary for the application of chemical coatings to prolong the shelf of the fruit. For the experiment the effect of various concentrations of gum Arabic, calcium lactate, glycerin and their different combination on ascorbic acid content of Kinnow fruits stored at room temperature were studied .Among all the treatment the maximum ascorbic acid content were found on fruits coated with gum Arabic 10%.

Kumar et al. (2018) As Kinnow is attractive and nutritious fruit it is available for short period due to its perishable nature. In this study the various coatings were used at different concentrations to know the effect of different post-harvest treatments and storage conditions on the post-harvest quality of Kinnow up-to 49 days was examined. The results was all coatings were effective to maintain the quality of fruits. Thus, gum Arabic coating was the best which maintained the minimal decay loss and the acidity, specific gravity, juice content at all periods of storage

Nadeem et al. (2018), studied the synergistic effect of salts and cellulose based coating on shelf life of Kinnow. The chemical treatment were calcium chloride 2%+HPMC (T 1), calcium chloride 2 % + HPMC (T 2),Magnesium sulphate 2% + HPMC 3% (T 3), Magnesium sulphate 2 % +HPMC 5% (T 4), calcium chloride + Magnesium sulphate 1 %+ HPMC 3 % (T 5) and calcium chloride 1 % + Magnesium sulphate 1% + HPMC 5 % (T 6). T 4 and T 6 treatments showed minimal chilling injuries respectively. Hence for the experiment T 6 treatment was considered to be best for various parameters.

Suman Bala et al. (2018), investigated on effect of different chemical treatments on enzymes activity of Kinnow fruits. To minimize the postharvest losses, the present investigation was carried out by studying the effect various concentrations of gum Arabic, calcium lactate and glycerin during storage at room temperature. Overall, the results revealed that gum Arabic (10%), and glycerin (2.5%) coated fruits had minimum cell wall degrading enzymes compress to control fruits.

Vivek et al. (2018).The study was carried out to enhance the shelf life of fruits by using preharvest application of fungicides and plant growth regulators and post-harvest treatments of different chemicals and salicylic acid. The data revealed that plant growth regulators weekend most effective to prolong the shelf life and minimizing the physiological loss in weight and decay loss of the fruits at room temperature, but citrashine and stafresh coatings significantly reduce the PLW,retains the firmness, TSS, vitamin C, reducing sugar, total sugar.

Arvind Kumar et al. (2019) made the present investigation titled “ effect of postharvest treatment s and 0packaging on storage life and quality of Kinnow fruit “.For the experimentation the chemicals used were CMC, chitosan, beeswax, 1-methyl cyclopropane, methyl jasmonates, salicylic acid. The observations were recorded up-to 75 days, the data showed that the fruits with CMC 2% ,can be stored up-to 60 days when treated along with MeJA (1mm) and packed in perforated PP 100 gauge film.

Gandhi et al.(2019) reported on the effect of different types of coating on quality and shelf life of Kinnow. For the experiment waxing, polythene, oil coating, waxing + polythene and open air as a control. Out of all the treatments polythene showed the best result with minimum physiological loss in weight.

Baswal et al. (2020), reported the post-harvest application of methyl jasmonate, 1- methyl cyclopropene and salicylic acid extends the cold storage life and maintain the quality of Kinnow mandarin. He used these chemicals at various concentrations to study the effect of fruit on cold storage and fruits quality of Kinnow up-to 75 days. The result indicated that all fruits were coated with chemicals extended storage life, delayed the cellulase activity up-to 60 days .It also maintained the vitamin c content, SSC, TA, sensory parameters of the fruits and delayed the spoilage also.

K. S. Gill et al. (2020), reported on influence of carboxy methyl cellulose, chitosan and beeswax coatings on cold storage life and quality of Kinnow mandarin fruit. The aim of the study was to procure the influence of different edible coatings on extending the fruit quality of Kinnow fruits. The fruits were coated and uncoated fruits were treated as control. Stored up-to 75 days, the fruits were sampled at 30th, 45th, 60th and 75th days of cold storage. The result was CMC coating extended cold storage life and maintained Kinnow mandarin fruit quality.

Saleem et al. 2021),made experiment on Carboxymethyl cellulose coating delays chilling injury development and maintains eating quality of Kinnow mandarin fruits during low temperature storage. He mentioned that during the post-harvest the application of coatings is an efficient way to reduce the mass loss and to conserve the quality of the fresh produce. In this experiment CMC coating effect were was studied on Kinnow fruits. It revealed that, it reduced decay, weight loss, chilling injury, conserved better sensory quality and suitable for the fruits.

Conclusion

Fruits are perishable in nature they cannot be kept for a long time during transportation and storing. Due to low adaptation of improved techniques during pre and post-harvest stage both external and internal chemical quality attributes are lost. Coating of fruits is an effective method in the post-harvest industry in order to replace natural waxes which are removed during washing hardly. However chemicals are used because to suppress microbial activity, thus maintain the quality of fruit to preserve fresh kinnow, control post-harvest decay. Coatings can be designed, used inventively, in order to delay maturity, reduce the water content, and prolong the shelf life of the fruits.

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