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Carnauba wax Coating to prolong storage life of Nagpur mandarin fruits

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FOREWORD

Nagpur mandarin is one of the important citrus fruits occupies 0.245 million ha area with 16.33 lakh tonnes production and 6.60 ton/ha productivity. It is easily peelable, table fruit having an excellent aroma and flavour consumed mostly in fresh form. Post-harvest management is one of the important scientific tool and techniques to enhance the quality and shelf life of Nagpur mandarin. Post-harvest management includes several activities to adopt in value chain. The post-harvest losses in Nagpur mandarin is enormous and varies from 25-26% of total production. Proper technological intervention can minimise these losses to the tune of 6-7% and this increase the fruits availability more than increase by production alone. It will also increase the profitability by increasing the growers share through value addition and providing gainful employment in rural area.

The post-harvest technology starts from pre-harvest management to harvest at proper maturity followed by washing and precooling of fruits, cleaning, grading, treatment, waxing, drying storage, packing and transport etc. Among them the suitable coating of fruits is one of important link of value chain to be applied effectively to enhance the shelf life of fruits to make it available in off season. The wax coating in different concentrations is used to enhance storage life of fruits of mandarin.

The extension bulletin entitled **"Carnauba wax coating to prolong storage life of Nagpur mandarin"** will be highly useful for extension personnels, horticulture department, and also private entrepreneurs. I am sure that information presented here will help to accelerate post harvest activities further in the country and benefit the farmers, consumers and others. I appreciate the effort put by Dr. Dinesh Kumar, and Dr. Lallan Ram Sr. Scientist (Hort.) in bringing out this useful publication in the form of extension bulletin. Which will be quite handy for the workers interested in this field.

Date: Feb, 2012
Place : Nagpur

(V.J. Shivankar)
Director

Carnauba Wax Coating to prolong storage life of Nagpur mandarin fruits

Introduction:

In India, loose jacketed Nagpur mandarin (*Citrus reticulata* Blanco), is well known cultivar for easy peeling nature having excellent aroma and flavor, contributing about 45% both in area and production to citrus industry. In general, the post-harvest losses have been recorded substantially about 25-26% in Nagpur mandarin during post-harvest handling of fruits due to several factors involved in value chain from fruit harvesting to consumption. These losses can be minimized with the adoption of advance technologies to extend the marketing distance and holding periods of commodities after harvest. Among these, cooling, waxing, controlled atmosphere, modified atmosphere packaging are the innovative methods. However, the use of coating, waxing has been gained popularities in this respect because of its convenience and low cost as the coating substances on the surfaces of fruits has been a useful practice to reduce moisture and postharvest quality losses of various fresh commodities. Wax coatings are made of natural or synthetic waxes and fatty acids (beeswax, carnauba, polyethylene, oleic acid), oils, shellac, emulsifier, plasticizers, antifoam agents, and surfactants.. In recent year, the performance of various wax micro emulsion as food and fruit coatings were evaluated for extended shelf life that act as a semipermeable barrier against gases, moisture and solute movement to reduce the respiration, water loss and oxidation reaction rates. The anaerobic conditions lead to the production of off-flavors, which are associated with the loss of fruit quality. Mandarin fruits are sensitive to anaerobic respiration. Looking the present scenario of awareness and risk factor of residual effect of non-edible chemicals, there is a dire need to have some good food grade coating emulsion which can prevent the post harvest loss as well as give the upliftment of entrepreneurship to the farmers and exporter. As it is very much known that while preparing the products like marmalades the shred of Nagpur mandarin peels are

Nagpur mandarin fruits at harvesting stage

used for binding purpose due to the presence of pectin content. These marmalades are directly consumed as a food stuff either with bread or other food items.

Currently, there are several coating substances available for commercial use for postharvest pre-storage treatment of fresh fruits. They generally contain shellac, natural waxes or sucrose esters of edible fatty acids as active components incorporated with other materials as well as various polysaccharide-based coatings. These materials, despite of their compositional differences, form an elastic film around the fruit which reduces the effect of environmental degrading factors

Among several Wax coating substances the carnauba wax formulation has been tried in Nagpur mandarin fruits at NRC for Citrus, Nagpur.

Coatings Characteristics

Coatings should have the following characteristics:

1. The coating should be water-resistant so as to remain intact and to cover all parts of a product adequately when applied.
2. It should not deplete oxygen or build up excessive carbon dioxide.
3. It should reduce water vapour permeability.
4. It should improve the appearance, maintain structural integrity, improve mechanical handling properties, carry active agents (antioxidants, etc.) and retain flavour of the produce.

Effectiveness of Coatings

The effectiveness of coatings for protection of fruit depends primarily on :

- Controlling the wettability of the coating solutions, which affects the coating.
- Thickness of the film coating formulations.
- Must wet and spread uniformly on the fruit's surface upon drying,
- Coating has adequate adhesion and cohesion.
- Durability to function properly must be formed.
- Coatings can act as carriers for food additives.
- As antioxidants and antimicrobial agents onto the surface of the food.

Role of Coatings

Coatings are thin layers of material applied to provide a barrier to moisture, oxygen and solute movement for the food. They are applied directly on the food surface by dipping, spraying or brushing to create a modified atmosphere. An ideal coating is defined as one that can extend storage life of fresh fruit without causing an-arabinoses and reduces decay without affecting the quality of the produce. Previously, coatings have been used to reduce water loss, but recent developments of formulated coatings with a wider range of permeability characteristics has extended their potential in using in handling the fresh produce. The effect of coatings on fruits depends greatly on temperature, alkalinity, thickness and type of coating, and the variety and condition of the produce.

Coatings for Oranges

Peel coating by dipping into emulsions of oil, wax and shellac delays the onset of ripening changes and prolongs the storage life. Skin coating with the above emulsions or alcoholic solution increased the resistance of the skin to gaseous diffusion, and thus greatly reduces the internal oxygen concentration, increases the carbon dioxide concentration, reduces the respiration rate and retards ripening changes such as yellowing.

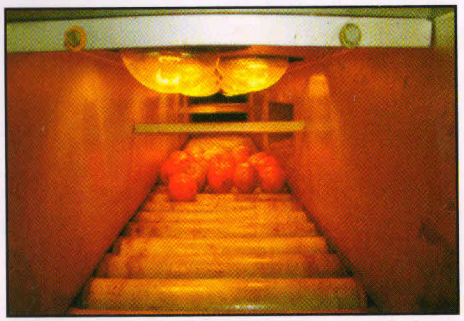
Carnauba Wax Emulsion

In citrus Industry, there is a need to have an emulsion either of a plant or animal based extract which is known almost safe for consumption point of view. Carnauba Wax emulsions is botanical natural carnauba palm product obtained from the leaves and have broad FDA approval for food contact applications which is considered as 'Queen of wax' due to wax extended shelf life properties for citrus fruits as per the evidence available.

Nagpur mandarin treated with carnauba emulsions

Carnuba emulsion coating of Nagpur mandarin

The coating effect of differential concentration of carnauba wax on shelf life and sensory attributes of Nagpur mandarin fruits under both refrigerated and ambient storage condition in *ambia* and *mrig* fruits were studied at National research centre for citrus, Nagpur.



Drying of carnauba emulsion coated fruits

The fruits were dipped in different carnuba wax concentrations namely. 5, 10, 15 and 20% and 6% stafresh. The treated fruits were completely air dried at ambient condition in mechanised packing line. The results indicated that the quality of *mrig* Nagpur mandarin fruit both physico-chemical parameters and sensory attributes were found to be better with 10% carnuba wax coating treated fruits at low temperature storage.

Nagpur mandarin fruits packed in CFB boxes

Carnuba based coating formulation influenced post harvest life and changes occurring in physico chemical and sensory attributes of Nagpur mandarin (*C. reticulata* Blanco) *ambia and Mrig* bahar fruits under refrigerated storage condition applying @ 5, 10, 15 and 20 % four concentration as treatments along with control. Carnuba wax 10 pecent concentration treated Nagpur mandarin *Ambia* fruits responded significantly to the physico-chemical attributes for 45 days of shelf life under refrigerated storage condition at 6 $\pm$ 1^{0}C temperature

Digital Thermostat base Refractometer sugar analysis

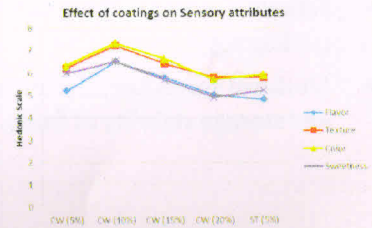
Storage of Nagpur mandarin fruits in cool chamber

physiological loss in weight (PLW) was recorded to be least 7.93% with better fruit firmness (23.50 N), maximum juice recovery (43.28%) and maintained quality like total soluble solid (11.03%) and Vitamin 'C' (28.47 mg/100 ml). While in *Mrig* fruits, least Physiological Loss in Weight (PLW) was recorded 7.44% with fruit firmness 29.28 Newton. The juice recovery was 42.54% and the quality was maintained with high Total Soluble Solids (9.80%) and Vitamin 'C' content (18.50 mg per 100 ml).

Under ambient condition the fruits treated with Cornuba wax formulations responded to the least physiological loss in weight, more firm fruits (32.77 N), juice recovery (44.05%), Total soluble solids (12.20%) and Vitamin -C (29.13 mg/100ml) juice, color ratio was a/b (0.39). which reflects the better response of Cornuba coating on physio-chemical attributes of Nagpur mandarin up to 21 days of ambient storage.

Sensory evaluation

The sensory evaluation was done periodically based on 9 point Hedonic scale by panelist, indicated that fruits coated with 10% of Carnuba wax responded better in relation to the sensory attributes, showed better sensory properties



Sensory evaluation by a panel of judges on 9 point hedonic scale

sweetness while colour development scored 7.30 with better texture.

Conclusion

It can be inferred that Nagpur mandarin *Ambia* and *Mrig* bahar fruits coated with 10% Carnuba wax formulations can be used for extending the shelf life of fruits for 21 days in ambient condition and up to 45 days under refrigerated storage condition with marketable quality.

Precaution: Following points need to considered during wax coating

- Collection of fruits and time of harvest
- Inadequate selection of the material
- Methods of application
- Uneven thick layer of coatings could cause anaerobic respiration
- Desiccation of the fruits affecting quality
- Homogenous covering of the fruit surface
- Suitable storage condition (temperature, relative humidity) and packaging
- Uniform spreading of wax emulsions applied also affect the quality and storage stability of fruits.

भाकृअनुप
ICAR

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Agrisearch with a human touch

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