

## Treatments Prior to Shipment

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### INTRODUCTION

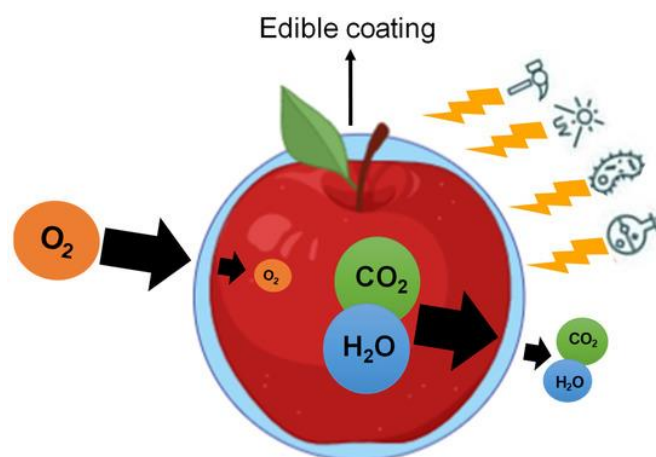
Fruits and vegetables are perishable commodities that require proper care for their longer shelf life. Following treatments should be given prior to shipment so that the commodities maintain the quality till they reach the consumer:

- **WASHING:** Washing involves eliminating dirt, debris, sands particles & microorganism present on fruits. After washing, surplus water should be removed by passing fruits over brushes or absorbent foam rollers. For some commodities such as Kiwifruits and Avocadoes, dry brushing may be sufficient to clean the produce.
- **CHLORINATION:** Chlorine in fresh water is used as disinfectant to wash commodities. Active chlorine @50-200 ppm in washing water eliminate fungi spore & bacteria from diseased fruits surface & also prevent contamination of healthy fruits.

**Agricultural chlorine is commercially available in three forms that have been approved:**

- **Chlorine gas (Cl<sub>2</sub>)-** It requires automated and controlled injection systems with in-line pH monitoring. It is economically feasible and thus, more in demand.
- **Calcium hypochlorite (CaCl<sub>2</sub>O<sub>2</sub>) -** It is the most common source of chlorine used for disinfection
- **Sodium hypochlorite (NaOCl) -** It is commonly used in small scale operations.

**WAXING:** Waxing refers to the coating applied to surface of fruits to improve appearance and increase shelf-life of fruits by reducing respiration, transpiration and moisture loss. It seals small cracks & wounds on rind or skin & protect from microorganism infection. Waxing is considered a cost effective substitute in reduction of spoilage when refrigerated storage is unaffordable. Coating also acts as carrier of active ingredients, such as antimicrobials, antioxidants, colour, flavours, nutrients & other additives used to improve quality.



### Some problems are also associated with waxing/ coating such as-

- Development of off-flavour due to anaerobic respiration and elevated ethanol & acetaldehyde contents
- Surface burn
- Wax whitening (chalking)
- Added cost
- Artificial appearance

### Methods of Wax Application:

- **Manual Rubbing:** Liquid waxes can be applied by manually rubbing the commodity and smearing the wax evenly over the surface. After application, the products should be left to air dry for about 15 minutes before packing.
- **Dipping/Submergence:** Paraffin wax is typically applied as a brief dip or submergence of the product in a bath of melted paraffin. Submergence time is usually one second or less. Upon removal from the melted solution, the paraffin solidifies almost instantaneously and the products are ready for packing within a minute.
- **Roller Brushing:** Liquid waxes can be applied automatically to the surface of the commodity by using a series of roller brushes. The wax is

dispensed from above and saturates the brushes, which rotate and spin the product, smearing the wax evenly over the product surface. Fruit should be damp dry prior to wax application to prevent wax dilution.

- **Plasticizer:** Compounds having low molecular weight that improve strength of coating by imparting strength, permeability and flexibility to coating are termed as Plasticizer. Eg.- Glycerol, Sorbitol, Mannitol, Propylene glycol and Polyethylene glycol
- **CHEMICALS:** Certain chemicals are used to improve shelf-life of fruits & reduce pathogenic stress from fruit after harvesting.
  - Fungicides like Diphenylamine (0.1- 0.25%) & Ethoxyquin (0.2- 0.5%) used as post harvest dip to control many disorders
  - Potassium Permanganate as ethylene absorbent keep ethylene below threshold level
  - Maleic hydrazine @1000-2000 ppm delays ripening in Mango fruits while it hasten ripening in Sapota
  - Foliar spray of IPC (Isopropyl-N-phenyl carbonate) reduce rate of

respiration, ripening & spoilage of fruits

- Hydrogen peroxide useful as an antibacterial agent that effective against Gram Negative bacteria (Califorms)
- Acetyldehyde vapour (0.05-0.5%) significantly reduced decay of harvested Strawberry & Grapes
- Calcium chloride (4-6%) dip or spray for bitter pit in Apples
- The addition of low concentrations of 2,4-D to waxes assists in keeping citrus penduncles green
- Sulphur dioxide schates (release SO<sub>2</sub>) reduce microbial growth
- Calcium carbonate increase shelf life of fruits
- MCP (Methyl cyclopropene) is ethylene absorbent, specially

used in Apple, Pear, Plum, Citrus, Guava *etc.*

- Thiophenate methyl is fungicide, specially used in apple

- **Plant Growth Regulators:**

PGR such as 2,4-D prevent development of stem end rot in citrus by retarding button senescence. Similarly, GA<sub>3</sub> helps in delayed ripening of Banana.

- **Degreening:** The main causes of greening are climatic conditions before harvest. Citrus often reaches commercial maturity with traces of green colour on the epidermis (flavedo). Citrus fruits are exposed for 24-72 hours (depending on degree of greening) to an atmosphere containing ethylene (5-10ppm) under controlled and high relative humidity 90-95%.



- **IONIZING RADIATION:** IR extends the life of perishable fruits through its action as surface pasteurisation & retardation of senescence process. It can destroy all micro-organisms and all stages of insect even inside the fruit. Eg.- Stone weevil inside the mango. Ripening of mango and banana fruits can be

delayed by application of ionizing radiation.

**Advantage of ionizing radiation:**

- Easy to apply
- Leaves no potential residue
- Fast & need minimal energy expenditure

• **BIOLOGICAL CONTROL:**

Biological control of plant disease is defined as “the decrease of inoculum or the disease-producing activity of a pathogen accomplished through one or more living organisms”.

• **NATURAL PLANT PRODUCTS :**

➤ **Mentha oil**– Checks growth of *Pencillum degitatum* & *P. iltalicum* in citrus

➤ **Tulsi oil**- Antifungal property & repelling property (liberate aroma)

➤ **Til oil**– Used as fruit coating (antitranspirant & also improve appearance)

➤ **Neem (*Azadirachta indica*)** - Antifungal property but used in fruits where rind is separable.

➤ **Nicotinoid**- Nicotine is a contact and nerve poison which affect soft bodied insect such as aphid. Its main source is tobacco.

➤ **Pyrethroids**- Its main source is white flower of *Chrysanthemum cinerariefolium* that acts as contact insecticide as it paralyses the housefly.

➤ **Limonene and Linalool**- Citrus peel extracts which cause insect paralysis.

➤ **Aloe vera gel**– Used as fruit coating

• **QUARANTINE TREATMENT:**

Fruit fly is major worldwide pest & their fruit host must be treated to kill 100% of immature inside fresh produce prior to export to other areas of world.

➤ Vapour heat treatment- Fruit boxes are stacked in a room which is heated & humidified by injection of steam to maintain 43° C in saturated air for 8 hours & holding temperature for a further 6 hours

➤ Hot water treatment - Mango fruits are dipped in hot water at 55° C for 5 minutes or hot water at 52° C with Benomyl (Benlate) at 0.1% concentration, for 1-3 minutes

**Post-Hot-Water Treatment Cooling:**

Hydrocooling mango fruit after hot water treatment decreases the flesh temperature much more rapidly than holding in air and can reduce hot water injury.