

Module 17

Degreening

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information

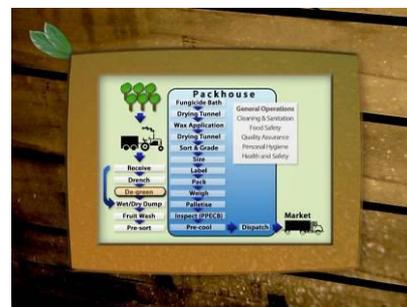
Reference

More information on degreening can be found in the CRI Production Guidelines, volume IV.

Introduction

Citrus fruit is judged by the housewife in the overseas supermarket mostly by what it looks like. It is for this reason just as important to produce a good looking fruit as one that tastes good.

Degreening means accelerating the natural colour change in fruit by using the ripening hormone ethylene. Fruit is exposed to ethylene gas in specially built rooms in the packhouse, for a specific period of time.



Ethylene

Ethylene is a maturation hormone that speeds up all cellular processes associated with the ripening, for instance the breakdown of acids that makes the fruit sweeter.

It also has to do with the abscission layer. When the rind is for instance damaged by a bird, the wound secretes ethylene and the fruit falls from the tree quicker because of accelerated ripening.

The specific action in the rind naturally is to break down the chlorophyll pigments in the flavedo. This process speeds up, and the orange carotene pigments also synthesise quicker. The degreening process has many different steps.



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definition

Chlorophyll Pigments

Chlorophyll pigments are the green pigments that give tree leaves and young fruit their colour, and are critical to photosynthesis.

Carotene Pigments

Carotene pigments are the orange pigments that give citrus fruit their colour. As chlorophyll pigments are broken down, carotene pigments synthesise faster and faster, thereby causing the fruit to change colour from green to orange.

Flavedo

The flavedo is the coloured part of the fruit rind, where chlorophyll pigments are broken down and carotene pigments are synthesised.

Fruit Preparation

Harvesting

Degreening starts in the orchard where colour must develop to a certain level. This is called colour break and must take place before fruit is picked. The internal quality of the fruit must also be acceptable before it is harvested. There must also be no blemishes on the fruit rind if it is to be degreened.

The second step is during picking in the orchard to separate fruit with more colour development from fruit that requires degreening, as there can be significant variation in colour development on a tree. The next step is to damage fruit as little as possible, since any injuries to the fruit will become obvious later.



Drenching

Next the fruit is transported to the packhouse, where it is drenched immediately with a mixture of water and fungicides to prevent decay. This practice also takes the field heat out of fruit and prevents moisture loss from the rind. After drenching, the fruit must be left to stand for 24 hours, to allow the water trapped between the fruit to evaporate. Any water on the rind will cause green spots where the ethylene couldn't penetrate.



information

Reference

Please consult **module 16 – Drenching** for more information on this practice.

Degreening Procedures

From there the fruit is put in a degreening chamber. The room must not contain any old, spoiled fruit that can transmit fungal spores. The area must also be regularly sanitised to remove any fungal spores on the surfaces.



Marking

In the degreening chamber every crate must be marked, stating the orchard of origin, as well as the colour the fruit was before degreening.



Ethylene Gas Release

Now the degreening chamber can be closed and the ethylene gas released. The ethylene should be between 1 and 3 parts / million, but not higher than 5 parts / million. Very high ethylene levels cause excessive respiration in the rind that will lead to negative aspects such as physiological defects.



Atmospheric Conditions

Another three aspects that must be monitored apart from ethylene levels are:

- ❖ Temperature
- ❖ Humidity
- ❖ CO₂ levels



Temperature is very important and the rule is: the thinner the fruit rind, the lower the temperature during degreening, even though degreening is better at higher temperatures. Satsumas are degreened at 18-21°C; Clementines, Novas and Mandarins at 19-22°C; navels and other oranges at 21-24°C; grapefruit and lemons at 23-25°C.



It is critical to control relative humidity in order to prevent moisture loss. The vapour pressure deficit in a degreening chamber is very high, so you can get a lot of moisture moving out of fruit.



Ideally, humidity must be kept between 94-96%, but it should not be lower than 90% for longer than an hour. This usually happens when the doors are opened and hot, dry air comes in.

CO₂ levels in a degreening chamber must be monitored carefully. CO₂ competes on a cellular level with ethylene. CO₂ binds on the cell, so the fruit must be exposed to degreening for longer, leading to higher respiration and deterioration in fruit quality.



To protect fruit from high CO₂ levels, CO₂ must be extracted by ventilation fans regularly from the chamber, and kept at a level lower than 0.3%, or 3,000 parts per million.

Monitoring

The next aspect of degreening is controlling and monitoring the process throughout. It is essential to buy proper equipment to monitor temperature, humidity and gas levels, and not to only rely on automated equipment.



These parameters must be monitored, because things can go wrong that will affect fruit quality negatively.

Fruit must be checked regularly. It is important to check colour development by sunlight or a torch, and not under neon lights as they can distort the colour.



Degreening Time

One of the most critical aspects of degreening is that it must happen as quickly as possible but **never for longer than 72 hours**.

Post-Degreening Procedures

Finally once the fruit is taken out of the degreening room, it must be kept at normal atmospheric conditions for 6-10 hours.

This will bring the gas composition of the rind and the environment in equilibrium. This means that oxygen must enter the rind and CO₂ and ethylene must escape before the fruit is packed.

This is also important to allow the turgidity of the rind to decrease. If not the oil glands can be damaged during packing, leading to oleocellosis.

After degreening there will be more blemishes on the rind. This is not as a result of degreening, but due to injuries during picking. The injuries are more obvious now because of the orange pigment development.



summary

Degreening Dos and Don'ts

- Degreen fruit only after **colour break**.
- **Pre-sorted** fruit according to colour.
- Fruit must be **dry** – leave for at least **24 hours** after drenching.
- **Ethylene gas concentration** – 1-3ppm, never higher than 5ppm
- **Temperature** is according to rind thickness:
 - Satsumas – 18-21°C
 - Clementines, Novas, Mandarins – 19-22°C
 - Oranges – 21-24°C
 - Grapefruit, lemons – 23-25°C
- **Relative humidity** – 94-96%
- **CO₂** levels – below 0.3%
- Fruit colour must be checked regularly by **natural** or **torch light**.
- Degreening must never take longer than **72 hours**.
- Fruit must be kept at **normal atmospheric conditions for 6-10 hours** after degreening.

active learning

Watch the DVD clips, read through the learning material and do workplace research to gather the knowledge and information to complete the assignments below.

Activity 17.1 – Flowchart

Do workplace research to determine how degreening is done in your packhouse. Draw a poster or flowchart, explaining the details of the process. Make sure that your poster communicates the following information:

- At what stage of the packhouse process flow or in the packline is fruit degreened?
- In what condition must the fruit be before it is degreened?
- What are the standard operating procedures for degreening in your packhouse, including the limits and settings for the process?
- Are there any potential hazards or cautions that workers involved in degreening should be aware of, in terms of food safety and residues, and personal health and safety?

Activity 17.2 – Internet Research

Do research on the internet to find out why ethylene is so effective for degreening citrus.

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- ✓ **Are there any potential hazards or cautions that workers involved in degreening should be aware of, in terms of food safety and residues, and personal health and safety?**



