Fruits and Vegetables Packaging

Introduction

- Fruit and vegetables play an important role in healthy nutrition.
- Fresh fruits and vegetables have a short shelf-life.
- Fruit and vegetables are living products undergoing various biological processes even after the products have been harvested.

Introduction

- The key to obtain optimal shelf life is to minimize physical damage to fresh produce.
- Packing with the use of suitable packaging is vital in this respect.

Packing protects contents from injuries

Impact bruises

- During packing — Dropping the product into package.
- After packing — Dropping packages during handling.
- Avoid — Careful unitized handling.

  Cushion pads in the bottom of packages or in between the produce.

Packing protects contents from injuries

Impact bruises

Packing protects contents from injuries

Compression bruises

- Occur due to intentional overpacking.
- Occur due to package failure.
- Avoid Proper package design.

  Reducing overpacking.

  Reducing overstacking.

Packing protects contents from injuries

Vibration bruises

- Occurs when products move within the package during transit.
- Avoid Produce must immobilize within the package.

  Proper design of the packages.

Packing protects contents from injuries

Vibration bruises

Packing must facilitate temperature management

- Success of the temperature management depends upon the good contact between the product in the package and the external environment.
- Ventilation holes make airflow pass the package surfaces and remove heat rapidly.
- Package vents should not be obstructed by internal packaging material.

Packing must facilitate temperature management

- For certain fruits, packages must be properly vented for both warming and gassing to make them ripen.

Packing must provide protection from water loss

- Occurs as a result of water vapour pressure gradient between the product and the surrounding.
- Packages act as partial barriers to the movement of water vapour from the product.
- Different types of moistures barriers are available in packages such as plastic (poly) liners, poly curtains and various coatings.

Packing must provide protection from water loss

- Use plastic liners with small perforations.
- Corrugated boards are applied with surface coatings like poly wax reduce the moisture uptake by the package and delay deterioration.

Packing must facilitate special treatments

- Sulfur dioxide fumigation of grapes for disease control and methyl bromide fumigation of various products for insect control.

✓The package must be well-vented to allow readily flow of the fumigant.

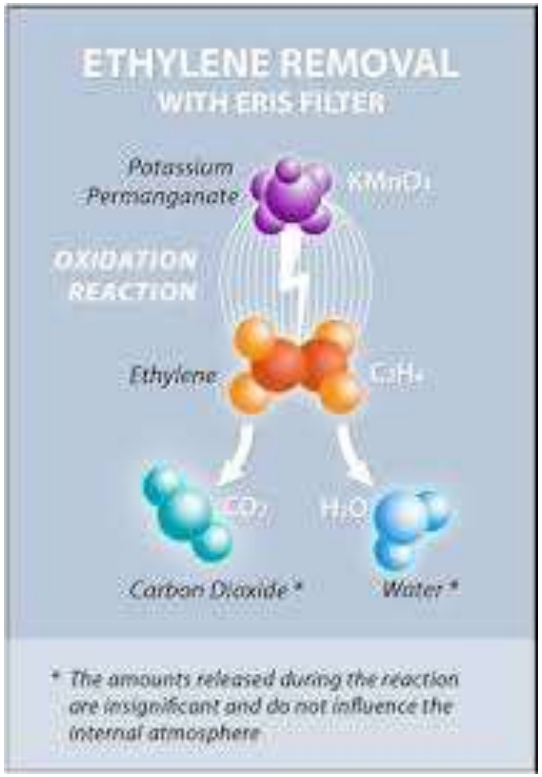
Packing must facilitate special treatments

- For certain fruits, packages must be vented enough to maintain uniform warming and ethylene treatment during fruit ripening.

Catalytic generator for ethylene production in ripening room

Packing must facilitate special treatments

- For others, packages must facilitate in package-ethylene scrubbing processes.



Active film of kaolin and zeolite is inserted in between the hollow space of corrugated cardboard as ethylene scrubbers.

Packing must facilitate special treatments

- Asparagus must also be packed upright with some headspace above the spear tips for the growth and elongation.

Packing of asparagus

Qualities of a packing material

- It should be easily transported when empty and occupy less space than when full.
- It must be easy to assemble, fill and close either by hand or by use of a simple machine.
- It must provide adequate ventilation for contents during transport and storage.
- Should provide temperature protection to the product.

Qualities of a packing material

- Its capacity should be suited to market demands.
- Its dimensions and design must be suited to the available transport in order to load neatly and firmly.
- It must be cost-effective in relation to the market value of the commodity for which used.
- It must be readily available, preferably from more than one supplier.

Qualities of a packing material

- Package weight should be compatible enough with hand lifting.
- Must tolerate exposure to high relative humidity often for long periods.
- Must withstand environmental conditions and handling abuses during storage, distribution and marketing.
- Should facilitate easy inspection of the products.

Qualities of a packing material

- It must securely close and protect the product during the distribution period.
- Packages must be designed in a way which promotes its reuse and recyclability.

Modified Atmosphere Packaging

Modified Atmosphere Packaging (MAP) - History

- MAP was first recorded in 1927 as an extension of the shelf-life of apples.
- In 1930 ‘s, it was used as MA storage to transport fruits and meet in ships to long distances.
- The method was not introduced commercially for retail packs until 1970 due to lack of consistent control of O_2 concentrations in the package.

Modified Atmosphere Packaging (MAP) - History

- Improved the types and properties of polymers.
- As a result, successful MAP systems for many commodities have been introduced.
- Higher consumer demand due to less use of preservatives.

Modified Atmosphere Packaging (MAP)

- MAP extends the storage life of perishables and reduces spoilage and decay.
- A food preservation method that maintains the natural quality of products.
- MAP is a technique used for prolonging the shelf-life of fresh and minimally processed food by changing the composition of the air surrounding the food in the package.

Modified Atmosphere Packaging (MAP)

- MAP reduces the respiration rate and activity of insects and microorganisms, and provides control of product ripening, retardation of senescence, browning of cut produce and prolongs the shelf-life.

Principles of MAP

1. MAP of fresh produce relies on the modification of the atmosphere inside the package.

Interaction between the respiration of the product and the transfer of gases through the packaging.

2. MA potentially reduces respiratory rate, ethylene sensitivity and production, ripening, softening and compositional changes, decay and physiological changes.

Principles of MAP

3. The initial atmosphere in the package can either be air or a gas mixture.
4. Atmosphere modification within the package depends on film permeability, commodity respiration rate, gas diffusion characteristics of commodity and weight of commodity, surface area, initial free volume and atmospheric composition within the package.

Principles of MAP

5. Temperature, relative humidity and air movement around the package influence the permeability of the film.

Objective of MAP

1. To achieve the equilibrium concentration of O_2 and CO_2 within the package within shortest possible time.

2. To maintain the equilibrium concentration of O_2 and CO_2 constant within the desired level required for the maximum possible storage life of the commodity.

Effects of MAP

1. As the concentration of O_2 inside the package falls below about 10-12%, respiration starts to slow.
2. Suppression of respiration continues until O_2 reaches about 2-5%.
3. If O_2 gets lower than 2-5%, fermentative metabolism takes place.

Effects of MAP

4. As the concentration of CO_2 increases above atmospheric level, a suppression of respiration rate, ethylene production, sensitivity to ethylene and suppression of activities of microorganisms results.
5. Diminution of enzymatic activities reduces substrate utilization and increase post harvest life of fruits and vegetables.

MAP gases

- CO_2, O_2 and N_2.
- CO_2 is a bacteriostatic. Its inhibitory effects increases with decrease in temperature.
- N_2 is an inert gas. Does not have any bacteriostatic effect. Use as a filler gas in MA gas mixture.

Methods of creating MA conditions

1. Active MAP

- Established by pulling a slight vacuum and replacing the atmosphere of the package with the desired gas mixture of CO_2, O_2 and N_2.
- The beneficial equilibrium atmosphere can be achieved quickly.
- Additional absorbers can be included in the package to scavenge CO_2, O_2 and ethylene.

Methods of creating MA conditions

2. Passive MAP

- Achieved by the interaction between the respiration of the product and the transfer of gases through the package.
- Matching the respiration rate of the packaged produce with the film permeation rate for CO_2 and O_2.

Desirable characteristics of films for MAP

- The film should match the required permeabilities for different gases.
- High ratio of CO_2/O_2 permeability.
- Low permeability to water vapour.
- Good transparency and glossy.
- Light weight.
- High tear strength and tensile strength
- Low temperature heat sealable.

Desirable characteristics of films for MAP

- Nontoxic and chemically inert.
- Soft, non-fogging and durable.
- Non-reactant with produce.
- Good thermal and ozone resistant.
- Good weatherability.
- Commercial suitability.
- Ease of handling.
- Ease of printing for labelling.

Polymeric Films in Use for MAP

- Plasticized PVC
- Polyethylene
- Polypropylene
- Polyvinyleden chloride
- Polyester
- Ethylene vinyl acetate
- Polybutylene
- polystyrene

MAP - Advantages

- Maintains freshness and extends shelf-life.
- Slows vital biological reactions (respiration) and prolongs the maintenance of post-harvest quality.
- Delay ripening.
- Reduction of weight loss, desiccation and shriveling.
- Reduction of physiological injury, disorder and pathological deterioration.
- Retards softening and compositional change.

MAP - Advantages

- Little or no chemical preservatives are used.
- Alleviation of chilling injury.
- Improved presentation and clear visibility of the product all around the package.
- Quality advantages like colour, moisture, flavour and maturity retention occurs.

MAP - Disadvantages

- Requirement of additional investment in machinery and labour in packing line.
- Spoilage of product due to improper packing and temperature abuse.
- Risk of microbial safety due to possible development of anaerobic pathogenic flora.
- Plastic films may be environmentally undesirable if not recycled.
- Still unavailable for most produce.