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CANNING OF FRUITS AND VEGETABLES

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History

During the first years of the Napoleonic wars, the French government offered a hefty cash award of 12,000 francs to any inventor who could devise a cheap and effective method of preserving large amounts of food. The larger armies of the period required increased and regular supplies of quality food. In 1809, Nicolas Appert, a French confectioner and brewer, observed that food cooked inside a jar did not spoil unless the seals leaked, and developed a method of sealing food in glass jars which was referred to as APPERTIZATION and now known as CANNING.

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Canning

- Canning was invented by Nicholas Appert in 1910 so also termed as Appertization.
- Canning is a method of preservation of food in which the food is processed and hermetically sealed in containers (of metal, glass, thermo stable plastic, or a multi-layered flexible pouch) through agency of heat.
- Canning provides a shelf life typically ranging from one to five years, although under specific circumstances it can be much longer.
- Heating is the principle factor to destroy the microorganisms and the permanent sealing is to prevent re-infection.

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Why Canning?

- The high percentage of water in most fresh foods makes them very perishable. They spoil or lose their quality for several reasons.
- Microorganisms live and multiply quickly on the surfaces of fresh food and on the inside of bruised, insect-damaged, and diseased food. Oxygen and enzymes are present throughout fresh food tissues. Proper canning practices minimize the effects of these microorganisms.
- Main objective of canning is to preserve the food by the application of heat so that it can be safely eaten at a later time. Safety of the consumer is the primary concern when food is canned.

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Foods that are canned

(a)<u>Low acid foods:</u> Meat, fish, poultry, dairy fall into a pH range of 5.0 to 6.8. This large group is commonly referred to as the low acid group.

(b)<u>Acid foods:</u> With pH values between 4.5 and 3.7. Fruits such as pear, oranges, apricots and tomatoes fall in this class.

(c) <u>High acid foods:</u> Such as pickled products and fermented foods. The pH values range from 3.7 down to 2.3, also Jams and Jellies are in this classification.

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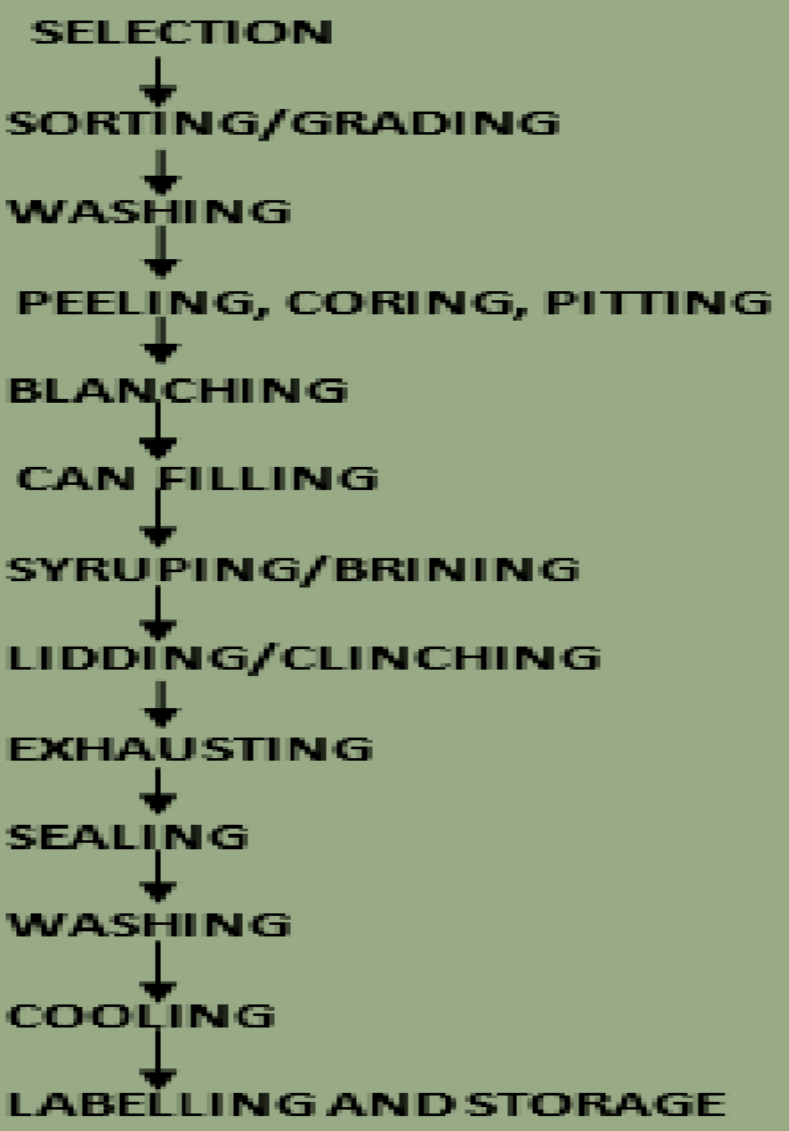
Flow chart



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Selection

- For canning, fruits and vegetables should be absolutely fresh.
- The fruit should be ripe, but firm and evenly matured.
- It should be freefrom all unsightly blemishes,insectdamage and malformation.
- Over-ripe fruit is generally infected with microorganisms and would yield a pack of poor quality.
- The vegetables should be tender and reasonably free from soil, dirt etc.

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Sorting & Grading

- After the preliminary sorting, the fruits and vegetables are graded.
- The grading is done with respect to size, color etc.
- Generally done by hands or the grading machines (screen graders, roller graders, rope or cable graders etc.).

Washing

- The graded fruits and vegetables are washed with water in different ways such as soaking or agitation in water, washing with cold or hot water sprays , etc.
- Vegetables may preferably be soaked in a dilute solution of potassium permanganate to disinfect them.
- Spray washing is the most efficient method.

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Peeling, Coring, pitting

- Peeling of fruits and vegetables can be done in many ways:
  1. by hand or with knife
  2. by machine
  3. by heat treatment(Scalding)
  4. by lye solution (dipping the fruits and vegetables in a solution of boiling caustic soda or lye solution of strength 1-2%for 30 seconds to 2 minutes.
- Cores and pits in fruits are removed by hand or by machine.

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Blanching

- Treatment of fruits and vegetables with boiling water or steam for short periods followed by cooling prior to canning, is called ‘blanching’.
- Blanching is done with the objective of:

✓ Loosening the skin of the fruit or vegetable.

✓ Eliminate the no. of microorganisms.

✓ Inactivating the enzymes, thus preventing the possibility of discoloration.

✓ Improving the flavor by reducing the astringency in some foods.

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Can Filling

- The cans are washed and subjected to a steam jet remove any adhering dust or foreign matter.
- Before filling of the contents(fruits and vegetables) a small amount of syrup(for fruits) or brine(for vegetables) is poured in the can so as to provide a medium to the contents.
- Can filling can be done by machine or hand filling can be also employed.
- In India, filling by hand using rubber gloves is the common practice.

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Syruping & Brining

- The cans are filled with hot sugar syrup for fruits(concentration 35-40%) and hot brine for vegetables(concentration 1-2%).
- The syrup or brine should be added to the can at a temperature of 79°C to 82°C, leaving a headspace in the can so that when the filled can is closed on the double seaming machine, the headspace left inside ranges from o.32 cm to 0.47 cm.
- Objective of this step is to improve the taste of the canned product and to fill up the inter space between fruits and vegetables.

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Lidding & Clinching

- Cans after being filled, are covered loosely with lid and passed through the exhaust box.
- Lidding is now replaced by CLINCHING in which the lid is partially seamed to the can by a single first roller action of double seamer.

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Exhausting

- By exhausting, risk of corrosion of tin plate and pin holing during the storage and discoloration of the product is reduced as the oxidation process is prevented.
- Cans are passed through a trough of water at 82-87°C or a moving conveyor belt through a steam box. The time varies from 5-25 min. on the nature of the substance.
- During exhausting, expelling of all the gases takes place which prevents spoilage of the canned product by ceasing the chemical reactions and also the bulging of can.

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Sealing

- After exhausting, the cans are sealed by special closing machines known as double seamers.
- There are hand operated as well as semi-automatic and fully automatic seamers.

Processing/Sterilization

- Processing consists of heat treatment which is sufficient to eliminate the growth of spoilage causing microorganisms.
- All fruits can be satisfactorily processed at 100°C and vegetables at 116-120°C.

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Washing & cooling

- After the cans are closed, they pass through a detergent spray washer to remove grease and other material. The washing should consist of hot water (66°C) then by suitable pre-rinse, detergent spray wash. Followed by a fresh warm water rinse (66°C).
- Immediately after processing, the cans are COOLING in water to a temperature of 36°C to 42°C. to avoid thermophilic spoilage or can rust. If the cans are cooled much below 36°C, they may not dry thoroughly and rusting well result. If the cans are cased at temperatures much over 42°C, thermophilic spoilage may occur.

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Labelling & Storage

- After the completion of the canning process, the cans are labelled, packaged and stored at a clean and dry place.
- Storage temperatures of sterile canned meat products should not be above 21.1°C, because higher temperatures markedly accelerate deterioration during storage, thus limiting shelf life.

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Can materials

For canning the various materials used are tin, steel, plastic and glass containers with metal closures. Although the wide variety of containers for canned foods, the metal ones are preferred because:

1) It has a high conductivity of heat. 2) It cannot easily be broken.

3) Being opaque, so any possible bad effects of light on food stuffs are avoided.

4) Be able to withstand the stresses imposed during thermal processing and cooling.

5) Be able to withstand the subsequent handling, which includes transportation, storage and distribution.

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Defects in Can

1. **Swell:** bulging of both can ends by positive internal pressure due to gas generated by microbial or chemical activity. Either hard or soft swell.
2. **Flipper:** a can with normal appearance but one end flips out when the can is struck against a solid object but snaps back to the normal under light pressure.
3. **Springer:** a can bulged from one end which if forced back into normal position, the opposite end bulges.
4. **Leakage:** perforated can.
5. **Overfilled can:** has convex ends due to overfilling and not regarded as spoiled

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Microbial Spoilage

Canned food	Products	Type of spoilage	Organism	Signs of spoilage	
				In the can	In the canned food
Corn, peas, spinach, asparagus	Low and medium acid products; pH above 4-6	Flat sour spoilage	*Bacillus steavo-thermophlilus*	Possible loss of vacuum	Lowered pH; sour, slightly abnormal odur, etc.
		Thermophilic anaerobic	*Clostridium thermosaccharo-lyticum*	Can swells, may burst	Fermented, sour cheesy, or butyric odour
		Sulfide spoilage	*Clostridium nigricans*	Can flat	Usually blackened, 'rotten egg' odour
		Putrefaction	*Clostridium sporogenes*	Can swells; may burst	Typical putrid odour; pH slightly above normal; may be toxic
Tomato juice, fruits, fruit juices	Acid products; pH below 4.6	Flat sour	*Bacillus thermo-acidurans*	Little change in vacuum	Slight pH change; off flavour and odour
		Butyric anaerobes	*Clostridium butyricum*	Can swells; may burst	Fermented, butyric odour
			Mostly lactic acid type of bacteria	Can swells; may burst	Acid odour
			Yeasts	Can swells; may burst	Fermented, yeasty odour
			Molds	Can flat	Surface growth, musty odour

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Advantages of Canning

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PACKAGING OF PRODUCTS

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Introduction

•Packaging is one of the more important steps in the long and complicated journey from grower to consumer

•Bags, crates, hampers, baskets, cartons, bulk bins, and palletized containers are convenient containers for handling, transporting and marketing fresh produce

•More than 1,500 different types of packages are used for produce and the number continues to increase as the industry introduces new packaging materials and concepts

•Packing and packaging materials contribute a significant cost to the produce industry; therefore it is important that packers, shippers, buyers, and consumers have a clear understanding of the wide range of packaging options available.

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Packaging is defined as a mean or system by which a fresh produce or processed product will reach from the production centre to ultimate consumer in safe & sound condition at an affordable price.

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Requirements of Packaging

- They must be non-toxic and compatible with the specific foods
- Sanitary protection
- Moisture and fat protection
- Gas and odour protection
- Light protection
- Resistance to impact
- Transparency
- Tamper proofness
- Ease of opening
- Pouring features
- Reseal features
- Ease of disposal
- Size, shape, weight limitations
- Appearance, printability
- Low cost
- Special features

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Function of Packaging

- To assemble the produce into convenient units for handling
- To protect the produce during storage and marketing (protection)

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Types of packages

Natural materials

i) Wood

- Pallets
- Pallet Bins
- Wire-Bound Crates
- Wooden Crates and Lugs
- Wooden Baskets and Hampers
- Corrugated Fiberboard

ii) Pulp Containers

iii) Paper and Mesh Bags

iv) Plastic Bags

v) Shrink Wrap

vi) Rigid Plastic Packages

vii) Plastic field boxes

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Natural materials

Baskets and other traditional containers are made from bamboo, rattan, straw, palm leaves etc.

Disadvantages:

- They are **difficult to clean** when contaminated with decay organisms.
- They **lack rigidity** and bend out of shape when stacked for long-distance transport.
- They cause **pressure damage** when tightly filled.
- They often have sharp edges or splinters causing **cut and puncture damage**.

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Wood pallet bins

- They are primarily used to move produce from the field or orchard to the packing house.
- Pallet bin can add up to big problems when several hundred are stacked together for cooling, ventilation, or storage. It is also important that stress points be adequately reinforced.

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Wooden crates & lugs

- Once extensively used for apples, stone fruit, and potatoes have been almost totally replaced by other types of containers.
- Advances in material handling have reduced their use to a few specialty items, such as expensive tropical fruit.

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Wooden basket & hampers

- Used for a wide variety of crops .They are durable and nested for efficient transport when empty.
- However, cost, disposal problems, and difficulty in efficient palletization have severely limited their use to mostly local grower markets where they may be re-used many times.

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Corrugated fiberboards

- It is manufactured in many different styles and weights. Because of its relativity low cost and versatility, it is the dominant produce container material and will probably remain so in the near future.

- Both cold temperatures and high humidity reduce the strength of fiberboard containers. Unless the container is specially treated, moisture absorbed from the surrounding air and the contents can reduce the strength of the container.

Cabbage, melons, potatoes, pumpkins, and citrus have all been shipped successfully in these containers. The container cost per produce is as little as one fourth of traditional size containers. Some bulk containers may be collapsed and re-used.

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Pulp containers

Made from recycled paper pulp and a starch binder are mainly used for small consumer packages of fresh produce. Pulp containers are available in a large variety of shapes and sizes and are relatively inexpensive in standard sizes.

- Can absorb surface moisture from the product
- Biodegradable
- Made from recycled materials
- Recyclable.

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Paper & mesh bag

- Potatoes and onions are the only produce items now packed in mesh bags.
- In addition to its low cost, mesh has the advantage of uninhibited air flow. Good ventilation is particularly beneficial to onions. Supermarket produce managers like small mesh bags because they make attractive displays that stimulate purchases.
- Have several serious disadvantages. Large bags do not palletize well and small bags do not efficiently fill the space inside corrugated fiberboard containers. Bags do not offer protection from rough handling. Mesh bags provide little protection from light or contaminants.

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Plastic bags

- Plastic bags (polyethylene film) are the predominant material for fruit and vegetable consumer packaging.
- Besides the very low material costs, automated bagging machines further reduce packing costs. Film bags are clear, allowing for easy inspection of the contents, and readily accept high quality graphics.

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Shrink wrap

- Shrink wrapping has been used successfully to package potatoes, sweet potatoes, apples, onions, sweet corn.
- Shrink wrapping with an engineered plastic wrap can reduce shrinkage, protect the produce from disease, reduce mechanical damage and provide a good surface for stick-on labels.

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Rigid plastic package

- Packages with a top and bottom that are heat formed from one or two pieces of plastic are known as clamshells.
- Clamshells are most often used with consumer packs of high value produce items like small fruit, berries, mushrooms, etc.

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Plastic field boxes

- They are usually made of polyvinyl chloride or polyethylene.
- They are durables and can last many years. They are designed in such a way that they can nest inside each other when empty to facilitate transport.

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Intelligent packaging

Package function switches on and off in response to changing external or internal conditions and communicate to the consumer about the status of the product

Examples-

1. Breathable polymers
2. Time temperature integrators

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Methods of packaging

•Field Packing – products are placed in their shipping materials during the harvesting process. The filled containers are then taken to a precooling facility where field heat is removed. Field packing is a common practice for strawberries as this method ensures optimal freshness.

•Shed Packing – products are processed and packed indoors at a central location. Produce is brought in from the field to the packing shed in field crates, bins or trucks. Products are precooled at the shed.

•Repacking – products are taken out of one container, regraded and placed in another. This might often occur at store or distribution warehouse level, when smaller containers are required for consumers.

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Cost effectiveness of packaging

- The use of packaging represents an added cost in marketing and the price of the marketed product must take account of the capital outlay and unit-packaging cost as well as expected profit.
- To make an exact assessment of the added value is difficult because many factors may offset the cost of packaging.

For example:

- Losses should be significantly reduced
- Presentation and quality of the product may make it more desirable, a competitive advantage.
- Marketable life of the produce may be extended.