FOOD PROCESSING

TOPIC 4

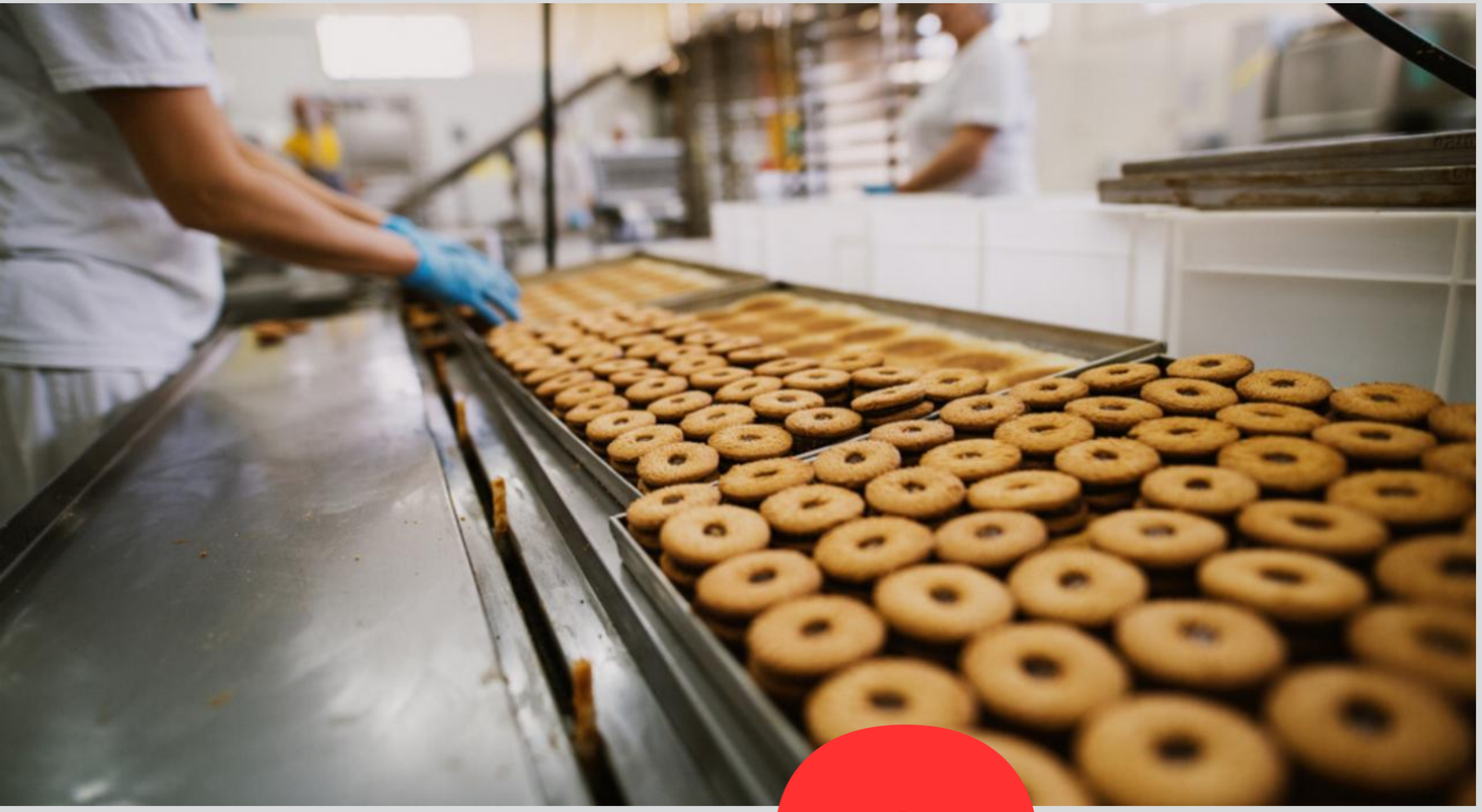
OBJECTIVES

Upon completion this chapter, student should be able to

- **Explain the purpose of processing food**
- **Explain common method for preserving food**

Food processing is the set of methods and techniques used to transform raw ingredients into food for consumption.

FOOD PROCESSING



WHY PROCESS FOOD?

- Extend edible time frame (Preservation)
- Make better tasting food
- Make more variety of food
- Convenience

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Food preservation is to prevent the growth of bacteria, fungi, or other microorganisms and retarding the oxidation of fats that cause rancidity, thus promoting longer shelf life and to increase the safety of food products.

FOOD PRESERVATION

OBJECTIVES OF PRESERVATION

- To protect food against microbes and other spoilage agents
- To ensure food is safe for future consumption
- To prolong food storage time
- To allow many foods to be available year around in great quantity and the best quality

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METHOD OF PRESERVATION

HEAT TREATMENT

DRYING & DEHYDRATION

COLD TREATMENT

FERMENTATION

FOOD ADDITIVE

PACKAGING

HEAT TREATMENT

- This is method uses heat to kill microorganisms or suppress their growth and to inactivate enzymes.
- Objective of heat treatment:
  - Eliminate microorganism
  - Minimize foodborne diseases
  - Increase storage life
- Heat treatment method :
  - Pasteurizing & blanching
  - Sterilization

- A thermal process used to eliminate specific pathogenic microorganisms from food.

- A process of heating a food, usually liquid, to a specific temperature (below boiling point) for a definite length of time, and then cooling it immediately.

- This process slows microbial growth in food such as milk, beer, fruit juices, liquid eggs.

- Example: milk is heating at 65°C for 30 minutes or 72°C for at least 16 seconds followed by quick cooling to about 4°C.

PASTEURIZATION

BLANCHING

- A blanching system achieves a process similar to pasteurization but with application to a solid food and to inactivate an enzymes system (fruits and vegetables).

- Boiling (temp ~ 95 °C) water sprayed onto fruits & veggies or soaked in boiling water for 1-5 minutes.

- Blanching is often used as a preliminary step for freezing, canning, or dehydration

- The heat sterilization involves exposing food to a temperature generally exceeding 100◦C for a period sufficient to inhibit enzymes and all forms of microorganisms including bacteria spore.

- Complete destruction of microorganisms at 121°C for 15 minutes or more.

BLANCHING

DRYING & DEHYDRATION

- One of the oldest methods of preserving food.
- Simple, safe and easy.
- Drying removes the moisture from the food thus microbes cannot grow and spoil the food.
- Drying slows down the action of enzymes.
- Foods can be dried :
  - sun drying
  - mechanical drying

During drying process :

- warm temperature causes the moisture to evaporate.
- low humidity allows moisture to move quickly from the food to the air.
- air current speeds up drying by moving the surrounding moist air away from the food.

DRYING & DEHYDRATION

- Factor effecting drying process
  - temperature.
  - Size & shape of food particles.
  - capacity of dryer.
  - air velocity.
  - atmosphere pressure.

DRYING & DEHYDRATION

Drying Method

HEAT TRANSFER MODE

CONVECTION	CONDUCTION	RADIATION	DIELECTRIC	COMBINED MODES
FLASH DRYER SPRAY DRYER FLUID BED DRYER CABINET DRYER TUNNEL DRYER ROTARY DRYER SPOUTED BED DRER	DRUM DRYER AGITATED PAN DRYER ROTARY DRYER TRAYS DRYER	INFRARED SHELF DRYER SUN DRYER	MICROWAVE OVEN MICROWAVE TUNNEL RADIOFREQUENCY DRYER	MICROWAVE CONVECTIVE DRYER MICROWAVE SPOUTED BED DRYER INFRARED CONVECTIVE DRYER RADIOFREQUENCY ASSISTED HEAT PUMP DRYER

DRYING & DEHYDRATION

COLD TREATMENT

- Involves freezing or refrigeration of food with different temperature ranges.
  a. Refrigeration: 4.5oC to 7oC
  b. Freezing: 0oC to -18oC
- Refrigeration and freezing reduce the rate of growth of microorganisms, but do not destroy them.
- Enzymatic and microbial growth continues at refrigeration temperatures, leading to breakdown of texture, color and flavor.
- Microorganisms grow rapidly at temperatures above 10oC.

COLD TREATMENT

- To reduce rate of spoilage during refrigeration, the following considerations should be made were applicable:
  - Cool and clean food materials before refrigeration storage
  - Seal package properly
  - Keep temperature low
  - Organize packages to allow air flow
  - Control humidity
  - Control atmosphere e.g. nitrogen or carbon dioxide
  - Reduce pressure (hypobaric control) to reduce availability of oxygen

COLD TREATMENT

- Freezing does not prevent undesirable changes to food product.
- Changes may occur at a slower rate, the following changes are observed in freezing:
  - Separation of liquid components e.g. seeping in jellies.
  - Texture damage resulting in soggy fruits and vegetables.
  - Freezer burns.
  - Development of off flavors

COLD TREATMENT

- Slow freezing normally leads to growth of ice crystals and rupturing of cell walls in fruits and vegetables.
- This cause them to become soggy and leak their juices. Rapid freezing retards the growth of ice crystals.
- Smaller crystals do not damage cell walls.
- This causes the texture and appearance of the products to be retained.

- Methods used for rapid freezing includes:
  - Blast freeze
  - Immersion freezing
  - Fluidized bed freezing
  - Follow these rules to improve efficiency of freezing food at home
  - Freeze at 0oC or lower to facilitate rapid freezing
  - Freeze immediately after packaging
  - Do not overload
  - Place packages in the coldest part of the freezer
  - Leave space between packages for air circulation
  - Avoid stacking/storing items on top of the freezer

COLD TREATMENT

COLD TREATMENT

CHILLING	FREEZING
Low cost	High cost
Low energy consumption	High energy consumption
Low quality losses	High quality losses
Limited shelf life	Longer Shelf life
Inhibit microbial growth	Kill some microorganism

DIFFERENCES BETWEEN CHILLING AND FREEZING

- Fermentation process is a breakdown of carbohydrate material by selected bacteria either aerobic or anaerobic which produces alcohol and acid.

- The term "fermentation" sometimes refers specifically to the chemical conversion of sugars into ethanol, producing alcoholic drinks such as wine, beer and cider.

- However, similar processes take place in the leavening of bread (CO_2 produced by yeast activity), and in the preservation of sour foods with the production of lactic acid, such as in sauerkraut and yogurt.

FERMENTATION

- Proteolysis & lipolysis may occur during fermentation.
  - Proteolysis is the breakdown of proteins into smaller polypeptides or amino acids.
  - Lipolysis is the metabolic pathway through which lipid triglycerides are hydrolyzed into a glycerol and free fatty acids.

- Fermentation acts as a preservation method by producing an acid which lowers the pH of the product, converting a perishable food into one that has a longer shelf-life.

FERMENTATION

TYPES OF MATERIALS	PRODUCTS
BEANS	SOY SAUCE, TEMPE, MISSO, NATTO, STINCKY TOFU,
GRAINS	BREAD, SOURE DOUGH, VINIGER, TAPAI, WISKY, SAKE, RICE WINE, IDLI,
VEGETABLES	KIMCHI, PICKLE, SAUERKRAUT
FRUIT	WINE, VINEGAR, CIDER, BRANDY, NATA DE COCO, PICKLING, CHOCO, COFFEE, TEMPOYAK
DAIRY	CHEESE, YOGURT, SOUR CREAM, BUTTER, KEFIR,
FISH	FISH SAUCE (BUDU), BELACAN, CINCALOK
MEAT	SALAMI, PEPPERONI, FERMENTED SAUSAGE
TEA	TEA, KAMBUCHIA

FERMENTATION

EXAMPLE OF FERMENTED FOOD

FERMENTATION

BENEFITS OF FERMENTATION

- Preservation
- Improved nutritive value
- Safe
- Low capital and energy cost
- Simple technology
- More shelf stable
- Has unique aroma and flavour characteristics

FERMENTATION

BACTERIA

Lactobacillaceae :
Produce lactic acid from carbohydrate (yogurt)

Lacetobacter :
Produce acetic acid from alcohol (vinegar)

YEAST

Saccharomyces cerevisiae :
Produce enzyme that favour desirable chemical reaction (bread)

production of alcohol in brewing of wine

MOLD

Penicillium :
Ripening & flavour of cheese

Aspergillus oryzae :
Breakdown of protein in koji making (soy sauce)

EXAMPLE OF FERMENTATION

- Food additives are substances added to food to preserve flavor or enhance its taste, appearance, or other qualities.

- Additives are added to ensure processed food remains safe and in good condition throughout its journey from factories or industrial kitchens, to warehouses and shops, and finally to consumers.

- Food additives can be derived from plants, animals or minerals, or they can be chemically synthesized.

FOOD ADDITIVES

FUNCTION	DESCRIPTION
Maintain product consistency	Provide consistency, stabilize and smooth product texture, prevent separation
Improve or maintain nutritional value	Enhanced or added value to product due to losses during processing
Maintain palatability and wholesomeness	Preservatives retard product spoilage caused by mold, air, bacteria, fungi or yeast
Provide leavening or control acidity/alkalinity.	Makes bakes goods to rise during baking Stabilize the acidity of foods
Enhance flavor or impart desired color.	Enhanced flavour and colour of the foods

FOOD ADDITIVES

CATEGORIES	DESCRIPTION
Preservatives	Antimicrobial : inhibit growth of bacteria, yeast & molds (salt, sugar, benzoic acid, nitrate salts) Antioxidant : slow oxidation of fats/lipids that leads to rancidity. Example ascorbic acid/sodium ascorbate (Vit C), Butylated hydroxyanisole (BHA), Butylated hydroxyltolune (BHT).
Colours	Artificial dyes such as Blue No. 1 (Brilliant blue, FCF), Citrus Red 2 (Orange skins), Green No. 3 (Fast green FCF), Yellow No. 5 (Tartrazine)
Flavouring subtances	Most common are sweeteners (sugar, dextrose, corn syrup, high fructose corn syrup), salt, spices.

FOOD ADDITIVES

CATEGORIES

FOOD ADDITIVES

CATEGORIES

CATEGORIES	DESCRIPTION
Flavour enhancer	Commonly added to commercially produced food products (eg. frozen dinners, instant soups, snackfoods) to make them taste more 'savoury‘. Monosodium glutamate (MSG), Monopotassium glutamate
Antioxidant	Enhanced flavour and colour of the foods
Food Conditioners	Emulsifier : prevent separation of the oil and water portion of food products. Such as lecithin, mono and di-glycerides and polysorbate Thickener : to increase viscosity, create smoothness and add body to many foods including gravies, pie filling, chocolate milk and puddings (gum and starch)

- Packaging defined as enclosure of products, items or packages in a wrap, pouch, bag, box, cup, tray, can, tube, bottle or other container form to perform of one or more of the following function :
  - containment,
  - protection,
  - preservation,
  - communication,
  - utility,
  - performance

PACKAGING

PACKAGING

PRIMARY PACKAGE

- *Major protective barrier.*
- *Package that have direct contact with contained products.*
- *Example : metal cans, paperboard, glass bottle, plastic pouch*

SECONDARY PACKAGE

- *Physical distribution carrier.*
- *Can be used in retail outlet of primary package*
- *Called as shelf ready package*
- *Example : Corrugated case or box*

TERTIERY PACKAGE

- Made up of a number of secondary package.
- Example : Scratch-wrapped pallet of corrugated case

- Plastic derived from Greek *plastikos* means easily shaped or deformed.
- Also known as a group of synthetic resinous or other substances that can be molded into any form.
- Plastics defined as macromolecular organic compounds obtained obtained from molecules with a lower molecular weight (MW) or by chemical alteration of natural macromolecular compounds.

PACKAGING

PLASTIC POLYMERS

- Types of plastic are ：
  - Polyethylene (PE)
  - Polypropylene (PP)
  - Polystyrene (PS)
  - Polyvinyl alcohol (PVOH)/ethylene vinyl alcohol (EVOH)
  - Polyester (PET)
  - Polyvinyl chloride (PVC)
  - Polyvinylidene chloride (PVDC)
  - Polyamides (PA or nylon)
  - Polycarbonate (PC)
  - Ionomers

PACKAGING

TYPES OF PLASTIC

- Paper and paperboard are the most commonly used packaging materials in the world.
- Paper is produced from plant fibers.
- More than 95% of paper is made from wood, and the remaining sources are mainly agricultural by-products, such as straw (of wheat, rye, barley, and rice), sugar cane bagasse, cotton, flax, bamboo, corn husks and so on.
- Paper and paperboard can be distinguished by thickness (caliper) and weight of the material.
- Material is generally termed “paperboard” when its thickness is more than 300 μm and/or its weight exceeds 250 g/m−2

PACKAGING

PAPER & PAPER BASED MATERIALS

PACKAGING

TYPES OF PAPER

- Types of paper are :
  - Kraft paper
  - Bleached paper
  - Greaseproof and glassine
  - Waxed paper
  - Vegetable parchment
- Types of paperboard are :
  - Whiteboard
  - Linerboard
  - Foodboard
  - Cartonboard (boxboard)
  - Chipboard
  - Corrugated board

- Metal is used in packaging in a variety of applications, from rack systems to tuna cans.
- For food packaging, four types of metal are commonly used: steel, aluminum, tin, and chromium.
- Steel and aluminum are commonly used in production of food cans, and are the primary materials for metal packaging. Food cans are most often made of steel, and beverage cans are usually produced from aluminum.
- Steel tends to oxidize when it is exposed to moisture and oxygen, producing rust, thus tin and chromium are used as protective layers for steel.

PACKAGING

METALS

- Glass is defined as “an amorphous inorganic product of fusion that has been cooled to a rigid condition without crystallizing”.
- Glass is made primarily of silica, derived from sand or sandstone. For most glass, silica is combined with other raw materials in various proportions.
- Glass is inert to a wide variety of food and non-food products, very rigid and strong against pressure, transparent, and nonpermeable (excellent barrier properties).
- The disadvantages of glass due to its heavy weight and fragility.

PACKAGING

GLASS