**Lec.1 Food technology**

Food technology has evolved into an interdisciplinary area of applied science and engineering based on chemical engineering and food science.

**Food industries can be divided into following sections:**

• Consumer food industry (confectionaries, bakery products, soft drinks etc.)

• Grain processing

• Marine products

• Dairy products

• Poultry and meat products

• Fruit and vegetable processing

• Fats and oils

• Sugar

**Emphasis of food industries**

Food industries emphasize on four different operations namely food storage, food processing, food transport and food preservation.

**Food storage**

Food storage includes improved storage of food such as refrigeration cycles, refrigerants, and better insulation. Food industries process the raw materials as soon as they are recovered. Sometimes due to unavoidable circumstances such as early arrivals, non-availability, market price considerations which change according to time, the raw materials have to store before processing.

* The storing area should be well ventilated, shaded, should use water baths, and if necessary, cold storage must be used. Before storage, all bruised, shriveled, discolored or soured portions should be removed.

**Food Processing**

Food processing involves conversion of raw plant and animal tissues into edible ingredients and separation of inedible and hazardous components, extraction or concentration of nutrients, flavors, colors and other useful components and removal of water.

Table: Classification of Unit Operations of Food Processing

|  |  |
| --- | --- |
| **Group of Operations** | **Typical Food Processing Operations** |
| Mechanical Transport | Pumping of Fluids, Pneumatic Conveying  Hydraulic Conveying, Mechanical Conveying |
| Mechanical Processing | Peeling, Cutting, Slicing, Size Reduction, Sorting, Grading, Mixing, Emulsification, Agglomeration, Extrusion, Forming |
| Mechanical Separations | Screening, Cleaning, Washing, Filtration  Mechanical Expression, Centrifugation |
| Heat Transfer Operations | Heating, Blanching, Cooking, Frying, Pasteurization  Sterilization, Evaporation, Cooling, Freezing, Thawing |
| Mass Transfer Operations | Drying, Extraction, Distillation, Absorption, Adsorption  Crystallization from Solution, Ion Exchange |
| Membrane Separations | Ultrafiltration, Reverse Osmosis |
| Non-Thermal Preservation | Irradiation, High Pressure, Pulsed Electric Fields |
| Packaging | Filling, Closing, Metallic, Aseptic Packaging |

**Types of food processing:**

(a)  Refining and Milling (b)  Canning (c)  Concentration (d)  Freezing (e)  Drying

(f)  Pasteurization and sterilization (g) Fermentation (h) Irradiation (i) Packaging

**Refining and Milling:**

• Sugar obtained from sugar cane is converted to final sugar by refining process.

  • Milling is the process of converting grain into flour by mechanical means.

   • In milling operation, grain is cleaned and crushed between two steel rolls.

**Canning:**

•Fresh food like fruits, vegetables, meat, fish are preserved for long time storage  by heat treatment and sealing into air-tight containers.

 •These cans may be made by tin, steel, which is often plastic-lined, aluminum or glass.

 •Heat treatment is given to the container by placing them in a steam pressure vessel at a temperature of 121°C depending on container size and nature of food.

 •The toxin produced by *Clostridium botulinum* bacteria, therefore processing must be done to destroy this microorganism.

* **Concentration:**

•Food stuff which naturally contains high percentage of water is concentrated before preservation.

•Milk is evaporated from 8.6% to 45% solid content.

 • Fruit juices are also concentrated before marketing.

 •For food concentration, three processes are available- evaporation with evaporators, reverse osmosis and freeze concentration.

* **Freezing:**

•Freezing does not kill the microorganisms which cause spoilage, but inactivate it.

• Nutrients are not destroyed by freezing.

•Inactivation of enzymes by heat treatment (blanching) is done before freezing to prevent unwanted changes.

•The amount of water in food is reduced before freezing to improve the quality of final product.

* **Drying:**

•Cereal grains, fruits, pastas, milk, coffee, tea, some vegetables and meats are dried.

•After drying volume is reduced to one tenth of the original volume.

•Dried foods are easy to transport and store.

• Nutritive value of dried food is usually unchanged but vitamins content is reduced.

•Microbial growth is controlled.

* **Pasteurization and sterilization:**

•Heat treatment inactivates the M.O but changes the taste of food and its appearance.

•High temperature short time (HTST) method exposes the milk to 72˚C for not less than 16sec, followed by rapid cooling, this process is called pasteurization.

•Pasteurization kills pathogenic microorganisms, eliminates food borne disease and inactive enzymes.

* **Fermentation:**

• Fermentation produces CO2 but no putrid odor, and   decomposition of carbohydrate.

•These industries produce vinegar, wine, beer and other alcoholic beverages.

* **Irradiation:**

• Irradiation is required to kill microorganism present in food to preserve proteins' food such as meat, fish, fresh fruits, vegetables, flour, spices etc.

•Irradiation does not denaturate protein, does not alter taste and does not leave any radioactive residue in the food.

• Loss of vitamins is less as compared to canning, freezing or drying.

* **Packaging:**

•The objective of packaging is to store and transport safely without deterioration of food.

•Containers are sealed so that no outside contaminant can enter and cause food spoilage.

•Cardboard boxes, cans, glass bottles, polythene, plastic coated paper, finely woven cloth are commonly used for packing.