



# MUTHAYAMMAL ENGINEERING COLLEGE

(An Autonomous Institution)

(Approved by AICTE, New Delhi, Accredited by NAAC & Affiliated to Anna University)  
Rasipuram - 637 408, Namakkal Dist., Tamil Nadu



LECTURE HANDOUTS

L 1

BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : I

Date of Lecture:

**Topic of Lecture:** Introduction to food technology

**Introduction :** Food Technology is a science branch that deals with the techniques involved in production, processing, preservation, packaging, labeling, quality management, and distribution of food products

**Prerequisite knowledge for Complete understanding and learning of Topic:**  
Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

- Technology is the science and application of scientific, as well as socio-economic knowledge and legal rules for production.
- Food technology uses and exploits knowledge of Food Science and Food Engineering to produce varied foods.
- Study of Food Technology gives in-depth knowledge of science and technology, and develops skills for selection, storage, preservation, processing, packaging, distribution of safe, nutritious, wholesome, desirable as well as affordable, convenient foods.
- It is the mass production of food products using principles of food technology to meet the diverse needs of the growing population.
- Food manufacturing is one of the largest manufacturing industries in the present times

Classes of Foods Based on Perishability

- Perishable foods
- Semi perishable foods
- Non-perishable

Processed foods

- Minimally processed foods

- Preserved foods

Foods do not change the character of the product substantially

- Manufactured foods

In such products, the original characteristics of the raw products are lost and some basic methods of preservation are used, often using various ingredients

- Formulated foods

These are products prepared by mixing and processing of individual ingredients to result in relatively shelf stable food products

- Food derivatives

In industry, components of foods may be obtained from the raw product through purification

- Functional foods

These are foods that can have a beneficial effect on human health

- Medical foods

These are used in dietary management of diseases

**Video Content / Details of website for further learning (if any):**

<https://www.youtube.com/watch?v=WfgKt3EVSTI>

**Important Books/Journals for further learning including the page nos.:**

B. Sivasanker, Food Processing and Preservation, Prentice-Hall Of India Pvt. Ltd., 2002, Pg. No. –12-15.

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LECTURE HANDOUTS

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BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : I

Date of Lecture:

**Topic of Lecture:** Constituents of food

**Introduction :** Chemically food is composed of following constituents: Carbohydrates, Proteins, Fats/Lipids, Vitamins, Minerals, Water.

**Prerequisite knowledge for Complete understanding and learning of Topic:**  
Basics of Biology and General engineering subjects

### Detailed content of the Lecture:

Primarily there are two main sources of food:

- Plants Sources and Animal Sources
- Fishes are sometimes treated separately as a third group:
- Marine source: All kind of fish.

Plant Sources:

- Fruits, vegetables, roots, stems, leaves, flowers, seeds, nuts, legumes, pulses, herbs, spices etc.

Animal Sources:

- Worldwide numerous species are considered edible.
- For Muslims only ruminants and selected birds are Halal / edible.
- Cows, buffalo, sheep, lamb, goat, deer, camel, hen, duck, turkey, quail.

### Types of food constituents:

On the basis of their functionality

1. Energy giving: Carbohydrates, Proteins, Fats
2. Growth & Body building: Proteins, Some minerals
3. Maintenance: Vitamins, Minerals

On the basis of requirement

1. Macronutrients: Carbohydrates, Proteins, Fats, Water

Macronutrients are the nutrients we need in larger quantities for energy and tissue maintenance.

They include carbohydrates, fats and proteins.

Fiber is also considered a macronutrient, although it is not a true nutrient, because it passes the gastrointestinal tract unabsorbed, and it is directly excreted.

Micronutrients are mostly vitamins and minerals, and are equally important as macronutrients but consumed in very small amounts.

They are essential nutrients, because the body can't make them or can't make them in sufficient quantity, and thus, they must come from the diet.

**Video Content / Details of website for further learning (if any):**

<https://www.youtube.com/watch?v=naauUbo4Ick>

**Important Books/Journals for further learning including the page nos.:**

B. Sivasanker, Food Processing and Preservation, Prentice-Hall Of India Pvt. Ltd., 2002, Pg. No. – 24-28.

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LECTURE HANDOUTS

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BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : I

Date of Lecture:

**Topic of Lecture:** Carbohydrates

**Introduction :** A carbohydrate is a biomolecule consisting of carbon (C), hydrogen (H) and oxygen (O) atoms, usually with a hydrogen-oxygen atom ratio of 2:1 (as in water).

**Prerequisite knowledge for Complete understanding and learning of Topic:**

Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

Carbohydrates:

- ❖ General chemical formula  $C_n(H_2O)_n$
- ❖ Organic compounds
- ❖ Hydrates of carbon (2:1 ratio of H and O)
- ❖ Most abundant class of organic compounds on earth

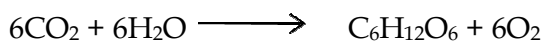
Carbohydrate Sources

Carbohydrates are ingested in a variety of forms

Starch from grains, glycogen from meat, and disaccharide and monosaccharide sugars from fruits and vegetables.

Formation:

Formed by the process photosynthesis

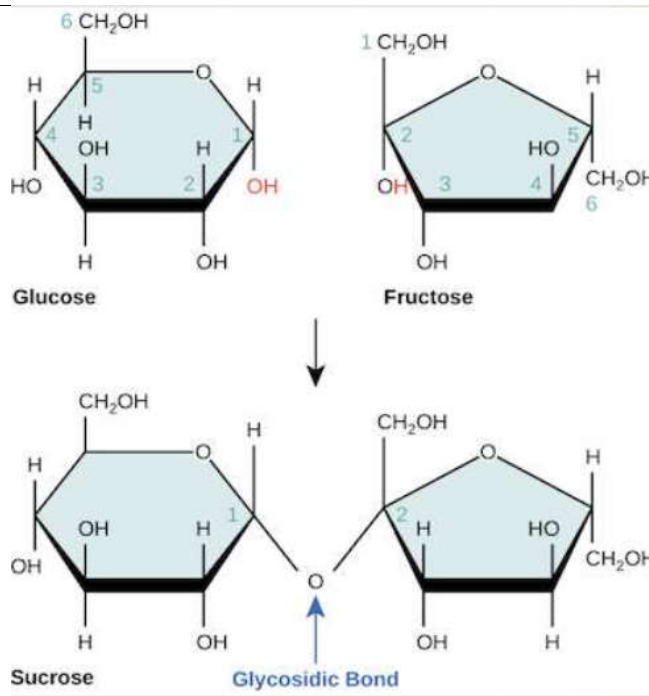


Classification:

Simple: monosaccharide,

disaccharides

Complex: oligosaccharides,



#### Carbohydrate metabolism

- Various biochemical processes responsible for the formation, breakdown and inter conversion of carbohydrates in living organisms.
- During digestion, complex carbohydrates are broken down into monosaccharides, which can be absorbed by the body.
- The most important carbohydrate is glucose, a simple sugar (monosaccharide) that is metabolized by nearly all known organisms.

#### Carbohydrate Utilization

- The monosaccharides that are absorbed in the small intestine are fructose, galactose, and glucose; the liver converts the first two into glucose.

Excess glucose is stored as glycogen in the liver or is converted into fat and stored in adipose tissue.

#### Video Content / Details of website for further learning (if any):

<https://www.youtube.com/watch?v=LeOUIXbFyqk>

#### Important Books/Journals for further learning including the page nos.:

B. Sivasanker, Food Processing and Preservation, Prentice-Hall Of India Pvt. Ltd., 2002, Pg. No. –32-36.

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LECTURE HANDOUTS

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BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : I

Date of Lecture:

**Topic of Lecture:** Proteins

**Introduction :**

Proteins are macromolecules formed by amino acids. Proteins are large size molecules (macromolecules), polymers of structural units called amino acids. A total of 20 different amino acids exist in proteins and hundreds to thousands of these amino acids are attached to each other in long chains to form a protein.

**Prerequisite knowledge for Complete understanding and learning of Topic:**

Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

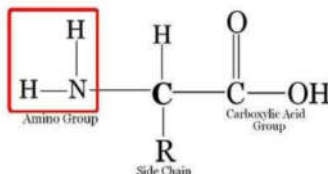
- Complex nitrogenous compounds
- Very high molecular weights
- About 2000 proteins exist in nature
- Composed of amino acids linked by peptide linkage
- Constituents of every living cell
- Participate in every aspect of cell metabolism
- Energy source providing 4 kcal (17 kJ) per gram
- Body protein is approximately 19% of flesh weight; 45% of this protein is present in muscle

**Classification**

- Classified on the basis of heat:
  - ❖ Coagulable
  - ❖ Non-coagulable
- Classified on the basis of solubility:
  - ❖ Globulins
  - ❖ Albumins
- On the basis of functionality:
  - ❖ Structural, hormones, enzymes, antibiotics, transport, storage, toxins
- On the basis of composition:
  - ❖ Simple
  - ❖ Conjugated: phosphoproteins, lipoproteins, glycoproteins, nucleoprotein,

### Amino Acids:

- Building blocks of proteins
- 20 naturally occurring
- Low molecular weight compounds
- Found in different combinations in different proteins Characterized by presence of a terminal (-COOH) & (-NH<sub>2</sub>)
- Connected by peptide linkages; formed between the carboxyl and amino group of two adjacent amino acids.
- In addition, disulfide bonds may form between the sulfur moieties of two sulfur-containing amino acids in the polypeptide chain.
- May be alkaline, acidic or amphoteric in nature
- May be aromatic or aliphatic



Essential	Non-Essential
<b>Histidine</b>	Alanine
<b>Isoleucine**</b>	Arginine
<b>Leucine**</b>	Asparagine
<b>Lysine</b>	Aspartic acid
<b>Methionine</b>	Cysteine
<b>Phenylalanine</b>	Glutamic acid
<b>Threonine</b>	Glutamine
<b>Tryptophan</b>	Glycine
<b>Valine**</b>	Proline
	Serine
* Branch Chain Amino Acids	Tyrosine

### Video Content / Details of website for further learning (if any):

<https://www.youtube.com/watch?v=HSCUAjZQhXI>

### Important Books/Journals for further learning including the page nos.:

B. Sivasanker, Food Processing and Preservation, Prentice-Hall Of India Pvt. Ltd., 2002, Pg. No. -38-42.

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BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : I

Date of Lecture:

**Topic of Lecture:** Lipids

**Introduction :** Lipids are molecules that contain hydrocarbons and make up the building blocks of the structure and function of living cells. Examples of lipids include fats, oils, waxes, certain vitamins (such as A, D, E and K), hormones and most of the cell membrane that is not made up of protein.

**Prerequisite knowledge for Complete understanding and learning of Topic:**

Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

Lipids constitute a heterogeneous compounds related by their physical properties

- Insoluble in water
- Soluble in non-polar organic solvents
  - ❖ Alcohol, ether, benzene, chloroform and acetone
- Important dietary constituents
  - ❖ High energy value
  - ❖ Deliver fat soluble vitamins
- Include fatty acids, triglycerides, phospholipids, sphingolipids, sterols, waxes, glycolipids and lipoproteins.
- Fats are esters of saturated or unsaturated fatty acids with glycerol; (Fatty acid+glycerol is called glyceride)
- Fats and oils are basically mixture of triglycerides.
- Fatty acids vary with respect to their size, number and position of double bonds found in the molecule.
- Classification:

Classified by the number of carbon atoms:

❖ Medium chain (C8-12)

❖ Long chain (C12+)

Classification by nutritional requirement

❖ Essential: Linoleic and  $\alpha$ -linolenic acid

❖ Non-essential: Palmitic, stearic, oleic acid

Classified by the saturation

• Saturated:

❖ Devoid of double bonds

❖ General formula  $\text{CH}_3(\text{CH}_2)_n\text{COOH}$ , (n= 2 to 24)

❖ Stearic acid  $\text{CH}_3(\text{CH}_2)_{16}\text{COOH}$

• Unsaturated:

❖ Presence of double bonds

❖ Monounsaturated fatty acids:

❖ Oleic acid ( $\text{CH}_3(\text{CH}_2)_7\text{CH}=\text{CH}(\text{CH}_2)_7\text{COOH}$ )

❖ Polyunsaturated fatty acids:

❖ Linolenic acid

$\text{CH}_3\text{CH}_2\text{CH}=\text{CH}.\text{CH}_2\text{CH}=\text{CH}.\text{CH}_2\text{CH}=\text{CH}(\text{CH}_2)_7\text{COOH}$

**Video Content / Details of website for further learning (if any):**

<https://www.youtube.com/watch?v=5BBYBRWzsLA>

**Important Books/Journals for further learning including the page nos.:**

B. Sivasanker, Food Processing and Preservation, Prentice-Hall Of India Pvt. Ltd., 2002, Pg. No. – 48-56.

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LECTURE HANDOUTS

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BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : I

Date of Lecture:

**Topic of Lecture:** Vitamins

**Introduction :** Vitamins are organic compounds that are needed in small quantities to sustain life. Most vitamins need to come from food. This is because the human body either does not produce enough of them, or it does not produce any at all. Each organism has different vitamin requirements.

**Prerequisite knowledge for Complete understanding and learning of Topic:**

Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

A group of organic compounds essential in small quantities for the normal metabolism of other nutrients and maintenance of physiological well-being.

- Essential/vital for life
- Cannot be synthesized by the body
- Must be obtained from the diet
- Found in varying quantities in different foods
- No single food contains all of them in sufficient quantities
- Absence or relative deficiency of vitamins in the diet can lead to a characteristic deficiency state and disease

Classification:

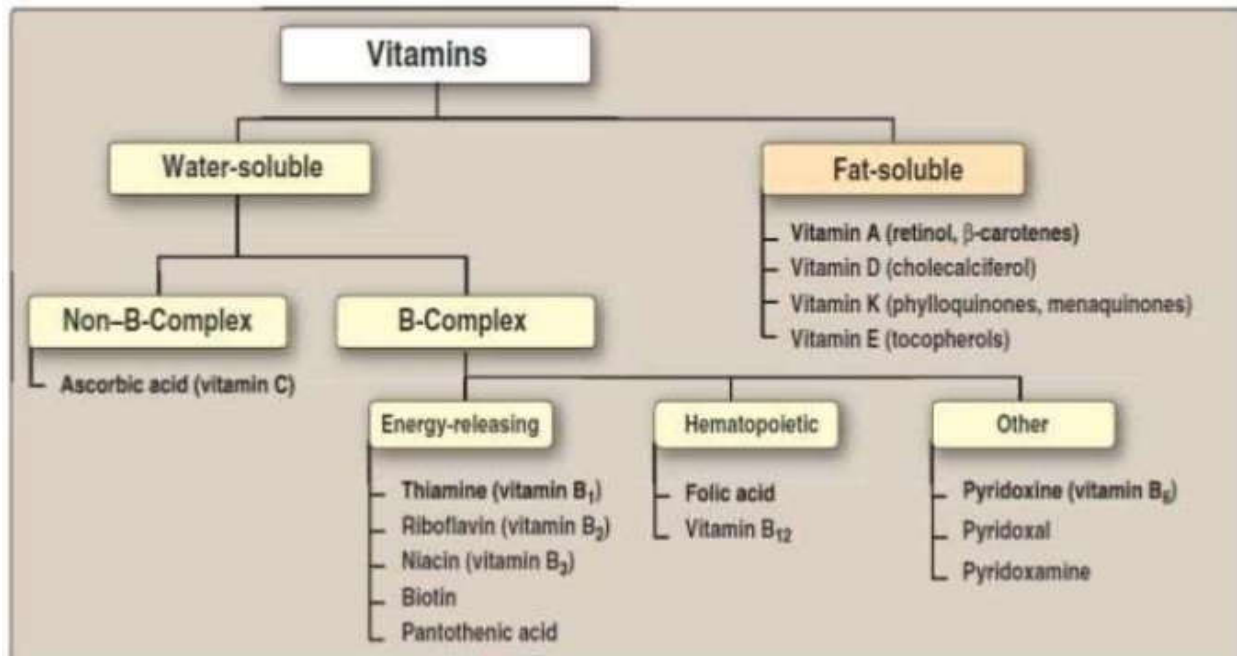
The vitamins are classified according to their solubility in water and fat solvents.

- Water Soluble Vitamins:
  - ❖ vitamin B1(thiamin), vitamin B2(riboflavin), vitamin B3(niacin),
  - ❖ biotin, vitamin B6(pyridoxine), pantothenic acid, folate, vitamin
  - ❖ B12(cobalamin) and vitamin C (ascorbic acid).

be included in the diet every day.

- Fat Soluble Vitamins:

- ❖ vitamin A (retinol), vitamin D (calciferol), vitamin E (tocopherol), and vitamin K (Phylloquinone)
- ❖ Fat soluble vitamins are stored in appreciable amounts in body tissues and, do not have to be supplied daily in the diet.



**Video Content / Details of website for further learning (if any):**

<https://www.youtube.com/watch?v=FmafSMv0e0>

**Important Books/Journals for further learning including the page nos.:**

B. Sivasanker, Food Processing and Preservation, Prentice-Hall Of India Pvt. Ltd., 2002, Pg. No. –68-72.

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LECTURE HANDOUTS

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BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : I

Date of Lecture:

**Topic of Lecture:** Minerals

**Introduction :** Minerals are those elements on the earth and in foods that our bodies need to develop and function normally. Those essential for health include calcium, phosphorus, potassium, sodium, chloride, magnesium, iron, zinc, iodine, chromium, copper, fluoride, molybdenum, manganese, and selenium.

**Prerequisite knowledge for Complete understanding and learning of Topic:**

Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

Minerals are inorganic substances required by the body for a variety of functions.

This includes: the formation of bones and teeth; as essential constituents of body fluids and tissues; components of enzyme systems; and nerve function.

Some minerals are needed in large amounts, grams per day, (e.g. Calcium, Magnesium, Phosphorus, Potassium, Sodium and Chloride), whilst others are needed in smaller amounts, micrograms per day, also known as trace minerals (e.g. Fluorine, Iodine, Iron, Selenium Zinc and Copper).

Very important in normal nutrition and metabolism

Constitute only about 4% of total body weight.

Functions:

Their functions are many and varied.

Two general functions include building and regulating

They provide the medium essential for normal cellular activity.

Provide hardness to bones and teeth.

Function as obligatory cofactors in metallo enzymes.

Classified by their occurrence in the Body:

- Macrominerals: required in amounts >100 mg/ day
- Microminerals: required less than macrominerals.

The major minerals of the human body:

calcium, phosphorus, magnesium, sodium, potassium, and chloride.

**Video Content / Details of website for further learning (if any):**

<https://www.youtube.com/watch?v=nDhDPVAO0G4>

**Important Books/Journals for further learning including the page nos.:**

B. Sivasanker, Food Processing and Preservation, Prentice-Hall Of India Pvt. Ltd., 2002, Pg. No. –78-80.

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LECTURE HANDOUTS

L 8

BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : I Date of Lecture:

**Topic of Lecture:** Food additives

**Introduction :** Food additives are substances added to food to preserve flavor or enhance its taste, appearance, or other qualities. Some additives have been used for centuries; for example, preserving food by pickling (with vinegar), salting, as with bacon, preserving sweets or using sulfur dioxide as with wines.

**Prerequisite knowledge for Complete understanding and learning of Topic:**

Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

Food additives are chemicals or ingredients which are added to food products for maintaining their stability.

Additives are artificial or natural chemicals, added to food, for microbial and chemical stability of foods or delay or even stop food rancidity.

**Functions of food additives:**

- Improve the taste or appearance of a processed food

Eg: beeswax –glazing agent is used to coat apples

- Improve the keeping quality or stability of a food

Eg: sorbitol –added to mixed dried fruit to maintain moisture level and softness of the fruit

Improve shelf life or storage time

Eg: sulphur dioxide added to sausage meat to avoid microbial growth

- Ensure nutritional value

- Maintain uniform quality and to enhance quality

parameters like flavour, colour etc., in large scale

production

**Types of food additives:**

**Direct or intentional food additives** which are added deliberately to improve its sensory quality, stability, ease in processing and retention of quality during handling and retailing .

**Indirect or unintentional food additives** which get included into foods incidentally during

### Classes of food additives

- Preservatives
- Food colours
- Food flavors and flavor enhancers
- High intensity / lowcalorie sweeteners.
- Antioxidants.
- Emulsifiers.
- Acidulants
- Anti-caking agents

E-codes are codes sometimes found on food labels in the European Union (Great Britain, France, Germany, Spain, Italy, Portugal etc.)

- The codes indicates an ingredient which is some type of food additives
- The “E” indicates that is a “European Union Approved” food additive
- Other countries have different food labeling laws

E-Codes number	Groups of Food Ingredients
E-100	Coloring agents
E-200	Preservatives
E-300	Anti-oxidants
E-400	Thickeners, Stabilizers, Gelling agents, Emulsifiers
E-500	Agents for physical characteristics
E-600	Flavor enhancers

### Video Content / Details of website for further learning (if any):

<https://www.youtube.com/watch?v=gU6qs5WEBug>

### Important Books/Journals for further learning including the page nos.:

B. Sivasanker, Food Processing and Preservation, Prentice-Hall Of India Pvt. Ltd., 2002, Pg. No. –90-94.

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LECTURE HANDOUTS

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BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : I Date of Lecture:

**Topic of Lecture:** Deteriorative factors and their control

**Introduction :** A series of continuous degradative changes occurring in a food item which may affect the product's wholesomeness, result in a reduction of its quality, and/or alter its serviceability.

**Prerequisite knowledge for Complete understanding and learning of Topic:**  
Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

Foods undergo deterioration to varying degrees in organoleptic properties, nutritional value, safety and aesthetic appeal.

The term food deterioration is often associated with advanced spoilage, which may make food unfit for human consumption.

In the broader sense any adverse change in attributes from an agreed upon measure of quality may be considered deterioration.

**Food Deterioration:** A series of continuous degradative changes occurring in a food item which may affect the product's wholesomeness, result in a reduction of its quality, and/or alter its serviceability.

**Wholesomeness:** Wholesomeness is a term that refers to freedom from pathogenic or otherwise harmful microorganisms.

or

A characteristic possessed by a food product that is conducive to good health and well being of the consumer.

**Spoilage:** food spoilage as an arbitrary end point of the deterioration process which denotes that a food item is unwholesome and, therefore, is no longer suitable for human consumption

**Unwholesome:** Unwholesome food is food procured, packed, or held under unsanitary conditions that renders it injurious to the health of the consumer

**Off-condition:** Off-condition is any variation from the expected appearance, feel, smell, or taste characteristics of a product when it was initially produced or processed for resale

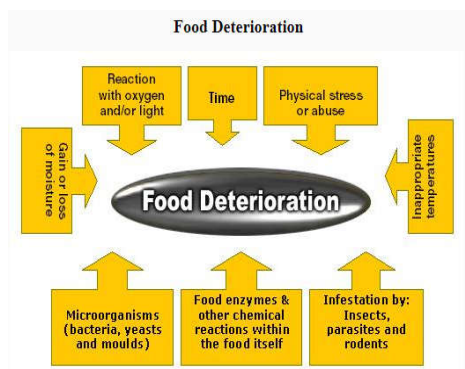
Reduced serviceability in a product may result in the use of additional processing methods to return the food item to its original state

**TABLE 7.1. Useful Storage Life of Plant and Animal Tissues**

Food Product	Generalized Storage Life 21°C (days)
Meat	1–2
Fish	1–2
Poultry	1–2
Dried, salted, smoked meat and fish	360 and more
Fruits	1–7
Dried fruits	360 and more
Leafy vegetables	1–2
Root crops	7–20
Dried seeds	360 and more

The major causes of food deterioration include the following:

1. Growth and activities of microorganisms, principally bacteria, yeasts, and Molds
2. Activities of natural food enzymes
3. Insects, parasites, and rodents
4. Temperature, both heat and cold
5. Moisture and dryness
6. Air, and more particularly oxygen
7. Light
8. Time



Video Content / Details of website for further learning (if any):

<https://www.youtube.com/watch?v=mPfk7GSa3CQ>

**Important Books/Journals for further learning including the page nos.:**

B. Sivasanker, Food Processing and Preservation, Prentice-Hall Of India Pvt. Ltd., 2002, Pg. No. – 98-104.

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LECTURE HANDOUTS

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BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : II Date of Lecture:

**Topic of Lecture:** General engineering aspects and processing methods

**Introduction :** A physical entity, which can be observed and/or measured, is defined qualitatively by a dimension. For example, time, length, area, volume, mass, force, temperature, and energy are all considered dimensions like unit of length may be measured as a meter, centimeter, or millimeter.

**Prerequisite knowledge for Complete understanding and learning of Topic:**  
Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

- ❖ Primary dimensions, such as length, time, temperature, and mass, express a physical entity.
- ❖ Secondary dimensions involve a combination of primary dimensions (e.g., volume is length cubed; velocity is distance divided by time).
- ❖ Physical quantities are measured by variety of unit systems.
- ❖ The most common systems include the Imperial (English) system; the centimeter, gram, second (cgs) system; and the meter, kilogram, second (mks) system.

SI Base Units		
Measurable attribute of phenomena or matter	Name	Symbol
Length	meter	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Amount of substance	mole	mol
Luminous intensity	candela	cd

Examples of SI-Derived Units Expressed in Terms of Base Units		
Quantity	SI Unit	
	Name	Symbol
Area	square meter	m <sup>2</sup>
Volume	cubic meter	m <sup>3</sup>
Speed, velocity	meter per second	m/s
Acceleration	meter per second squared	m/s <sup>2</sup>
Density, mass density	kilogram per cubic meter	kg/m <sup>3</sup>
Current density	ampere per square meter	A/m <sup>2</sup>
Magnetic field strength	ampere per meter	A/m
Concentration (of amount of substance)	mole per cubic meter	mol/m <sup>3</sup>
Specific volume	cubic meter per kilogram	m <sup>3</sup> /kg
Luminance	candela per square meter	cd/m <sup>2</sup>

#### Physical properties

- Food engineering is related to the analysis of equipment and systems used to process food on a commercial production scale.

#### Mechanical Properties

- Mechanical properties are those properties that determine the behavior of food materials when subjected to external forces.

#### Rheological properties

- The majority of industrial food processes involve fluid movement.

#### Thermal Properties

- In the food industry every process involves thermal effects such as heating, cooling or phase transition.

#### Electrical Properties

- The electrical properties of foods are particularly relevant to microwave and ohmic heating of foods and to the effect of electrostatic forces on the behavior of powders.

#### Video Content / Details of website for further learning (if any):

<https://www.youtube.com/watch?v=WRYoGiOobqU>

#### Important Books/Journals for further learning including the page nos.:

Zeki Berk, Food Process Engineering and Technology, Academic press, 2009, Pg. No. – 7-14.

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LECTURE HANDOUTS

L 11

BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : II Date of Lecture:

**Topic of Lecture:** Preliminary processing methods

Introduction : The preliminary preparative operations in food processing include: Cleaning, Sorting and Grading of food raw material. These may be considered as separation operation.

**Prerequisite knowledge for Complete understanding and learning of Topic:**

Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

- **Cleaning** involves the separation of contaminants from the desired raw materials.
- **Sorting** involves the separation of the raw materials into different categories based on their physical characteristics such as size, shape and colour.
- **Grading** involves the separation of the raw materials into categories based on the differences in their overall quality

**Cleaning of food raw materials**

Different food raw materials are associated with different types of contaminants.

These include

- Mineral contaminants- soil, sand, stone metallic particles, grease and oil.
- Plant part- stalks, pits, husks and rope,
- Animal parts and contaminants – excreta, hair, insects eggs and body part
- Chemical contamination- sprayed residues of pesticides, insecticides and fertilizers
- Microbial contaminants – microorganisms and their metabolites.

The chosen cleaning process must satisfy the following requirements in order to achieve the aforesaid objective:-

minimum wastage of good material

2. Damage of cleaned raw material must be avoided
3. Recontamination of the cleaned food should be avoided by complete removal of the contaminants.
4. The design of the process equipment should be such that recontamination of the cleaned food due to flying dust or wash water is prevented.
5. The cleaning process must leave the cleaned surface in acceptable condition,
6. The volume and concentration of liquid effluents must be kept be minimum and the effluents should be disposed off effectively.

**Video Content / Details of website for further learning (if any):**

<https://www.youtube.com/watch?v=QmxWHLJeQWc>

**Important Books/Journals for further learning including the page nos.:**

Zeki Berk, Food Process Engineering and Technology, Academic press, 2009, Pg. No. – 25-36.

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LECTURE HANDOUTS

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BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : II Date of Lecture:

**Topic of Lecture:** Preliminary processing methods

**Introduction :** The preliminary preparative operations in food processing include: Cleaning, Sorting and Grading of food raw material. These may be considered as separation operation.

**Prerequisite knowledge for Complete understanding and learning of Topic:**  
Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

### Wet cleaning methods

Wet cleaning has the advantage of removing firmly adherent soils and owing the use of detergents and sanitizers.

Wet cleaning methods include:

- Soaking,
- Spray washing,
- Flotation washing

**The two main objectives of cleaning food raw materials are:**

1. Removal of contaminants which constitute a health hazard or which are aesthetically unacceptable.
2. Control of microbiological loads and biochemical reactions which impair subsequent process effectiveness and product quality.

### Sorting of foods

Sorting and grading are terms which are frequently used interchangeably in the food processing industry, but strictly speaking they are distinct operations.

Sorting is a separation based on a single measurable property of raw material units, while grading is the assessment of the overall quality of a food using a number of attributes.

Sorting methods include:

- Weight sorting,
- Shape sorting

- Photometric or colour sorting.

#### Grading

This term is often used interchangeably with sorting but strictly means the assessment of overall quality of a food using a number of attributes.

Sorting (that is separation on the basis of one characteristic) may therefore be used as part of a grading operation but not vice versa.

Grading methods may be classified into two types:

- Quality control procedures in which the quality of the food is determined by laboratory tests on samples drawn statistically from a batch of food.
- Procedures in which the total quantity of food is subjected to physical separation in quality categories. This grading may be carried out manually or by specialized machines.

#### **Video Content / Details of website for further learning (if any):**

<https://www.youtube.com/watch?v=QmxWHLJeQWc>

#### **Important Books/Journals for further learning including the page nos.:**

Zeki Berk, Food Process Engineering and Technology, Academic press, 2009, Pg. No. – 45-52.

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LECTURE HANDOUTS

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BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : II Date of Lecture:

**Topic of Lecture:** Conversion

**Introduction :** Size reduction is a process of reducing large solid unit masses into small unit masses, coarse particles or fine particles. Size reduction process is also termed as Comminution/Diminution/Pulverizations. Solid pieces of food is reduced by the application of grinding, compression or impact forces.

**Prerequisite knowledge for Complete understanding and learning of Topic:**

Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

Different methods of size reduction are classified according to the size range of particles produced:

1. Chopping, cutting, slicing and dicing:

(a) large to medium (stewing steak, cheese and sliced fruit for canning)

(b) medium to small (bacon, sliced green beans and diced carrot)

(c) small to granular (minced or shredded meat, flaked fish or nuts and shredded vegetables)

2. Milling to powders or pastes of increasing fineness (grated products > spices > flours > fruit nectars > powdered sugar > starches > smooth pastes)

3. Emulsification and homogenisation (mayonnaise, milk, essential oils, butter, ice cream and margarine)

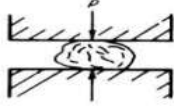
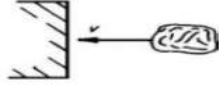

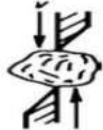
**Benefits in size reduction:**

- Increase in the surface-area-to-volume ratio of the food.
- Increases the rate of drying,
- Increases the rate heating or cooling
- Improves the efficiency and rate of extraction
- Facilitating mixing and blending
- Facilitates heat exchange, chemical and biological reactions

**Forces Used in Size Reduction**

The types of forces commonly used in food processes are compressive, impact, attrition or

In a combination operation, more than one type of force is usually acting. For example, crushing, grinding, and milling take place in powdered sugar, flour, mustard, and cocoa production.

Force	Schematic diagram	Principle	Example of equipment
Compressive		Nutcracker	Crushing rolls
Impact		Hammer	Hammer mill
Attrition		File	Disc attrition mill
Cut		Scissors	Rotary knife cutter

**Video Content / Details of website for further learning (if any):**

[https://www.youtube.com/watch?v=Q\\_Wdwe5\\_m9g](https://www.youtube.com/watch?v=Q_Wdwe5_m9g)

**Important Books/Journals for further learning including the page nos.:**

Zeki Berk, Food Process Engineering and Technology, Academic press, 2009, Pg. No. – 66-75.

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BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : II

Date of Lecture:

**Topic of Lecture:** Conversion

**Introduction :** Size reduction is a process of reducing large solid unit masses into small unit masses, coarse particles or fine particles. Size reduction process is also termed as Comminution/Diminution/Pulverizations. Solid pieces of food is reduced by the application of grinding, compression or impact forces.

**Prerequisite knowledge for Complete understanding and learning of Topic:**

Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

**The Mechanism of Size Reduction**

In the grinding process, materials are reduced in size by fracturing them.

In the process, the material is stressed by the action of mechanical moving parts in the grinding machine and Initially the stress is absorbed internally by the material as strain energy.

Stress → Strain → Fracture in lines of Weakness → Released Heat

Some of the energy is taken up in the creation of new surface, but the greater part of it is dissipated as heat.

**Energy for Size reduction**

Energy required depends upon:

1. The hardness of the material
2. The tendency of the material to crack (friability).

The minimum energy needed to rupture the material.

Excess energy is lost as heat.

This loss should be kept as low as practicable

1. Kick's law
2. Rittinger's law
3. Bond's law

Kick's law states that the energy required to reduce the size of particles is proportional to the ratio of the initial size of a typical dimension (for example the diameter of the pieces) to the final size of that dimension:

$$E = K_K \ln \left( \frac{d_1}{d_2} \right)$$

Where  $E(J)$  = the energy required per mass of feed,  $K_K$ =Kick's constant,  $d_1$ = the average initial size of pieces, and  $d_2$  =the average size of ground particles.

Rittinger's law states that the energy required for size reduction is proportional to the change in surface area of the pieces of food (instead of a change in dimension described in Kick's law):

$$E = K_R \left( \frac{1}{d_2} - \frac{1}{d_1} \right)$$

Bond's law is used to calculate the energy required for size reduction from

$$\frac{E}{W} = \sqrt{\left( \frac{100}{d_2} \right)} - \sqrt{\left( \frac{100}{d_1} \right)}$$

**Video Content / Details of website for further learning (if any):**

<https://www.youtube.com/watch?v=oeugjWvlReg>

**Important Books/Journals for further learning including the page nos.:**

Zeki Berk, Food Process Engineering and Technology, Academic press, 2009, Pg. No. – 85-96.

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III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : II Date of Lecture:

**Topic of Lecture:** Preservation operations

**Introduction :** The term food preservation refers to any one of a number of techniques used to prevent food from spoiling. It includes methods such as canning, pickling, drying and freeze-drying, irradiation, pasteurization, smoking, and the addition of chemical additives.

**Prerequisite knowledge for Complete understanding and learning of Topic:**

Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

Food preservation prevents the growth of microorganisms (such as yeasts), or other microorganisms (although some methods work by introducing benign bacteria or fungi to the food), and slowing the oxidation of fats.

Food preservation may also include processes that inhibit visual deterioration, such as the enzymatic browning reaction in apples after they are cut during food preparation.

Many processes designed to preserve food involve more than one food preservation method.

Preserving fruit by turning it into jam, for example, involves boiling (to reduce the fruit's moisture content and to kill bacteria, etc.), sugaring (to prevent their re-growth) and sealing within an airtight jar (to prevent recontamination).

Methods of preservation:

- Traditional Techniques
- Modern Industrial Techniques

Parameter	Symbol	Application
High temperature	F	Heating
Low temperature	T	Chilling, freezing
Reduced water activity	$a_w$	Drying, curing, conserving
Increased acidity	pH	Acid addition or formation
Reduced redox potential	$E_h$	Removal of oxygen or addition of ascorbate
Biopreservatives		Competitive flora such as microbial fermentation
Other preservatives		Sorbates, sulfites, nitrites

**Video Content / Details of website for further learning (if any):**

<https://www.youtube.com/watch?v=2PgVWLjK0gE>

**Important Books/Journals for further learning including the page nos.:**

Zeki Berk, Food Process Engineering and Technology, Academic press, 2009, Pg. No. – 115-125.

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BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : III

Date of Lecture:

**Topic of Lecture:** Cereal grains

**Introduction :** Cereal grains are the seeds that come from grasses such as wheat, millet, rice, barley, oats, rye, triticale, sorghum, and maize (corn). About 80 percent of the protein and over 50 percent of the calories consumed by humans and livestock come from cereal grains.

**Prerequisite knowledge for Complete understanding and learning of Topic:**

Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

- A cereal is any grass cultivated (grown) for the edible components of its grain (botanically, a type of fruit called a caryopsis), composed of the endosperm, germ, and bran.
- The term may also refer to the resulting grain itself (specifically "cereal grain").
- Cereal grain crops are grown in greater quantities and provide more food energy worldwide than any other type of crop and are therefore staple crops.
- Edible grains from other plant families, such as buckwheat (Polygonaceae), quinoa (Amaranthaceae) and chia (Lamiaceae), are referred to as pseudocereals.
- In their natural, unprocessed, whole grain form, cereals are a rich source of vitamins, minerals, carbohydrates, fats, oils, and protein.
- When processed by the removal of the bran, and germ, the remaining endosperm is mostly carbohydrate.
- In some developing countries, grain in the form of rice, wheat, millet, or maize constitutes a majority of daily sustenance.
- Cereals are nutritionally important sources of dietary protein, iron, vitamin B complex, vitamin E, carbohydrates, niacin, riboflavin, thiamine, fibre and traces of minerals important for both humans and animals.
- Soluble bran in cereals is also helpful for lowering blood cholesterol levels and also prevent cardiovascular diseases.
- Maize also known as corn, is a cereal grain first domesticated by indigenous peoples in

of maize surpassing that of wheat or rice

- Rice is the seed of the grass species *Oryza glaberrima* (African rice) or *Oryza sativa* (Asian rice).
- As a cereal grain, it is the most widely consumed staple food for a large part of the world's human population, especially in Asia and Africa.
- It is the agricultural commodity with the third-highest worldwide production
- Wheat is a grass widely cultivated for its seed, a cereal grain which is a worldwide staple food.
- The many species of wheat together make up the genus *Triticum*; the most widely grown is common wheat
- Barley, a member of the grass family, is a major cereal grain grown in temperate climates globally.
- It was one of the first cultivated grains, particularly in Eurasia as early as 10,000 years ago.
- Barley has been used as animal fodder, as a source of fermentable material for beer and certain distilled beverages.
- Sorghum is the cultivation and commercial exploitation of species of grasses within the genus *Sorghum* (often *S. bicolor*).
- These plants are used for grain, fibre and fodder.
- The plants are cultivated in warmer climates worldwide.
- Oats are best grown in temperate regions.
- They have a lower summer heat requirement and greater tolerance of rain than other cereals, such as wheat, rye or barley
- Rye (*Secale cereale*) is a grass grown extensively as a grain, a cover crop and a forage crop.
- It is a member of the wheat tribe (*Triticeae*) and is closely related to barley (genus *Hordeum*) and wheat (*Triticum*).

**Video Content / Details of website for further learning (if any):**

<https://www.youtube.com/watch?v=LS8IajmZzQ4>

**Important Books/Journals for further learning including the page nos.:**

S Clark, S Jung, & B Lamsal, Food Processing Principles and Applications, Wiley, 2014, Pg. No. – 293 -302.

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BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : III

Date of Lecture:

**Topic of Lecture:** Pulses

**Introduction :** Pulses are the edible seeds of plants in the legume family. Pulses grow in pods and come in a variety of shapes, sizes and colors.

**Prerequisite knowledge for Complete understanding and learning of Topic:**

Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

Pulses are the dried edible seeds of certain plants in the legume family.

The United Nations Food and Agriculture Organization (FAO) recognizes 11 types of pulses grown worldwide.

The four main types of pulses grown in Canada are dry peas, lentils, beans and chickpeas.

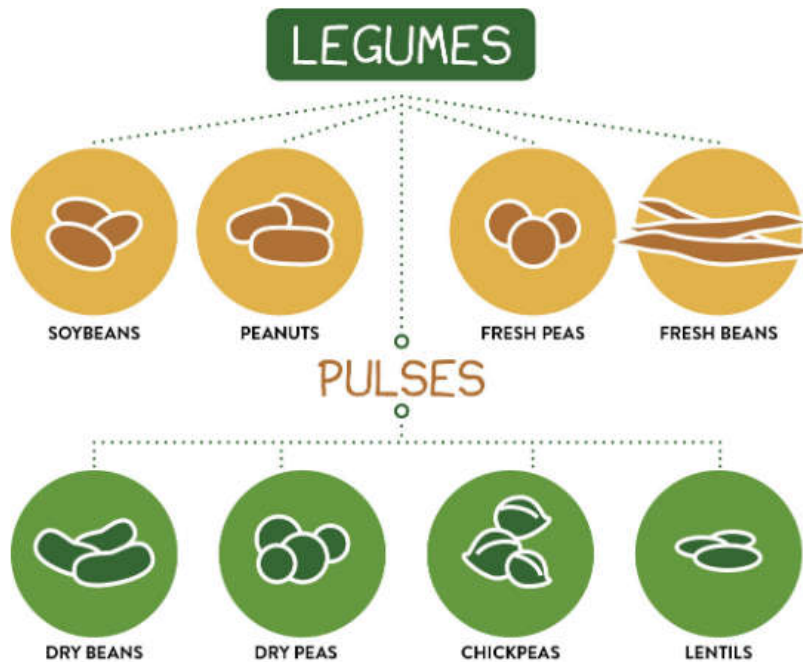
Pulses are very high in protein and fibre, and are low in fat.

Pulses are also nitrogen-fixing crops that improve the environmental sustainability of annual cropping systems.

Pulses come in a variety of shapes, sizes and colours and can be consumed in many forms including whole or split, ground in to flours or separated into fractions such as protein, fibre and starch.

Other foods in the legume family like fresh beans and peas are not considered pulses – the term “pulse” only refers to the dried seed.

Soybeans and peanuts are also not considered pulses because they have a much higher fat content, whereas pulses contain virtually no fat.



**Video Content / Details of website for further learning (if any):**

<https://www.youtube.com/watch?v=3y6V-PqUCmQ>

**Important Books/Journals for further learning including the page nos.:**

S Clark, S Jung, & B Lamsal, Food Processing Principles and Applications, Wiley, 2014, Pg. No. – 305-331.

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BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : III

Date of Lecture:

**Topic of Lecture:** Vegetables

**Introduction :** Vegetables are parts of plants that are consumed by humans or other animals as food. The original meaning is still commonly used and is applied to plants collectively to refer to all edible plant matter, including the flowers, fruits, stems, leaves, roots, and seeds.

**Prerequisite knowledge for Complete understanding and learning of Topic:**  
Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

**Processing systems**

1. Small-Scale Processing.
2. Intermediate-Scale Processing.
3. Large-Scale Processing.

**Small-Scale Processing.**

This is done by small-scale farmers for personal subsistence or for sale in nearby markets. In this system, processing requires little investment: however, it is time consuming and tedious.

Until recently, small-scale processing satisfied the needs of rural and urban populations. However, with the rising rates of population and urbanisation growth and their more diversified food demands, there is need for more processed and diversified types of food.

**Intermediate-Scale Processing.**

In this scale of processing, a group of small-scale processors pool their resources.

This can also be done by individuals. Processing is based on the technology used by small-scale processors with differences in the type and capacity of equipment used.

The raw materials are usually grown by the processors themselves or are purchased on

These operations are usually located on the production site of in order to assure raw materials availability and reduce cost of transport.

This system of processing can provide quantities of processed products to urban areas.

**Large-Scale Processing.**

Processing in this system is highly mechanised and requires a substantial supply of raw materials for economical operation.

This system requires a large capital investment and high technical and managerial skills.

Because of the high demand for foods in recent years many large-scale factories were established in developing countries.

**Video Content / Details of website for further learning (if any):**

<https://www.youtube.com/watch?v=LZQpqQ5E-7g>

**Important Books/Journals for further learning including the page nos.:**

S Clark, S Jung, & B Lamsal, Food Processing Principles and Applications, Wiley, 2014, Pg. No. – 339 - 360

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BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : III

Date of Lecture:

**Topic of Lecture:** Fruits

**Introduction :** Fruits are the means by which angiosperms disseminate seeds. Edible fruits, in particular, have propagated with the movements of humans and animals in a symbiotic relationship as a means for seed dispersal and nutrition

**Prerequisite knowledge for Complete understanding and learning of Topic:**  
Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

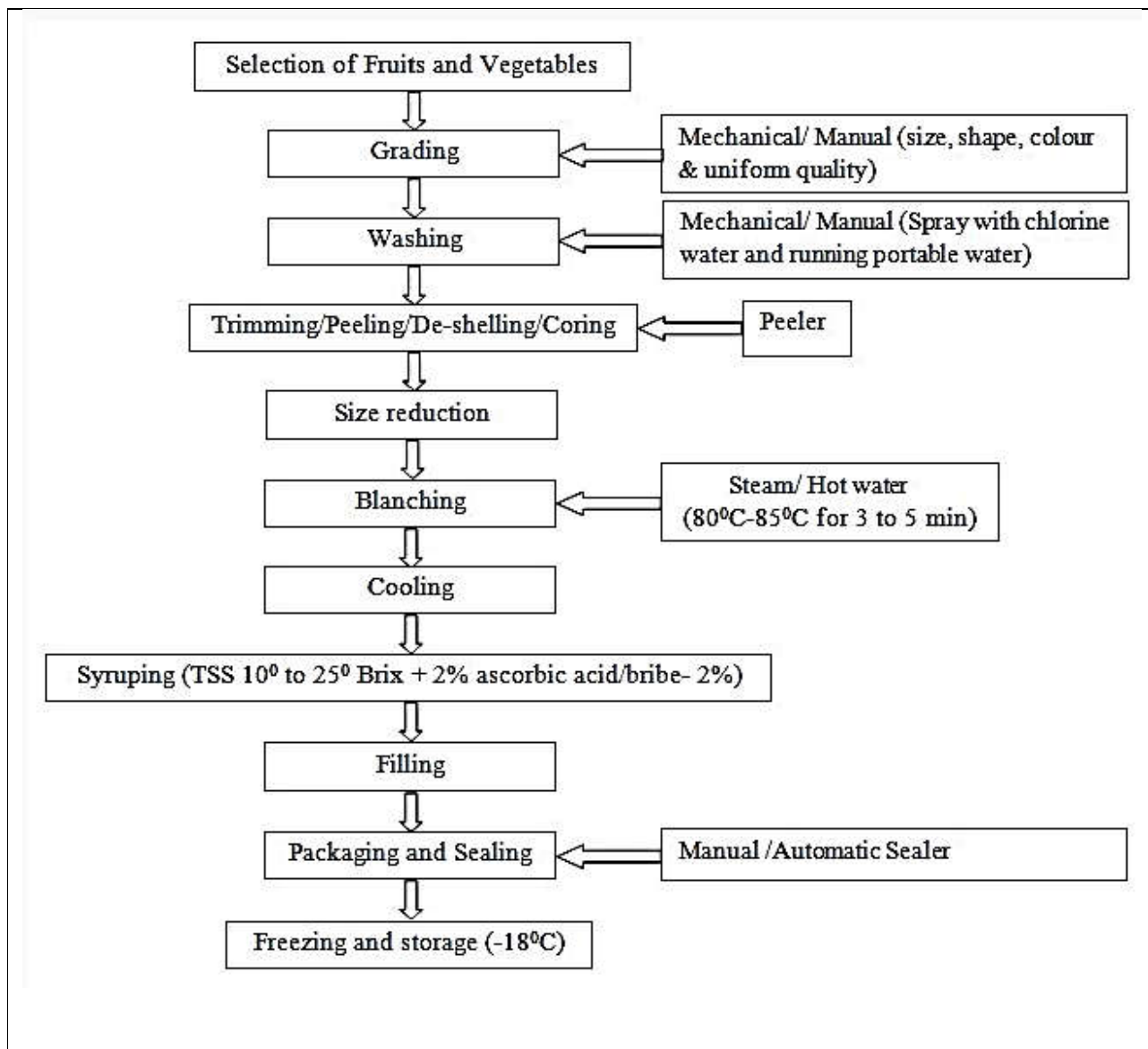
Fruits are the most perishable commodities and are important ingredients in the human dietaries.

Fruits are seasonal in nature and prices go down considerably during the glut period and production becomes uneconomical due to distress sale.

The costs involved in preventing the losses are always cheaper than the cost of production; hence, processing receives greater attention in recent years.

Processing methods:

- Freezing
- Dehydration
- Canning



**Video Content / Details of website for further learning (if any):**

<https://www.youtube.com/watch?v=LZQpqQ5E-7g>

**Important Books/Journals for further learning including the page nos.:**

S Clark, S Jung, & B Lamsal, Food Processing Principles and Applications, Wiley, 2014, Pg. No. – 363-369.

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BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : III

Date of Lecture:

**Topic of Lecture:** Spices

**Introduction :** A spice is a seed, fruit, root, bark, or other plant substance primarily used for flavoring or coloring food. Spices are distinguished from herbs, which are the leaves

**Prerequisite knowledge for Complete understanding and learning of Topic:**  
Basics of Biology and General engineering subjects

### Detailed content of the Lecture:

- Indian spices are known for its flavours
- India is known as 'Home of Spices and also Land of spices
- India- Largest producer, consumer and exporter of spices
- China - second largest producer
- >90% for domestic consumption
- 109 spices- all over world
- India- 52 spices
- India is producing 5.95 million tonnes of spices from an area of about 3.21 million hectares

### Spices Production in India

Spices	Production (in Tonnes)
Pepper	26700
Cardamom (s)	4650
Cardamom (L)	935
Chilli	241000
Ginger	21550
Turmeric	79500
Seed Spices	120200
Other Spices	41720
Curry powders/Paste	17000
Mint Products	14750
Spice Oils & Oleoresins	7,265
Total	575270

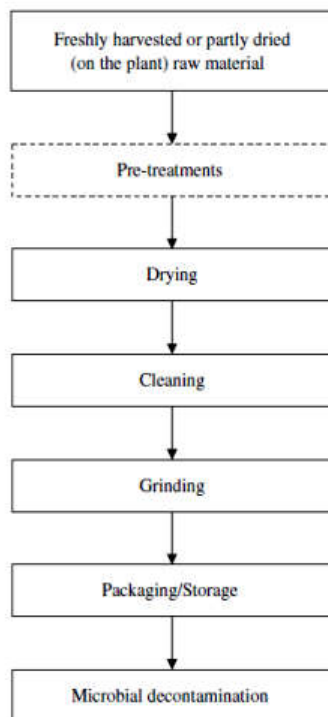
### Spices in Five Categories

- Major spices:-Black pepper, Cardamoms, Chilies, Ginger and Turmeric
- Seed spices:-coriander, celery, fennel, Cumin

- Misc spices:- garlic, saffron, long pepper

#### Problems associated with spice production

- High microbial loads and aflatoxin contamination
- Losses of valuable compounds due to endogenous enzyme activities
- Losses of valuable compounds due to conventional processing and storage



Conventional process for the production of spices (steps in dotted lines are optional).

#### Video Content / Details of website for further learning (if any):

<https://www.youtube.com/watch?v=x-m3SnyURa8>

#### Important Books/Journals for further learning including the page nos.:

S Clark, S Jung, & B Lamsal, Food Processing Principles and Applications, Wiley, 2014, Pg. No. – 280-283.

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BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : III

Date of Lecture:

**Topic of Lecture:** Fats and oils

**Introduction :** All fats and oils are a mixture of saturated fatty acids and unsaturated fatty acids. Unsaturated fatty acids include monounsaturated and polyunsaturated fats. Oils are fats that are liquid at room temperature, like the vegetable oils used in cooking. Oils come from many different plants and from fish.

**Prerequisite knowledge for Complete understanding and learning of Topic:**

Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

Fats and oils are water-insoluble compounds consisting of mainly triacylglycerols: three fatty acids esterified to a glycerol molecule.

Products are generally called "fats" when they are solid at room temperature and "oils" when they are liquid at room temperature

Edible fats and oils contribute to the flavor, texture, aroma, and mouth feel of foods, while providing nutritive value.

They are commonly of :

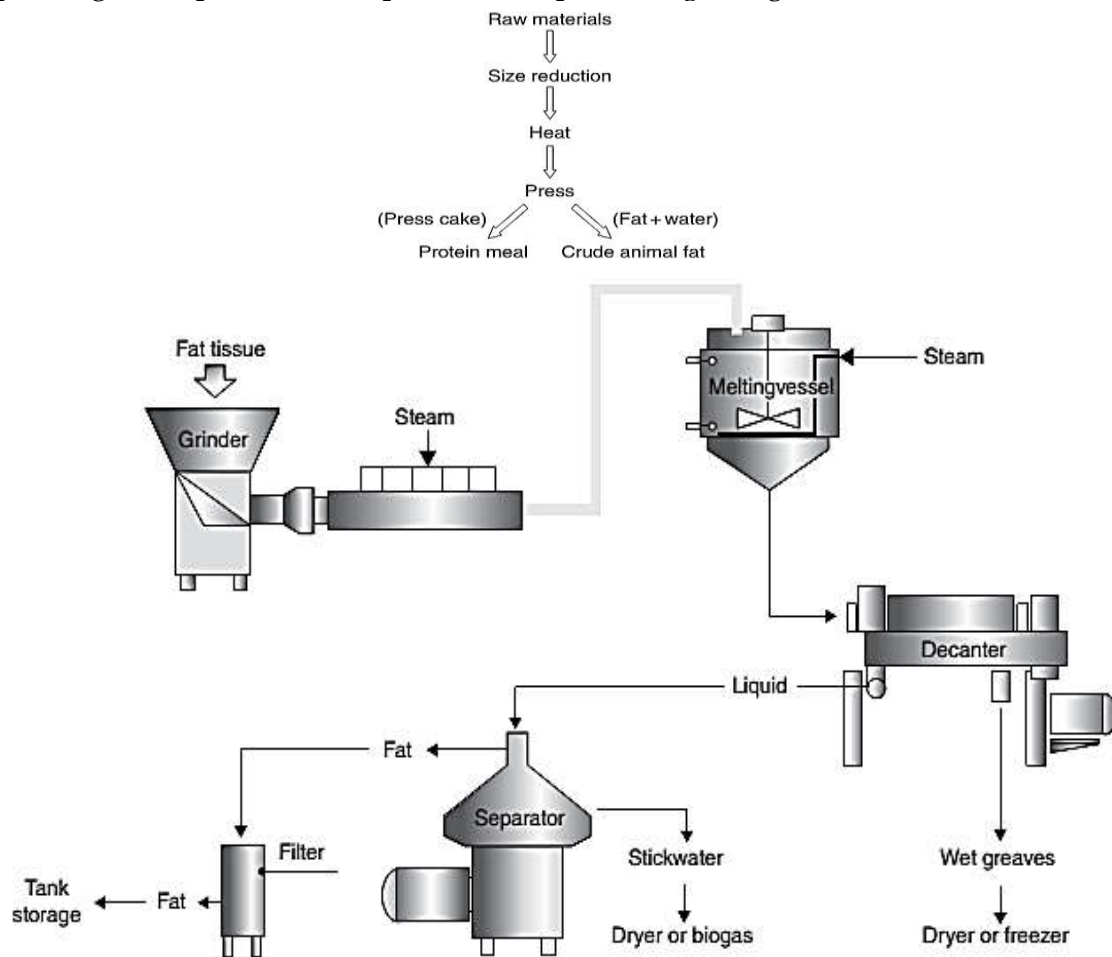
- Vegetable origin (e.g. palm oil, rapeseed oil, soyabean oil, olive oil, cocoa butter, etc)
- Animal origin (e.g. pork lard, beef tallow, fish oils) as well as from animal milk fats.

Fatty acids can be grouped into four main types:

- Saturated
- Monounsaturated
- Polyunsaturated
- Trans

Refining step	Targeted component(s) for removal	Other components removed
Degumming	Phosphatides	Filterable solids (e.g. waxes), trace metals
Neutralization	Free fatty acids	Phosphatides, soaps, trace metals, pigments
Bleaching	Pigments	Phosphatides, soaps, trace metals, waxes
Deodorization	Free fatty acids (physical refining) Secondary oxidation products (chemical refining)	Sterols, tocopherols, tocotrienols, carotenoids, pigments

Most rendering processes refer to the processing of fat-rich or bone-rich raw materials. A simplified generic process description for the processing of high-fat raw material



Video Content / Details of website for further learning (if any):

<https://www.youtube.com/watch?v=42iIEIW9REU>

**Important Books/Journals for further learning including the page nos.:**

S Clark, S Jung, & B Lamsal, Food Processing Principles and Applications, Wiley, 2014, Pg. No. – 457-462.

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BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : III

Date of Lecture:

**Topic of Lecture:** Bakery; Confectionery

**Introduction :** Bakery and Confectionery is a field wherein aspirants need to prepare and present food that is rich in sugar and carbohydrates. Candidates who wish to make a future in this field need to be passionate about baking.

**Prerequisite knowledge for Complete understanding and learning of Topic:**  
Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

Confectionery is the art of making confections, which are food items that are rich in sugar and carbohydrates.

Confectionery is an important food item of great popularity among wide range of population. It has been enjoyed as a major food delicacy from ancient times.

The term confectionery is ambiguous and describes a spectrum of sweet goods.

It takes on different meaning depending on the country in which it is used, for example in the United Kingdom the term applies to any sweet product including cakes.

In the United States confectionery is candy and includes sugar confectionery and chocolate confectionery.

Globally, confectionery foods represent 50% by volume of foods produced and 60% by value.

**Classification of Confectionery**

Confectionery can be classified into four major groups.

They are as follows:

- Sugar confectionery
- Chocolate confectionery
- Flour confectionery

## Confectionery Production Principles

All confectionery products have a number of common requirements.

They must have an extended shelf life under ambient storage conditions and although this may be assisted by protective packaging their inherent properties must provide stability against microbial deterioration and stability of shape.

Toffee is a confection made by caramelizing sugar or molasses along with butter, and occasionally flour.

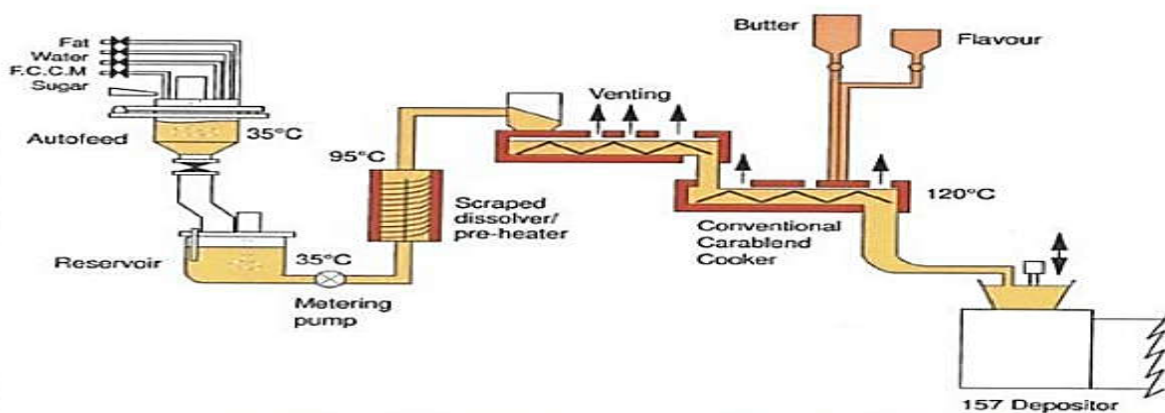
The mixture is heated until its temperature reaches the hard crack stage of 149 to 154 °C.

While being prepared, toffee is sometimes mixed with nuts or raisins.

The basic ingredients used in the production of toffee are:

- Sugar (sucrose)
- Glucose syrup
- Milk Protein
- Fat
- Salt
- Water
- Other additives e.g. colour, flavour etc.

### Toffee Plant



Video Content / Details of website for further learning (if any):

<https://www.youtube.com/watch?v=mOm-d4V1sS8>

Important Books/Journals for further learning including the page nos.:

S Clark, S Jung, & B Lamsal, Food Processing Principles and Applications, Wiley, 2014, Pg. No. – 280-283.

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LECTURE HANDOUTS

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BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : III

Date of Lecture:

**Topic of Lecture:** Chocolate products

**Introduction :** Chocolate is a preparation of roasted and ground cacao seeds that is made in the form of a liquid, paste, or in a block, which may also be used as a flavoring ingredient in other foods.

**Prerequisite knowledge for Complete understanding and learning of Topic:**  
Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

The seeds of the cacao tree have an intense bitter taste and must be fermented to develop the flavor.

After fermentation, the beans are dried, cleaned, and roasted.

The shell is removed to produce cacao nibs, which are then ground to cocoa mass, unadulterated chocolate in rough form.

Once the cocoa mass is liquefied by heating, it is called chocolate liquor.

The liquor may also be cooled and processed into its two components:

cocoa solids and cocoa butter.

Baking chocolate, also called bitter chocolate, contains cocoa solids and cocoa butter in varying proportions, without any added sugar.

Powdered baking cocoa, which contains more fiber than cocoa butter, can be processed with alkali to produce dutch cocoa.

Since nibs are directly from the cacao tree, they contain high amounts of theobromine.

Most nibs are ground, using various methods, into a thick, creamy paste, known as chocolate liquor or cocoa paste.

This "liquor" is then further processed into chocolate by mixing in cocoa butter and sugar.

Alternatively, it can be separated into cocoa powder and cocoa butter using a hydraulic press. This process produces around 50% cocoa butter and 50% cocoa powder. Standard cocoa powder has a fat content around 10–12%.

Cocoa butter is used in chocolate bar manufacture, other confectionery, soaps, and cosmetics. The basic blends of ingredients for the various types of chocolate (in order of highest quantity of cocoa liquor first), are:

- Dark chocolate: sugar, cocoa butter, cocoa liquor, and (sometimes) vanilla
- Milk chocolate: sugar, cocoa butter, cocoa liquor, milk or milk powder, and vanilla
- White chocolate: sugar, cocoa butter, milk or milk powder, and vanilla

**Video Content / Details of website for further learning (if any):**

<https://www.youtube.com/watch?v=8wpAvXR6wI0>

**Important Books/Journals for further learning including the page nos.:**

S Clark, S Jung, & B Lamsal, Food Processing Principles and Applications, Wiley, 2014, Pg. No. – 290-295.

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BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : III

Date of Lecture:

**Topic of Lecture:** Soft and alcoholic beverages

**Introduction :** A drink (or beverage) is a liquid intended for human consumption. In addition to their basic function of satisfying thirst, drinks play important roles in human culture.

**Prerequisite knowledge for Complete understanding and learning of Topic:**

Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

Common types of drinks include plain drinking water, milk, coffee, tea, hot chocolate, juice and soft drinks.

In addition, alcoholic drinks such as wine, beer, and liquor, which contain the drug ethanol, have been part of human culture for more than 8,000 years.

Non-alcoholic drinks often signify drinks that would normally contain alcohol, such as beer and wine, but are made with a sufficiently low concentration of alcohol by volume.

Production process includes:

- Purification of water
- Pasteurisation
- Juicing
- Infusion
- Percolation
- Carbonation
- Fermentation
- Distillation
- Mixing

**Non-alcoholic drinks**

A non-alcoholic drink is one that contains little or no alcohol.

This category includes low-alcohol beer, non-alcoholic wine, and apple cider if they contain a sufficiently low concentration of alcohol by volume (ABV).

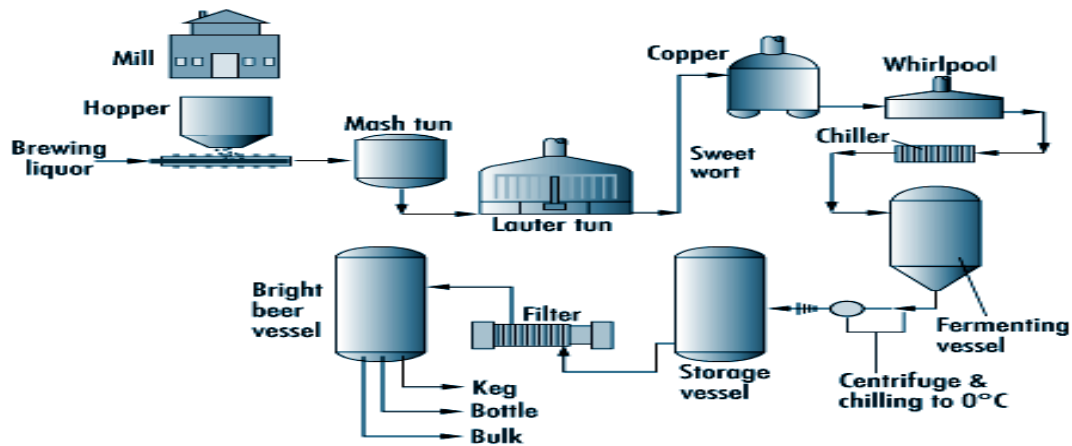
Types of non alcoholic beverages:

- Water
- Milk

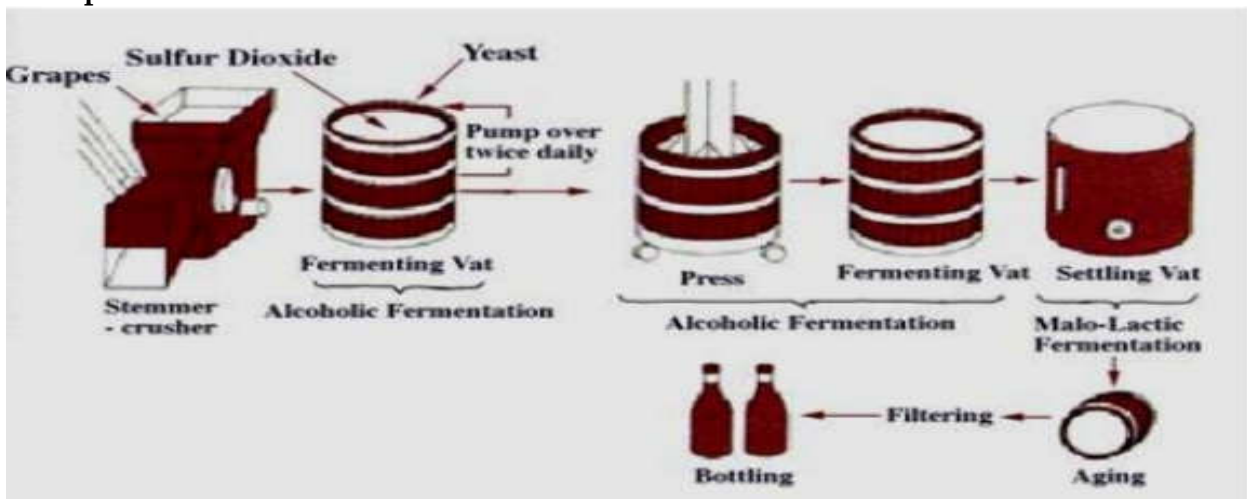
## Alcoholic drinks

- Beer
- Cider
- Wine
- Spirits

Beer production:



Wine production:



Video Content / Details of website for further learning (if any):

<https://www.youtube.com/watch?v=bKunpGA2r7U>

Important Books/Journals for further learning including the page nos.:

S Clark, S Jung, & B Lamsal, Food Processing Principles and Applications, Wiley, 2014, Pg. No. – 383 -402.

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BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : III

Date of Lecture:

**Topic of Lecture:** Dairy products

**Introduction :** Dairy products or milk products are a type of food produced from or containing the milk of mammals. They are primarily produced from mammals such as cattle, water buffaloes, goats, sheep, camels and humans. Dairy products include food items such as yogurt, cheese and butter.

**Prerequisite knowledge for Complete understanding and learning of Topic:**

Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

Milk is produced after optional homogenization or pasteurization, in several grades after standardization of the fat level.

Milk can be broken down into several different categories based on type of product produced, including cream, butter, cheese, infant formula, and yogurt.

Milk varies in fat content. Skim milk is milk with zero fat, while whole milk products contain fat.

The dairy industry involves processing raw milk into products such as consumer milk, butter, cheese, yogurt, condensed milk, dried milk(milk powder), and ice cream, using processes such as chilling, pasteurization, and homogenization.

Typical by-products include buttermilk, whey, and their derivatives.

Dairy industries have shown tremendous growth in size and number in most countries of the world.

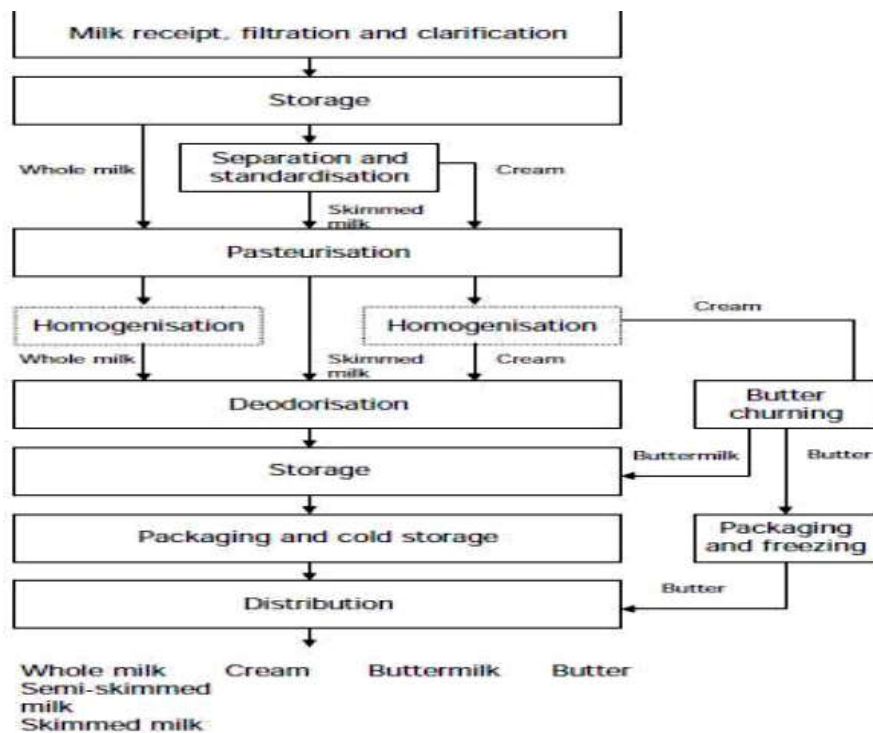
Dairy processing plants can be divided into two categories:

Fluid milk processing involving the pasteurization and processing of raw milk into liquid milk for direct consumption, as well as cream, flavored milk, and fermented products such as buttermilk and yogurt.

Industrial milk processing involving the pasteurization and processing of raw milk into value-added dairy products such as cheese and casein, butter and other milk fats, milk

Dairy processing activities:

- Raw Milk Collection, Reception and Storage
- Separation and Standardization
- Homogenization
- Heat Treatment and Cooling of Milk Products
- Milk and Dairy Product Production
- Milk production
- Cheese production
- Butter production
- Milk powder production
- Packaging of Milk and Dairy Products



Video Content / Details of website for further learning (if any):

<https://www.youtube.com/watch?v=1iYPYQu98Z0>

Important Books/Journals for further learning including the page nos.:

S Clark, S Jung, & B Lamsal, Food Processing Principles and Applications, Wiley, 2014, Pg. No. – 405-431.

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BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : III

Date of Lecture:

**Topic of Lecture:** Poultry meat

**Introduction :** Poultry can be defined as domestic fowls, including chickens, turkeys, geese and ducks, raised for the production of meat or eggs and the word is also used for the flesh of these birds used as food.

**Prerequisite knowledge for Complete understanding and learning of Topic:**  
Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

- Poultry meat is a good source of protein and has a lipid content and low calorific value.
- It is palatable, tender and easily digestible

**Properties of poultry**

- High in protein
- Low in fat
- Excellent source of essential amino acids
- Also a good source of Phosphorus, iron, copper, zinc, B vitamins (12 & 6)
- Dark meat and skin are higher in fat than white

**Abattoir:** It is a food factory where all the operations are dictated by the standards of hygiene and animal welfare. It aims at producing wholesome meat for consumer in the most humane way possible.

**Carcass:** The harvested dressed animal, wherein the hide, hooves, head and internal organs are removed.

**Lairage:** place where the animals are rested before slaughtering to preserve enough glycogen to be converted to lactic acid.

**Slaughtering**

Slaughtering refers to killing of domestic livestock. The slaughter involves some initial cutting, opening the major body cavities to remove the entrails but usually leaving the carcass in one piece. Later, the carcass is usually butchered into smaller cuts.

1. Traditional method

- Kosher
- Halal
- Jhatka

2. Modern method

- Procurement
- Lairage
- Ante-mortem Inspection
- Stunning
- Sticking
- Bleeding
- Scalding
- Picking
- Pinning
- Singeing
- Evisceration / Cropping and Venting
- Post mortem inspection
- Washing
- Chilling and Draining
- Grading
- Packaging
- Storage

**Video Content / Details of website for further learning (if any):**

<https://www.youtube.com/watch?v=1CBfORVzpnU>

**Important Books/Journals for further learning including the page nos.:**

S Clark, S Jung, & B Lamsal, Food Processing Principles and Applications, Wiley, 2014, Pg. No. – 437-450.

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BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : III

Date of Lecture:

**Topic of Lecture:** Fish processing

**Introduction :** The term fish processing refers to the processes associated with fish and fish products between the time fish are caught or harvested, and the time the final product is delivered to the customer.

**Prerequisite knowledge for Complete understanding and learning of Topic:**  
Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

Larger fish processing companies often operate their own fishing fleets or farming operations. The products of the fish industry are usually sold to grocery chains or to intermediaries.

Fish are highly perishable.

A central concern of fish processing is to prevent fish from deteriorating, and this remains an underlying concern during other processing operations.

Fish processing can be subdivided into fish handling, which is the preliminary processing of raw fish, and the manufacture of fish products.

Another natural subdivision is into primary processing involved in the filleting and freezing of fresh fish for onward distribution to fresh fish retail and catering outlets, and the secondary processing that produces chilled, frozen and canned products for the retail and catering trades

**CAUSES OF SPOILAGE**

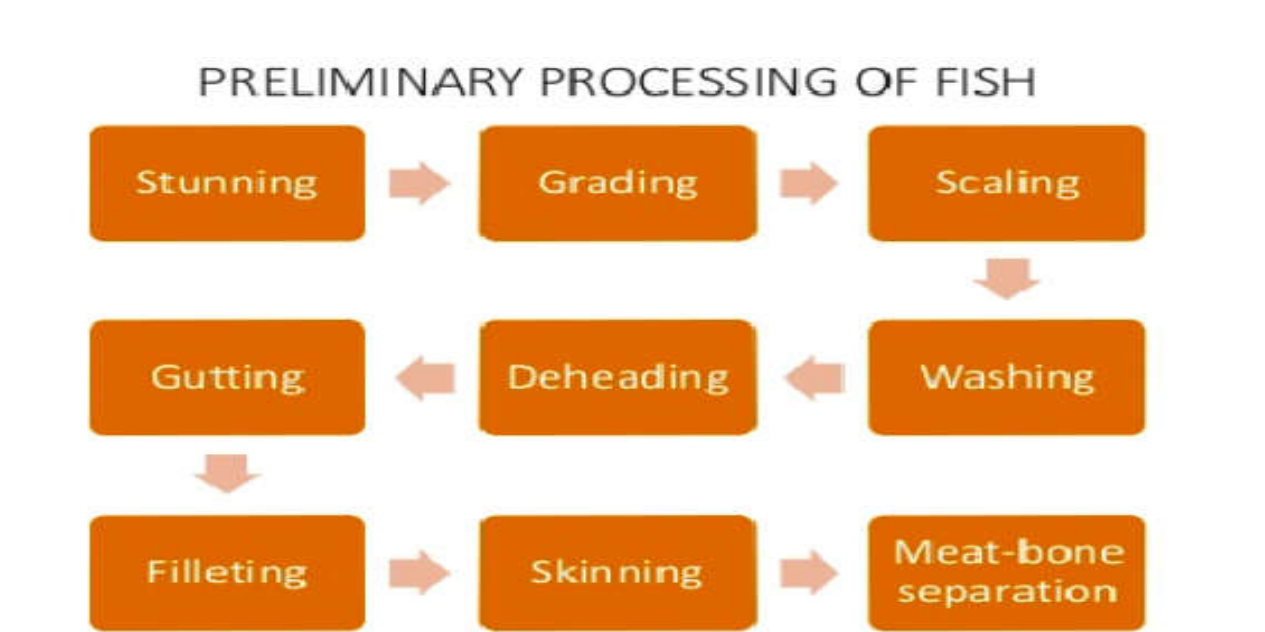
The fish spoilage may be caused by 3 causes

- a) Bacteria
- b) Digestive enzymes

The flesh of freshly caught fish is sterile while the spoiling microflora is present in external slime and digestive tracts.

Fatty fishes may develop spoilage due to all 3 above mentioned causes.

If not gutted soon after catch, strong digestive enzymes affect the viscera and belly walls and cause discoloration- 'belly bum' or disruption- 'torn bellies'



**Video Content / Details of website for further learning (if any):**

<https://www.youtube.com/watch?v=0jdWiy7N2ok>

**Important Books/Journals for further learning including the page nos.:**

S Clark, S Jung, & B Lamsal, Food Processing Principles and Applications, Wiley, 2014, Pg. No. – 501-525.

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BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : IV

Date of Lecture:

**Topic of Lecture:** Preservation by heat and cold

**Introduction :** Food preservation prevents the growth of microorganisms and slowing the oxidation of fats.

**Prerequisite knowledge for Complete understanding and learning of Topic:**  
Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

Food preservation may also include processes that inhibit visual deterioration, such as the enzymatic browning reaction in apples after they are cut during food preparation.

Many processes designed to preserve food involve more than one food preservation method.

**Principles Of Food Preservation**

1. Keep the food alive as long as possible. Kill the animal or plant just before it is to be used
2. After killing the food clean it, cover it and cool it as quickly as possible. This will slowdown the deterioration for a short time
3. For long term and practical preservation inactivating or controlling microorganisms, enzymes and reducing or eliminating chemical reactions are to be done

**Preservation by heat (thermal processes):** microorganisms and enzymes are destroyed at high temperatures.

The extent of destruction depends on the temperature, the time of exposure and, of course, on the heat resistance of the microorganism or enzyme in question in the given medium.

Exposure to high temperature does not only destroy microorganisms and enzymes.

It also accelerates a multitude of chemical reactions leading to changes in texture, flavor,

Some of these changes are desirable and constitute the complex process known as 'cooking'.

Others are objectionable and are collectively named 'thermal damage'.

**Preservation by removal of heat (low temperature processes):**

The activity of microorganisms and enzymes as well as the velocity of chemical reactions are depressed at low temperatures.

In contrast to heat, low temperature does not destroy enzymes and microorganisms to any significant extent, but merely depresses their activity.

Preservation by cold encompasses two distinct technological processes:

chilling (maintaining the food at low temperature above the freezing point of the food) and

freezing (below the freezing point).

The difference between the two is not only in the temperature.

A substantial part of the preservation effect of freezing is due to the change of phase, from liquid to solid, with the corresponding reduction in molecular mobility

**Preservation by reduction of water activity:**

It is well known that microorganisms cannot develop at water activity levels below a limit value depending on the microorganism.

Enzyme activity is also water activity dependent. Drying, concentration, addition of solutes (sugar, salt) are preservation techniques based on the reduction of water activity.

**Video Content / Details of website for further learning (if any):**

<https://www.youtube.com/watch?v=2PgVWLjK0gE>

**Important Books/Journals for further learning including the page nos.:**

Zeki Berk, Food Process Engineering and Technology, Academic press, 2009, Pg. No. – 375-383.

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LECTURE HANDOUTS

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BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : IV

Date of Lecture:

**Topic of Lecture:** Dehydration

**Introduction :** Dehydration, in food processing, means by which many types of food can be preserved for indefinite periods by extracting the moisture, thereby inhibiting the growth of microorganisms.

**Prerequisite knowledge for Complete understanding and learning of Topic:**

Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

Food drying is a method of food preservation in which food is dried (dehydrated or desiccated).

Drying inhibits the growth of bacteria, yeasts, and mold through the removal of water.

Dehydration has been used widely for this purpose since ancient times; the earliest known practice is 12,000 B.C. by inhabitants of the modern Middle East and Asia regions.

Water is traditionally removed through evaporation (air drying, sun drying, smoking or wind drying), although today electric food dehydrators or freeze-drying can be used to speed the drying process and ensure more consistent results

Drying:

- Removal of water from the food by non-conventional energy sources like sunlight and wind.

Dehydration:

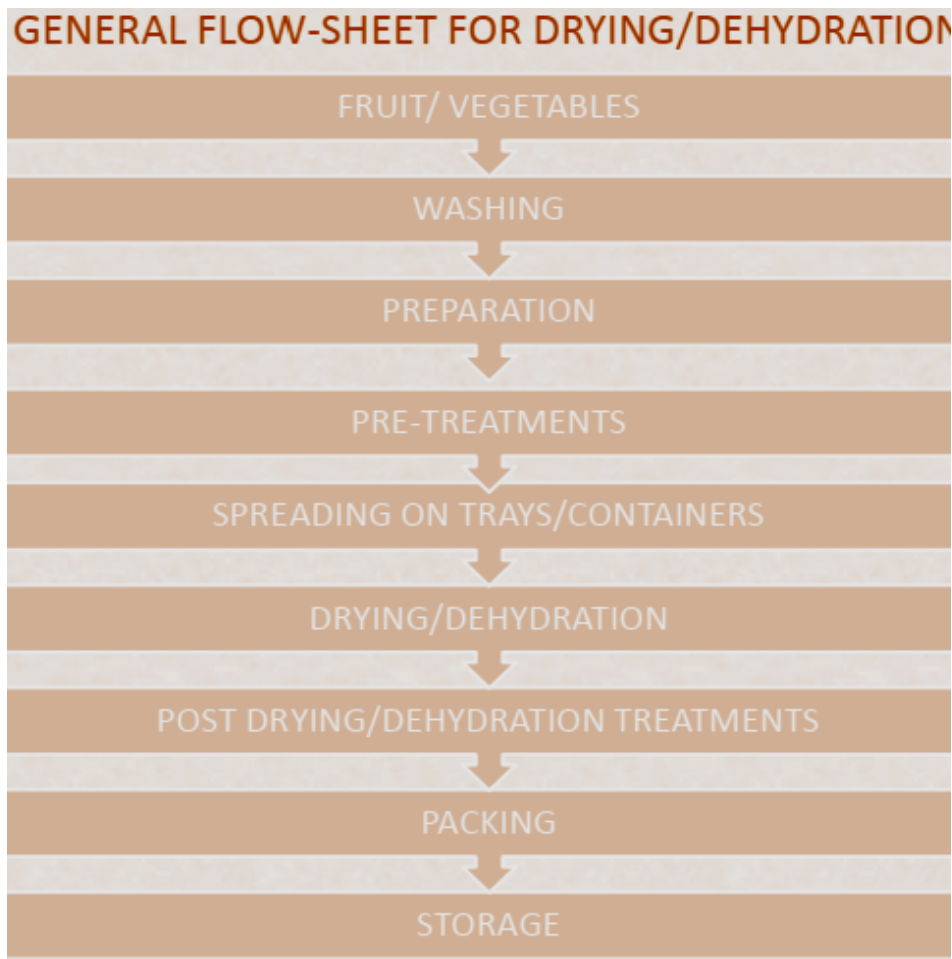
- The process of removal of water from the food under the controlled conditions like temperature, relative humidity and air flow etc.

Drying And Dehydration

- One of the oldest methods of preserving food.
- Both drying and dehydration mean the removal of water.
- Removes moisture stops the growth of bacteria, yeasts & moulds that normally spoil food.
- Slows down but does not completely inactivate enzymes.

measure, easy to serve and easy to store.

- They have unlimited shelf life under proper storage conditions.
- Transportation, handling and storage costs are reduced.
- Provide an important modern marketing requirements.
- Easy and economical way to save surplus food for a later time.
- Portability – Can take it anywhere you go.
- Helps in minimizing post harvest losses



**Video Content / Details of website for further learning (if any):**

<https://www.youtube.com/watch?v=PlfFYz9FIYg>

**Important Books/Journals for further learning including the page nos.:**

Zeki Berk, Food Process Engineering and Technology, Academic press, 2009, Pg. No. – 459-480.



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BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : IV

Date of Lecture:

**Topic of Lecture:** Dehydration / Drying

**Introduction :** Dehydration, in food processing, means by which many types of food can be preserved for indefinite periods by extracting the moisture, thereby inhibiting the growth of microorganisms.

**Prerequisite knowledge for Complete understanding and learning of Topic:**  
Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

Mechanism involved

1. Heat and mass transfer

Heat into product

Moisture out of product

2. Development of dried thick layer

At initial stages of drying moisture from surface of food is removed later it becomes slow because of development of dried thick layer, which is due to loss of more moisture from outer surface of food and remaining of more moisture in the centre of food.

3. Establishment of moisture gradient

When dried thick layer is formed and act as insulation against rapid heat transfer.

Water retain in the centre of food which have moisture gradient to get out on the surface which will not loose faster and establishes moisture gradient.

4. Establishment of normal Equilibrium Relative Humidity (ERH)

This is the humidity at which the product neither loses nor gains moisture from atmosphere.

Below this atmospheric humidity level, the food can be further dried while above this humidity. it cannot.

Factors affecting drying rate

- Temperature
- Velocity of air
- Surface area
- Size of product
- Tray load
- Relative humidity of air
- Atmospheric pressure and vacuum

**Video Content / Details of website for further learning (if any):**

<https://www.youtube.com/watch?v=PlfFYz9FIYg>

**Important Books/Journals for further learning including the page nos.:**

Zeki Berk, Food Process Engineering and Technology, Academic press, 2009, Pg. No. – 480-507.

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BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : IV

Date of Lecture:

**Topic of Lecture:** Freezing

**Introduction :** Food Freezing may be defined as the processing of food by lowering the temperature so that almost all of the water inside become frozen

**Prerequisite knowledge for Complete understanding and learning of Topic:**  
Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

Temperature of a food is reduced to freezing point. A proportion of the water changes in state to form ice crystals

Preservation achieved due to combination of

- low temperatures
- Reduced water activity

Physical, biochemical, chemical and microbiological degradation restrained.

Refrigerant

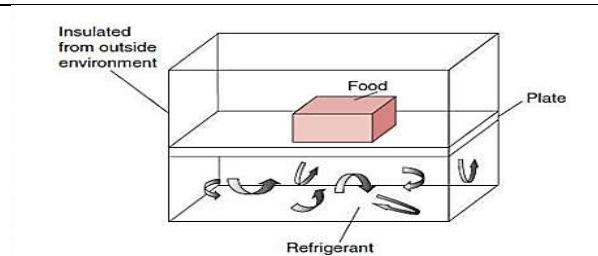
- A chemical substance usually a fluid that can readily absorb heat.
- Used in cooling system such as air conditioner or refrigerator.
- Have good thermodynamic properties
- BP below the target temperature
- Moderate density
- High critical temperature
- High heat of vaporization
- Examples- CFC

**Freezing System**

**Indirect Contact Systems**

In numerous food-product freezing systems, the product and refrigerant are separated by a barrier throughout the freezing process.

Although many systems use a nonpermeable barrier between product and refrigerant,



**Plate Freezers**

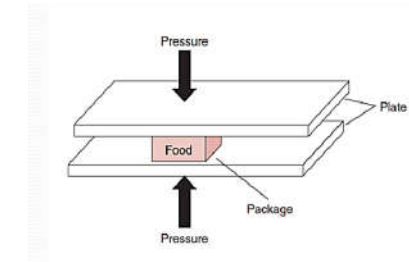
The most easily recognized type of indirect freezing system is the plate freezer, air-blast freezing.

As indicated, the product is frozen while held between two refrigerated plates.

**Plate Freezers**

The most easily recognized type of indirect freezing system is the plate freezer, air-blast freezing.

As indicated, the product is frozen while held between two refrigerated plates.



**Video Content / Details of website for further learning (if any):**

<https://www.youtube.com/watch?v=3qEwflif89U>

**Important Books/Journals for further learning including the page nos.:**

Zeki Berk, Food Process Engineering and Technology, Academic press, 2009, Pg. No. – 511-516.

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LECTURE HANDOUTS

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BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : IV

Date of Lecture:

**Topic of Lecture:** Freezing

**Introduction :** Food Freezing may be defined as the processing of food by lowering the temperature so that almost all of the water inside become frozen

**Prerequisite knowledge for Complete understanding and learning of Topic:**  
Basics of Biology and General engineering subjects

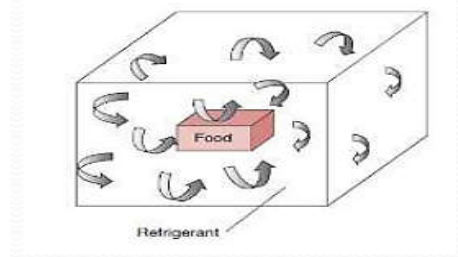
**Detailed content of the Lecture:**

**Direct-Contact Systems**

Several freezing systems for food operate with direct contact between the refrigerant and the product

In most situations, these systems will operate more efficiently since there are no barriers to heat transfer between the refrigerant and the product.

The refrigerants used in these systems may be low-temperature air at high speeds or liquid refrigerants with phase change while in contact with the product surface.

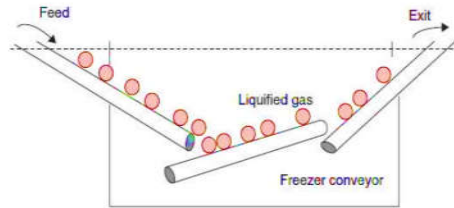


**Immersion freezing**

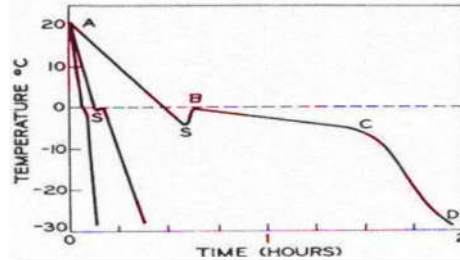
By immersion of the food product in liquid refrigerant, the product surface is reduced to a very low temperature.

Assuming the product objects are relatively small, the freezing process is accomplished very rapidly .

For typical products, the freezing time is shorter than for the air-blast or fluidized-bed systems.



Characteristic curve: freezing curve



Product	°C
Milk, eggs	-0.5
Meat	-1.7 → -2.2
Fish	-0.6 → -2.0
Vegetables	-0.8 → -2.8
Fruit	-0.9 → -2.7
1 M saccharose solution	-2.65
1 M NaCl solution	-3.45

Video Content / Details of website for further learning (if any):

<https://www.youtube.com/watch?v=3qEwflif89U>

**Important Books/Journals for further learning including the page nos.:**

Zeki Berk, Food Process Engineering and Technology, Academic press, 2009, Pg. No. – 517 -525.

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Rasipuram - 637 408, Namakkal Dist., Tamil Nadu



LECTURE HANDOUTS

L 33

BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : IV

Date of Lecture:

**Topic of Lecture:** Irradiation

**Introduction :** Food irradiation is a processing and preservation technique with similar results to freezing or pasteurisation. During this procedure, the food is exposed to doses of ionising energy, or radiation.

**Prerequisite knowledge for Complete understanding and learning of Topic:**

Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

Food irradiation is used to improve food safety by extending product shelf life (preservation), reducing the risk of food borne illness, delaying or eliminating sprouting or ripening, by sterilization of foods, and as a means of controlling insects and invasive pests.

Food irradiation extends the shelf life of irradiated foods by effectively destroying organisms responsible for spoilage and food borne illness and inhibiting sprouting.

Consumer perception of foods treated with irradiation is more negative than those processed by other means.

The food is never in contact with the ionizing source, but still kills the living bacteria in the food.

All independent research, the U.S. Food and Drug Administration (FDA), the World Health Organization (WHO), the Centers for Disease Control and Prevention (CDC), and U.S. Department of Agriculture (USDA) have performed studies that confirm irradiation to be safe.

In order for a food to be irradiated in the US, the FDA will still require that the specific food be thoroughly tested for irradiation safety.

The radiation absorbed dose is the amount energy absorbed per unit weight of the target

Dose is used because, when the same substance is given the same dose, similar changes are observed in the target material(Gy or J/kg).

Dosimeters are used to measure dose, and are small components that, when exposed to ionizing radiation, change measurable physical attributes to a degree that can be correlated to the dose received.

<b>Levels of food irradiation.</b>		
	<b>Applications</b>	<b>Dose (kGy)</b>
<b>Low dose (up to 1 kGy)</b> <b>Radurization</b>	Inhibit sprouting (potatoes, onions, yams, garlic)	0.06 - 0.2
	Delay in ripening (strawberries, potatoes)	0.5 - 1.0
	Prevent insect infestation (grains, cereals, coffee beans, spices, dried nuts, dried fruits, dried fish, mangoes, papayas)	0.15 - 1.0
	Parasite control and inactivation (tape worm, trichina)	0.3 - 1.0
<b>Medium dose (1 kGy to 10 kGy)</b> <b>Radicidation</b>	Extend shelf-life (raw and fresh fish, seafood, fresh produce, refrigerated and frozen meat products)	1.0 - 7.0
	Reduce risk of pathogenic and spoilage microbes (meat, seafood, spices, and poultry)	1.0 - 7.0
	Increased juice yield, reduction in cooking time of dried vegetables	3.0 - 7.0
<b>High dose (above 10 kGy)</b> <b>Rappertization</b>	Enzymes (dehydrated)	10.0
	Sterilization of spices, dry vegetable seasonings	30.0 max
	Sterilization of packaging material	10.0 - 25.0
	Sterilization of foods ( for NASA and hospitals)	44.0

**Video Content / Details of website for further learning (if any):**

<https://www.youtube.com/watch?v=kRDZNgkc9CI>

**Important Books/Journals for further learning including the page nos.:**

Zeki Berk, Food Process Engineering and Technology, Academic press, 2009, Pg. No. – 533-542.

**Course Faculty**

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LECTURE HANDOUTS

L 34

BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : IV

Date of Lecture:

**Topic of Lecture:** Microwave heating

**Introduction :** Microwaves can preserve fruits and vegetables by heating, pasteurizing and sterilizing foods using electromagnetic radiation in the microwave frequency range.

**Prerequisite knowledge for Complete understanding and learning of Topic:**  
Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

- Microwaves are part of electromagnetic spectrum in the frequency range falling between radio and infrared region.
- Two frequencies have been set aside for exclusive use of microwave heating application namely 915 MHz and 2450 MHz.
- Microwave heating is a method that offers technique of heating requiring neither conduction nor convection.
- Microwave generates heat within the food rapidly raising the temperature to the desired extent.
- Special oscillator tubes called magnetrons and klystrons, which generate the microwaves are used.
- These devices convert low frequency electrical energy into hundreds and thousands of megacycles.
- Heating with microwave frequency involves primarily two mechanisms dielectric and ionic. Water in the food is often the primary component responsible for dielectric heating.
- Due to their dipolar nature, water molecules try to follow the electric field associated with electromagnetic radiation as it oscillates at the very high frequency.
- Such oscillation of trip molecules produces heat.
- The microwaves are generated by special oscillator tubes called "Magnetrons and Klystron".

- The electromagnetic energy, at microwave frequency is conducted through a coaxial tube or wave guide at a point of usage.
- Both Magnetron and Klystron are electron tubes which generate microwaves.
- Application of Microwave in dairy and Food Processing
- Baking: for internal heating microwave, for external heating hot air (electric coil) or infrared for crust formation.
- Concentrating: concentration of heat sensitive fluids and slurries at relatively low temperature in relatively short time.
- Cooking: it cooks relatively larger pieces without high temperature gradients between surface and interior (for continuous cooking of meals).
- Curing: effective for glue-line curing of laminates (as in package) without direct heating of the laminate themselves.
- Drying: microwave selectively heats water with little direct heating of most solids. Drying is uniform throughout the product, drying at relatively low temperature.
- Enzyme inactivation (blanching): rapid and uniform heating inactivates enzymes, so it is adapted for blanching of fruits and vegetables without leaching losses associated with hot water or steam and it does not overcook the outside before core enzymes are inactivated.
- Finish drying: when most of the water has been removed by conventional drying, microwaves remove the last traces of moisture from the interior of the product quickly, and without overheating the already dried material.
- Freeze drying: the ability of the microwave energy to selectively heat ice crystals in matter makes it attractive for accelerating the final stages of freeze drying.

**Video Content / Details of website for further learning (if any):**

<https://www.youtube.com/watch?v=anPTACvth1E>

**Important Books/Journals for further learning including the page nos.:**

Zeki Berk, Food Process Engineering and Technology, Academic press, 2009, Pg. No. – 522-528.

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LECTURE HANDOUTS

L

BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : IV Date of Lecture:

**Topic of Lecture:** Sterilization and pasteurization

**Introduction :** The moderate heat treatment of pasteurization allows the destruction of pathogenic microorganisms present in their vegetative form, and a large number of spoilage microorganisms.

**Prerequisite knowledge for Complete understanding and learning of Topic:**  
Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

Pasteurisation is a process in which packaged and non-packaged foods (such as milk and fruit juice) are treated with mild heat, usually to less than 100°C (212°F), to eliminate pathogens and extend shelf life.

The process is intended to destroy or deactivate organisms and enzymes that contribute to spoilage or risk of disease, including vegetative bacteria, but not bacterial spores.

Since pasteurization is not sterilization, and does not kill spores, a second "double" pasteurization will extend the quality by killing spores that have germinated.

**Some examples of convention pasteurization treatments**

Product	Temperature	Time	Remark
Milk	62.8°C	30 min	LTH
Milk	71.7°C	15 sec	HTST
Milk	137.8°C	2 sec	UHT
Ice-Cream	71.1°C	30 min	LTH
Ice-Cream	82.2°C	16-20 sec	HTST
Grape Wines*	82-85°C	1 min	in bulk
Fruit Wines*	62.8°C	depends	bottled hot
Beer	60°C	depends	bottled hot
Dried fruits	65.6-85°C	30-90 min	
Grape Juice*	76.7°C	30 min	
Apple Juice*	85-87.8°C	30-60sec	bottled in bulk
Carbonated Drinks*	65.6	30 min	in common

Pasteurization is a mild heat treatment of liquid foods (both packaged and unpackaged) where products are typically heated to below 100 °C.

The heat treatment and cooling process are designed to inhibit a phase change of the product.

The acidity of the food determines the parameters (time and temperature) of the heat treatment as well as the duration of shelf life.

Parameters also take into account nutritional and sensory qualities that are sensitive to heat.

In acidic foods (pH <4.6), such as fruit juice and beer, the heat treatments are designed to inactivate enzymes and destroy spoilage microbes.

Due to the low pH of acidic foods, pathogens are unable to grow.

The shelf-life is thereby extended several weeks.

In less acidic foods (pH >4.6), such as milk and liquid eggs, the heat treatments are designed to destroy pathogens and spoilage organisms (yeast and molds).

Not all spoilage organisms are destroyed under pasteurization parameters, thus subsequent refrigeration is necessary.

**Video Content / Details of website for further learning (if any):**

<https://www.youtube.com/watch?v=kN2uUn1IU98>

**Important Books/Journals for further learning including the page nos.:**

Zeki Berk, Food Process Engineering and Technology, Academic press, 2009, Pg. No. – 561-568.

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LECTURE HANDOUTS

L 36

BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : IV

Date of Lecture:

**Topic of Lecture:** Fermentation and pickling; packing methods

**Introduction :** Fermentation produces lactic acid to help preserve the food. Some foods are brined, but not cured. These will have vinegar added to them for preservation. Fresh Pack or Quick Process Pickles - This method involves a boiling hot pickling mixture of vinegar, spices, and seasonings

**Prerequisite knowledge for Complete understanding and learning of Topic:**

Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

Pickling is the process of preserving or extending the shelf life of food by either anaerobic fermentation in brine or immersion in vinegar.

The pickling procedure typically affects the food's texture, taste and flavor.

The resulting food is called a pickle, or, to prevent ambiguity, prefaced with pickled.

Foods that are pickled include vegetables, fruits, meats, fish, dairy and eggs.

A distinguishing characteristic is a pH of 4.6 or lower, which is sufficient to kill most bacteria.

Pickling can preserve perishable foods for months.

Antimicrobial herbs and spices, such as mustard seed, garlic, cinnamon or cloves, are often added.

If the food contains sufficient moisture, a pickling brine may be produced simply by adding dry salt.

For example, sauerkraut and Korean kimchi are produced by salting the vegetables to draw out excess water.

Salient Features

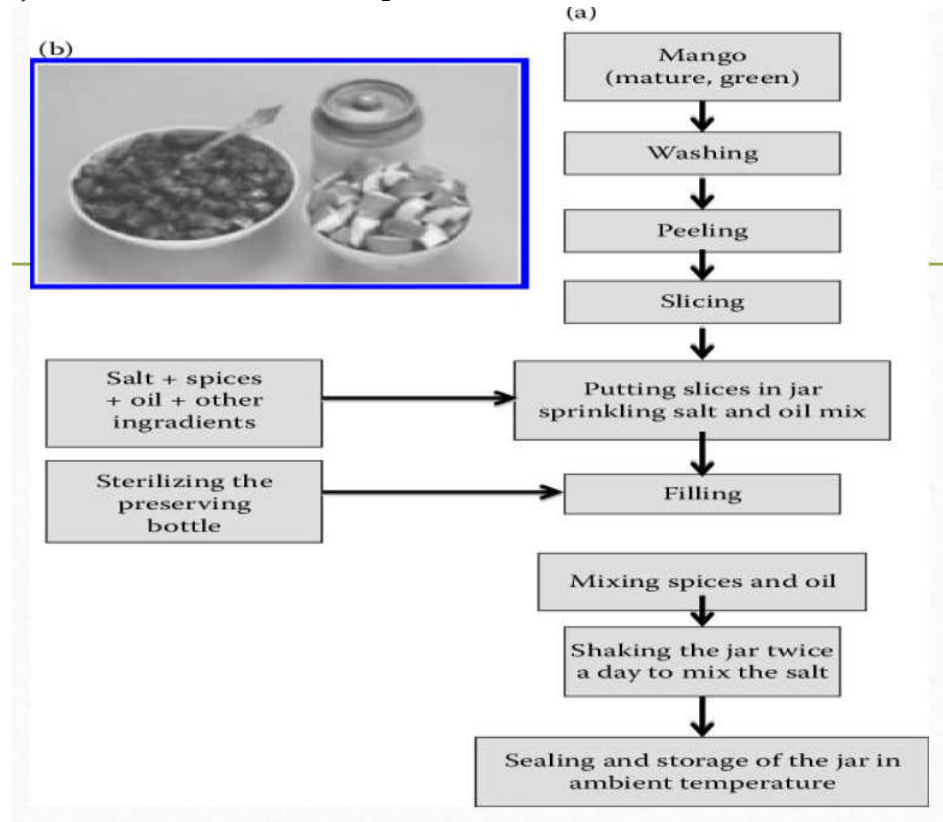
- Brining or coming.
- Food salty or sour taste.
- pH less than 4.6
- Preserve perishable foods.
- Antimicrobial herbs and spices.

## 2. Relishes

### 3. Fruit pickles

#### Pickling Equipment

- Utensils made of zinc, iron, brass, copper, or galvanized metal should **not** be used.
- For fresh-pack pickling large container made of stainless steel, glassware.
- For fermenting and brining, a crock or stone jar, an unchipped enamel-lined pan, a glass jar, a bowl, used for small quantities



Video Content / Details of website for further learning (if any):

<https://www.youtube.com/watch?v=VFR2TFgrzrY>

Important Books/Journals for further learning including the page nos.:

Zeki Berk, Food Process Engineering and Technology, Academic press, 2009, Pg. No. – 429-449.

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LECTURE HANDOUTS

L 37

BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : V Date of Lecture:

**Topic of Lecture:** Food packaging

**Introduction** Food packaging is packaging for food. A package provides protection, tampering resistance, and special physical, chemical, or biological needs. It may bear a nutrition facts label and other information about food being offered for sale.

**Prerequisite knowledge for Complete understanding and learning of Topic:**

Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

- Physical protection - The food enclosed in the package may require protection from shock, vibration, compression, temperature, bacteria, etc.
- Barrier protection - A barrier from oxygen, water vapor, dust, etc., is often required. Permeation is a critical factor in design.
- Containment or agglomeration - Small items are typically grouped together in one package to allow efficient handling
- Information transmission - Packages and labels communicate how to use, transport, recycle, or dispose of the package or product.
- Marketing - The packaging and labels can be used by marketers to encourage potential buyers to purchase the product.
- Security - Packaging can play an important role in reducing the security risks of shipment.
- Convenience - Packages can have features which add convenience in distribution, handling, stacking, display, sale, opening, reclosing, use, and reuse.
- Portion control - Single-serving packaging has a precise amount of contents to control usage. Bulk commodities (such as salt) can be divided into packages that are a more

sealed one-liter bottles of milk, rather than having people bring their own bottles to fill themselves.

Primary packaging is the main package that holds the food that is being processed.

Secondary packaging combines the primary packages into one box being made.

Tertiary packaging combines all of the secondary packages into one pallet.

**Video Content / Details of website for further learning (if any):**

<https://www.youtube.com/watch?v=M0bPuhybRt4>

**Important Books/Journals for further learning including the page nos.:**

Zeki Berk, Food Process Engineering and Technology, Academic press, 2009, Pg. No. – 545 - 547.

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LECTURE HANDOUTS

L 38

BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : V Date of Lecture:

**Topic of Lecture:** Basic packaging materials

**Introduction :** Materials that have traditionally been used in food packaging include glass, metals (aluminum, foils and laminates, tinplate, and tin-free steel), paper and paperboards, and plastics. Moreover, a wider variety of plastics have been introduced in both rigid and flexible forms.

**Prerequisite knowledge for Complete understanding and learning of Topic:**

Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

Numerous reports industry associations agree that use of smart indicators will increase.

There are a number of different indicators with different benefits for food producers, consumers and retailers.

Temperature recorders are used to monitor products shipped in a cold chain and to help validate the cold chain.

Digital temperature data loggers measure and record the temperature history of food shipments.

They sometimes have temperatures displayed on the indicator or have other output (lights, etc.):

The data from a shipment can be downloaded (cable, RFID, etc.) to a computer for further analysis.

These help identify if there has been temperature abuse of products and can help determine the remaining shelf life.

They can also help determine the time of temperature extremes during shipment so corrective measures can be taken.

Time temperature indicators integrate the time and temperature experienced by the indicator and adjacent foods.

Some use chemical reactions that result in a color change while others use the migration of a dye through a filter media.

Radio frequency identification is applied to food packages for supply chain control and has shown a significant benefit in allowing food producers and retailers create full real time visibility of their supply chain.

Plastic packaging being used is usually non-biodegradable due to possible interactions with the food.

Also, biodegradable polymers often require special composting conditions to properly degrade.

Normal sealed landfill conditions do not promote biodegradation.

Biodegradable plastics includes biodegradable films and coatings synthesized from organic materials and microbial polymers.

Some package materials are edible.

There is an increasing development and production of food packaging materials containing substances and realising systems intended to extend shelf life: carbon dioxide (CO<sub>2</sub>) emitters.

Barcodes have been used for decades in packaging many products.

2D barcodes used in autocoding are increasingly applied to food packaging to ensure products are correctly packaged and date coded.

The ability of a package to fully empty or dispense a viscous food is somewhat dependent on the surface energy of the inner walls of the container.

The use of superhydrophobic surfaces is useful but can be further improved by using new lubricant-impregnated surfaces.

**Video Content / Details of website for further learning (if any):**

<https://www.youtube.com/watch?v=Nxla-0kwWnk>

**Important Books/Journals for further learning including the page nos.:**

Zeki Berk, Food Process Engineering and Technology, Academic press, 2009, Pg. No. –548-553.

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LECTURE HANDOUTS

L 39

BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : V Date of Lecture:

**Topic of Lecture:** Types of packaging materials

**Introduction :** Materials that have traditionally been used in food packaging include glass, metals (aluminum, foils and laminates, tinplate, and tin-free steel), paper and paperboards, and plastics. Moreover, a wider variety of plastics have been introduced in both rigid and flexible forms.

**Prerequisite knowledge for Complete understanding and learning of Topic:**

Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

Packaging materials come in different shapes with various functions relative to their properties.

It is essential for the packaging material to have a balance between its shape and its function. Given the packaging's main purpose of preservation, containment, and protection of food, the packaging material can be rigid, flexible, or semi-flexible.

Rigid packages include bottles, trays, cans, jars, and caps.

Flexible packages include bags, cling wraps, bubble wraps, shrink wraps, squeezable tubes, foam trays, stand-up packets, and vacuum bags.

Semi-flexible packages include caps and closures, boxes, and tetra packs.

Food packaging types differ in various ways, such as weight, size, durability, and barrier properties

Food Packaging Materials

Metals

There are various forms of metal food packaging, such as cans, tubes, containers, films, caps and closures. Cans are generally made of aluminium or steel, and they are the most commonly used metal packages of food and beverages.

Aluminium

Aluminium is generally used for beverage cans, foils, tubes, trays, pouches, and coffee capsules. It has good resistance to temperature fluctuations and acts as an excellent gas barrier, which extends the food's shelf-life.

Steel

Steel is used for cans, containers, caps, and closures. Organic coatings are also required to

### Paper

Paper is one of the oldest packaging materials, dating back to the 17th century . Paper and paperboard are mostly used for packaging dry foods.

### Glass

Glass is another permanent packaging material that has been used for millennia. The earliest evidence of glass making was around 7000 B.C

### Plastics

Plastics are the most common and most wide-ranging materials used for food packaging. Some of their widespread uses are bottles, trays, bags, foils, cups, pots, pouches, and bowls. The volume of plastic allocated to food packaging amounts for around 40% of

### **Video Content / Details of website for further learning (if any):**

<https://www.youtube.com/watch?v=bQ19gZLKfRY>

### **Important Books/Journals for further learning including the page nos.:**

Zeki Berk, Food Process Engineering and Technology, Academic press, 2009, Pg. No. – 554-557.

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LECTURE HANDOUTS

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BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : V Date of Lecture:

**Topic of Lecture:** HACCP - Introduction

**Introduction :** HACCP stands for Hazard Analysis Critical Control Point. It is a system where the food manufacturer or handler identifies the potential hazards that can be introduced while the food is in the production process or in the care of the organization, and determines how those hazards can be eliminated.

**Prerequisite knowledge for Complete understanding and learning of Topic:**

Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

The Hazard Analysis and Critical Control Points (HACCP) system is a logical, scientific approach to controlling hazards in meat production.

HACCP is a preventive system assuring the safe production of food products.

The application of HACCP is based on technical and scientific principles that assure food safety.

An ideal application would include all processes from the farm to the table.

The principle of HACCP can be applied to production, meat slaughter and processing, shipping and distribution, food service and in home preparation.

HACCP is a systematic preventative system that uses common sense application of scientific principles.

The most important aspect of HACCP is that it is a preventative system rather than an inspection system of controlling food safety hazards.

Prevention of hazards cannot be accomplished by end product inspection, so controlling the production process with HACCP offers the best approach.

The application of HACCP is systematic because structured hazard analysis and

The process is common sense in that each processor understands their operation and is best able to assess controlling the process.

HACCP is also science-based and so the controls that are placed in the process should be based on scientific information.

The HACCP system has two major components.

The HA of HACCP represents the logic in the hazard analysis which identifies the where and how of hazards.

The CCP of HACCP represents the critical control points that provide the control of the process and the proof of the control.

The end objective of HACCP is to make the product as safe as possible and to be able to prove that the product was processed as safe as possible.

This does not mean that HACCP provides 100% assurance of food safety to consumers, but does mean that a meat processing company is doing the best job possible for safe food production.

The assurance of safety comes from the process of identifying the hazards, establishing controls for the identified hazards, monitoring the controls and periodically verifying that the system works.

**Video Content / Details of website for further learning (if any):**

<https://www.youtube.com/watch?v=AgocMgeKZVw>

**Important Books/Journals for further learning including the page nos.:**

S Clark, S Jung, & B Lamsal, Food Processing Principles and Applications, Wiley, 2014, Pg. No. – 535-538.

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LECTURE HANDOUTS

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BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : V

Date of Lecture:

**Topic of Lecture:** HACCP Principles

**Introduction :** HACCP is a management system in which food safety is addressed through the analysis and control of biological, chemical, and physical hazards from raw material production, procurement and handling, to manufacturing, distribution and consumption of the finished product.

**Prerequisite knowledge for Complete understanding and learning of Topic:**

Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

HACCP is described as "a food safety program developed for astronauts; focuses on preventing hazards that could cause food-borne illnesses by applying science-based controls, from raw material to finished products.

Traditionally, industry and regulators have depended on spot-checks of manufacturing conditions and random sampling of final products to ensure safe food.

This approach, however, tends to be reactive, rather than preventive, and can be less efficient than the new system.

HACCP offers a number of advantages over the past system. Most importantly,

HACCP:

focuses on identifying and preventing hazards that may render food unsafe is based on sound science permits more efficient and effective government oversight, primarily because the recordkeeping allows investigators

To see how well a firm is complying with food safety laws and following practices that reduce the risk of unsafe food over a period rather than how well it is doing on any given day places responsibility for ensuring food safety appropriately on the food manufacturer or

barriers to international trade.

Principle 1: Conduct a hazard analysis.

Principle 2: Determine the critical control points (CCPs).

Principle 3: Establish critical limits (CL).

Principle 4: Establish monitoring procedures.

Principle 5: Establish corrective actions.

Principle 6: Establish verification procedures.

Principle 7: Establish record-keeping and documentation procedures.

**Video Content / Details of website for further learning (if any):**

[https://www.youtube.com/watch?v=\\_xWhEdcKsYU](https://www.youtube.com/watch?v=_xWhEdcKsYU)

**Important Books/Journals for further learning including the page nos.:**

S Clark, S Jung, & B Lamsal, Food Processing Principles and Applications, Wiley, 2014, Pg. No. – 539-542.

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BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : V Date of Lecture:

**Topic of Lecture:** Implementation and maintenance of the HACCP plan

**Introduction :** HACCP is a management system in which food safety is addressed through the analysis and control of biological, chemical, and physical hazards from raw material production, procurement and handling, to manufacturing, distribution and consumption of the finished product.

**Prerequisite knowledge for Complete understanding and learning of Topic:**

Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

The successful implementation of a HACCP plan is facilitated by commitment from top management.

The next step is to establish a plan that describes the individuals responsible for developing, implementing and maintaining the HACCP system.

Initially, the HACCP coordinator and team are selected and trained as necessary.

The team is then responsible for developing the initial plan and coordinating its implementation.

Product teams can be appointed to develop HACCP plans for specific products.

An important aspect in developing these teams is to assure that they have appropriate training.

The workers who will be responsible for monitoring need to be adequately trained.

Upon completion of the HACCP plan, operator procedures, forms and procedures for monitoring and corrective action are developed.

Often it is a good idea to develop a timeline for the activities involved in the initial implementation of the HACCP plan.

record-keeping, corrective action procedures and other activities as described in the HACCP plan.

Maintaining an effective HACCP system depends largely on regularly scheduled verification activities.

The HACCP plan should be updated and revised as needed.

An important aspect of maintaining the HACCP system is to assure that all individuals involved are properly trained so they understand their role and can effectively fulfill their responsibilities.

**Video Content / Details of website for further learning (if any):**

<https://www.youtube.com/watch?v=X2kw40KyVnY>

**Important Books/Journals for further learning including the page nos.:**

S Clark, S Jung, & B Lamsal, Food Processing Principles and Applications, Wiley, 2014, Pg. No. – 545-557.

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LECTURE HANDOUTS

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BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : V Date of Lecture:

**Topic of Lecture:** Introduction to Food Labeling

**Introduction :** Food labeling provides consumers with information about their food, helping them to make informed decisions about which food to buy. It is important that this information is accurate and not misleading.

**Prerequisite knowledge for Complete understanding and learning of Topic:**  
Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

Food Labelling serves as a primary link of communication between the manufacturer or packer of food on the one hand and distributor, seller, and user or consumer on the other hand.

By way of labeling the manufacturer introduces his product to his distributor or seller and to the target consumer or user of his product by providing all the information regarding his product on the label.

The manufacturer can impress the consumer or its target user that it is the product of his choice, which suits him/her according to his/her needs.

Thereby, the correct and required labeling undoubtedly promotes the sale of his product.

As per Food Laws every packaged food article has to be labeled and it has to be labeled in accordance to the law applicable in the country of the user.

Every packaged food article for the domestic use has to be labeled in accordance to the related Indian Food Law i.e.

Food Safety and Standards (Packaging and Labelling) Regulations, 2011, notified by Food Safety and Standards Authority of India (FSSAI).

The packaged food for export has to be labeled in accordance to the food laws and

In order to safe guard the interest of the consumer, The Food Safety and Standards (Packaging and Labelling) Regulations, 2011, provides that every packaged food article has to be labeled and it shall provide the following information

- The name of Food
- List of Ingredients,
- Nutritional Information,
- Declaration regarding Veg or non-veg,
- Declaration regarding Food Additives,
- Name and complete address of the manufacturer or packer
- Net Quantity,
- Code No./Lot No./Batch No.,
- Date of manufacture or packing,
- Best Before and Use By Date,
- Country of Origin for imported food and
- Instructions for use

**Video Content / Details of website for further learning (if any):**

<https://www.youtube.com/watch?v=nXicJcXV0M>

**Important Books/Journals for further learning including the page nos.:**

S Clark, S Jung, & B Lamsal, Food Processing Principles and Applications, Wiley, 2014, Pg. No. – 171-183.

**Course Faculty**

**Verified by HOD**



# MUTHAYAMMAL ENGINEERING COLLEGE

(An Autonomous Institution)

(Approved by AICTE, New Delhi, Accredited by NAAC & Affiliated to Anna University)  
Rasipuram - 637 408, Namakkal Dist., Tamil Nadu



LECTURE HANDOUTS

L 44

BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : V Date of Lecture:

**Topic of Lecture:** Labeling regulations

**Introduction :** Labeling means to introduce a product for sale by providing comprehensive information about the product to the target consumer market besides ensuring safety standards of the regulatory body. A useful elaborated information about the label leaves good impression on the consumers seeking required details about the product

**Prerequisite knowledge for Complete understanding and learning of Topic:**  
Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

This Packaging and Labelling Regulations are summarized in the following modules:

- General Requirements and Manner of Labelling
- The name of Food and List of Ingredients,
- Nutritional Information,
- Declaration regarding Veg or Non-veg,
- Declaration regarding Food Additives,
- Name of Manufacturer or packer and Country of Origin
- Net Quantity
- Lot No. /Batch No./Code No.
- Date of manufacture or packing and Best Before or Use By Date,
- Instructions for Use
- Specific Requirements and Manner of Labelling for Infant Milk Substitute and Infant Foods

irradiated foods

- Specific Requirements and Manner of Labelling of Other Food Products
- Specific Restrictions on product labels and advertisement
- Exemptions from labeling requirements

**Video Content / Details of website for further learning (if any):**

[https://www.youtube.com/watch?v=TBhB\\_HMzl7E](https://www.youtube.com/watch?v=TBhB_HMzl7E)

**Important Books/Journals for further learning including the page nos.:**

S Clark, S Jung, & B Lamsal, Food Processing Principles and Applications, Wiley, 2014, Pg. No. – 184-186.

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LECTURE HANDOUTS

L 45

BIOTECH

III/V

Course Name with Code : 16BTE01 / FOOD TECHNOLOGY

Course Faculty : Dr. N. SARAVANAN

Unit : V Date of Lecture:

**Topic of Lecture:** Food labeling process

**Introduction** Food labelling standards are given by FSSAI under Food Safety and Standards (Packaging and labelling) Regulations, 2011. It states that every pre packaged food must possess a label displaying information which shall not be false, deceptive or misleading in any manner.

**Prerequisite knowledge for Complete understanding and learning of Topic:**

Basics of Biology and General engineering subjects

**Detailed content of the Lecture:**

Food Safety and Standards Authority of India (FSSAI) is an autonomous body established by the Government of India under the Ministry of Health & Family Welfare.

It usually sets standards for food so that there is no chaos in the minds of consumers, traders, manufacturers and investors.

In the food and beverage packaging, there is one important aspect called food labelling.

On the food labelling, there are crucial aspects related to the product and even of the producer.

The information is usually for the safety of the consumer and it is mandatory that every packaged food article has to be labeled and it shall provide the following information

Name of the food:

Name of the food/product is one of the first FSSAI Guidelines on Labelling of Food Products.

As the name suggests, the name of the food product should be in clear format on the packaged product in clear font.

List of Ingredients means the elements which have been utilized for making the final product.

It is very necessary that the manufacturer mentions all the ingredients fairly and do not cheat the end-consumer. The manufacturer can land in problem if tends to cheat the consumer.

Nutritional Information means the calories which gets from fats, saturated fat, trans fat, cholesterol, sodium, carbohydrates, dietary fiber, sugars, protein, vitamin A, vitamin C, calcium, and iron present in the product. The calories are mentioned on all the products

Hence, according to the FSSAI Guidelines on Labelling of Food Products, the manufacturer on the label should mention whether the product is vegetarian or non-vegetarian. Whether the product is vegetarian or non-vegetarian can easily be known by just looking at the small sign present on the corner of the label. Green colour indicates the product being vegetarian and red colour indicates that the product is non-vegetarian. Food additives are substances which are added to food in order to preserve flavor or enhance its taste and appearance. Hence, it is very necessary to give a declaration regarding the additives added on the label or the package. In this, the name of the manufacturer and place of the manufacturing is usually mentioned. The manufacturer has to give complete address of his factory which includes street address, city, state, and zip code. Without mentioning any of these, products can be considered fake in the market. Net Quantity is also FSSAI Guidelines on Labelling of Food Products. Net Quantity here refers to the weight of the product. The weight of the product and the packaging weight are usually combined together and then mentioned in the Net Quantity.

**Video Content / Details of website for further learning (if any):**

<https://www.youtube.com/watch?v=i6FFVgaqz94>

**Important Books/Journals for further learning including the page nos.:**

S Clark, S Jung, & B Lamsal, Food Processing Principles and Applications, Wiley, 2014, Pg. No. – 187-190.

**Course Faculty**

**Verified by HOD**