

FOOD PROCESS ENGINEERING

PRAVEENA.S FOOD SAEFTY OFFICER - FSSAI

FOOD PROCESS ENGINEERING

Course Title: Food Process Engineering

To know about food processing techniques, preservation methods, processing of animal and plant products, milk technology, and beverage production.

1. INTRODUCTION TO FOOD PROCESSING

1.1 Definition of Food Processing

Food processing refers to the **conversion of raw agricultural products into consumable food products** through physical, chemical, and biological methods.

It improves:

- | |
|---|
| <ul style="list-style-type: none">• Shelf life• Safety• Taste• Nutritional value• Convenience |
|---|

1.2 Importance of Food Processing

Food processing plays a crucial role in the food industry because it:

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|---|
| 1. Prevents food spoilage |
| 2. Reduces food waste |
| 3. Ensures food safety |
| 4. Enhances food quality |
| 5. Improves food availability throughout the year |
| 6. Supports large-scale food distribution |
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2. TYPES OF FOODS

Foods are generally classified into:

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1. Perishable Foods

- Milk
- Fruits
- Vegetables
- Meat
- Fish

These spoil quickly due to microbial growth.

2. Semi-Perishable Foods

• Eggs
• Potatoes
• Onions
• Nuts

They have moderate shelf life.

3. Non-Perishable Foods

• Cereals
• Pulses
• Sugar
• Flour

These can be stored for long periods.

3. UNIT OPERATIONS IN FOOD PROCESSING

Unit operations are the **basic steps involved in food processing industries.**

3.1 Refining and Milling

- Used mainly for cereals and grains.
- Milling converts grains into flour.
- Refining removes bran and germ to improve texture and shelf life.

Example:

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- Wheat → Wheat flour
 - Rice → Polished rice
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3.2 Canning

Canning is a **preservation technique where food is sealed in airtight containers and heat treated.**

Steps:

1. Cleaning
2. Blanching
3. Filling
4. Exhausting
5. Sealing
6. Sterilization
7. Cooling

Advantages:

- Long shelf life
 - Prevents microbial contamination
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3.3 Concentration

Concentration removes **water from food products.**

Example:

- Fruit juice concentrates
- Milk concentration

Methods:

- Evaporation
 - Reverse osmosis
 - Freeze concentration
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3.4 Freezing

Freezing preserves food by **reducing temperature below -18°C** .

Benefits:

- Slows microbial growth
- Maintains nutritional quality
- Extends shelf life

Examples:

- Frozen vegetables
 - Frozen fish
 - Frozen meat
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3.5 Drying

Drying removes moisture from foods to prevent microbial growth.

Methods:

• Sun drying
• Tray drying
• Spray drying
• Freeze drying

Examples:

- Dried fruits
 - Milk powder
 - Spices
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3.6 Pasteurization

Pasteurization involves **heating food to kill harmful microorganisms without affecting quality**.

Commonly used for milk and beverages.

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Methods:

1. **LTLT (Low Temperature Long Time)**
63°C for 30 minutes
 2. **HTST (High Temperature Short Time)**
72°C for 15 seconds
 3. **UHT (Ultra High Temperature)**
135–150°C for 2–5 seconds
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3.7 Sterilization

Sterilization destroys **all microorganisms including spores.**

Example:

- Canned foods
 - UHT milk
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3.8 Fermentation

Fermentation is a **biochemical process where microorganisms convert sugars into alcohol or acids.**

Examples:

- Yogurt
 - Bread
 - Pickles
 - Vinegar
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3.9 Irradiation

Food irradiation uses **ionizing radiation to kill microbes and pests.**

Benefits:

- Increases shelf life

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- Reduces foodborne diseases
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3.10 Packaging

Food packaging protects food from:

- Contamination
- Physical damage
- Moisture
- Oxygen

Types of packaging materials:

- Glass
 - Metal
 - Plastic
 - Paper
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4. FOOD PRESERVATION

4.1 Principles of Food Preservation

Food preservation prevents spoilage by controlling:

1. Microorganisms
 2. Enzyme activity
 3. Chemical reactions
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4.2 Methods of Food Preservation

1. Low Temperature

- Refrigeration
- Freezing

2. High Temperature

- Pasteurization

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- Sterilization

3. Drying

Removes moisture.

4. Chemical Preservation

Use of preservatives such as:

- Salt
- Sugar
- Vinegar
- Sodium benzoate

5. Fermentation

Production of acids or alcohol to prevent spoilage.

5. FOOD ADULTERATION

5.1 Definition

Food adulteration refers to **adding inferior substances to food or removing valuable components.**

It reduces food quality and can cause health problems.

5.2 Common Food Adulterants

Food	Adulterant
Milk	Water, starch
Turmeric	Metanil yellow
Pepper	Papaya seeds
Tea	Iron filings
Coffee	Chicory

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5.3 Simple Detection Methods

Milk:

- Water detection by lactometer
- Starch detection using iodine

Turmeric:

- Metanil yellow detection using acid test

Pepper:

- Papaya seeds float in water
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6. FOOD STORAGE

6.1 Cold Storage

Cold storage preserves food at **low temperatures (0–5°C)**.

Commonly used for:

- Fruits
- Vegetables
- Meat
- Dairy products

Advantages:

- Slows microbial growth
 - Maintains food quality
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7. EGG PROCESSING

7.1 Structure of Egg

Egg consists of:

- Shell

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- Albumen (egg white)
 - Yolk
 - Air cell
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7.2 Composition

Egg contains:

- Protein
 - Fat
 - Vitamins
 - Minerals
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7.3 Nutritive Value

Egg is considered a **complete protein source**.

Benefits:

- Muscle development
 - Brain function
 - Energy production
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7.4 Preservation of Eggs

Methods include:

- Refrigeration
 - Freezing
 - Drying
 - Oil coating
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7.5 Cooking of Eggs

Common egg preparations:

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- Boiled egg
 - Fried egg
 - Omelette
 - Scrambled egg
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8. MEAT PROCESSING

8.1 Structure of Meat

Meat consists of:

- Muscle fibers
 - Connective tissue
 - Fat
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8.2 Classes of Meat

- Beef
 - Pork
 - Mutton
 - Lamb
 - Poultry
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8.3 Post Mortem Changes

After slaughter:

1. Rigor mortis
 2. Aging
 3. Tenderization
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8.4 Meat Preservation Methods

- Freezing
- Curing

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- Smoking
 - Drying
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9. POULTRY PROCESSING

Steps involved:

1. Slaughtering
 2. Bleeding
 3. Scalding
 4. Defeathering
 5. Evisceration
 6. Chilling
 7. Packaging
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10. FISH PROCESSING

10.1 Composition of Fish

Fish contains:

- High quality protein
 - Omega-3 fatty acids
 - Vitamins
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10.2 Fish Spoilage

Spoilage occurs due to:

- Microbial growth
 - Enzyme activity
 - Oxidation
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10.3 Fish Preservation Methods

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- Icing
 - Freezing
 - Canning
 - Salting
 - Drying
 - Smoking
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11. MILK PROCESSING

11.1 Filtration and Clarification

Removes dirt and impurities.

11.2 Standardization

Adjusting fat content of milk.

Example:

- Whole milk
 - Toned milk
 - Skim milk
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11.3 Homogenization

Homogenization breaks fat globules to prevent cream separation.

11.4 Pasteurization Methods

1. **LTLT Method**
 2. **HTST Method**
 3. **UHT Method**
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11.5 Packaging and Storage

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Milk is packed in:

- Bottles
- Plastic pouches
- Cartons

Stored under refrigeration.

12. PROCESSING OF FRUITS AND VEGETABLES

12.1 Vegetables

Vegetables provide:

- Vitamins
- Minerals
- Fiber

Processing steps:

1. Washing
 2. Peeling
 3. Cutting
 4. Blanching
 5. Canning or freezing
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12.2 Fruits

Fruits are rich in:

- Vitamin C
 - Sugars
 - Antioxidants
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12.3 Fruit Processing Products

Common products include:

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- Fruit juice
 - Jam
 - Jelly
 - Marmalade
 - Squash
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13. BEVERAGES

13.1 Definition

Beverages are **liquid drinks consumed for refreshment or nutrition.**

13.2 Types of Beverages

1. Alcoholic beverages
2. Non-alcoholic beverages

Examples:

- Tea
 - Coffee
 - Fruit juices
 - Soft drinks
-

13.3 Coffee Processing

Steps include:

1. Harvesting
 2. Roasting
 3. Grinding
 4. Brewing
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13.4 Tea Processing

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Types of tea:

- Black tea
- Green tea
- Oolong tea

Steps:

1. Withering
 2. Rolling
 3. Fermentation
 4. Drying
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14. PRACTICAL EXPERIMENTS

Food Adulteration Detection

- Milk adulteration test
- Turmeric adulteration test

Preparation of Pickle

- Selection of vegetables
 - Addition of salt and spices
 - Fermentation and storage
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Egg Practical

- Preservation of eggs
 - Preparation of different omelets
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Milk Practical

- Organoleptic test
 - Specific gravity using lactometer
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Fruit Practical

- Fruit juice preparation
 - Fruit jam preparation
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Beverage Practical

- Preparation of good tea
 - Preparation of coffee
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CONCLUSION

Food process engineering is essential for **ensuring safe, nutritious, and long-lasting food products**. Modern food processing technologies help reduce food waste, improve food security, and support the growing global population.

Understanding the principles of food processing, preservation, and quality control is important for students, researchers, and professionals working in the food industry.
