

# **Handbook on Fruits, Vegetables & Food Processing with Canning & Preservation (3rd Edition)**

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Natural foods such as fruits and vegetables are among the most important foods of mankind as they are not only nutritive but are also indispensable for the maintenance of the health. India is the second largest producer of fruits and vegetables in the world. Fertile soils, a dry climate, clean water and abundant sunlight help the hard working farmers to produce a bountiful harvest. Although there are many similarities between fruits and vegetables, there is one important difference that affects the way that these two types of crop are processed like fruits are more acidic than vegetables. Food processing is the set of methods and techniques used to transform raw ingredients into food or to transform food into other forms for consumption. Food processing typically takes clean, harvested crops or butchered animal products and uses these to produce attractive, marketable and often long shelf-life food products. Canning is a method of preserving food in which the food is processed and sealed in an airtight container. Food preservation is the process of treating and handling food to stop or greatly slow down spoilage (loss of quality, edibility or nutritive value) caused or accelerated by micro organisms. One of the oldest methods of food preservation is by drying, which reduces water activity sufficiently to prevent or delay bacterial growth. Drying also reduces weight, making food more portable. Freezing is also one of the most commonly used processes commercially and domestically for preserving a very wide range of food including prepared food stuffs which would not have required freezing in their unprepared state. Fruits and vegetable processing in India is almost equally divided between the organized and unorganized sector, with the organized sector holding 48% of the share. The present book covers the processing techniques of various types of fruits, vegetables and other food products. This book also contains photographs of equipments and machineries used in fruits, vegetables and food processing along with canning and preservation. This book is an invaluable resource for new entrepreneurs, food technologists, industrialists etc.

## **1. Characteristics of the Food Industry**

Components of the Food Industry

Allied Industries

Interrelated Operations

## **2. Food Quality Assurance**

The Need

A Role for Government

Microbiological Standards

A Role for Industry

Design of Company QA Program

Objectives  
Raw Material Quality Assurance  
In-process Quality Assurance  
Finished Product Quality Assurance

### 3. Quality Factors in Foods

Appearance Factors

Color and Gloss

Consistency

Textural Factors

Measuring Texture

Texture Changes

Flavor Factors

Additional Quality Factors

Quality Standards

Planned Quality Control

### 4. Preserve, Candied and Crystallized Fruits and Vegetables

Preserve

General considerations

Candied Fruits/Vegetables

Process

Glazed Fruits/Vegetables

Crystallized Fruits/Vegetables

Problems in Preparation of Preserves and Candied Fruits

### 5. Food Preservation by Fermentation

Life with Microorganisms

Fermentation of Carbohydrates

Industrially Important Organisms in Food Preservation

Order of Fermentation

Types of Fermentations of Sugar

Fermentation Controls

Wine

Preservation

Sterilization Filtration

Beer

Vinegar Fermentation

Principles of Vinegar Fermentation

Vinegar Making

Preparation of Yeast Starter

Alcoholic Fermentation

Acetic Fermentation

Cheese

Kinds of Cheese

Cottage Cheese

Swiss Cheese

Blue Cheeses

### 6. Chemical Preservation of Foods

What Are Food Additives?

Importance of Chemical Additives

Legitimate Uses in Food Processing

Undesirable Uses of Additives

- Safety of a Food Additives
- Functional Chemical Additive Applications
- Specific Uses of Chemical Additives
- Additives Permitted and Prohibited in the United States
- Chemical Preservatives
- Microbial Antagonists
- Sorbic Acid
- Antibiotics
- Quality Improving Agents
- Other Chemical Additives
- Artificial Flavoring
- Artificial Coloring

- 7. Cold Preservation and Processing
  - Distinction Between Refrigeration and Freezing
  - Refrigeration and Cool Storage
  - Requirements of Refrigerated Storage
  - Controlled low Temperature
  - Air Circulation and Humidity
  - Modification of Gas Atmospheres
  - Changes in Food During Refrigerated Storage
  - Freezing and Frozen Storage
  - Initial Freezing Point
  - Freezing Curve
  - Changes During Freezing
  - Choice of Final Temperature
  - Food Composition
  - Noncompositional Influences
  - Freezing Methods
  - Air Freezing
  - Packaging Considerations
  - Some Additional Developments

- 8. Heat Preservation and Processing
  - Sterilization
  - Commercially Sterile
  - Pasteurization
  - Blanching
  - Selecting Heat Treatments
  - Heat Resistance of Microorganisms
  - Thermal Death Curves
  - Margin of Safety
  - Heat Transfer
  - Conduction and Convection Heating
  - Cold Point in Food Masses
  - Determining Process Time and Process Lethality
  - Protective Effects of Food Constituents
  - Different Temperature-Time Combinations
  - Heating Before or After Packaging

- 9. Food Pickling and Curing
  - Pickled Fruits and Vegetables
  - Use of Salt Stock

Sour Pickles, Sweet Pickles, Processed Dill Pickles  
Sauerkraut  
Olives  
Fermented And Pickled Products  
Deterioration  
Nutritional Value  
Bloater Damage Control  
Controlled Fermentations in Commercial Brining Tanks  
Brine Recovery  
Defect Reduction  
The Principles of Fish Salting  
The Influence of the Composition of Salt  
Commercial Methods of Salting Fish  
Brine-salting  
Dry-salting  
Comparative Efficiency of Brine-salting and Dry-salting  
Some-curing Processes  
Cold-smoking (Heavy Salt Cure)  
Smoked Salmon  
Hard-smoked Salmon  
Meat Curing and Smoking  
Pickled Meats  
Salt  
Sugar and Corn Syrup Solids  
Nitrite and/or Nitrate  
Nitrosamines  
Phosphates  
Sodium Erythorbate  
Cured Meat Color  
Role of Nitrite and/or Nitrate in Meat Color  
Sausages and Table-ready Meats  
Dry Sausage Manufacture  
Processing  
Fermentation

## 10. Food Preservation by Drying

Drying-A Natural Process  
Dehydration-Artificial Drying  
Dehydration vs. Sun Drying  
Why Dried Foods?  
Dehydration Permits Food Preservation  
Humidity-Water Vapor Content of Air  
RH-The drying Medium  
Types of Driers  
Adiabatic Driers  
Heat Transfer through a Solid Surface  
Criteria of Success in Dehydrated Foods  
Freeze-Dehydration (Freeze Drying)  
Triple Point of Water  
Temperature Changes in Meat Freeze-dehydration  
Influence of Dehydration on Nutritive Value of Food  
Dehydration of Fruits  
Dehydration of Vegetables

Dehydration of Animal Products  
Dehydration of Fish  
Dehydration of Milk  
Dehydration of Eggs  
Packaging of Dehydrated Foods

## 11. Food Preservation by Canning 1

Temperature vs. Pressure  
Heat Resistance of Microorganisms Important in Canning  
Factors Influencing the Heat Resistance of Spores  
Heat Resistance of Enzymes in Food  
Heat Penetration into Food Containers and Content  
Storage of Canned Foods  
External Corrosion of Cans  
Coding the Pack  
Influence of Canning on the Quality of Food  
Color  
Flavour and Texture  
Protein  
Improvements in Canning Technology  
Retort Pouches  
Testing a Good Seal  
Hazard Analysis

## 12. Pickles

Preservation with Salt  
Preservation with Vinegar  
Preservation with Oil  
Preservation with Mixture of Salt, Oil, Spices and Vinegar  
Problems in pickle making

## 13. Chutneys and Sauces/Ketchups

Chutneys  
Recipes for chutneys  
Sweet mango chutney  
Apple chutney  
Plum chutney  
Wood apple chutney  
Apricot chutney  
Papaya chutney  
Tomato chutney  
Aonla chutney  
Sauces (Ketchups)  
Recipes for sauces (ketchups)  
Tomato sauce  
Apple sauce  
Plum sauce  
Papaya sauce  
Mushroom sauce  
Aonla sauce  
Problem in the preparation of sauces/ketchups

## 14. Mushroom Processing

- Dehydration
- Preparation of ketchup
- Preservation with salt and acetic acid
- Pickling
- Canning
- Mushroom poisoning

## 15. Tomato Processing

## 16. Jam, Jelly and Marmalade

- Jam
- Problems in jam production
- Jelly
- Important considerations in jelly making
- Pectin
- Acid
- Sugar
- Judging of end-point
- Marmalade
- After pectin extraction

## 17. Freezing of Fruits and Vegetables

- Preparation of fruits/vegetables for freezing
- Methods of freezing
- Sharp freezing (Slow freezing)
- Quick freezing
- By direct immersion
- Advantages
- Disadvantages
- By indirect contact with refrigerant
- By air blast
- Cryogenic freezing
- Dhydro-freezing
- Freeze-drying
- Changes during freezing and storage for frozen products
- Freezing process for fruits and vegetables

## 18. Vinegar

- Types of vinegar
- Steps involved in vinegar production
- Outline Scheme of Vinegar Production
- Preparation of vinegar
- Slow process
- Orleans slow process
- Quick process (Generator or German process)
- Precautions
- Problems in vinegar production

## 19. Drying and Dehydration of Fruits and Vegetables

- Advantages of dehydration over sun-drying
- Spoilage of dried products
- Reconstitution test for dried/dehydrated products
- Reconstitution test

## 20. The Canning Process

Cans

Types of Cans

Square and Pullman Base

Pear Shaped

Round Sanitary

Drawn Aluminum

Oblong

Can Materials

Retorts

Nonagitating Retorts

Continuous Agitating Retorts

Hydrostatic Retorts

Establishment of Retort Schedule

Pasteurized Canned Products

Closing

Pasteurizing Cook

Cooling

Storage and Shelf Life

Aseptic Canning

## 21. Food Freezing

Development of a Frozen Food Industry

The Freezing Point of Foods

Percentage Water Frozen vs. Temperature of Food and Its Quality

Size of Ice Crystals Formed

Volume Changes During Freezing

Refrigeration Requirements in Freezing Foods

Freezing in Air

Freezing by Indirect Contact with Refrigerants

Direct Immersion Freezing

Packaging Requirements for Frozen Foods

Influence of Freezing on Microorganisms

Influence of Freezing on Proteins

Influence of Freezing on Enzymes

Influence of Freezing on Fats

Influence of Freezing on Vitamins

Freezing of Bakery Products

Packaging

Storage Life of Frozen Bread

Cookies and Cakes

Frozen Dairy Foods

The Ice Cream Industry

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Manufacture of Ice Cream

The Mix

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## 22. Cookie and Cracker Production Technology

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Dough Machining and Forming

Dough Relaxing

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Scrap Return

Salter or Sugar Sprinkling

Rotary Molding

Extruder-Dough Formers

Wire Cut

Rout Press

The Fruit Bar Coextruder

Baking

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Convection (Indirect) Ovens

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Icings

Enrobing

Sandwiched Cookies and Crackers

Biscuit Packaging

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Four Types of Popcorn

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Quality factors

Processing

Formulated Puffed Snacks

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Other Grain Products

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Extruders and Extruding

Types of Extruders

Snacks that Are Cooked and Formed

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Corn Cereals

- Oat Cereals
- Processing Ready-to-Eat Breakfast Cereals
- Flakes
- General Considerations
- Corn Flakes
- Wheat flakes
- Bran Flakes
- Shreds
- Shredded Wheat Biscuits
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- General Considerations
- Oven-puffed Rice
- Puffing by Extrusion
- Sugar-coated Products
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## 25. Canned Meat Formulations

- Corned Beef Hash
- Federal Meat Inspection Regulations
- Preparation
- Meat
- Potatoes
- Onions
- Canning
- Beef Stew
- Federal Meat Inspection Regulations
- Preparation
- Meat
- Potatoes
- Carrots
- Onions
- Preparation
- Canning
- Chili Con Carne
- Federal Meat Inspection Regulations
- Preparation
- Canning
- Vienna Sausages
- Federal Meat Inspection Regulations
- Preparation
- Canning
- Meat Balls with Gravy
- Federal Meat Inspection Regulations
- Preparation
- Canning
- Sliced Dried Beef
- Federal Meat Inspection Regulations
- Preparation
- Drying and Smoking
- Canning
- Luncheon Meat
- Federal Meat Inspection Regulations
- Preparation

Canning  
Processing  
Sterile  
Pasteurized  
Potted Meat  
Federal Meat Inspection Regulations  
Preparation  
Canning  
Canned Hams-Pasteurized and Sterile  
Federal Meat Inspection Regulations  
Preparation  
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Closing  
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Pasteurized  
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Packaging  
Processing

## 26. Cured or Smoked Meats

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Smoking/Cooking  
Cooked Ham  
Baked Ham  
Preparation  
Country Ham  
Preparation  
Westphalian Ham  
Preparation  
Scotch Ham  
Prosciutti Ham  
Preparation  
Honey Cured Hams  
Preparation  
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Canadian Bacon  
Wiltshire Bacon  
Beef Bacon  
Jowl Bacon  
Fat Backs and Heavy Bellies  
Smoked Pork Loin  
Picnic  
Shoulder Butt

Corned Beef  
Smoked Fresh Meat  
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Procedure  
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## 27. Sausage Formulations

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Instructions

Instructions

Instructions

Instructions

Instructions

### Semidry or Summer Sausages

Instructions

Instructions

Instructions

Instructions

### Dry Sausages

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Instructions

### Emulsion-Type Sausages

Instructions

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Instructions

### Liver Sausage and Braunschweiger

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Instructions

### Speciality Items

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Instructions

Mortadella

Instructions

### Linguica (Portuguese Sausage)

Instructions

Instructions

## 28. Processing of Rice

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Milling of Rice

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Abrasive Milling of Rice

Lye-peeling

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Further Processing of Rice

Boiling and Steaming

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Quick-cooking Rice

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## 29. Creaming, Emulsions, and Emulsifiers

Emulsifier and Emulsions

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Hydrophilic-Lipophilic Balance (HLB)

Oil-in-Water Emulsions

Type of Emulsifier used in Cookies and Crackers

Phosphatides and Lecithin

Synthetic Emulsifiers

Function of Emulsifiers in Cookies and Crackers

Eggs

Emulsifier

Mixing Operation in Cookie and Cracker Doughs

Mixing Operation

Creaming Method

Two-stage Method

Three-stage Method

Baking Cookies and Crackers

Emulsion Stability

Viscosity

To Lower Viscosity

To Increase Viscosity

Elevated Temperature

Inversion Phase

Phase Equilibria

Batter Aeration

## 30. Principles of Food Packaging

Introduction

Functions of Food Packaging

Requirements For Effective Food Packaging

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Primary, Secondary, and Tertiary

Form-Fill-Seal Packaging

Hermetic Closure

Food-Packaging Materials and Forms

Metal  
Metal Cans  
Can Construction  
Can Corrosion  
Can Sizing  
Glass  
Glass Containers  
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Plastics  
Laminates  
Retortable Pouches and Trays  
Edible Films  
Wood and Cloth Materials  
Package Testing  
High Barrier Plastic Bottles  
Aseptic Packaging in Composite Cartons  
Military Food Packaging

Directory Section  
Suppliers of the Plant and Machinery  
Addresses of Packaging Machinery  
Suppliers of Raw Material Suppliers

Machinery & Equipments (Photographs)

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