

# Food Packaging Technology Handbook (3rd Revised Edition)

**Author:** NIIR Board of Consultants Engineers

**Format:** Paperback

**ISBN:** 9788193733981

**Code:** NI93

**Pages:** 528

**Price:** Rs. 1,895.00 US\$ 50.95

**Publisher:** NIIR PROJECT CONSULTANCY SERVICES

Usually ships within 5 days

Food Packaging Technology Handbook (3rd Revised Edition)

(Biodegradable Films, Materials , Polymers, Aseptic Packaging, Labels and Labelling, Packaging of Cashew Nuts, Dairy Products, Milk, Fish, Meat, Shrimps, Canning of Vegetables, Fruits with details of Machinery and Equipments)

Food packaging technology is primarily concerned with packaging activities regarding protection of food products from biological, physical or chemical agents. With the growth of modern civilization, people are getting more concerned with hygiene and quality of the food.

The packaging industry's growth has led to greater specialization and sophistication from the point of view of health and environment friendliness of packing material. The demand on the packaging industry is challenging, given the increasing environmental awareness among communities. The food packaging industry is growing at the rate of 22 to 25 per cent per annum. In near future it is going to be a booming industry.

Packaging has played a critical role as a differentiator in promoting brands, especially for packaged food products. With the increase in urbanization and emergence of supermarkets and hypermarkets, differentiating food products through the aesthetic appeal of packaging has become important for food manufacturers. Furthermore, consumers are increasingly paying more attention to the ingredients and contents of the package. This provides an opportunity for the food packaging technology & equipment manufacturers as food manufacturers need to differentiate their products by conveying the benefits of packaging technology on the labels and packets, such as shelf life, the time required for preparing the food, and nutritional contents to the consumers.

Biodegradable packaging is produced using biopolymers, which are molecules often found in living organisms, like cellulose and proteins. This means they can be safely consumed, degrade quickly, and often be created from waste plant products. The main applications of bio-based and biodegradable plastics are currently in (food) packaging, food service ware, (shopping) bags, fibres/nonwovens and agricultural applications. Bio-based drop-in plastics such as bio-PE and bio-PET are identical to fossil-based counterparts and can be used in exactly the same applications.

The more recently developed bio-based plastics (bio-PE and bio-PET) are also mainly used in food packaging. The increasing awareness of the environmental impact of packaging products and a willingness to replace packaging materials by alternatives with e.g. a lower carbon footprint or made from renewable

resources are the main driver for development and the use of these materials.

This book gives comprehensive account of food packaging, which is the most important part to preserve the food for a long time. The present volume has been written primarily for the benefit of new entrepreneurs, technologists, technical libraries and for those who want to diversify in the field of food industry.

## Contents

### CONTENTS

#### 1. Introduction

Containment

Protection/Preservation

Communication

Utility

Packaging Systems

Primary Packaging

Secondary Packaging

Tertiary Package

Unit Load

Consumer/Industrial Packaging

Biodegradable Packaging

Development of Bioplastic

Biopolymers

Starch Based Plastics (Biodegradable)

Bio-based and Biodegradable Plastics from  
Genetically Modified Organisms

#### 2. Biodegradable films for Food Packaging and Application of Nanotechnology in

Biodegradable Food Packaging

Biodegradable Polymer Films for Food Packaging

Biodegradable Polymers from Biomass Products

Starch

Cellulose

Other Materials

Pectin

Chitin and Chitosan

Proteins

Advantage and Limitations of Biodegradable  
Polymer

Nanotechnology in Biodegradable Polymer

#### 3. Biodegradable Materials for Food Packaging

Applications

Materials

Aliphatic Polyesters

Manufacturing Process

Manufacturing Filament Yarn

Polymerization

Drying

Melt Spinning

Drawing the Fiber

Winding  
Manufacturing Staple Fiber  
Drawing Tow  
Crimping  
Setting  
Cutting  
Polylactide Aliphatic Copolymer (CPLA)  
Polycaprolactone (PCL)  
Synthesis and Physicochemical Properties of PCL  
Poly (Lactic Acid) (PLA)  
PLA Processing  
Extrusion  
Injection Molding  
Injection Stretch Blow Molding  
Cast Film and Sheet  
Thermoforming  
Polyurethane Foams  
Processing Technology  
Fillers for Bio based Packaging Materials  
Cellulose Fiber  
Wood Fiber  
Technical Requirements  
Types of Degradable Plastic  
Oxo-Biodegradable Plastic  
Fossil Resources  
Hydro-Biodegradable Plastics

#### 4. Biodegradable Polymers in Food Packaging

Polymers  
Biopolymers  
Origin and Description of Biobased Polymers  
Starch  
Production Process  
Polylactic Acid  
Poly (hydroxyalkanoates) (PHAs)  
PHAs Production  
Polycaprolactone (PCL)  
Cellulose and Derivatives

#### 5. Packaging Materials for Processed Foods

Metal Cans  
Materials Used in Can Manufacture  
The Steel Base  
Thickness of Steel Base  
Mechanical Properties  
Basic Types of Metal Plate  
Surface Finish  
The Tin Coating  
Marking of Differentially-Coated Plate  
K Grade Tinplate  
Grading of Tinplate  
General

Tin-Free-Steel (TFS) Sheets  
Tinplate and Its Application  
Aluminium Cans  
Manufacture of Three-piece Cans  
Side Seam Welding  
Types of Side Seam Welders  
Other Types of Side Seams  
Can Ends  
Manufacture of Ends  
Flanging, Beading and Double Seaming  
Lacquers and Their Application  
Plastic Lamination  
The Future for Can Coatings  
Discolouration in Lacquered Cans  
Lacquer Performance  
The Cans  
The Two-Piece Can  
DRD Cans  
D&I or DWI Cans  
Container Innovations  
Corrosion of Tinplate  
Corrosion in Lacquered Cans  
Permissible Limits of Tin  
Limits for Lead  
Can Sizes  
Inspection and Tear-down Examination of  
Double Seam  
On the Seam  
After Tear Down  
Critical Parameters  
Optical Measurements  
Performance Testing  
Selection of Tin Coating Depending on the  
Corrosivity of Packs  
Specifications for the Metal Cans  
Glass Containers  
Composition of Glass  
Improvements in Glass Manufacture  
Hot and Cold End Treatment of Surface  
Coating  
Lightweight Containers  
Glass Container Characteristics  
Basic Parts of a Glass Container  
Glass Neck Ring Finish  
Closures for Glass Containers  
Parts of Glass Closures  
Vacuum Closures for Glass Containers  
(i) Pry-off (side-seal) Cap  
(ii) Lug-type or Twist Cap (Non-Baby Food Type)  
(iii) Lug Type Caps for Baby Foods  
(iv) PT (Press-on, twist-off cap)  
Sealing of Glass Containers  
Crown Corks

Procedure for Determining Capper Efficiency  
Evaluation of Glass Container Closures  
Pry-off (side seal) Type Caps  
Lug Type Caps  
Vacuum Measurements  
PT (Press-on, twist-off) Cap  
Cocked-up Cap and Dud Detections  
Sampling Plan and Inspection  
Tamper-Evidence of Processed Containers  
Plastic Packaging Material  
General Properties  
Polyethylene (PE)  
Polypropylene (PP)  
Polyethylene Terephthalate (Polyester) (PET)  
Polyamide (PA) or Nylon  
Polyvinylchloride (PVC)  
Polyvinylidene Chloride (PVDC)  
Polystyrene (PS)  
Polycarbonate  
Ethylvinylalcohol (EVOH)  
Polyvinyl Alcohol (PVA)  
Regenerated Cellulose (Cellophane)  
Cellulose Acetate (CA)  
Paper, Paperboard and Foil  
Pack Requirements  
Water Vapour Transmission (WVTR) of Plastics  
Oxygen Absorption  
Fabrication of Flexible and Rigid Plastic  
Packages  
Container Fabrication  
PP/Foil/PP Laminated Tray  
Co-extrusion  
Closures for Hot-Fill or Retortable Plastic  
Containers  
Cartons for Liquids  
Packaging Requirements for Distribution  
Off-flavours in Packed Food  
Can and Can Coatings  
Plastic Packaging  
Economic Considerations

## 6. Packaging Trend of Carbonated and “Still”

Beverages

Introduction

Carbonated Beverages

Basic Manufacturing/Packaging Technology

Glass Bottles

Plastic Bottles

Bottling System

Bottle Filling

Bottle Crowning or Bottle Capping

Aluminium Cans

Non-Carbonated Beverages / “Still” Drinks

## Aseptic Packaging System (Tetrapak)

Plastic Bottles

Plastic Closures

Purpose of Hot Filling

Flexible Pouches

Retortable Pouches

Bag-In-Box System

(a) Bags

(b) Containers

(c) Fillers

## 7. Aseptic Packaging of Foodstuffs

Introduction

The Product and Performance Range

The Functionality of Steam Aseptic Machines

Sterilization of Packaging Material

Forming the Cups

Positioning Stations

Sterile Zone

The Machine Technology

Drive and Control Engineering

Dosing Techniques

Labelling

Guidelines on Aseptic Packaging

Aseptic Packaging and Low-Germ Packaging

Aseptic Packaging

Low-Germ and Recontamination - Free

Packaging

## 8. Modified Atmosphere Packaging

Gases Used in Map

Techniques of Map

Gas Flushing

Compensated Vacuum

Different Modified Atmospheres

High Oxygen Atmosphere Packaging

Low Oxygen Atmosphere Packaging

Vacuum Packaging

Active Packaging or Functional Packaging or

Interactive Packaging

Packaging Materials

## 9. Labels and Labelling

Definition

Purpose of Labels

Identification

Information

Decoration

Types of Labels

Plain Paper Labels

Pre-gummed Paper Labels

- Thermoplastic Paper Labels
- Pressure-sensitive Paper Labels
- Plain Paper Labels
- Pre-gummed Paper Labels
- Thermoplastic Labels
- Pressure Sensitive Labels or Self-Adhesive Labels
- Swing Labels — Tie on Tags
- Printing of Labels
- Alternative Markings
- Surface Treatment
- Materials Used for Labels
- Papers
- Foil and Laminates
- Plastics
- Adhesives
- Labelling Machinery
- Regulations
- Labels for Freight Containers
- Information
- Position
- Language
- Pictorial Markings for Handling Instruction
- IS
- Recent Trends

#### 10. Packaging of Milk

- Packaging of Milk and Milk Products
- Liquid Milk
- Concentrated Milks
- Milk Powder
- Ice Creams
- Butter
- Ghee
- Cheese
- Indigenous Milk Products

#### 11. Trends for Cheese and Other Dairy Products

- Packaging
- Milk Powder-Bulk
- Milk Powder-Retail
- Butter
- Yogurt
- Ice-Cream
- Cheese
- Cheese - Retail

#### 12. Packaging of Malted Milk Foods

- Introduction
- Present Packaging System
- Glass Containers
- Variant
- Advantages
- Disadvantages

Modality of Usage  
Pet Containers  
Variet  
Advantages  
Disadvantages  
Modality of Usage  
Flexible Packaging Materials  
Process of Packaging (Schematic)  
Variet  
Browns (Malted milk food)  
Whites (Malted milk food)  
Nutritional Health Beverage  
Advantages  
Disadvantages  
Modality of Usage  
Significance of Packaging on FFS  
Functional Requirement

### 13. Packaging of Cashew Nuts

Introduction  
Packaging System  
(a) Specification of Tinplate Containers  
(b) Specification for CFB Box  
Recent Developments  
Alternate Packaging Systems  
(a) Bag - in - Box (Flexible) System  
(b) Bag - in - Box (Semirigid System)  
Consumer Packs

### 14. Lined Cartons for Packaging of Food

Products  
Concept of Lined Carton Packaging System  
Manufacture of Lined Cartons  
Sequence of Operation  
Printing  
Varnish/lamination  
Punching  
Folding & Lining  
Carton Filling & Sealing Machines  
Sequence of Operation  
Vacuum & Gas Flushing  
Constituents of the Lined Carton  
Tests  
Liners  
Criteria for the Selection of Liners  
1. The Product to be packed which includes  
2. Performance properties include  
3. Marketing Demands include  
Versatility of Lined Cartons  
Product: Package Compatibility  
Future Prospects of the Lined Carton Packaging  
System



## 15. Canning of Vegetables and Animal Products

Asparagus

White Variety

Beans

Green (french waxed)

Broad Bean, Field Bean, Pigeon Pea (green) and

Cluster Bean

Cabbage

Carrots

Cauliflower

Corn

Whole-Grain Corn

Cream Style Corn

Creamogenised Corn

Vaccum-Packed Whole-Kernel Corn without

Brine

Cultivation and Maturity

Husking

Silking

Grading

Whole-grain Corn

Filling

Cream-style Corn

Handling of A10 Cans of Cream-style Corn

Corn-on-the-Cob

Drumsticks

Gourds (Cucurbits)

Mushroom

Okra

Peas

Potato

Spinach

Tomato

Crushed Tomato

Canning of Acidified Vegetables

A. Lowering the pH Using Acid

B. Lowering the pH by Fermentation

Fermentation Procedure

Microbial Changes during Fermentation

pH Considerations in the Thermal Processing of

Acidified Vegetables

Canning of Fermented Vegetables

Sterilisation Requirements

Process Schedule for Vegetables Packed in Glass

Containers

Thermal Process Schedule for Marine and

Animal Products

Process Schedule for Soups

## 16. Canning of Fruit Products

pH Considerations in the Canning of Fruits

Strength of Covering Syrup

Pink Discolouration in Canned Fruits

Apricot  
Cherries  
Guava  
Grapes  
Mango  
Muskmelon (Cucutnis melo)  
Mandarin Orange (Citrus reticulata, Blanco)  
Segments  
Papaya (Carica papaya)  
Peaches  
Pears  
Pineapple  
Process Schedule  
Crushed Pineapple  
Plums  
Canned Dried Prunes  
Strawberries  
Fruit Cocktail  
Strained Baby Foods  
Fruit Juices, Beverages, Pulps and Concentrates  
Tomato Juice

## 17. Packaging of Fish in Modified Atmospheres

Introduction  
Modified Atmosphere Packaging  
Application to Fish  
Norwegian Practice  
Disadvantages  
Conclusion

## 18. Packaging of Fresh Meat

Product Characteristics  
Packaging Principles  
Packaging Materials & Techniques

## 19. Packaging of Shrimps

Introduction  
Product Forms  
Processing and Packaging  
(a) Glazing  
(b) Code Slip  
(c) Inner Wrap  
(d) Primary Carton  
(e) Master Carton  
(f) Closure and Reinforcement  
Marking  
Storage and Transportation  
Quality Control and Inspection System  
New Trends  
Packaging Requirements for IQF Shrimps  
Consumer Packs for IQF Shrimps  
1. Deep Drawn Plastic Pouches  
2. Printed Preformed Pouches

Flexible Vacuum Packed Pouches in Paper  
Board Cartons  
Labelling and Marketing for IQF Shrimps

20. Equipment Commonly used for Food  
Processing and Preservation  
Design Considerations  
Indian Scenario  
Special Development Needs  
High Speed Specialised Centrifugal Separators  
Large Capacity Spray-drying and Roller-drying  
Plants  
Evaporation and Aroma Recovery Plants  
Specialised Energy Efficient Heat Exchangers  
Aseptic Processing and Packaging Equipment  
Special Types of Forming and Cooking  
Machinery  
Latest Types of Freezing and Freeze Drying  
Equipment  
System Designs  
R & D Efforts  
Food Machinery Listing  
Equipments commonly used in Food  
Preservation  
Food Dehydration  
(a) Sun Dryer  
Solar Dryer  
(b) Cabinet or Tray Dryer  
(c) Tunnel Dryer  
(d) Conveyor Dryer (Conveyor band dryer/belt  
dryer)  
(e) Spray dryer  
(f) Freeze Dryer  
(g) Drum Dryer  
(h) Fluidized Bed Dryer  
(i) Spouted Bed Dryer  
(j) Flash Dryer  
(k) Microwave Dryer  
Food Irradiation  
Food Irradiation Technology  
(a) Ionizing Radiations  
(b) Sources of Radiations  
(c) Process Control  
Food Freezing and Refrigeration  
(a) Refrigeration Systems in Cold and Freezer  
Storage  
(b) Compression Refrigeration System  
Ammonia Systems  
Food Canning  
Metal or Tin Cans  
Glass Cans

21 Active Packaging

Active Packaging Technologies  
Antimicrobial Packaging  
Ethylene Scavengers  
Oxygen Scavenging  
Carbon Dioxide Scavenging or Release  
Humidity Buffering Films and Liquid Water  
Removal  
Modified Atmosphere Packaging (MAP)  
Aroma and Odour Removal  
Regulations  
Market Scenario

22. Nanotechnology in Food Packaging  
Nanomaterials in Food Packaging  
Nanocomposites  
Silver Nanoparticles and Nanocomposites as  
Antimicrobial Food Packaging Materials  
Nanosensors  
Oxygen Sensors  
Stress and Temperature Sensors  
Biosensors  
Advantages Nanotechnology to Food Packaging  
Market Scenario

23. BIS Specifications

24. Sample Plant Layouts

25. Photographs of Machinery with Supplier's Contact Details

## About NIIR

**NIIR PROJECT CONSULTANCY SERVICES (NPCS)** is a reliable name in the industrial world for offering integrated technical consultancy services. NPCS is manned by engineers, planners, specialists, financial experts, economic analysts and design specialists with extensive experience in the related industries.

Our various services are: Detailed Project Report, Business Plan for Manufacturing Plant, Start-up Ideas, Business Ideas for Entrepreneurs, Start up Business Opportunities, entrepreneurship projects, Successful Business Plan, Industry Trends, Market Research, Manufacturing Process, Machinery, Raw Materials, project report, Cost and Revenue, Pre-feasibility study for Profitable Manufacturing Business, Project Identification, Project Feasibility and Market Study, Identification of Profitable Industrial Project Opportunities, Business Opportunities, Investment Opportunities for Most Profitable Business in India, Manufacturing Business Ideas, Preparation of Project Profile, Pre-Investment and Pre-Feasibility Study, Market Research Study, Preparation of Techno-Economic Feasibility Report, Identification and Section of Plant, Process, Equipment, General Guidance, Startup Help, Technical and Commercial Counseling for setting up new industrial project and Most Profitable Small Scale Business.

NPCS also publishes various process technology, technical, reference, self employment and startup books, directory, business and industry database, bankable detailed project report, market research report on various industries, small scale industry and profit making business. Besides being used by manufacturers, industrialists and entrepreneurs, our publications are also used by professionals including project engineers, information services bureau, consultants and project consultancy firms as one of the input in their research.

Our Detailed Project report aims at providing all the critical data required by any entrepreneur vying to venture into Project. While expanding a current business or while venturing into new business, entrepreneurs are often faced with the dilemma of zeroing in on a suitable product/line.

---

**NIIR PROJECT CONSULTANCY SERVICES** , 106-E, Kamla Nagar, New Delhi-110007, India. **Email:** [npcs.india@gmail.com](mailto:npcs.india@gmail.com) **Website:** [NIIR.org](http://NIIR.org)

Sun, 28 Apr 2024 05:52:25 +0530