

Logo

106-E, Kamla Nagar, New Delhi-110007, India.  
Tel: 91-11-23843955, 23845654, 23845886, +918800733955  
Mobile: +91-9811043595  
Email: npcs.ei@gmail.com, info@entrepreneurindia.co  
Website: www.entrepreneurIndia.co

## **Handbook on Modern Packaging Industries (2nd Revised Edition)**

<b>Code:</b> NI72	<b>Format:</b> paperback
<b>Indian Price:</b> ₹1675	<b>US Price:</b> \$150
<b>Pages:</b> 848	<b>ISBN:</b> 9788178330860
<b>Publisher:</b> Asia Pacific Business Press Inc.	

## **Description**

Packaging is a means of ensuring the safe delivery of a product to the ultimate consumer in a sound condition at the minimal overall cost. Packaging not only differentiates one brand from another but also, at times, gives a preview of the product being sold. Although it is a subject of recent technological origin, the art of packaging is as old as the primitive humans. Packaging is the science, art, and technology of enclosing or protecting products for distribution, storage, sale, and use, also refers to the process of design, evaluation, and production of packages and can be described as a coordinated system of preparing goods for transport, warehousing, logistics, sale, and end use. Packaging contains, protects, preserves, transports, informs, and sells. In many countries it is fully integrated into government, business, institutional, industrial, and personal use. The continual technological growth systems have undergone significant changes in recent years. A lot of packaging process has been streamlined to give a more scientific and rational approach. The role of packaging continues from the coordinated system of preparing goods to the end use. It has become a big tool for launching new specific products in different shapes and sizes. The packaging industrial growth has led to greater specialization and sophistication from the point of view of health (in the case of packaged foods and medicines) and environment friendliness of packing material. The demands on the packaging industry are challenging, given the increasing environmental awareness among communities. The packaging industry is growing at the rate of 22 to 25 per cent per annum thus is to play a unique role in preserving the wealth or value created by many industries.

This book describes the techniques and process behind packaging of different specific products which are used in our day to day life. The specific products include cereal,

spices, edible oils, drinking water, chocolate and confectionery, fruits and vegetables, marine products and many more. Some of the vital contents of the book are adhesives for packaging industries, factors affecting adhesion, tin plate containers for foods, pharmaceuticals and cosmetics, tin plate usage in packaging, packaging of cereals and cereal products, trends in packaging of spices and spice products, packaging of edible oils, vanaspati and ghee, metal containers for food packaging, packaging aspects of sugar and chocolate confectionery, packaging for irradiated foods, packing of meat & meat products in tin containers etc.

This book is an invaluable resource for all its readers, entrepreneurs, scientists, existing industries, technical institution, etc in the field of packaging.

## **Content**

### **1. Adhesives for Packaging Industries**

Typical Application in packaging

Classification

(a) Loss of water or solvent

(b) Loss of Heat

Theories of adhesion

a. Mechanical Interlocking

b. Electrostatic Interaction

c. Diffusion Theory

d. Absorption Theory

Factors affecting adhesion

Spreading

Roughness

Porosity

Diffusion

Rheology

Thickness

Pressure

Starch

Degradation Products of Starch

Comparison between starch and Sodium Silicate

Polyurethane

Basic urethane chemistry

Acrylics

Casein

Natural Rubber

Polyvinyl Acetate

Polyvinyl Alcohols

## 2. Tin Plate Containers for Foods, Pharmaceuticals and Cosmetics

Manufacturing Process

Can Sealants

## 3. Tinplate Containers

Definition

Uses

Types

Open Top containers

General Line containers

Nomenclature

Manufacturer of Tinplate containers

Decoration

Sizing

Coating

Printing

Varnishing

Lacquering

Manufacture in Press Shop

Slitting

Component/end manufacture on presses

Ancillary operations

Manufacture of Assembly Lines

Slitting

Notching

Folding

Forming

Locking

Soldering/Cementing

Flanging

End seaming

Ancillary operations (if any)

Packing/Palletising

Flattened Cans

Process Control

Blackplate Containers

## Tinplate Closures

### 4. Metal Container Industry In India

Raw Material

Manufacturing Process

### 5. Tin Plate Usage In Packaging

Round Ends tinplate Layout Systems And Procedures

Straight and Single

Double Row Staggered

Straight, Single Scrolled

Double Row Staggered Scrolled

Multiple Row Fully Staggered Plain

Double Row Staggered With Primary (deep)  
or Secondary Scroll

Coil Feed : Single Or Multiple Die Set up:

### 6. Packaging of Cereals and Cereal Products

Spoilage Factors

Whole Grains & Split Pulses

Jute Bags

Advantages of Jute Bags and Jute Fabrics

High mechanical strength

Soft surface with high resistance to friction

Porous structure

Disadvantages of Jute Bags

Availability

Mineral oil contamination

Insect breeding

Cost

High Density Polyethylene (HDPE)/

Propylene (PP) Woven Sacks

Manufacturing Process of HDPE Woven Sacks

Extrusion Of Slit Film

Looming

Lamination

Cutting

Stitching

Printing

Bale Pressing and Packing

- Advantages of HDPE & PP Woven Sacks
- Disadvantages of HDPE & PP Woven Sacks
- Quality Parameters to be Considered for Woven Sacks
- Consumer Packs for Whole Food Grains
- Milled Grain Products (Flours)
- Bulk Packs
- Consumer Packs
- High Molecular High Density Polyethylene (HMHDPE)
- Co-Extruded Films
- Biaxially Oriented Polypropylene Film : (BOPP)
- Laminates
- Processed Cereal and Pulse Products
- Cereal Based Convenience Foods
- Weaning Foods

## 7. Trends in Packaging of Spices and Spice Products

- Packaging of Ground Spices
- Bulk Packaging and Storage of Whole Spices
- Packaging of Oleoresins and Volatile Oils
- Insect Infestation and Fumigation
- Literature Data on Packaging
- Future Trends

## 8. Packaging of Edible Oils, Vanaspati and Ghee

- Introduction
- Spoilage Factors
- Distribution Pattern
- Packaging Systems/Types of Pack
- Package Types
- Tinplate Containers
- Glass Bottles
- Semi-Rigid Containers
- HDPE (High Density Polyethylene) Containers
- PET (Polyethylene Terephthalate) Bottles
- PVC (Poly Vinyl Chloride) Bottles
- Other Semi-rigid Packs
- Flexible Pouches
- Analysis of Needs and Shifts
- Structures and Critical Polymers
- Critical Polymers

Polyester

A Closer Look

Flexibles as Economical Media

Flexibles as Effective Solid Waste Reducing Media

Indian Standard for Packaging of Edible Oils, Vanaspati and Ghee

Legislations

Conclusion

## 9. Metal Containers for Food Packaging

Abstract

Introduction

Tinplate Containers

Developments in Tinplate Manufacture

Structure of Tincoating

Light tin coated steel (LTS)

Developments in can fabrication

Two Piece Cans

Drawn Thin Redraw (DTR) and precision sidewall thickness control (PSTC) process

Plain Cans

Acid resistant lacquered cans

Sulphur resistant lacquered cans

High Tin Fillet (HTF) can

Corrosion problem in food cans and its inhibition

Quality control tests

Thickness of tinplate

Grain structure of tincoating

Coating continuity (porosity) test (ISV)

Tin oxide

Chromium in passivation layer

Special property tests

Tincoating

Tin Free Steel Cans

Manufacture

Cansuper

Hinac coat

Hi-top

Stainless weirchrome

Fabrication of TFS cans

Mira seam

Conoweld  
Forge welding  
Advantages and Disadvantages of Tin Free Steel  
Physical characteristics of HI-Top Plate  
Corrosion resistance  
Lacquering quality  
Formability  
Weldability and solderability  
Canning Food Products in Tin-free steel cans  
Fish products  
Meat products  
Fruit and Vegetable products  
Aluminium containers  
Package forms  
Aluminium closures and ends  
Conventional closures  
Easy open ends are of two types  
Packaging of Food Products in Aluminium Cans  
Fruit and vegetable products  
Lacquered cans  
Meat products  
Marine products  
Milk products  
Alcoholic drinks  
Corrosion in Aluminium cans  
External decoration and Printing  
Future Scope  
Evaluation of indigenous electrolytic tinplate  
Assessment of differential tinplate  
Evaluation of indigenous aluminium cans for processed foods  
Acknowledgement

## 10. Packaging of Drinking Water

Brief History  
Main Processing System  
Packaging Materials  
Bottle Filling<sup>113</sup>  
Bottle Labelling

## 11. Bottle Labelling

Introduction  
The Product Group  
Packaging Materials for Snack Foods  
Packaging Systems  
Gas flushing  
Compensated vacuum

## 12. Packaging Aspects of Sugar and Chocolate Confectionery

Introduction  
Packaging Requirements  
Packaging Requirements  
Sugar Confectionery  
Chocolates  
Packaging Materials and Packages  
Packaging Materials

## 13. Packaging for Biscuits

Protection Presentation, Information and Convenience  
The Wrapping Materials  
The Packaging Styles

## 14. Packaging Trends for Cheese and Other Dairy Products

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

## 15. Packaging of Milk

## 16. Packaging of Fish

Introduction  
Important Quality Aspects of Fresh Fish  
Packaging Concepts  
Vacuum Packaging  
Modified Atmosphere Packaging  
Active Packaging  
Packaging Requirements



Examples

Conclusion

Final Remarks and Future Developments

## 17. Packaging for Irradiated Foods

Food Borne Illness is a Global Concern

Commercialization of Food Irradiation Worldwide

Food Irradiation in the U.S.A.

Barriers to Widespread Commercialization of

Food Irradiation in the U.S.A.

The Consumer Acceptance Barrier

The Cost Barrier

The Capacity Barrier

The Regulatory Barrier

Pasteurized Milk Case History

Packaging for Irradiation

Packaging Materials for use during Irradiation of Food

What action should Food Processors Take?

## 18. Development in Modified Atmosphere Packaging Of Meat, Poultry and Fish

Introduction

Historical Development

Modified Atmosphere Technology

Equipments and Films For MAP

Patents Available

Effects of Gases on MAP Foods

Effect of MAP on the Quality of Fresh Meats

Effect of Map on Processed Meats

Package Integrity and Quality of MAP Foods

Safety Concerns of MAP Muscle Foods

Cost Benefit Relationship

## 19. Packing of Meat & Meat Products in Tin Containers

Raw Materials

Cans and Lids

Coating

Vinyl Lacquers

Phenolic Lacquers

Corrosion

Internal Corrosion

Filling Operations  
Can Seaming  
Dehydrated Meat Products

## 20. Aseptic Packaging

Microbiological Aspects of Aseptic Packaging  
Sterilization of the Packaging Material Food Contact Surface  
The Tetra Classic Aseptic System (TCA)  
The TBA/3-System  
The TBA/8 and TBA/9 Systems  
The TBA/10-System

## 21. Aluminium Cans for Heat-Sterilized Food Products

Summary  
Current Usage  
Characteristics  
Recent Innovations  
Material Recyclability  
Conclusion

## 22. Aluminium Container for Fish Canning

Introduction  
Materials and Methods  
Results and Discussion  
Conclusion

## 23. Aluminium in Flexible Packaging

Introduction  
Benefits of Aluminium based Packaging Materials  
Technical properties of Aluminium Foil  
Some Technical Applications of Aluminium Foil  
Other way of Classifying Applications  
Various Popularly known product groups and structures  
Why Aluminium is preferred in Various Applications  
Machines and Equipment for the manufacture of  
Flexible Packaging Material  
Wet Laminating Machine  
Dry Laminating Machine  
Hot Coating Laminating Machine  
Extrusion Laminating Machines

Coating Machine  
Printing Machines  
Various QC Test Relevant to Applications  
Modern Trends in Packaging  
X. New Technologies  
Solventless Lamination  
Advantages of Solventless Lamination  
Digital Printing

24. Aluminium Foil in Pharmaceutical  
Packaging-Recent Developments  
Influential factors on pharmaceutical products  
The Alu-Alu blister (Formpack)  
Multi Axial Dehnung (Stretching)  
Lidding foils  
Summary and outlook

25. Aluminium Foil  
Standard Conditions of Bare Aluminium Foil  
Standard Finishes of Bare Aluminium Foil

26. Aluminium and Foil Production Methods  
How Aluminium is Made  
Rolling Aluminium Foil

27. Aluminium In Packaging : Current Scenerio

28. The Process of Producing Collapsible Aluminium Tubes  
Accumulator  
Producing Tubes of different Diameters and Forms  
Chains in Dryers and Ovens  
Lubrication of Machines  
Technical Developments

29. Aluminium Cans in Packaging  
Introduction  
Aluminium  
Properties  
Manufacturing Process  
Coating and Decoration

Recycling  
Easy Open Ends  
Lacquers and Coating  
Testing and Quality Control  
Future

30. Aluminium Foils for Composite Containers  
Aluminium Foil Membrane on Tin Cans

31. Aluminium Collapsible Tubes

32. Aluminium collapsible tubes their suitability-reliability-availability

33. Pharmaceutical Packaging Collapsible Tubes  
Pharmaceutical Containers  
Collapsible Tubes  
Advantages of collapsible tubes  
Pharmaceutical Forms Packed in Collapsible Tubes  
Selection in metal collapsible tubes  
Testing of collapsible tubes  
Eye Ointment tube  
Shelf life tests  
Filling of collapsible tubes

34. The Birth of an Aluminium Collapsible Tube

35. Embossing Aluminium Foil

36. Wooden Containers  
Classification of Timbers  
Seasoning of Wood  
Physical and Mechanical Properties of Timber  
Mechanical Properties  
Methods of Preservation of Timber  
Form and size of Each Component  
Thickness of Components  
Size and Spacing of Nails  
Number of Planks in a Shook  
Type of Joints  
Style of Container

Reinforcements  
Workmanship  
Consideration for a Design of the Box  
Easy Load  
Average Load  
Difficult Load  
Grouping of Indian Timbers  
Plywood Boxes - Battened Construction

### 37. Tinplate Container for Packaging of Fruit and Vegetable Products

Abstract  
Introduction  
Standards for Metal Containers  
Summary

### 38. Tetra Pak Application in Food Packaging

Introduction

### 39. Printing on Foil

### 40. Aerosol

A Pressurised Form of Packaging and Dispensing a product

### 41. Foil Bag, Pouch and Envelope Production

Envelope making  
Pouch making  
Folding Carton Production  
Foil/Fibre can and Drum Production

### 42. Packaging of Cashew Kernels in Tin Plate Containers

### 43. Packaging of Paints in Tin Plate Containers

### 44. Application to Food Packaging-Form-Fill-Seal Machines

### 45. Shrink Packaging-Food Products

### 46. The Aerosol Package-Container Manufacture

### 47. Sterilization Methods for Packaging Materials used in aseptic systems

Testing Procedures

Requirement of Aseptic Systems

#### 48. Blow Moulded Containers for Food Packaging

Basic Process Concepts

Technology Development for Food Packaging

Aseptic Containers

Barrier Containers

PET Containers

Newer Developments

#### 49. Thermoformed and Blow Moulded Containers for Food Packaging Applications

Introduction

Polypropylene

Polystyrene

#### 50. Role of BOPP Films in Food Packaging

Introduction

Manufacture

Properties of BOPP Films

Advantages

Role of BOPP Film in Food Packaging

New Developments in BOPP Films

Conclusion

#### 51. Modified Atmosphere Packaging of Fresh Fruits and Vegetables

Factor Influencing Shelf-life of Fruits and Vegetables

Respiratory Metabolism

Controlled Atmosphere (CA) Storage Technology

Advantages of MAP Technology

Limitations of MAP Technology

Dynamics of Gaseous Exchange in MAP

MA Package Design

Mathematical Modelling of Gaseous Exchange in MAP

Computer-Aided Design of MAP

Verification of Predicted Values

Tailored Plastics Film-Laminates

#### 52. Plastics

Distinction Between Plastics, Fibres and Elastomers

Techniques of Polymerization  
Processing of Plastics  
Compression Moulding

53. Plastic Corrugated Board

54. Polyester Film

55. Nylon-6 Film - A Revolution in Packaging

56. Plastic Woven Sacks

Introduction

Plastic Woven Sack Materials

High Density Polyethylene (HDPE)

Polypropylene (PP)

Method of Making Woven Sacks

Flexible Intermediate Bulk Containers (FIBC)

Construction of FIBC

Use of Woven Sacks/FIBC

Conclusion

57. Low Density Polyethylene

Additives

58. High Density Polyethylene

59. PVC in Packaging

60. Biaxially Oriented Polypropylene Film

61. Expanded Polyethylene Material

62. Expanded Polystyrene

Properties of EPS

63. Shrink and Stretch Wrapping

Shrink Packaging

Stretch Wrapping

Pilfer- Proof Packs

Pallet Stretch Wrapping

## 64. New Developments Paper pulp Based Moulded Containers for Fruits and Vegetables

Apple Tray Packaging Concept

Consumer Pack Trays

Tray Hand Wrapping Machine

Conclusion

## 65. Solid Fibre Board Box as a Transport Pack

B. Combination Board-What is it?

C. Solid fibre board with moisture/water proof inner or outer lining

D. Solid Fibre Board with Hessian Lining

Conclusion

## 66. "Quality Control-Specifications and Performance Requirements of Fird Boxes"

Quality Control

Quality Control on Cor

Specifications and Performance Requirements of Fibreboard Boxes

## 67. Folding Board Cartons and Coated Cartons Manufacture

Introduction

Relevant Properties of Paper/Board for Carton Manufacture

Grammage

Caliper

Bursting Strength

Shade

Grain Direction

Folding

Moisture Content

Stiffness

Manufacturing Process

Computer Controlled Inking

## 68. Cellulosic Films

## 69. Multiwall Paper Sacks

## 70. Speciality Papers for Packaging

## 71. Flexible Packaging Laminates and Coatings Application

Disaster Relief Packages



Snack Food Packaging  
Corn Chips  
Cross Laminated Film  
Modified Atmosphere Packaging  
Fresh Red Meat  
Fish  
Cold Seal Adhesives for Flexible Packaging  
Hot Melt Adhesives  
Metallising Film/Paper

## 72. Adhesive Tapes

Introduction

## 73. G.I. Drums-Oil Drums-Closures

Introduction

Capacity

Type of Drums

Standardisation of Metal Container

Selection of Drums

Manufacture of Drums

Reconditioning Industry

Quality Control

Closures

Essential Functions of Closures

Recent Development in Drums

Market Analysis

Market Share and Competitors Activities

## 74. Packaging in Glass Containers

Testing

## 75. Laminated Tubes

Introduction

Market Trends

## 76. Converting Materials and Methods

Coatings

Adhesives

Laminating Materials

Laminating Aluminium Foil

## Coating Aluminium Foil

### 77. Aseptic Packaging Materials and Package Forms

#### 78. Printing Inks for Food Packaging

Printing Processes and Printing Inks

Dispersion

Hue and Strength

Drying Time

Strength (Concentration of Pigment): Reduction Test

#### 79. Closures in Food Packaging

Introduction

Functions of a closure

Components involved in a good seal

Materials used in the manufacture of closures

Resilient Materials

Facing Materials

Compatibility of closures and migration limits

Factors Effecting A Good Seal

Types of closures

Roll-on-Pilferproof Closures

Screw Caps

Lug Cap

Crown Caps

Plastic Closures

Epilogue

#### 80. Packaging Laws and Regulations

SWMA

PFA Rules

Ingredients

Other Labelling Rules under PFA

FPO Rules

MFPO Rules

Agmark Rules

Directory Section

Suppliers of Machinery & Plants

Suppliers of Raw Materials

# **About NIIR Project Consultancy Services (NPCS)**

NIIR Project Consultancy Services (NPCS) is a reliable name in the industrial world for offering integrated technical consultancy services. Its various services are: Pre-feasibility study, New Project Identification, Project Feasibility and Market Study, Identification of Profitable Industrial Project Opportunities, Preparation of Project Profiles and Pre-Investment and Pre-Feasibility Studies, Market Surveys and Studies, Preparation of Techno-Economic Feasibility Reports, Identification and Selection of Plant and Machinery, Manufacturing Process and/or Equipment required, General Guidance, Technical and Commercial Counseling for setting up new industrial projects and industry. NPCS also publishes various technology books, directories, databases, detailed project reports, market survey reports on various industries and profit making business. Besides being used by manufacturers, industrialists, and entrepreneurs, our publications are also used by Indian and overseas professionals including project engineers, information services bureaus, consultants and consultancy firms as one of the inputs in their research.

NIIR PROJECT CONSULTANCY SERVICES

106-E, Kamla Nagar, New Delhi-110007, India.

Tel: 91-11-23843955, 23845654, 23845886, +918800733955

Mobile: +91-9811043595

Email: [npcs.ei@gmail.com](mailto:npcs.ei@gmail.com), [info@entrepreneurindia.co](mailto:info@entrepreneurindia.co)

Website: [www.entrepreneurIndia.co](http://www.entrepreneurIndia.co)