Disposable Products Manufacturing Handbook

Everyday life products manufacturers worldwide produce a multitude of items that are intended for one use only. A disposable is a product designed for a single use after which it is recycled or is disposed as solid waste. The term often implies cheapness and short-term convenience rather than medium to long-term durability. The term is also sometimes used for products that may last several months distinguish from similar products that last indefinitely.

The fast moving life and modernization simultaneously lead to the necessity of disposables in one’s life. One cannot wash utensils all the time, neither can afford to arrange fine and good cutlery of glass or steel in a party for the guest. At such times, people rush for the disposables available in the market with variety of colors and designs.

For a manufacturer, to produce disposables is a good deal keeping in view the present demand and growth in the market. This handbook is a complete well to do package for a layman to understand the basic steps to be followed for setting up a plant for a particular disposable product. The book contains raw material details, product manufacturing process, machinery details, images with raw material and machinery suppliers. The Disposable Products Manufacturing Handbook is about producing Plastic Cups, Cutlery, Paper Cups, Banana Leaf Plates, Facial tissues, Wet Wipes, Toilet Paper Roll, Sanitary Napkins, Baby Diapers, Thermocol Products, PET Bottles that are used by masses in their day to day life. This well-established text provides a comprehensive coverage of the manufacturing processes adopted to manufacture various disposable products. It gives a holistic view of products produced, which has inputs from diverse fields. The book discusses the importance and objectives of processes and material used for the production of disposable products. Many examples have been provided to illustrate the concepts discussed.

Contents

1. INTRODUCTION
   Plastic
   Polypropylene
   Polystyrene (PS)
   Different Types of Disposable Products in Market
   Pet Bottles
Thermocol & Its Products
Paper Cup
Plastic Cutlery
Facial Tissue, Wet Wipes and Toilet Rolls
Plastic Cups
Disposable Banana Leaf Plates
Baby Diaper and Sanitary Napkin
Diaper
Sanitary Napkin

2. PLASTICS
Introduction
Composition
Additives
Classification
Thermoplastics & Thermosetting Polymers
Other Classifications
Biodegradability
Natural vs. Synthetic
Crystalline vs. Amorphous
Properties of Plastics
Toxicity
Plastics & Their Uses

3. THERMOPLASTIC
Stress Strain Graph of Thermoplastic Material
Acrylic
Nylon
Polyethylene
Polypropylene
Polystyrene
Polyvinyl Chloride
Teflon
Properties of Various Thermoplastic Products

4. THERMOSETTING PLASTIC
Process
Properties and Their Uses
Examples

5. POLYETHYLENE
Structure of Polyethylene
Process
Monomer
Polymerization
Production of Polyethylene
From Naphtha
As a Gas
Properties
6. POLYETHYLENE TEREPHTHALATE (PET OR PETE)

Production
Dimethyl Terephthalate Process
First Step
Second Step
Terephthalic Acid Process
General Process Involved in the Manufacturing of PET

Properties
General Properties
Application
Sustainable
Polyethylene Terephthalate Films
Intrinsic Viscosity
A PET soft drink bottle
Fiber Grade
Film Grade
Bottle Grade
Monofilament, Engineering Plastic
Property Chart for PET
Drying of PET
Copolymers
Degradation
Acetaldehyde
Antimony
Safety
Bottle Processing Equipment

7. POLYPROPYLENE
Chemical and Physical Properties
Polypropylene Resistance
Polypropylene Quick Facts
Polypropylene Fabrication
Degradation
Synthesis
Industrial Processes
Manufacturing
Properties & Applications
A Common Application for Polypropylene is as Bi-Axially Oriented Polypropylene (BOPP)
Other Useful Properties
PP Structure
PP Parameters
Basic Types of PP
Crystallinity
Presence of Selected Additives during Polymerization
Antioxidants and Stabilizers
Nucleants and Clarifiers
Antistatic Agents
Chemical Resistance
Stress Cracking Resistance
Permeability
Organoleptics
Notch Effects

8. POLYSTYRENE
Structure
Polymerization
Atactic Polystyrene
Syndiotactic Polystyrene
Properties of Polystyrene
Properties of Polystyrene
Physical Properties
Mechanical Properties
Optical Properties
Thermal Properties
Electrical Properties
Chemical Properties
Uses
Strength, Durability, Comfort, Safety
Applications of PS
Packaging
Appliances
Consumer Electronics
Construction
Medical
Other
Degradation
Biodegradation
Incineration
Forms Produced
Sheet or Molded Polystyrene
Disposable Polystyrene Razor
Foams
Expanded Polystyrene
Extruded Polystyrene Foam
Fused Cell Expanded Polystyrene Foam
Copolymers
Oriented Polystyrene

9. INJECTION MOULDING
Process Characteristics
Advantages of Injection Molding
Disadvantages of Injection Molding
Applications
Examples of Polymers Best Suited for the Process
Equipment
Mold
Injection Molding Die with Side Pulls
Mold Design
Mold Storage
Tool Materials
Machining
Cost
Injection Process
What is Injection Molding Cycle?
Different Types of Injection Molding Processes
Process Cycle
Equipment
Injection Unit
Clamping Unit
Machine Specifications
Tooling
Mold Base
Mold Channels
Mold Design
Materials
Tolerances and Surfaces
Power Requirements
Molding Defects
Silver Streaks
Short Shot
Jetting
Flow Marks
10. EXTRUSION MOULDING
Types of Extrusion
Plastic Extrusion
Single Screw Extrusion Machinery
Extrusion Dies
Screw Design
Cooling and Sizing Equipment
Pros and Cons of Extrusion Molding
Pros
Cons
Defects

11. COMPRESSION MOULDING
Process Definition
Process Characteristics
Process Schematic
Pros & Cons of Compression Moulding
Pros
Cons

12. BLOW MOLDING
Typologies of Blow Molding
Extrusion Blow Molding
Continuous Extrusion Equipment
Intermittent Extrusion Machinery
Advantages of Blow Molding
Disadvantages of Blow Molding
Spin Trimming
Injection Blow Molding
Disadvantages
Injection Stretch Blow Molding Process
Advantages
Disadvantages
Process Explanation
Advantages
Disadvantages
What is PET Blow Moulding?
PET Blow Moulding Process
Advantages of Blow Molding
Defects & Troubleshooting
Blow Moulding Glossary
13. THERMOFORMING
Vacuum Thermoforming
Process
Applications
Pressure Thermoforming
Advantages of Pressure Forming
Applications for Pressure Forming
Mechanical Thermoforming
Thin Gauge and Heavy (Thick) Gauge Thermoforming
Types of Thermoforming Molds
Applications
Benefits
When and Where does Thermoforming Fit?
Plastics Used
Thermoforming Materials
ABS
HDPE
HIPS
PETG
PC
Acrylic
Chart of Plastic Materials - Advantages, Disadvantages and Industry Examples
Advantages of Thermoforming
Pros & Cons of Thermoforming
Pros
Cons

14. PLASTIC CUPS
Introduction
Plastic Cups
Manufacturing Method
Thermoforming
Heating
Forming
Cooling
Trimming
Machine Type
Application of Thermoforming Technique
Raw Material
Steps
Polypropylene Characteristics
Compatibility of Polypropylene with Common Products
Properties of Poly Propylene
Specific Gravity
Mechanical Properties
Electricals
Chemical Resistance
Specification of Thermoforming Machines
Moulds
Glass
Cups
Plates
Spoons
Printing on Polypropylene
Printing on Cups, Glasses and Plates
Roto Gravure Printing
For Multicolor Printing
Flow Diagram for Disposable Plastic Cups
Plant and Machinery Details
Thermoforming Machine
Specifications
Thermoformable Extrusion Line
Mono & Multilayer Thermoformable Sheet Lines
Specifications
Plastic Cup thermoforming Machine
Usage
Hydraulic Automatic Cup Making Machine
Parameter
Functions and Characteristics
Complete Line: Extrusion + Cup Making Machine
Plastic Sheet Extruder
A. Main Parameters
B. Configuration and Specification
1. Main Extruder: one
2. Non-stop Fast Screen Changer With Double-sieve: one set
3. Die-Head
Calendar Roll Stack: one
4. Thermostat System: Two sets (Only use for making PS sheet)
5. Air Cooling Stand: one
6. Trimming Unit: one
7. Haul Off Unit: one
8. Single-shaft Winder (One set)
9. Electronic Control Cabinet: one set
10. Waste sheet re-winder: one set
Main Technical Data
Feature
Key Electric Components
Assistant Machines
Automatic Cup Stacking Machine
Usage
Main Technical Parameter
Screw Air Compressor
Industrial Chiller (Air Cooled)
Model Specification
Thermoforming/Vacuum Forming Sheet Extrusion Line
PP/PS Specification
Multi-Laye Cp-Extrusion Sheet Line
Technical Specification
Features
HIPS / ABS / PC / PMMA / PS Extrusion Sheet Line
Technical Specification
Suppliers of Plant & Machinery
Raw Material Suppliers
15. BABY DIAPER & SANITARY NAPKINS

Introduction
Baby Diaper
Types of Diapers
Disposable
Reusable: Cloth Diaper
Sanitary Napkins
Uses and Applications
Baby Diaper
Sanitary Napkin
Properties of Baby Diapers
Properties of Sanitary Napkins
Advantages & Disadvantages of Disposable Diaper
Features of Disposable Baby Diapers
Components of Disposable Diaper
Raw Materials for Manufacturing of Disposable Diaper
Absorbent Pad
Nonwoven Fabric
Other Components
Diaper Structure
Diaper Acceptance Criteria
Function of Baby Diaper
Manufacturing Process
Formation of the Absorbent Pad
Preparation of the Nonwoven
Assembly of the Components
Mathematical Models for Disposable Diaper Manufacturing
By-Products/Waste
Quality Control
Process Flow Sheet for Baby Diapers Manufacture
Absorbent Pad Formation
Formation of Topsheet and Bottomsheet from Non-Woven Fabric
Assembly of Components
Preparatory Processes for Sanitary Napkins
Opening
First Stage is Opening
Second Stage
Third Stand: Kiering, Bleaching & Washing
Bleaching
Sterilisation
Dry Heat
Auto Claving
Exposure to Ethylene Oxide
Hydro-Extracting
Drying
Raw Materials Required
Raw Materials Description
Roll Pulp
Non-Woven Fabric
Polyethylene Film
Tissue
Hot Melt & Polyextruded Adhesive
Pressure Sensitive Adhesive
Silicone Release Paper
Specifications of the Raw Materials
Wood Pulp
Non-Woven Fabric
Silicone Release Paper
Hot Melt

Process of Manufacture of Sanitary Napkins
(A) Preparation of Cotton Lint Sliver
(1) Cotton Opening
(2) Lapping
(3) Carding
(4) Draw Frame
(5) Tissue Paper Wrapping
(B) Manufacture of Sanitary Napkins
(1) Cone Winding
(2) Knitting & Insertion of Tissue paper Wrapped Sliver
(3) Cutting & Looping of Both Ends of Sanitary Napkins
(4) Packing

Process Flow Sheet for Sanitary Napkins
Disposable Diaper Machine Photographs
Full Servo Baby Diaper Making Machine Specifications
Full Servo Pull-Up Baby Diaper Machine Specifications
Main Technical Parameter
Main Function Features
Sanitary Napkins Machinery Photographs
Fast & Easy Packing Wing Style Sanitary Napkin Equipment Specifications
Structure & Configuration
Main Technical Parameter
Fast-Easy Packing Women Sanitary Pad Machine
Function & Assemble Parts
Structure & Character
Main Technical Parameter
Sanitary Napkin Production Line
Main Machine
Crusher
Model: Multiple-Function Machine for Sanitary Napkin
Main Production Line Specifications
Suppliers of Plant and Machinery (For Baby Diapers)
Suppliers of Raw Materials
Suppliers of Plant and Machinery (For Sanitary Napkins)
Raw Materials Suppliers

16. DISPOSABLE BANANA LEAF PLATE
Introduction
Function
Properties of Banana Leaf Plates
Use and Application of Banana Leaf Plates
17. FACIAL TISSUE & BABY WET WIPES

Introduction
What is a Tissue Paper?
Properties
Production
Applications
Hygienic Tissue Paper
Facial Tissues
Paper Towels
Wrapping Tissue
Toilet Tissue
Table Napkins
Facial Tissue
Properties
Manufacturing Process for Facial Tissues
Steps
Pulping and Retting
Pressing
Creping
Reeling and Cutting
Uses of Facial Tissue
Size
Effects
Wet Wipes
Introduction
Production
Uses
Baby Wipes
Cleansing Pads
Industrial Wipes
Pain Relief
Personal Hygiene
Manufacturing Process Flow Diagram for Facial Tissue & Wet Wipes
18. PAPER CUPS
Introduction
Advantages of Paper Cups
Waterproofing
Printing on Paper Cups
Properties of Paper Cups
Environmental Impact
Recycling
Paper vs. Plastic
Emission
Habitat Loss Trees Used
Lids
Uses & Applications
Per Case Contents Measurements
Manufacture
Process Flow Chart
Other Processes
1. Paper Cup Manufacturing Process
   Cup Forming Process
2. Paper Cup Making Machine Technical Data
Complete Production Line for Paper Cup Forming
Flow Chart
1. High Speed Extrusion Laminating Machine
   Process 1
2. Four Color Flexographic Printing Machine
   Process 2
3. Computerized Micro-Gap Flat Creasing and Die Cutting Machine
   Process 3: Cut the Printed Roll Paper into Small Pieces
4. High Dpeed Paper Slitting Machine
   Process 4: Split the Big Roll PE-Coated Paper into Small Roll Paper
5. Middle Dpeed Paper Cup Forming Machine
   Machinery with Specifications
   1. High Speed Extrusion Laminating Machine
Features of High Speed Extrusion Laminating Machine
Main Parameters of High Speed Extrusion
2. Four-color Flexographic Printing Machine Laminating Machine
Specifications of Four-color Flexographic Printing Machine
3. Creasing & Cutting Machine
Description of Creasing & Cutting Machine
Features of Creasing & Cutting Machine
Technical Parameters of Creasing & Cutting Machine
4. Middle Speed Paper Cup Forming Machine
Characteristics
Advantages of Middle Speed Paper Cup Forming Machine
Technical Parameters
5. Paper Cup Forming Machine
Main Parameters of Paper Cup Forming Machine
6. Double Side PE Coated Paper Cup Machine
Description of Double Side PE Coated Paper Cup Machine
Technical Parameters of Double Side PE Coated Paper Cup Machine
Suppliers of Plant and Machinery
Suppliers of Raw Material

19. PET BOTTLES
Introduction
Uses & Applications
Production of Base (Amorphous) Pet Chips
Properties
Main Advantage of PET
Food Grade
Aesthetics
Strength
Weight
Airtight & Leak Proof
Chemical Resistance
Manufacturing Process
Plasticizing the PET
Injection Molding the PET Preform
Heating the PET Preform
Process Flow Diagram
Stretch Blow Molding the PET Container
PET Container Ejector
Machinery Suppliers
Pet Stretch Blow Molding Machine
Technical Specifications
Pet Blow Molding Machine
Specification
PET Bottle Making Machine
Technical Specifications
High Pressure Three Cylinder Air Compressor
Specification
Automatic Pet Blow Moulding Machine
Two Stage PET Blow Moulding Machine
Features of Automatic Pet Blow Moulding Machine
Machine Technical Specifications
20. THERMOCOL & ITS PRODUCTS

Introduction
Typical Properties
Applications
Uses & Applications
Food Packaging
Properties of Thermocol
Light Weight
Durability
Moisture Resistance
Thermal Efficiency
Shock Absorption
Versatility
Ease of Use
Environmental Benefits
Manufacturing Process
Basic Raw Material Required
Basic Plant and Machinery Required
For Plates
For EPS Glass & Cups
Method Used
Process
Making Styrene
Making Polystyrene
Preparing the Beads
Making Expanded Polystyrene Foam (EPF)
Molding
Making Extruded, Expanded Polystyrene Foam
Cutting, Bonding and Coating
EPS Products (Plates/Cups/Glasses)
Raw Material & Availability
Moulding
Main Equipment and Technical Parameter
For Plates
1. PS Foam Sheet Extrusion Line
Components
A. Mixer
B. Automatic Feeding System (Automatic Self-control System)
C. 1st Extruder
D. 2nd Extruder
E. Cooling System
F. Hauling-off System
G. Winding Device
2. Automatic Vacuum Forming Machine
Components
3. Double Worktables Hydraulic Cutting off Machine (PLC controlling)
4. Crusher
5. Recycling System
For EPS Glass & Cups
A. Material expander: (1 set)
B. Dryer: 1set
C. Crusher: 1set
D. Central System of Sending Material: 1set
E. Foaming Machine: 4 sets
F. Other Assistant Equipments
1. Water Tank (10m3): 2
2. Cooling Water Tower
3. Centrifuge
4. Air Compressor
Manufacturing Process
Basic Raw Material Required
Basic Plant and Machinery Required
For EPS Glass, Cups and Plates
Process Description
Process Flow Diagram
Flow Diagram for EPS (Thermocol) Plates/Cups/Glasses
Raw Material, Product & Machinery Photographs
Fully Automatic Shape Moulding Machine
Features & Technical Specification
Automatic EPS Shape Moulding Machine
Fully Automatic EPS Shape Molding Machine
Automatic Thermocol Packing Machine
EPS Pre-Expander Machine
EPS Preformer
EPS/Thermocol Block/Sheet Cutting Machine
Tech Details
PD Foam Sheet Extrusion Line
Automatic Vacuum Forming Machine
Features
Automatic EPS Foam Cup Molding Machine
EPS Foam Cup Making Machine
Foam Cup Manufacturing Machine
Technical Data
Suppliers of Plant & Machinery
Suppliers of Raw Material

21. PLASTIC CUTLERY
Introduction
Importance of Plastic Cutlery
#1 - Cost
#2 – Convenience
Problems
#1 – The Vast Majority of Plastic Cutlery cannot be Recycled
#2 – It creates Waste
Properties of Plastic Cutlery Items
Uses of Disposable Plastic Cutlery Items
Manufacturing Process
Disposable Plastic Cutlery Items
Basic Raw Material Used
Basic Plant and Machineries Required
Step 1: Loading
Step 2: Liquification
Step 3: Mould Loading
Step 4: Moulding
Step 5: Packaging
Product Specification
Process Flow Diagram
Plant & Machinery Details
Injection Moulding Machine
Component List for Injection Moulding Machine
Technical Parameter
Types of Machine
Spare Parts
Mould for the Production of Plastic Spoons
Cutlery Packaging Machine
Product Description
Scope of Application
Features
Universal Machinery
Manufacturing Factory 1
Manufacturing Factory 2
Packaging Machine
Rotary Packing Machine
I. Main Performance and Structure Features
II. Application
III. Optional Devic
IV. Specification
Suppliers of Plant & Machineries

22. TOILET PAPER ROLLS
Introduction
Description
Bleaching of Fibers
Chemicals
Material
Color and Design
Manufacturing Process Flow Diagram for Toilet Paper Roll
Uses
Manufacturing Process for Toilet Paper Rolls
Toilet Paper Machinery Details
Full-automatic High-speed Rewinding and Perforated Toilet Paper Machine
Description of the Equipment
Features
Technical Data
Optional Equipment
The Name of Spare Part of the Machine
Specification of Raw Paper
Toilet Paper Cutting Machine
Functions and Features
Main Technology Parameter
Toilet Roll Embossing Machine
Specifications
Toilet Paper Processing Equipments
1. Rewinding Machine
2. Toilet Paper Rolls Slitter
3. Sealing Machine
4. Product
Supplier of Plant and Machinery
Suppliers of Raw Material

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.


NPCS also publishes varies 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.

NIIR PROJECT CONSULTANCY SERVICES , 106-E, Kamla Nagar, New Delhi-110007, India. Email: npcs.india@gmail.com Website: NIIR.org