Polypropylene: Trends and Developments in Packaging

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Polypropylene
Versatile Polymer : Designer’s Choice
The Polypropylene Journey

- Year 1957 – The journey began at Ferrara, Italy
- 50+ and growing strong by leaps and bounds.
- Unbounded growth from few gm then to 44 MMT now.
- 2nd largest plastic consumed in the world.
- Prof. Ziegler & Natta received Noble prize for Catalyst development in 1963

PP-The Most Invented Invention...!!!
-David B. Sicilia co-author of The Entrepreneurs: An American Adventure, 1986

Yet young and the journey continues
PP - A Versatile Polymer
...With the widest Performance Envelope

IZOD impact at RT, J/m²

Optimum impact-stiffness balance

Flexural modulus, MPa

0 200 400 600

0 1000 2000
Global PP Demand

PP - CARG 3.7%

Source: CMAI 2011
Polypropylene – India Growth Opportunities

PP Consumption 2005

- BOPP: 8%
- F & F: 5%
- Extrusion: 3%
- IM: 36%
- TQ: 16%
- Raffia: 32%

PP Consumption 2011 (Proj)

- Extrusion: 7%
- F & F: 8%
- BOPP: 9%
- TQ: 9%
- IM: 35%
- Raffia: 32%

Journey from 1.3 MMT to 3.2 MMT by 2011
Polypropylene for Packaging
Packaging – Revolutionizing Classical 4 “P” Model

Polypropylene in Packaging – Adding the 5th Dimension
Clarified Polypropylene
Characteristics of Clarified PP

Glass like transparency

- Excellent moisture barrier & Chemical resistance
- Higher continuous use ambient temperature
- Hot fill(upto 98° C), Retortable & Microwaveable
- Excellent balance of stiffness, flexibility
- Live Hinge property
- Excellent ESCR property
- Cost effective

Clarified Polypropylene (cPP) ideally suited for Modern Life Style
cPP Consumption

India vis-à-vis Global Average

7.5 %

3.1 %

Strive to Meet Global Average
Incorporation of Ethylene in PP

- Chain regularity disturbed.
- Decrease in crystallinity and rate of crystallization.
- Restrict the size of crystalline aggregates.
- Better clarity.

Use of Clarifier (Nucleation)

- Large number of crystallites having size less than wavelength of light.
- Effect: Better clarity and high stiffness.
Nucleated vs Clarified PP

Nucleators and clarifiers induce formation of smaller spherulites that scatter less light.

Inorganic Nucleators: Larger than the wavelength of light.
Sorbitol-based Clarifiers form a fibrous network within the resin that makes the crystallites smaller than the wavelength of light.
(Source: Milliken Chemical)
Polypropylene morphology

Standard PP  Nucleated PP

Photomicrographs - cross-polarized light

100 microns
Polypropylene morphology

Mechanism of Nucleation

- Non-Nucleated
  - Polymer Melt
  - No Crystallization
  - Partially Crystallized
  - Fully Crystallized

- Nucleated
  - Nucleating Agent
  - Crystallization Begins
  - Partially Crystallized
  - Fully Crystallized

Cooling
Clarified Polypropylene
Indian Perspective
cPP – Diverse Process Technologies

Processing Techniques

Moulding
- TWIM
  - RTE / RTS Containers
- IM
  - Housewares, Consumables & Medicare
- ISBM
  - Pharma & Beverages

Extrusion
- EBM
  - Cosmeceuticals
- Sheet & TF
  - Disposable containers

Partnership with Machinery mfrs. – Key to future Success
Infusion of new technologies (ISBM & TWIM) to fuel growth
Clear Business Opportunities by Clarified Polypropylene
OEM’s: GSK, Heinz, Cadbury, GCMMF

Total Current Market: 85 KTA

- 50% is packed in bottles & 50% in refill pouches
- Market is growing at 15%
- GSK controls 70% market

Complete Market Acceptance of CPP Containers
cPP Beverage Analysis

- Flav water
- Sports Drinks
- Dairy Bev.
- Water
- Long shelf Juices
- Fresh Juices
- Beer
- CSD’s

CSD’s is Oxygen Sensitive

CPP is the Winner - Strategy to substitute glass & Tetra-Pack
Dairy: Flavored Milk

- Burfi
- Peda
- G'Janum
- Kalakand
- Kunda
- Khurchar
- Kulfi
- Rabri
- Basundi
- Khoa
- Ghee
- Butter
- Malai
- Fat Rich Product
- Heat Desiccated Products
- Milk based Desserts
  - Kheer
  - Payasam
  - Phirmi
  - Ghevar
  - Sevian
  - Sohan Halwa
  - Gajar Halwa
  - Cashew Barfi
- Curd
- Yoghurt
- Lassi
- Chaas
- Chhanna
- Paneer
- Fresh Milk
- Flavoured Milk
- Rasgolla, Sandesh, Rosomalai, Chhana Murki, Chhana Polao, Panta
Dairy: Flavored Milk Contd...

Manufacturing Process
Dairy: Flavored Milk Contd...
Dairy: Flavored Milk Contd...

Industry Scenario
- 80 Dairies - 300 KL / Day - Growing @ 25 %
- Requirement - 45 Cr Bottles per Anum
- PP Business Potential - 13 KTA

Major Players
- Amul – (Leader, Mkt share of 60 %)
- Mother Dairy / Verka / Prabhat / Aavin / Cavine Kare

Down Stream Requirement :
- Amul alone needs 600,000 Bpd
- ISBM Machines with 12 Cavity Mould : 7 Nos
- Capital Investment : Rs 12 Crs

Successful Completion to Open New Avenues in other beverages
**Hot Filled Fruit Drink**

**Target Market:** Low Juice Content Fruit Drinks

**Existing Material:** Glass, HR-PET, Tetrapak

**Status:**
- Trend Changing towards Health Drinks
- Government emphasis on Processed food sector

**cPP Offers:**
- Hot fillability upto 98 deg C
- High Filling Temp -> lower Preservative Requirements
- Lower Bottle Weight Vis-à-vis PET

*CPP Finding rightful place in Hot Filled Products*
Drinking / Flavoured Water

OEM’s : Bisleri, Pepsi, G.C. Beverages, National Foods, Railways

Existing Material: PET

Total Current Market: 85 KTA

- High Growth market (30% annually)
- PP offers Weight advantage apart from Soft touch and no Acetaldehyde Generation
- Contact Clarity same as glass
- Bottle & Cap both from PP – Ease of recycling

35 % Lower Density than PET : Commercial USP of cPP

Water : Promising Market for cPP
RTE Food

Target Market: RTE Food / Mithai Packaging

Existing Material: Paper Cartons / Trays

End User: RTE Outlets, Food-Courts, Mithai Shops, Meal Vendors, Local Sweet and confectionary shops

Status:
- TF Containers are in use for select Mithai Pkg.
- Meal Trays are also being used by few selected vendors
- Glasses & Cups are being used for liquid / creamy foods

Market Overview:
- Ethnic Food Mkt is 2.9lakh TPA
- Organized Mkt marginal – Growing@15%
- Demand for Attractive high end packaging is growing
- Possible to Pack Hot Foods
- Microwavable Packaging

Changing Food Habits: Driver for Disposable Containers
On-Going Projects: Jam and Honey

**Target Market:** Fruit Jams, Honey, Bread Spreads

**Existing Material:** Glass,

**cPP Offers:**
- cPP Bottles can be Hot Filled – an important requirement for Jam Filling
- No Breakage – Ease of handling
- Lower Weight
Optical Media: DVD Boxes

- Infotainment Industry - India is catching up very fast with global trend.
- Optical Media a major growth area for Infotainment.
- DVD a very fast growing application while VCD a declining market.
- Global DVD production estimated to 30 Bn in 2005.
- USA, Europe & China account for 95% of global market.
- India’s share is < 1%

~ 12% MADE IN CHINA
Optical Media (DVD Boxes)

**Target Market:** Movie Houses

**Existing Material:** Styrenics

**Status:**
- Sony has completely switched over to cPP DVD Boxes
- Presently they are importing all their requirements from China
- DVD Market is growing at very high speed

Total Disc production (CD/DVD): 1 Bn Pc/Yr
DVD market Growth rate 92%

*Catering High-Tech with HDD & Blue Ray Formats*
Pharmaceutical

**Target Market:** Pill Vials, I.V. Fluid Bottles, Ayurvedic Cough Syrups

**OEM’s:** PDPL, GSK (Pharma), Pfizer, Alpha

**Status:**
- New Grade SR20NS Successfully Established
- Requisite Pharmacopeia certification Obtained

*India becoming favored destination for Multinational Pharma Industry*
Moisture Barrier and Adequate Transparency:
CPP Containers find larger acceptance day by day
Polypropylene:
Extrusion Blow Moulding (EBM)
EBM: Freedom of Design including Transparency
Polypropylene:
Thermoforming
Thermoformed Products
Polypropylene :
Thin Wall Injection Moulding (TWIM)
Retailing to require large quantities of TWIM Containers for RTE Foods Items

Presently no Real TWIM Downstream in India
Trends in Bulk Packaging
• It is a form of weave in which adjacent PP warp tapes are twisted around consecutive weft tapes to form a spiral pair, effectively locking each weft in place.
Advantages of Leno Bags

- Excellent breath ability, good tensile and burst strength.
- Used for onions, potatoes, garlic, cabbage, beet root, brinjal, carrot and coconuts.
- Can be printed and labeled.
- Available in wide range of colours.
- Light in weight & cost effective compared to jute bags.
- Does not impart odour to packed contents
- Capacity: 1 to 50 Kg.
Leno Bags for Potato Storage

- India 3rd largest producer of potatoes.
- Most suitable for Cold Storages – due to better aeration, leno bags reduces power consumption by 30%.
- Leno and CIPC – to create synergy for storage packaging.
- No sweating of potatoes hence lower wastage
- Ideal for sweat less potatoes due to controlled sugar level in potatoes.
Woven Sack for Bulk Packaging

Agri-Horticultural Produce
- Sugar / Food Grains
- Fruits & Vegetables
- Tea & Coffee

India is 2\textsuperscript{nd} Largest producer of Horticulture Produce, Sugar and Food grains
Packaging and storage of Food grains and Sugar is a challenging job.
Both are hygroscopic and thermally active.

Ideal Packaging System should have:
- Adequate Mechanicals.
- Sustain the quality on long term storage
Field Trials- PWS for food grain Packaging

- 100% satisfaction in Sugar and Foodgrain application
- No deterioration in grain/sugar quality
- Reduced need for prophylactic treatment
- Stable stacks, free of bulges and burstings
- No infestation due to rodents, birds, etc.
- No moisture gain/loss
- Hygienic and compatible with Edible Items
- Hooking & Worker Friendly

Certification Received from HAFED, NAFED, NSI, IARI etc.

PP Woven Sacks meets all the functional requirements
PP Woven Sacks meets all the functional requirements.
IIP Study report synopsis:

- Shelf life evaluation on moisture content and organoleptic properties of tea stored in PP Woven Sacks also found to be better than in jute bags.
- Chemical quality of tea stored in jute & PP Woven Sacks were comparable.
- Mechanical properties of PP Woven Sacks found to be better than jute bags.
- Transport worthiness and stackability found to be comparable to that of jute bags.

*Cost effective functional solution to bulk tea packaging.*
Target Market: Hot Filled Juices, Pickles, Trays for Biscuits, RTE-Meal & Tea Bags

Status:
- Very High demand for packaging of various consumable food items
- RTE (Ready to Eat), RTD (Ready to drink), RTC (Ready to Cook) Take away Foods, Processed Foods
- Trays and Punnets for Confectionery, Fresh Fruits Pastries, Tea Bags.
Key Projects

Breathable Films:
- Extend shelf life, preserve freshness, flavor and reduce the need for preservatives.
- Equilibrium respiration rate for extended shelf life
- Use in: Leafy vegetables, Fruits

PP in core layer in a 3 layer structure:
- Enhanced clarity, gloss and moisture barrier
- Superior strength and stiffness
- Use in: Salt, sugar, candy/toffee, preservatives
Key Projects

Multilayer Thermoformed Trays:

- Multilayer thermoformed trays to withstand cold temperature (-19°C) & ambient temperature (40°C).
- Enhanced Aesthetics
- Use in: Liquid concentrates / Instant Meals / Soup / Noodles
- Products: 5
Plastic Bubble Guard Cartons- Advantages

- Light Weight & Easy to Handle
- Good Aesthetics, excellent printability
- High Strength & Durability
- Safe & Hygienic
- Design Flexibility
- Easy availability
- Maintenance Free & Washable
- Dimensional Consistency
- Eco-friendly
- Value Addition to the Product
- High Salvage Value
- Reusable & Recyclable

Above all ...

Moisture Resistant so...

Reduction in Wastages
PP – Caps & Closures
PP – Paint Pails

PP Containers for Water Based Paint Pails
Manufacturing Technology Envelop
to cater all the customer needs
### RIL Technology Layout

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RIL Partnership
Role of Business Development Group

- Evolution of concept
- Explore / Identify new market
- Identify Modern technology
- Identify Entrepreneur / Investor
- Downstream development
- Nurturing new application / Promotion / Market extension
- Securing Approvals From Testing Agencies & End-user
- Regulations / Mandation for driving Growth
A Vital link amongst M/c Mfg. - Business - Converter - End User

Machinery
Manufacturers

Extensive support from

- PARC – technical support
- Nodal Agencies
- Govt. Agencies – for Spec in

End Users
Processors

Concept to Commercialisation
In short......

- Concept Marketing
- Product Identification
- Market Survey
- Feasibility Studies
- Development
- Implementation
- Supply chain
- Nurturing new development

360° Support - Complete package of Value Added Services to Customers & Entrepreneurs
Thank You!