



सीएसआईआर-भारतीय विषविज्ञान अनुसंधान संस्थान  
CSIR-INDIAN INSTITUTE OF TOXICOLOGY RESEARCH

वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद्  
COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH



## Safety Regulations, Compliance and Testing of Ancillary Materials for Food Packaging - Labeling Materials, Adhesives, Inks, Markings (National, International and Comparisons)



**Prof V.P.Sharma**

**CSIR-Indian Institute of Toxicology Research, Lucknow**

**e mail ID : [vpsitrc1@rediffmail.com](mailto:vpsitrc1@rediffmail.com)**

## Market Scenario & Challenges

The plastic market is extremely functional, versatile and significantly vital to our economy

- Role of ancillary materials - Covers a large group of products and play a vital role towards completeness of a package
- Safety Assessment of Packaging Materials- Overall Migration, Toxicological Safety Assurance
- Absence or inadequacy may impair performance functionally/ aesthetically/ statutorily
- Limited country-of-origin labeling hampers efforts to understand the link between where a food is grown and the chemical burden it carries.



### Sir CV Raman

- First Asian to be awarded Noble prize in Physics.
- Proposed the breakthrough theory 'Raman effect'
- Co-proposer of Raman-Nath theory along with Nagendra Nath
- Only non-German whose paper was published in 'Handbuckder Physik'
- A field of study, Raman Spectrography, Has been named after him
- Honors
  - Knight Bachelor (1929)
  - Nobel Prize in Physics (1930)
  - Bharat Ratna
  - Lenin Peace Prize





## Functions & Additives

Plastics ancillary equipment- material storage, conveying, blending, coloring, drying, magnetic tool clamping, parts conveying, separation and granulation of scrap.

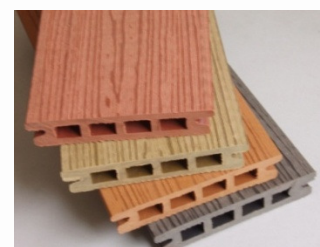
Plastic additives- increasingly being utilized for varied functions which include property modifiers, extenders, stabilizers and processing aids in industrial applications.

Additives such as antimicrobials, antioxidants, UV stabilizers, plasticizers, impact modifiers and others are largely used in compound formulations to improve chemical and physical properties

Adhesives for laminates- join parts

Printing Inks

Caps/Closures



FDA maintains educational information, databases and listings related to food allergens, ingredients, food additives, color additives and Generally Recognized As Safe [GRAS] substances.

■ Packaging and Food Contact Substances

■ Irradiation of Food Packaging

■ Labelling, Nutrition, Environmental Decisions, Geographical conditions



## Factors for Selection of Closures

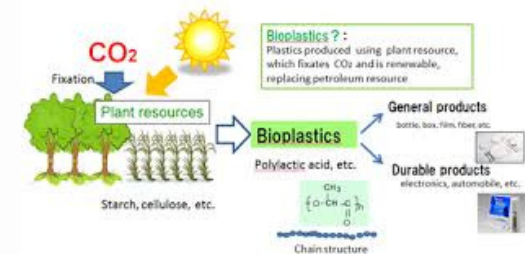
Product characteristics, dimensional stability, heat resistance, environmental stress, compatibility etc.

Raw Material for closures- PP, LDPE, HDPE, PS, Glass, Metals

## New Technological Advancements

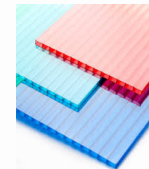
Lactide technology, which enables a high renewable content in combination with vast opportunities to develop products with optimized performance for different bioplastic applications.

There is a strong trend towards sustainability and renewable material in the world. With one million plastic bags being used per minute throughout the year, many end up languishing in the environment.



## Migration of Substances from Packaging Materials to Food

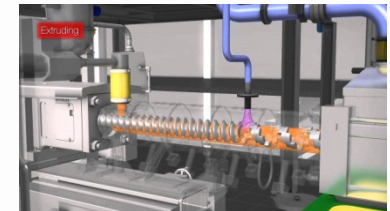
- Role of ancillary materials in food packaging complimenting packaging ensuring food safety and security
- Establish safety of ancillary materials in food packaging with focus on overall migration, toxicological safety
- Current practices followed in India for ensuring safety of food packaging-Spoilage, contamination during transportation
  - Preservation of product over stipulated time
  - Preserve organoleptic properties, convenience in dispensing, resealing, avoid pilferage, holding vacuum and pressure
  - Barrier to moisture, air, gases, vapors of volatile liquid
  - The same printing ink system may be safe for use on food packaging or unsuitable depending on - the packaging material it is printed on, the printing conditions, the food that is packed with the printed packaging, the conditions during the packaging manufacturing and filling



## Adherence to high standards for food packaging inks a must for consumer safety Selection of Ink and type of printing process, substrate, finish, drying process.....

- Food packaging is naturally sensitive area and manufacturers must focus on the highest levels of manufacturing controls in line with the imperative of protecting the consumer, tamper resistant packaging/ closure and liners , shelf life, economics
- It is the responsibility of all suppliers in the value chain to ensure that their contributions do not in any way endanger consumer health -through the migration of harmful chemicals into the food stuffs
- Torque require to remove should be optimum
- ✓ Permeation , Migration

May be identified by sensitive chemical analysis.





## **Toluene Free; higher level of solvent retention**

- Higher risks of migration of toxic impurities, which is avoided using alcohol/acetate system; unlike alcohol/acetate system, there is very limited ink chemistry possible with toluene and therefore, cannot be used in multipurpose ink series.
- Universal ink concept; reverse printing of the films to be avoided unless there is functional barrier between ink and foodstuffs
- Very low solvent retention in the print, trouble free running at maximum speed, instant adhesion on substrates ; development of thermochromic inks

## **Security Devices**

- Prevent tampering , prevent pilferage and theft from retail
- Anti-counterfeiting devices
- On-press label and online label verification
- Security of the product, promotional opportunities
- Withstand processing, sterilizing, pasteurization, autoclaving – steps involved in life cycle

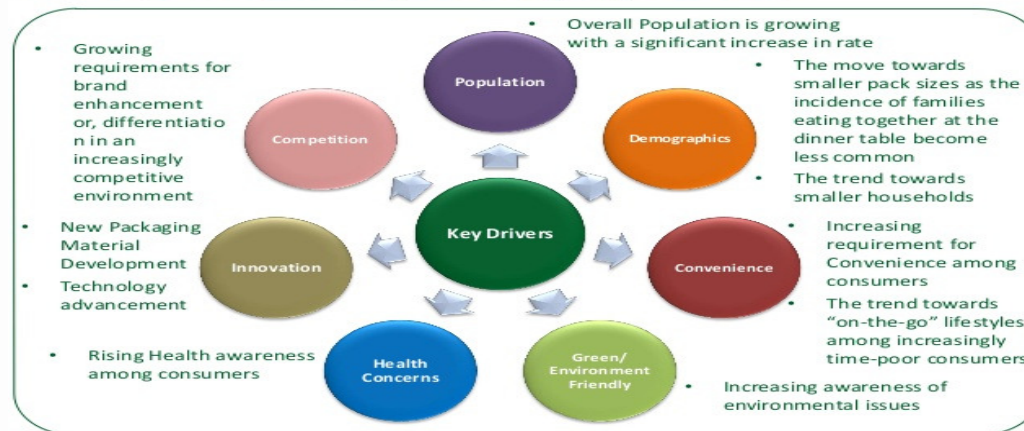


Plastic additives market is estimated to grow on enhanced demand in construction, packaging, consumer goods and automobile industries till 2022.

Presence of huge untapped market segments will open up future opportunities.  
Cured adhesives must be transparent, colourless, possess the required level of thermal and chemical resistance

Laminating adhesives- General, Medium, High, Ultrahigh Performance based

### Drivers: Influencing Packaging Demand

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## Labeling

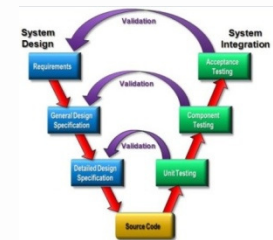
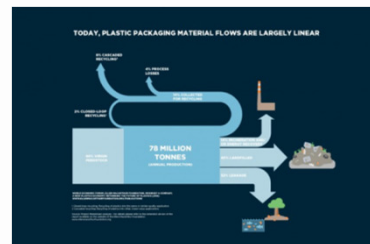
Includes equipment , control, package, directions for use, maintenance manuals, Fragrance labels etc

■ Increase in the production speed and the pressure for the ecological cleaner system has led to water based, radiation cure technology, digital flexoprinting processes in place of conventional system.

■ Rigid plastics and glass are the major materials used for packaging beverages, accounting for 70% of the market.

■ PET is the major rigid plastic packaging substrate used to pack a wide range of beverages fruit based beverages, bottled water.

■ An estimated 55% of the packaged water bottles market, rest accounted by bulk packaging and pouches.



## Compliance to International guidelines of FDA/WHO/OECD/FSSAI/BIS/HACCP/ISO 22000/Codex Alimentarius etc are necessary.

- The U.S. FDA has formulated the Federal Code of Regulations, Title 21, Part 177 to regulate the types of indirect additives used in food contact substances.
- These requirements are a set of guidelines established to regulate maximum permissible additive quantities used in food processing and packaging applications.
- The global industry is characterized by volatile raw material prices coupled with stringent environmental regulations for manufacturing plasticizers, UV stabilizers and other additives.



- Right packaging is highly essential to avoid spoilage and to maintain its quality and freshness before food products would reach to consumers.
  - Varied types of packaging - norms set by the government
  - For businesses, being able to adapt to the trends set by the new consumer typology is the key to success.
  - Packaging industries are undergoing a process of constant innovation, seeking both to improve the performance of existing solutions and new ways to provide value without increasing the production costs
- Polymers are the backbone of all ancillary materials used for packaging-thermoset/ thermoplast depending upon the requirement



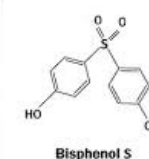
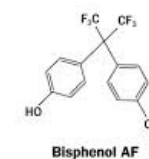
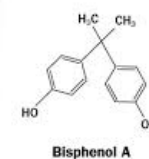
**Food may pick up contaminants at multiple steps along the supply chain, from the point where raw ingredients are raised to the final dishing up of a meal.**

**A study explores a possible mechanism for anticipating and assessing chemical transport through food**

**The residue level of specific pesticides depends on their use and therefore on both the crop and the regional pests**



**New laboratory studies in Japan indicate that the twin, called bisphenol AF, or BPAF, may be even more potent than BPA in altering the effects of steroid hormones such as estrogens in the body.**





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The plastics industry needs to address concerns about the harmful substances that plastics may contain-plasticizers, stabilizers, etc. Non Intentionally added substances in foods are generally less well understood and regulated.

The temperature to which final packaging is exposed during processing may affect levels of BPA transport. Several other steps along the way may impart impurities, by-products, contaminants from recycling processes, and breakdown products from additives and plastic polymers.

These may affect the endocrine system in the long term and can also lead to fertility and thyroid problems, as well as diabetes. Bisphenols make plastic stronger and prevent yellowing in the products but the substances could leach when in contact with fat, such as that in meat and milk.

Phthalates, chemicals used in making plastics, had been linked to obesity.

***Source: Volume 125 | number 1 | January 2017 Environmental Health Perspectives***

## Safety concerns

- Contaminants from the post consumer material may appear in the final food-contact product made from the recycled material,
- Recycled post-consumer material not regulated for food-contact use may be incorporated into food-contact packaging, and
- Adjuvants in the recycled plastic may not comply with the regulations for food-contact use.

Contract packaging service to obtain the best quality packaging available.  
A co-manufacturer may benefit by cost, speed, quality and innovation.

- ✓ Improving the design of nutrition labels to promote healthier food choices and reasonable portion sizes
- ✓ Global Food Demand Scenarios for the 21<sup>st</sup> Century





Innovations in the field are focused on the device indicators' interaction with the product, delivering information conditions like freshness, humidity, leakings, temperature, etc., and new devices, like the data matrix system and the new RFID technologies.

Environment Protection-Sustainability, Recycling, composting, material lightness, PETs, bioplastics, etc.

Improvements— Size, family packs, microwaveable or bakeable packs, and self-heating/cooling containers.

### **Conformance to applicable regulations is mandatory**

Some are country specific such as the US FDA and the US Department of Agriculture; others are regional such as the European Food Safety Authority.

Certification programs - Global Food Safety Initiative

Food packaging considerations may include: use of Hazard analysis and critical control points, Verification and validation protocols, Good manufacturing practices, use of an effective **Quality Management System**, Track and trace systems, requirements for label content.



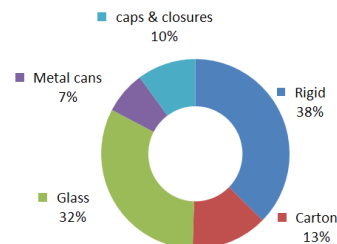




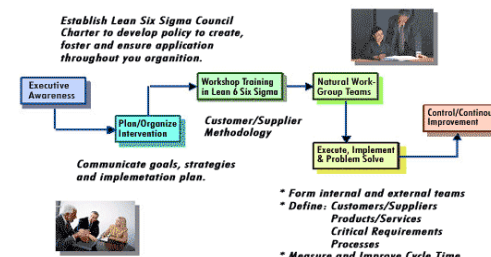
## Food Packaging Testing

- Measurement of a characteristic or property involved with packaging : primary packages, shipping containers, unit loads.
- The quality and safety of food packaging and other food contact-related materials, is a primary concern for all consumers, businesses, and governments across the global supply chain.
- Food safety testing measures the effects and interactions of the levels of packaging: contents, external forces, end-use; qualitative or quantitative procedure.
- Package testing- **Physico, Chemical, Mechanical and Toxicological evaluation:** determine suitability of food contact materials.
- Expertise includes food safety testing, quality assessment and control, problem solving and support in research and development; involves food safety and quality of the food packaging material till support in development and failure analyses.
- **Capacity Building**

Narrowing of the gap between basic and applied research - create natural bridge to translational research, communication between the applied research arenas.



### Roadmap to Implementing the Six Steps to Lean Six Sigma



Source: <http://foodpackaging.conferenceseries.com>

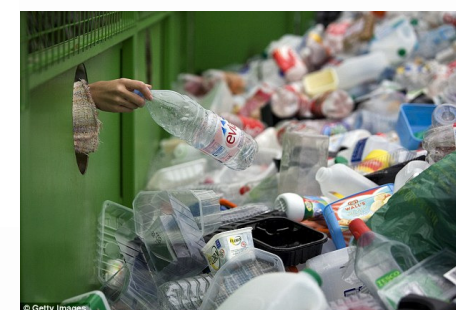
Effectively balancing innovation with cost-efficiency keeps the consumer's needs at the forefront while still remaining effective in demonstrating the product and its benefits.



Growing concerns clustered around the fundamental fear that the world faces a daunting waste management problem

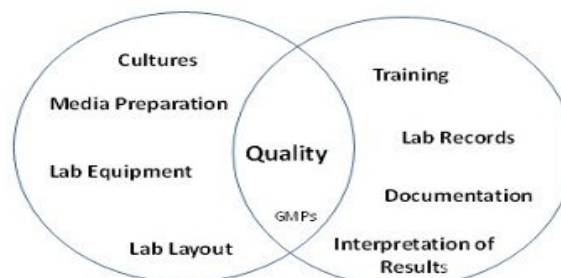
Sustainable packaging may be as effective, efficient, cyclic and safe.

Changing lifestyles, which will all influence market growth in the foreseeable future.



➤ Role of Packaging:-

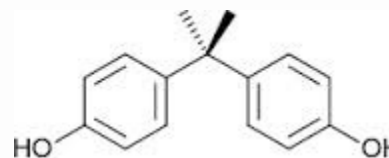
- Protection-against light
  - against reactive gases
  - against moisture
  - against microbes
  - against physical damage
  - against pilferage and adulteration
- Presentation
- Identification
- Information
- Compatible
- Convenience



Efforts are needed to prevent the accumulation of microplastics in the sea. Researchers have demonstrated that microplastics are transferred in the marine food web. They may account for the majority of marine micro litter accumulating in the food chain.

Developments in aspects: laminated specifications, security, Time-temperature, Sleeveless, barcodes, watermarks, decorative gravure printing, holography.

Packaging logistics is a multidisciplinary approach, integrating the packaging system and logistic system to enhance the efficiency and effectiveness of the entire supply chain.



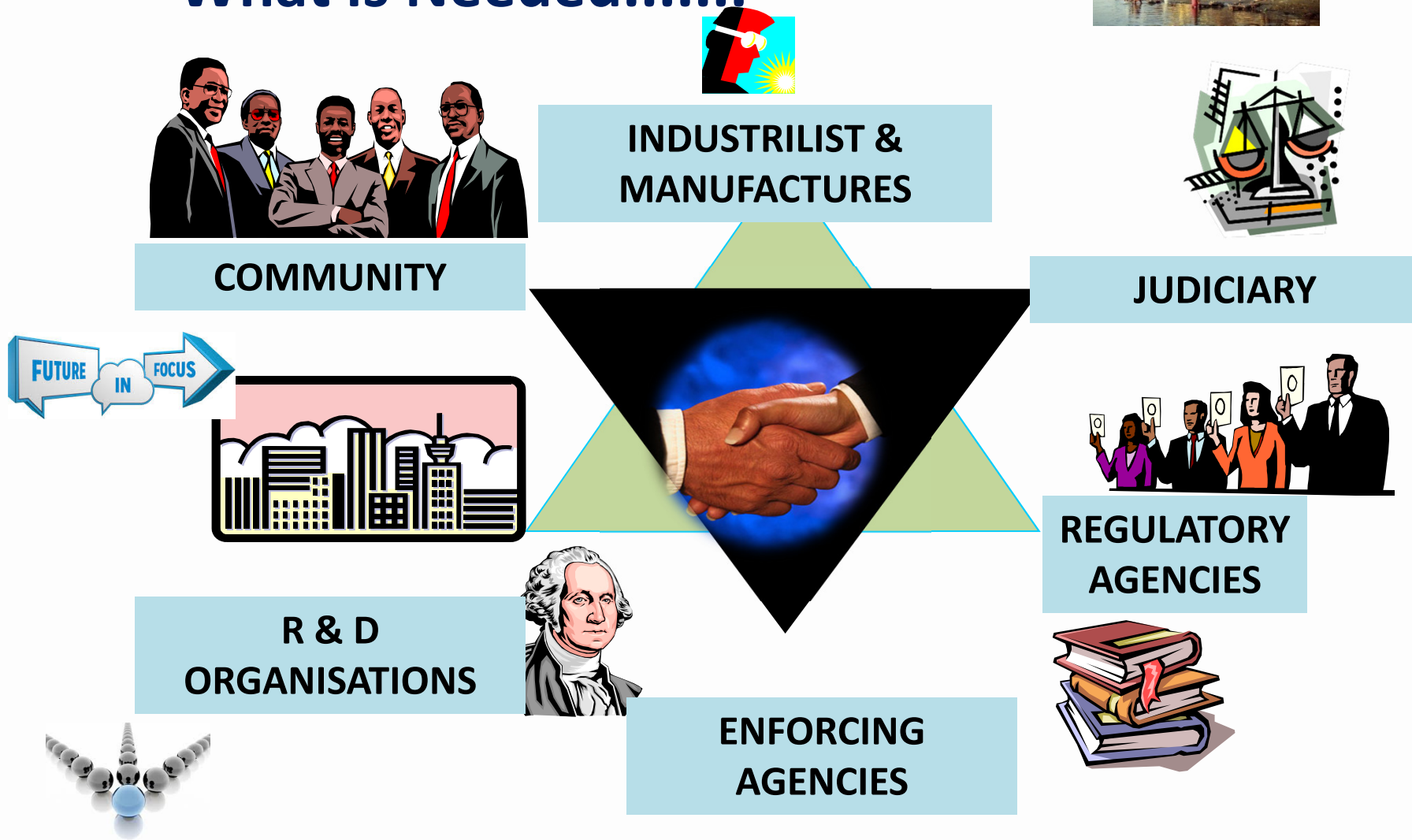
Nanotechnology-enabled food packaging may be categorized- improved packaging, active packaging, intelligent or smart packaging.



#### Major Health Hazards of Phthalates

- Premature birth
- Birth defects of male sex organs
- Reduced fertility
- Prostate and testicular cancer
- Learning disabilities
- Behavior problems
- Asthma and allergies
- Early puberty in girls
- Breast growth in boys
- Obesity and diabetes

# What is Needed.....





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International Life Sciences Institute



ensured in  
 a country only if

Enough food IS available

capacity to buy food

no barrier on access to food.

FOOD SECURITY



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