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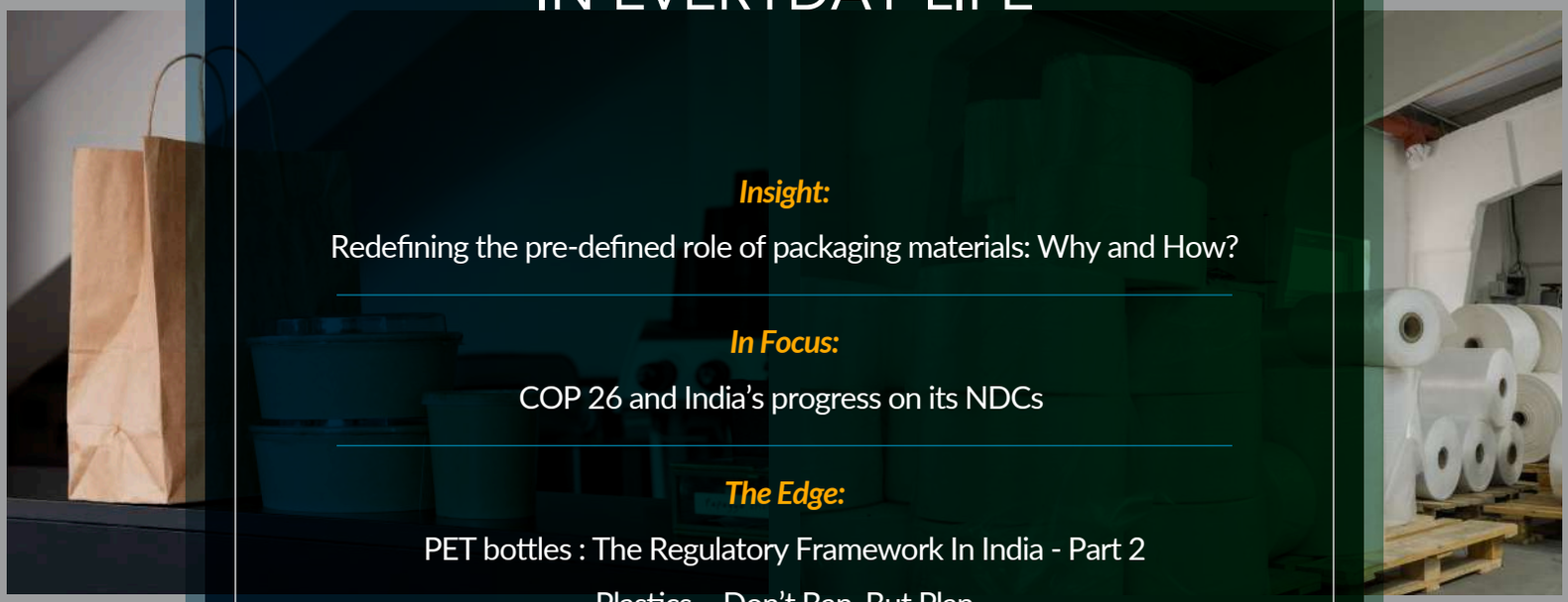
Issue 03 | November 2021

SAMVAAD

SCIENTIFIC DISCOURSE ON ENVIRONMENTAL SUSTAINABILITY

DIALOGUES FROM SAFE

ROLE OF PACKAGING MATERIALS IN EVERYDAY LIFE



FROM THE EDITOR

India's Tryst with Materials Sustainability— Present and the Future

The conversations around materials and their sustainability are picking up pace. India on its part is striving hard to reduce the carbon intensity of its economy by 45% and achieve its target of net zero by 2070. The world is observing the policies India is making with a keen eye which has enabled the country to push back on tough targets. But are we making the right choices?

In this issue of SAMVAAD, policy experts zero in on the possible solutions, that are a good alternative to plastics packaging and have a low carbon footprint. The recently announced Plastic Waste Management (Amendment) Rules 2021, the debate on Single-use plastics is fast garnering attention.

While these subjects become an integral part of India's story of environmental sustainability, is the world's third largest emitter of CO2 behind China ready to do what it takes to make an impact? The answer is a strong 'yes'. India is today on the 'Cusp of Environmental Sustainability Curve' becoming the first Asian country to bunch the Plastics Pace. In a nation where 9.46 million tonnes of plastic waste are generated each year, and 40% of plastics waste generated is not collected; these are important decisions. In this edition, we have Former Padma Shri Awardee, Prof. Dr. Rajagopalan Vasudevan, deliberating on the constructive use of SUPs in light of the recently announced 'Plastic Waste Management (Amendment) Rules 2021'.

This issue of SAMVAAD also takes a deeper dive into the 'Role of packaging in everyday life' where we cover different materials like Aluminium by Anil Lahoti, Ball Beverage Packaging, Paper by Rohit Pandit, Indian Paper Manufacturers Association (IPMA), Glass by Ashwin Bhadri, Equinox Labs, and last but not least, Plastics by Nandan Bhat, EcoKaari - Humanizing Fashion giving us an insight into the bigger picture.

Continuing with the discussion of materials sustainability, Dr. Vijay G Habbu. Polymer Scientist and Adjunct Faculty, ICT Mumbai shares his perspective on the role of PET. From projects like 'Tidy Trails', where experts seek to sustainably manage post-consumer plastic waste in Mathura-Vrindavan to upgraded food-grade plastic recycling facility and a new polyolefins recycling unit being commissioned near Hyderabad, with an investment of over $ 10 million, India is taking some significant steps in fighting the environmental crisis.

Ryan A. Marshall
Managing Editor

INSIGHT

Redefining the pre-defined role of packaging materials: Why and How?

Feature Story:
Defining a new beginning in our understandingof materials and their sustainability, the Indian government is pulling all strings to commit to the environmental cause. From the discussions on transitioning to a circular economy for plastics to taking steps to improving the methods of recycling all kinds of materials, we are taking small yet concrete steps. To understand the subject in depth, we got experts to speak about the different materials, their sustainability and the need for policies that propel the change in the right direction.

Amit Lahoti,
Vice President and General Manager - India & South East Asia, Ball Beverage Packaging.

Nandan Bhat,
Founder & Director, EcoKaari – Humanizing Fashion

Rohit Pandit,
Secretary General, Indian Paper Manufacturers Association (IPMA)

Ashwin Bhadri,
CEO of Equinox Labs.

"The beverage industry currently relies upon four major types of packaging substrates which are Glass Bottles, PET, Multi-Layer and Aluminum Cans. Consumers are becoming very conscious about sustainability, recycling and resource efficiency and are demanding eco-friendly packaging from the brands. Today right from alcoholic beverages to energy and health drinks the Indian beverage market is flooded with varieties of options. The packaged Food and Beverage segment has witnessed an increase since the recent COVID19 pandemic began. With dining at restaurants severely restricted, take-outs and home deliveries have become more frequent than before. All these developments have led, inevitably, to an increase in packaging – which, in most cases, is meant to be discarded," said Amit Lahoti,

Underlining the role that aluminium plays in creating this circular economy that experts have been talking about, Mr. Lahoti expressed, "According to a recent global survey; 83% of global respondents believe it's important or extremely important for companies to design products that can be reused or recycled. Also 74% of the consumers want environment friendly packaging containers be made available to them. Amongst all the packaging substrates, Aluminum Beverage Cans are a naturally sustainable and an eco-friendly choice as aluminum is an infinitely recycled, permanent material. Recycled aluminium saves raw materials, energy consumption and CO_2 emissions. Recycling reduces the energy needed for primary metal production by 95 % for aluminium and cuts GHG emissions accordingly."

He further added, the combined greenhouse gas (GHG) emissions associated with the

transportation and refrigeration of beverages in aluminum cans, in turn, are lower than those associated with beverages in glass or plastic bottles under the same conditions.

Aluminium beverage cans are the perfect example of a circular economy as they could be recycled over and over with no loss of quality. They have a lower carbon footprint as compared to other pack formats. A great proof of this is the fact that around 75% of all aluminium ever produced in the world is still in use today. Another interesting data point shows that used beverage cans can be recycled and returned to the shelf within 60 days. This "design for circularity," combined with high end-of-life economic value, makes recycling of cans viable, and should be the goal if we are to move from a –linear "take-make-waste" society toward a fully circular economy.

With the UN planning to sign a treaty with many nations to improve the collection of used plastics and increase infrastructure for recycling the materials; the world is looking at India with great hope and expectations. Nandan Bhat, said that it's time to understand the disposal and usage of materials like plastics. "The main issue is not with plastic as a material; it has transformed everyday life; the problem is the usage and disposal. The concerns such as accumulation of waste in landfills and oceans and problems for wildlife resulting from ingestion or entanglement in plastic and more. We upcycle non-biodegradable and difficult-to-recycle plastic bags, grocery bags, multi-layered wrappers of cookies, chips and glittery gifts wrap and old audio/video cassette tapes."

The conversation on plastics and materials sustainability always has 'paper' at its core. According to Rohit Pandit, "Paper can be recycled up to 5-7 times. Almost 80% of paper produced in India is made from recovered paper and agro-residue like wheat straw and bagasse. The rest is made from wood which is procured from farmers engaged in agroforestry promoted by the Paper Industry. Farmers grow trees like any other crop and sell their harvest to paper mills. Paper Industry grows more trees than it harvests. As a result, not only are farm incomes being supplemented by agroforestry, but it is also enhancing the green cover in the country and helping in mitigation of harmful effects of climate change through carbon sequestration."

Asserting how paper is one of the most environmentally sustainable products as it is

INSIGHT

biodegradable, recyclable, Mr. Rohit added, “Since paper is green, it is never too early to switch to paper-based alternatives for the larger good of the environment.”

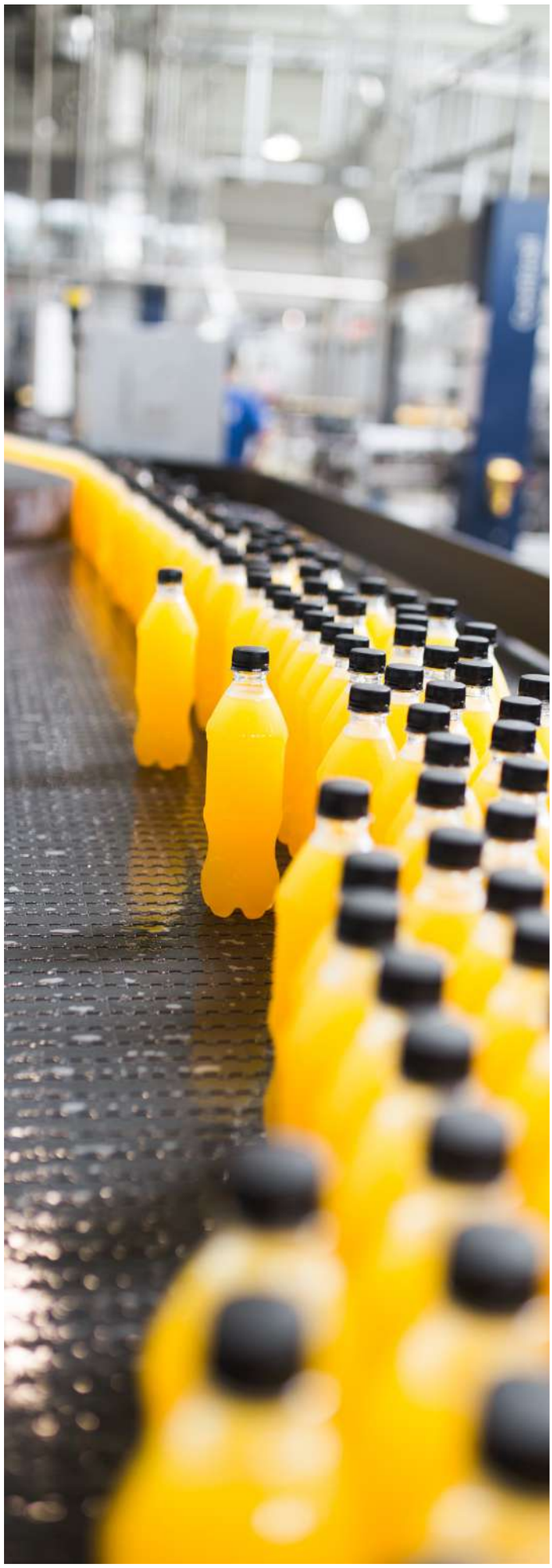
Government agencies across the globe have stringent regulatory policies when it comes to food packaging. It’s extremely important to adhere to these policies to ensure safety and assurance to your consumers. In India, FSSAI has a comprehensive set of guidelines that all food product manufacturers should follow for smooth business operations. “Packaging regulations ensure that the integrity of the food product isn’t compromised in any way. Talking about packaging materials, glass is extensively used and preferred these days as it helps to preserve food, protecting it against contaminants and can be recycled. It helps in keeping the food fresher for a longer period of time,” added Ashwin Bhadri,

He further added, “FSSAI has been very rigorous with its compliance policies and all packaged food of any nature should provide a detailed description of the contents without anything being tampered to comply with the regulations. This is not just beneficial for the consumers but also for manufacturers, traders, and investors. Also, as the head of a leading Testing and Auditing Agency for the last 16 years, it’s safe to say that a well-defined label on the product leaves a lasting impression in the minds of consumers and safety always comes first in the food industry.”

1. The main issue is not with plastic as a material; the problem is the usage and disposal

2. Recycled aluminium saves raw materials, energy consumption and CO_2 emissions

3. Since paper is green, it is never too early to switch to paper-based alternatives for the larger good of the environment



IN FOCUS

COP 26 AND INDIA'S PROGRESS ON ITS NDCs

Neha Pahuja,
Fellow, Earth Science and Climate Change, The Energy and Resources Institute (TERI).

India's climate action is embedded in its developmental policy & local environmental benefits. The development pathway of India is marked by the dependence on climate-sensitive sectors- agriculture, water, health, infrastructure, natural ecosystems and forests and energy. This makes the socio-economic system of the country highly vulnerable to climate change and its impacts. Still, India went ahead and submitted one of the most ambitious nationally determined contributions (NDCs).

India is on track to meet (and exceed) two out of three of its quantified NDC targets by 2030, namely (i) reducing emissions intensity of GDP by 33-35% from 2005 levels, and (ii) 40% non-fossil fuel electric installed capacity in 2030. Further, India is among a few countries in the world where sustainability and economic progress go hand-in hand and despite on-going developmental efforts, forest and tree cover is also increasing. This makes India the only G-20 country whose Paris pledges for 2030 is on track with a 2°C pathway[1] . India has shown leadership with initiatives such as International Solar Alliance (ISA), which is promoting 'One Sun, One World, One Grid'; and Coalition for Disaster Resilient Infrastructure (CDRI). These initiatives aim to build resilient infrastructure systems to ensure sustainable development.

Recently, many countries like European Union (EU), Japan, South Korea and others have come forward with their goals to be net zero by 2050. Norway has submitted its revised and enhanced NDCs to the United Nations Framework Convention on Climate Change (UNFCCC) whileSingapore has submitted its long-term low emissions development strategies (LTS). However, it is a well-known fact that the world is still far behind on emissions reductions. The aggregate emissions pathway consistent with the goal of limiting warming to well-below 2°C has also been well documented , as is the aggregate gap with current emissions pathways. Assessment of the underlying transformation pathways is

required. The first Global stocktake under Article 14 of Paris Agreement will begin in 2023 to bring about clarity on the degree of additional commitments that will be needed. The need of the hour is to assess structural changes in high emitting sectors. This can provide a more concrete picture of actionable indications of where and what precise efforts are required in a particular sector, technology, or when the mitigation lever needs to be activated.

India is not in a position to commit to a revised NDC or an LTS yet given its huge development deficit. For India to be able to enhance its NDC before the stipulated time, it is important that there is more clarity on (i) the enabling means of implementation or support available internationally, and (ii) the effective implementation of the existing implementation by all parties. Nevertheless, there is merit in recognizing that India can follow a 1.5°C path at a low cost by adopting a set of measures consistent with low carbon development while meeting the objective of inclusive economic growth, energy security and clean air. A set of institutional measures backed by appropriate policy, technology and capacity are however required at the national and sub-national levels.

Domestically, India has had success story in the Renewable Energy sector, which was possible only due to a highly conducive policy environment, a steady influx of capital, falling prices and new technologies. This has given India the confidence to announce a highly ambitious target of 450 Giga Watts (GW) of renewable energy. Of this 100 GW has already been achieved. Making it fourth in the world in terms of installed RE capacity. The electricity sector in India, however, continues to be highly dependent on coal and is responsible for around 40% of India's energy related GHG emissions. With rising per capita incomes and affordability, the demand for electricity is expected to grow substantially in (i) residential and commercial sector (mainly because of space cooling, cooking requirements), (ii) industrial sector (mainly because of requirements of growing economy) and (iii) transport sector (because of electric mobility), (iv) agriculture sector (rising irrigation demand and farm mechanisation).

Energy sector in India is on the cusp of rapid technology development and innovation, and is supported by falling prices in renewable energy and energy storage on the back of a tremendous demand for energy. . While this is indicative of energy transition, this desired transition in the sector will not happen on its own unless an enabling environment is created with policies, measures and initiatives not only at the national level but also at the sub-national level.

A similar enabling environment needs to be created in other sectors as well. For example, while electrification in the transport sector will have positive impact on reducing emissions, the costs of building infrastructure will be huge. Likewise, hydrogen technologies and energy storage systems have a huge potential of mitigating climate change with Mission Hydrogen looking to provide much needed impetus in this direction.

While India is progressing on climate action, leadership and support is required from the developed countries to support India with much needed capital and technology which will go a long way in ensuring that India can fully capitalise on the opportunities that exist to bring about a more sustainable and greener tomorrow.

https://climateactiontracker.org/countries/india/

1. India is the only G-20 country whose Paris pledges for 2030 is on track with a 2°C pathway

2. The need of the hour is to assess structural changes in high emitting sectors

THE EDGE

PET BOTTLES : THE REGULATORY FRAMEWORK IN INDIA

PART 2 – The Safety PET packaging for human health

Dr. Vijay G. Habbu,
Polymer Scientist and Adjunct Professor, Institute of Chemical Technology (ICT), Mumbai.

In Issue 2 of Samvvad, Dr. Habbu, outlined the process of manufacturing and also described the benefits of recycling of PET. Issue 3 now sees the continuation of the discussion by discussing the safety of PET as a packaging material for food and water.

A] THE SAFETY OF PLASTIC PACKAGING MATERIALS

Packaging falls in two main families: Rigid and Flexible. Bottles, jars, etc. obviously belong the class of rigid packaging and much of the regulations governing them followed soon after those for films and other flexible packaging, such as pouches, packets, sachets, etc. in the early 1980s.

All packaging materials – glass, plastics, paper, paperboard, metals - are subject to strict regulations that limit how much of any "chemical of concern" can migrate (leach out) into the food contents. These are maximum permitted amounts (Specific migration limit (SML)), so that chemicals if released from a container below those levels cause no harm to humans. **FSSAI Regulations 2018**[1] has set up SMLs for 7 heavy metals on the lines of **EU 10/2011**.

Further, it has to be noted that, **IS 9845** (first introduced in 1981), governs the quality of Plastics materials intended to come in contact with Foodstuffs:

- This has set an Overall Migration Limit (the maximum aggregate quantity of leaching of

ALL chemicals permitted below which they will not be harmful) of 60ppm (60mg/kg) or 10mg/dm2

- It is presently getting revised to include SMLs for Antimony (0.04ppm) and DEHP (1.5ppm) as directed by **FSSAI Regulations-2020**[2]

- The SMLs proposed by FSSAI are drawn from the world's best standard for Plastic packaging for Food Contact, viz. **EU 10/2011.**

See Table 2 for a compilation of all these SMLs.

A 1999 Standard from BIS, **IS 10171** provides a Guide on Suitability of Plastics for Food Packaging. This lists more than 55 food types, divided in 13 food categories. PET, like other materials, has been in this approved list since its inception in 1982. The **FSSAI Regulations-2018** too have endorsed a similar

1. Food Safety and Standards (Packaging) Regulations, 2018 (24th December 2018)
2. Food Safety and Standards (Packaging) Amendment Regulations, 2020 (7th February 2020)

list of food types that can be packaged in PET articles.

PET bottles and containers are used to pack liquids not just having critical human impact, but for other products too such as industrial, home care, personal care. For many of these containers, specifications are available in the Indian Standards.

The chemical safety having been established in **IS 12252, IS 9833 and IS 9845.**
For ease of understanding, let me classify PET packaging as follows:

- For Group A liquids: Water, pharmaceuticals, food (beverages, edible oil **IS 12887:1989**, liquor **IS 14537:1998,** vanaspati **IS 14764:2000,** etc.)

- For Group B liquids: personal care products (e.g. shampoos), home care products (floor cleaners, etc.), sanitizers, pesticides IS 13123:2000, etc.

See Table 3 for a summary of Indian Standards specific to PET.

B] PET CONTAINERS FOR PACKAGED DRINKING WATER

There is no standard specific to rigid PET containers for packaging water,
but 15410: 2003 "Containers for packaging of natural mineral water and packaged drinking water" – states that the transparency of the plastic containers (PET among others) shall not be less than 85% in light transmittance.
Even **FSSAI Regulations 2018** aver this requirement of 85% transparency for coloured and colourless plastic containers for packaging of water.

C] PET PACKAGING FOR PHARMACEUTICALS

Use of PET (and other plastics) for the packaging of pharmaceuticals has been approved and revised continuously by the Ministry of Health's autonomous body, the Indian Pharmacopoeia Commission as can be seen in its **IP-2018**[3] as has been approved by **Pharmacopoeias of other countries** (USA, Europe, British, Japan, etc.)

IS 7803 Specification for plastic containers for pharmaceutical use,
Part 1: Other than parenteral and ophthalmic preparations (Reaffirmed in **2018**)

- (Original, September 1975) Clause 3.1: "Only virgin plastic material shall be used in the manufacture of the containers"

- (Amendment-1, November 1980) Clause 3.1: "Only virgin polyethylene material shall be used in the manufacture of the containers"

- (Amendment-2, July 2003) Clause 5.2: "For the manufacture of this product one or more of the virgin material covered in following Indian Standard shall be used: **12252:1987 (PET)"**

Stability Studies Ensure Compatibility

3. Indian Pharmacopoeia-2018, Chapter 6: Primary Packages For Pharmaceutical Articles, 6.2.1.2. Plastic Containers For Non-Parenteral Preparations, 6.2.1.2.1. Polyethylene Terephthalate (PET) Containers

Between PET Packaging Components and the Stored Drug Formulations

The Indian Drug and Cosmetics Act of 1940, as amended (under Schedule M, Section 16.10, and Appendix I) states that >> manufacturer of pharmaceutical products "shall conduct stability studies of the products to ensure and assign their shelf life at the prescribed conditions of storage" as per the **International Conference on Harmonisation of Technical Requirements for Registration of Pharmaceuticals for Human Use (ICH) stability guidelines Q1A – Q1F guidelines**[4] . These guidelines define the stability data that is mutually acceptable in other global regions by the **World Health Organization (WHO)** Member States,[5]" as these tests ensure that drug products are stable in the packaging, under the climatic conditions specific to the geography.

Other Medical Applications Of PET

In addition to packaging of Pharma products, PET is also used in other medical applications[6] such as

Medical Devices in contact with human tissue. The US-FDA considered the safety of polyethylene terephthalate when approving the following as Class II medical devices:

i) PET for surgical sutures and for soft tissue approximation and/or ligation, including cardiovascular, ophthalmic, and neurological tissue as it complies with its 21 CFR 878.5000.

ii) Esophageal and gastrointestinal dialators having balloon made of polyethylene terephthalate, since they are in compliance with 21 CFR 876.5365.

iii) Patches, pledgets, and intracardiac devices (surgical mesh) are made of polypropylene, polyethylene terephthalate, or polytetrafluoroethylene. They are fabric devices placed in the heart to repair septal defects, for patch grafting, to repair tissue, and to buttress sutures (21 CFR 870.3470).

D] CONCLUSION

PET is a polymer that is exclusively used in packaging, unlike other plastics that have other application sectors.

Ever since its invention in the 1970s in the USA, PET has made great strides in the packaging applications due to its safety, inertness, transparency, lightweight, availability in adequate quantities and versatility in shapes and of course, its lighter eco-footprint. It is these qualities in addition to its affordability that PET has replaced traditional packaging materials of packaging like glass, metals, paper, paperboard, in both rigid and flexible formats, for the packaging of almost all items (foodstuff, water, pharmaceuticals, industrial, homecare, personal care products).

Like the world over, India too has in place a robust regulatory framework to comprehensively assure and ensure that PET is safe for humans and the environment, since 1980s. It is the same PET that gets used at all the sporting events and by leaders the world over!

Annex A gives a summary of International Standards related to PET packaging.

4. http://www.ich.org/products/guidelines/quality/article/quality-guidelines.html
5. WHO Technical Report Series, No. 953, 2009, Annex 2, Stability testing of active pharmaceutical ingredients and finished pharmaceutical products.
6. Safety Assessment of Modified Terephthalate Polymers as Used in Cosmetics, Cosmetic Ingredient Review, 1101 17th Street, NW, Suite 412 " Washington, DC 20036-4702 " ph 202.331.0651 " fax 202.331.0088 " cirinfo@cir-safety.org

Table 2: Specific Migration Limits of certain chemicals in plastic packaging for food items

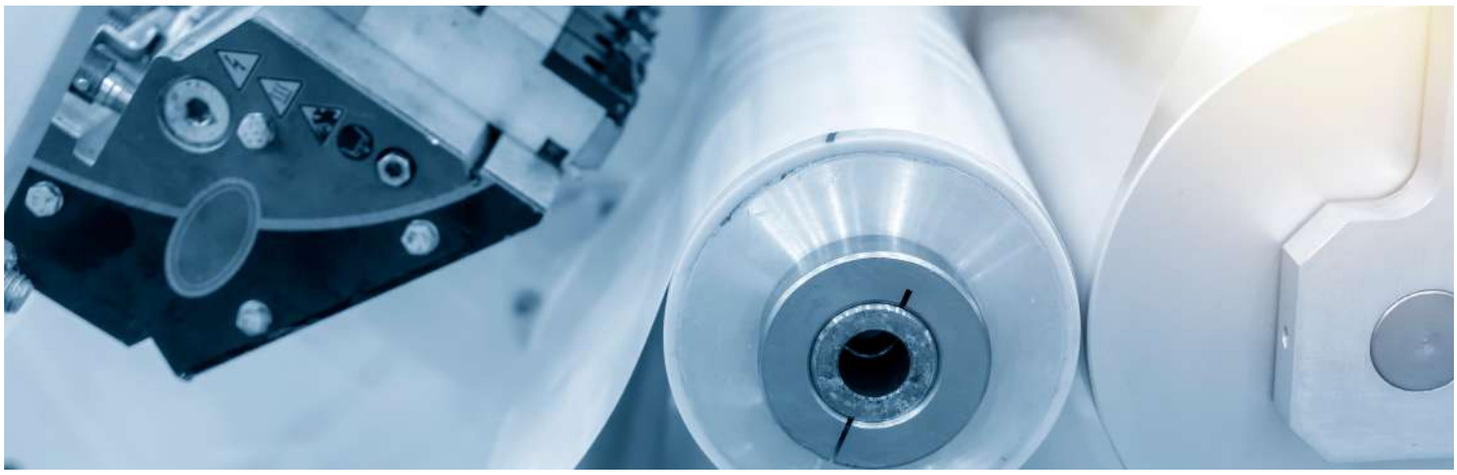
Sr. no.	Substances	Chemical Symbol	Maximum Migration Limit *		
			as per FSSAI Regulation		as per EU 10/2011
		Abbreviation	mg/kg, (ppm)	Regulation date	mg/kg, (ppm)
	METALS				
1	Antimony	Sb	0.04	07-Feb-20	0.04
2	Barium	Ba	1.00	24-Dec-18	1.00
3	Cobalt	Co	0.05	24-Dec-18	0.05
4	Copper	Cu	5.00	24-Dec-18	5.00
5	Iron	Fe	48.0	24-Dec-18	not listed
6	Lithium	Li	0.6	24-Dec-18	0.6
7	Manganese	Mn	0.6	24-Dec-18	0.6
8	Zinc	Zn	25.0	24-Dec-18	5.0
	ORGANIC				
9	Phthalic acid, bis(2-ethylhexyl)ester	DEHP	1.5	07-Feb-20	1.5
			* Also termed as Specific Migration Limit (SML)		

Table 3: Indian Standards dedicated to PET articles

S. No.	IS No.	IS Title	Amendments	Reaffirm. Year	Tech. Committee
	IS 12229: 1987	Positive list of constituents of polyalkylene terephthalates (PET & PBT) for their safe use in contact with foodstuffs, pharmaceuticals and drinking water	1,2	2015	PCD 12
1	IS 12887: 1989	Polyethylene terephthalate (PET) bottles for packaging of edible oils - Specification	1,2,3	2018	PCD 21
2	IS 13193: 1992	Polyalkylene terephthalates (PET and PBT) for moulding and extrusion - Specification	1,2	2018	PCD 12
3	IS 14537: 1998	Polyethylene terephthalate (PET) bottles for packaging of alcoholic liquors - Specification	0	2018	PCD 21
4	IS 13123: 2000 First Revision	Packing of liquid pesticides - Polyethylene terephthalate (PET) bottles (Up to 5 Litres Capacity) - Specification	1	2020	PCD 21
5	IS 14764: 2000	Polyethylene terephthalate (PET) containers for packaging of vanaspati specification	0	2020	PCD 21
6	IS 12252: 2017 First Revision	Polyalkylene terephthalates (PET and PBT), their copolymers and list of constituents in raw materials and end products for their safe use in contact with foodstuffs and pharmaceuticals	0	First Revision 2017	PCD 12
7	IS 16630: Part 1:2018/ ISO 12418-1:2012	Plastics – Post - Consumer poly (Ethylene Terephthalate) (PET) bottle recyclates: Part 1 designation system and basis for specifications	0		PCD 12
8	IS 16630: Part 2:2017/ ISO 12418-2:2012	Plastics - Post - Consumer poly (Ethylene Terephthalate) (PET) bottle recyclates: Part 2 preparation of test specimens and determination of properties	0		PCD 12

DR. VIJAY HABBU

THE EDGE



ANNEX A : INTERNATIONAL REGULATIONS ON PET

Food Packaging:

1. Regulation (EC) No 1935/2004 on materials and articles intended to come into contact with food.
2. Regulation (EC) No 2023/2006 on good manufacturing practice for materials and articles intended to come into contact with food.
3. Regulation (EU) No. 10/2011 on plastic materials and articles intended to come into contact with food.
4. Council of Europe (CoE) Resolution AP (89) 1 "On the use of colorants in plastic materials coming into contact with food"
5. Directive 2000/13/EC on the approximation of the laws of the Member States relating to the labelling, presentation and advertising of foodstuffs.
6. US FDA 21 CFR 177.1630 - Polyethylene phthalate polymers.
7. Japanese Food Sanitation Act of 1947.
8. Japan Hygienic Olefin and Styrene Plastics Association (JHOSPA).
9. Mercosur - Technical Regulation GMC/RES. Nº 39/19 on Positive List of Additives for Plastic Food Contact Materials.

Pharmaceutical Packaging:

10. US Pharmacopoeia (USP) Chapter <661> Containers – Plastics
11. The European Pharmacopoeia (EP) (Sections 3.1.15, 3.2.2.1, 3.2.2)
12. ICH guideline Q3D (R1) on elemental impurities. (WHO)

Cosmetics Packaging:

13. Regulation (EC) No 1223/2009 on cosmetic products.

Toys:

14. EN 71-3:2019 Safety of Toys - Part 3: Migration of Certain Elements.

Electrical Appliances:

15. IEC 62474 - Material Declaration for Products of and for the Electrotechnical Industry.
16. Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS).

Packaging:

17. Directive 94/62/EC on packaging and packaging waste.
18. Toxics in Packaging Legislation (formerly known as CONEG legislation), USA

1. PET bottles and containers are used to pack liquids not just having critical human impact, but for other products too

2. PET is a polymer that is exclusively used in packaging, unlike other plastics that have other application sectors

3. India has in place a robust regulatory framework to comprehensively assure and ensure that PET is safe for humans and the environment, since 1980s

Plastics – Don't Ban, But Plan

Prof. R. Vasudevan,
Department of Chemistry,
Environmental Information systems,
Thiagarajar College of Engineering

Industrial revolution during the middle of last century particularly after the two world wars has resulted in a total change in the pattern of living in the world. Industrial growth has promoted urban development across the globe, resulting in deforestation, construction of concrete jungles/forests around the industries by occupying cultivable lands. Demand for raw materials such as wood, glass, iron, cement, etc. has led not only to exploitation of natural resources but also global warming and pollution in the air, water, and land. This development is affecting the living conditions of other species of nature and they are becoming extinct. The chief contributor for this is human beings, who is exploiting nature and its resources more due to his intellectual arrogance for the sake of his own development.

During the 19th Century, the emergence of plastics in the world was purely a gift from God to safeguard natural resources. Plastics find its use in various fields of applications such as, engineering, packaging, health care, aerospace, automobiles, and other fields. The introduction of plastics in the engineering fields as a substitution for wood, metal, glass, and ceramics, etc. not only saved our forests but also our mineral resources. Plastics helped introduce better packaging leading to improved preservation of food, increasing the shelf life of many materials while keeping costs low. Hence, plastics have become the poor man's need and common man's friend. The role of plastic in electrical and electronic industry speaks volumes about its importance.

Moreover, the use of waste plastics has reduced the usage of natural resources. Thus, plastics have become an unavoidable material among the public. At this point, it should be appreciated that the plastic may be considered as an environment saver and not as a pollutant. Even in the present COVID – 19 period, plastics have come-in handy and important, as they are used in personal protective equipment, masks, and other gadgets. It is necessary to understand that the emergence of plastics has made life of a man better and it helps to safeguard the natural resources. To me it is a Gift from God.

But the scenario today of plastics is totally different, the same plastics which are useful, are now the major pollutants of pancha bhootas, due to its disposal. This problem is observed more in the case of Single-Use

THE EDGE

Plastics (SUPs) - the throw away plastics, throughout the world. Here, one needs to understand that this problem is a manmade problem and a result of our poor habits to dispose waste. Being a cheaper material and having no value after its use, we have developed a bad habit of simply discarding these items without a second thought, especially in the case of SUPs. SUPs are in the process of being banned across the world to solve the plastic problem, although this may have a negative effect on thousands of industries and the overall way of life for the man. As an initial step to address the severity of the problem, even, the Indian government has compiled a list of SUPs to be banned to reduce the pollution and the environmental impact of these.

It is important for this to be a red flag from the government, to make the people (both marketer and consumer) understand the importance of the need for a proper disposal ecosystem. If irresponsible disposal is not checked, it will result in a total ban on plastics, which in turn will affect our industrial growth and indirectly the gross domestic product (GDP) in the long run. Polymer manufacturing industries support our GDP to an extent of 30 %. The common man's facilities will also get affected and therefore it is important to take cognizance of these issues and find and deploy course corrective measures at the earliest.

Plastics utility is going on increasing day by day and more and more products are entering the market, resulting in more waste generation. The use of plastics has become un-avoidable in our everyday lives. Then what is the solution?
There is nothing called as waste. If one can understand its potential, it can be converted into useful product to facilitate a circular economy. For example, once if you find the right disposal technique of converting waste plastics into useful products, there will be a rethinking among the people and the government. They may change their attitude and policies.
Here is an example in this context. The plastics,

though not easily decomposable biologically, it has a wonderful binding property in the molten state. Using this potential property, a technology is developed at Thiagarajar College of Engineering, Madurai to use all plastics film waste either mono, multi-layer or metallized layer (<90 micron) for the construction of plastic tar road. This technology has already been approved by Indian Road Congress (IRC: SP:98:2013) and the government is implementing this technology throughout the country and in the border roads too. If this is made as mandatory for road laying throughout the country, we will need more than 200 lacs

tonnes of waste plastic, whereas today we have only approximately 10 lacs tonnes of waste plastics. Moreover, at Thiagarajar College of Engineering, another product called Plastone a structural material is being developed using waste plastics. When this comes into use, we require another 200 lacs tonnes of waste plastics. Plastics are the need of the hour. Recently in his speech at Pondicherry, The Honorable Vice President of our country also insisted on such innovations, which are environmentally friendly.

Awareness on proper disposal of waste plastics must be created among general public, students, public utility halls, marketplaces and street corridor vendors, community hall administrators and government officials. Each one is expected to understand their role and take ownership to carry out the same effectively and sincerely. Let us join to help the government towards developing a litter free India.

While we develop clean habits of plastic waste disposal, we should do more research to develop bio-decomposable polymers, use of non-toxic additives and plasticizers, multi packet system instead of multilayer plastics. The problems we face are problems for all of us. Together with the right focus, problems can be solved. “It is our plastics; it is our problem”. Let us understand the importance of plastics. Our watchword should be “Not to Ban, but to Plan”. Banning plastics is not the solution. Importance should be given for better disposal culture, by developing proper system of reusing and by proper planning we can solve the problem of plastic pollution.

1. During the 19th Century, the Emergence of plastics in the world was purely a gift from God to safeguard natural resources

2. If one understands the potential of waste, it can be converted into useful product to facilitate a circular economy

News at a Glance – Materials Sustainability

1. NTU scientists develop sweat-powered battery for wearable devices

Scientists at Nanyang Technological University (NTU), Singapore have developed a sweat-powered battery, capable of generating enough energy to operate commercial temperature sensors. The stretchable battery will be used on wearable devices such as watches and health sensors. It also does not require charging. When sweat meets the battery, it improves the conductivity of the silver flakes and causes an electric current to flow. As the stretchable textile used is very absorbent, it retains a lot of sweat, allowing the battery to remain powered even when the rate of sweating is inconsistent. When sweat meets the battery, it improves the conductivity of the silver flakes and causes an electric current to flow

2. Recyclable "bioactive" paper bag promises alternative to plastic food wrap

The Fraunhofer Institute for Process Engineering and Packaging and the Fraunhofer Institute for Interfacial Engineering and Biotechnology have presented an innovative and sustainable solution for food packaging. The coated papers developed as part of the BioActive Materials project are an alternative to the packaging currently used for all kinds of food. The paper bag keeps the products inside from drying out, and also kills the bacteria that causes food to spoil. The bag's main body is made of fully recyclable paper and its inner surface is coated with a blend of natural waxes and proteins.

3. UNDP, HDFC and Greater Noida Authority ink pact for dry waste management facility

Recently, United Nations Development Programme (UNDP) inked a pact with HDFC Bank and Greater Noida Industrial Development Authority (GNIDA) to set up a material recovery facility. The dry waste management program of the UNDP is a unique attempt that brings all the stakeholders in the waste value chain to demonstrate a sustainable waste management model in the country. A circular economy on plastics is created by closing the loop and connecting the plastic recycling value chain players comprising waste collectors, recyclers and many more

4. Ultrathin glass films exhibit exotic liquid phase

Researchers in the US have discovered an entirely new liquid phase that arises when ultrathin films of glass are deposited directly onto cooled substrates. An intense X-ray source has been used to reveal extremely dense, highly stable structures within the films, which transitions to more conventional bulk liquids above a certain temperature.

ABOUT SAFE

Science Alliance for Environment (SAFE)

The Science Alliance for Environment brings together an interdisciplinary group of domain experts to provide comprehensive and authentic scientific inputs on issues related to environmental sustainability.

Its objectives are to develop an implementable roadmap for providing solutions to issues that have an undesirable impact on our environment.

This will be accomplished by initiating a dialogue amongst science & technology professionals, domain experts comprising business, economics, law, civil society representatives, policy experts and government functionaries.

Under the aegis of SAFE, groups of experts will participate in workshops, seminars and panel discussions to raise awareness about issues, problems and solutions based on evidence-based science, technology-driven solutions and international best practices. One of the current focuses of SAFE is to provide a balanced perspective on materials and their consumption as well as production from the point of view of environmental sustainability.

The recommendations as well as the outcomes of the deliberations of SAFE will be widely disseminated in the public domain. They will provide valuable inputs and alternative viewpoints to chart the journeys towards environmental sustainability.

ABOUT SAMVAAD

A platform for scientific communication on environmental sustainability of materials

A digital periodical under the aegis of SAFE, SAMVAAD aims to initiate a constructive dialogue on all aspects of environment sustainability with current focus on materials sustainability. Our mission is to create a platform that analyses developments, events, best practices, studies and reports related to science & technology, education, economics, ethics and public policy connected to our habitats and environment. Domain experts in the SAFE network would offer their observations and perspective on these topics. It gives us great pleasure to introduce you to this inaugural issue of SAMVAAD.

SAFE's Advisory Board

Prof. G.D. Yadav

Professor G.D. Yadav has served as the Vice-Chancellor & R.T. Mody Distinguished Professor & Tata Chemicals Darbari Seth Distinguished Professor of Leadership & Innovation and, J.C Bose National Fellow (DST) at Institute of Chemical Technology, Mumbai from May 2009 until November 2019. Currently, he serves as the Emeritus Professor of Eminence at ICT. Dr. Yadav was associated with a number of central government committees of CSIR, DST, DBT, UGC, AICTE, MHA and other professional bodies, IIChE, ACS, ICS, ICMA (ICC),MInSoc, CPCB, etc. He has 117+ US patents, 101 Ph Ds, 122 masters thesis supervision, 461 papers and membership of 5 Boards of industries.

Dr. S. Sivaram

Dr. Sivaram is presently an Padmashri awardee and an INSA senior scientist and honorary professor at Indian Institute of Science Education and Research (IISER), Pune. Prior to this, he has served as the director of CSIR-NCL (2002-10), CSIR Bhatnagar fellow (2010-15) and J.C. Bose Fellow (2006-15) at NCL. Dr Sivaram obtained his Ph.D. and D.Sc. (honoris causa) from Purdue University, USA. He has to his credit over 245 publications in peer reviewed scientific journals and is cited as an inventor in 51 granted European and US as well as 52 Indian patents. The President of India conferred on him the civilian award Padma Shri in 2006, His research interests are in the area of polymer science and technology.

Prof. Y.K. Gupta

Dr. Y.K. Gupta is presently the president at All India Institute of Medical Sciences (AIIMS), Bhopal and Jammu. He is also the Principal Advisor (project) at THSTI-DBT, GOI and Chairman, Bharat Immunological and Biological Corporation Limited (BIBCOL). He has headed/advised various government committees, departments and organizations over the years such as National Dope Testing Lab, National GLP Technical committee, CSIR- IITR, Pharmacovigilance Program of India, etc. He has more than 300 publications in international and national journals along with being awarded several honors in the medical field.

Ms. Sanchita Jindal

Ms. Sanchita Jindal has served as Scientist G (Adviser - Technical) and Director with the Ministry of Environment, Forest and Climate Change for over 28 years. She has contributed in planning, coordination and implementation of environmental policies in the country, specifically on management of hazardous chemicals and wastes and environment impact assessment. She was instrumental in notifying most of the rules and guidelines in these sectors specifically waste management rules of the year 2016 on Solid Waste Management, Plastic Waste Management, C&D Waste Management, Bio-medical Waste Management, E-waste Management, Hazardous Waste Management and EIA Notification, 2006. She was Member Secretary of two EACs for Environment Clearance.

Dr. Vijay G. Habbu

Dr. Vijay G. Habbu is presently an adjunct professor at Institute of Chemical Technology (ICT). Over the years, he has worked as a senior scientist and head of polymer processing dept. at NCL, Pune, as Works Manager in a Polymer Processing Unit and later joined Reliance where he led the Polyester Sector's R&T until his superannuation. He consults as a Mentor in the Sustainability group of Reliance's PetChem sector.

Dr. Habbu serves as an expert member on several government committees, such as Indian Pharmacopoeia Commission, BIS, FSSAI, Maharashtra government expert committee on Plastics. He is also on the editorial boards of the Journal of Packaging Technology & Research and Colourage.