UN environment programme

National Productivity Council

Counter MEASURE FOR PLASTIC FREE RIVERS

National Policy Workshop Webinar Series
On
Countermeasures for Riverine and Marine Plastic Litter in India
12 -22 May 2020

Session 1: The Science and technology of Plastics & techniques/best practices of plastics pollution assessment and investigation

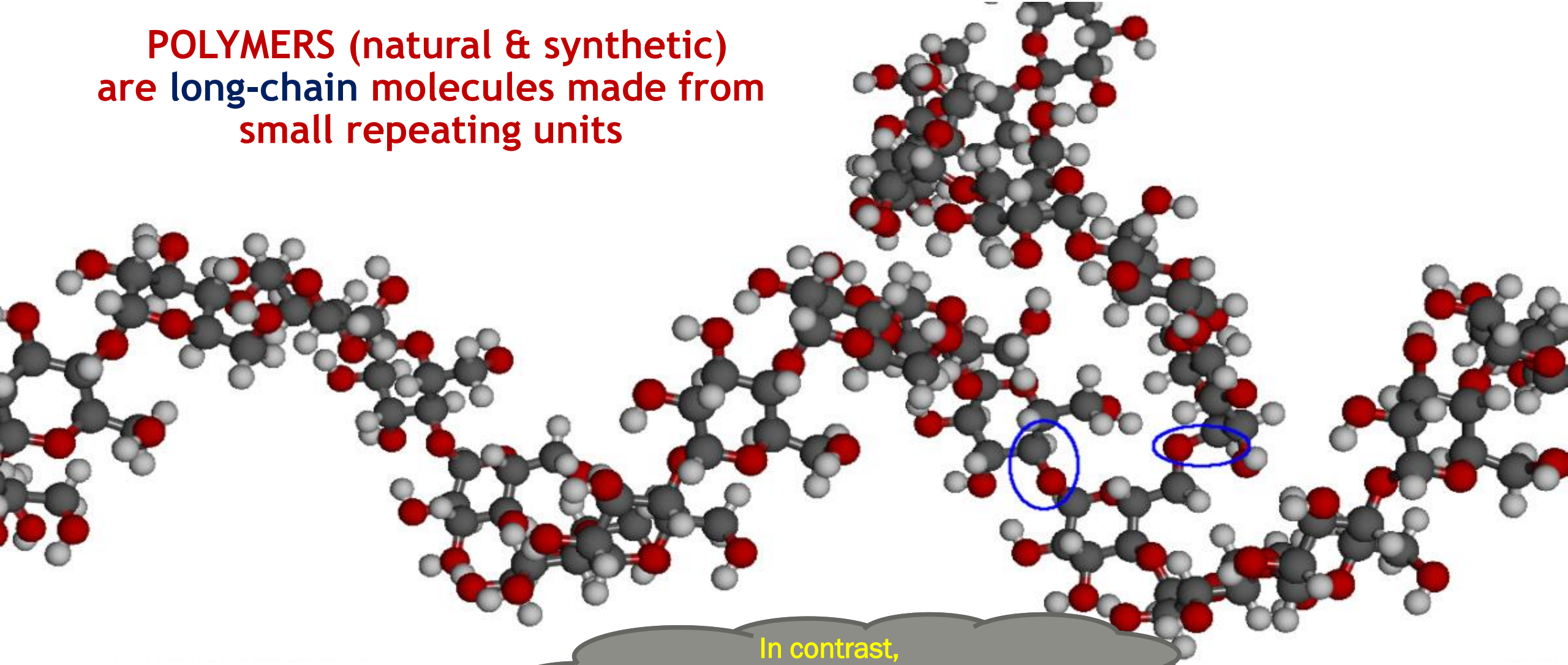
UNDERSTANDING PLASTICS:

THEIR UTILITY AND ENVIRONMENTALLY SAFE HANDLING

INSTITUTE OF CHEMICAL TECHNOLOGY

WHAT ARE POLYMERS?

POLYMERS (natural & synthetic)
are long-chain molecules made from
small repeating units



In contrast,
Water, Salt, Alcohol , sugar, etc.
are small molecules

Size comparison at molecular level,
not physical sizes of articles

Manifestations of Polymeric materials

1. Plastics

2. Fibres (Textiles)

3. Rubbers / Elastomers

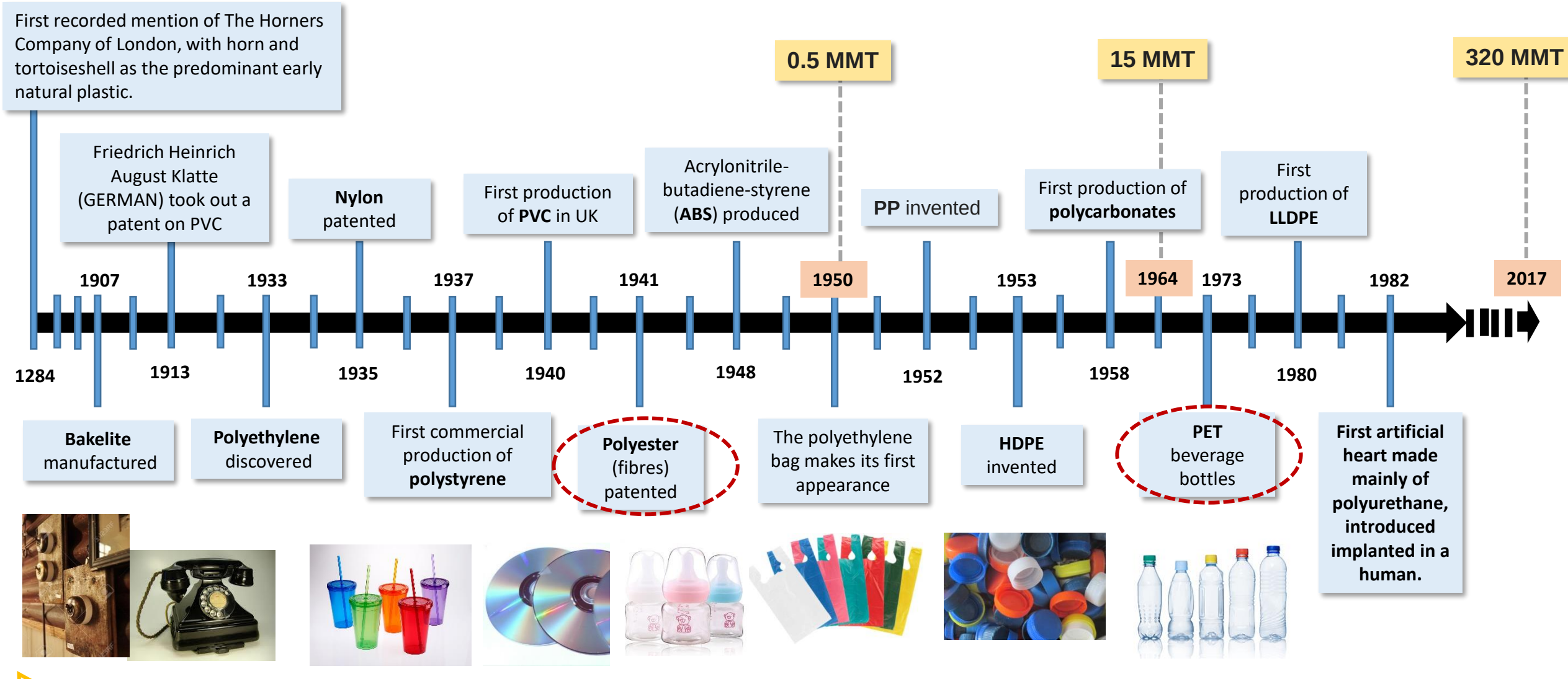
4. Coatings

5. Adhesives

6. Cosmetics

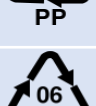
POLYMERS are all around us!

Inventions of Plastics : Timeline



Fascinating evolution of synthetic plastics over the past 110 years (cum. 8300 MMT)

Recyclable Plastics: Identification Codes As per IS 14534 (1998)

Plastic Identification Code	Name of the plastic (Polymer)	Constituents of the plastic (Monomers)	Typical End Uses (Food & Non-Food)
	Polyethylene terephthalate (PET, PETE)	Terephthalic acid + isophthalic acid + Ethylene glycol (or MEG)	Beverage bottles, Jars, Films, Strappings, Fibre and Filaments, Non-wovens, Medical devices, etc.
	High-density polyethylene (HDPE)	Ethylene	Bath-wares, water storage tanks, other household containers, packaging films, pipes, fuel tanks, etc.
	Polyvinyl chloride (PVC)	Vinyl Chloride monomer (VCM)	**Pipes and fittings,** Wire and cables, Footwear, Floorings, blister films,, blood bags, toys,
	Low-density polyethylene (LDPE)	Ethylene	Milk pouches, containers, packaging films, agriculture films and tubings
	Polypropylene (PP)	Propylene	Chairs, Furniture, Containers, Packaging films, Automotive components and Washing Machines, textiles, disposable syringes, etc.
	Polystyrene (PS)	Styrene	Housings for electrical and electronic goods, Disposable cups and containers, Foams, etc.
	All Other recyclable plastics Example 1: **Polycarbonate (PC)** Example 2: **Acrylonitrile butadiene styrene (ABS)**	PC = Bisphenol-A + Phosgene or Diphenyl carbonate ABS = acrylonitrile + butadiene + styrene	PC: Safety helmets, Aircraft, Security and Automotive components, Construction tools, Data Storage devices ABS: Electronic and Automotive components, Pipes, Instruments body parts, etc.

The codes are only to differentiate each plastic and have no other meaning

Plastic Articles Manufacturing Process

Material Formation

Monomers

Catalyst → **Polymerization**
High Temp./Long times (hours)

Plastics Resin

Petrochemical Refiners

Very Large Scale
5 major refiners in India

Polymer Manufacturers

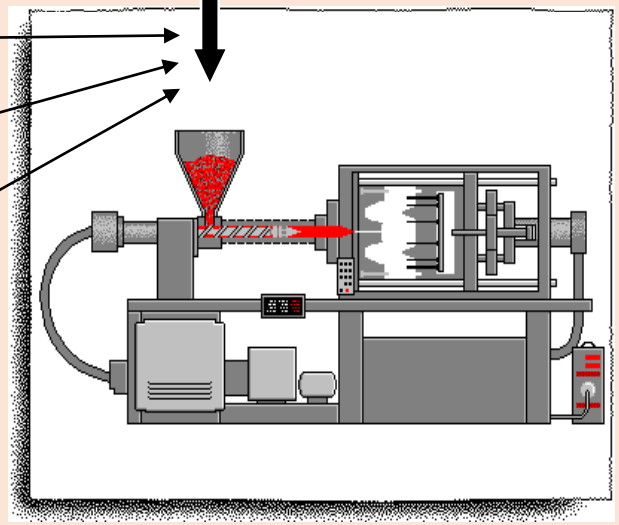
Large Scale
17-18 major manufacturers in India

Shape Formation

Colorants
Additives
Fillers

(Optional)

As per IS 9833



- **Extrusion**
- **Casting**
- **Moulding**
  - Injection
  - Blow
  - Roto

  High Temperature/Short times (seconds)
- **3-D Printing**

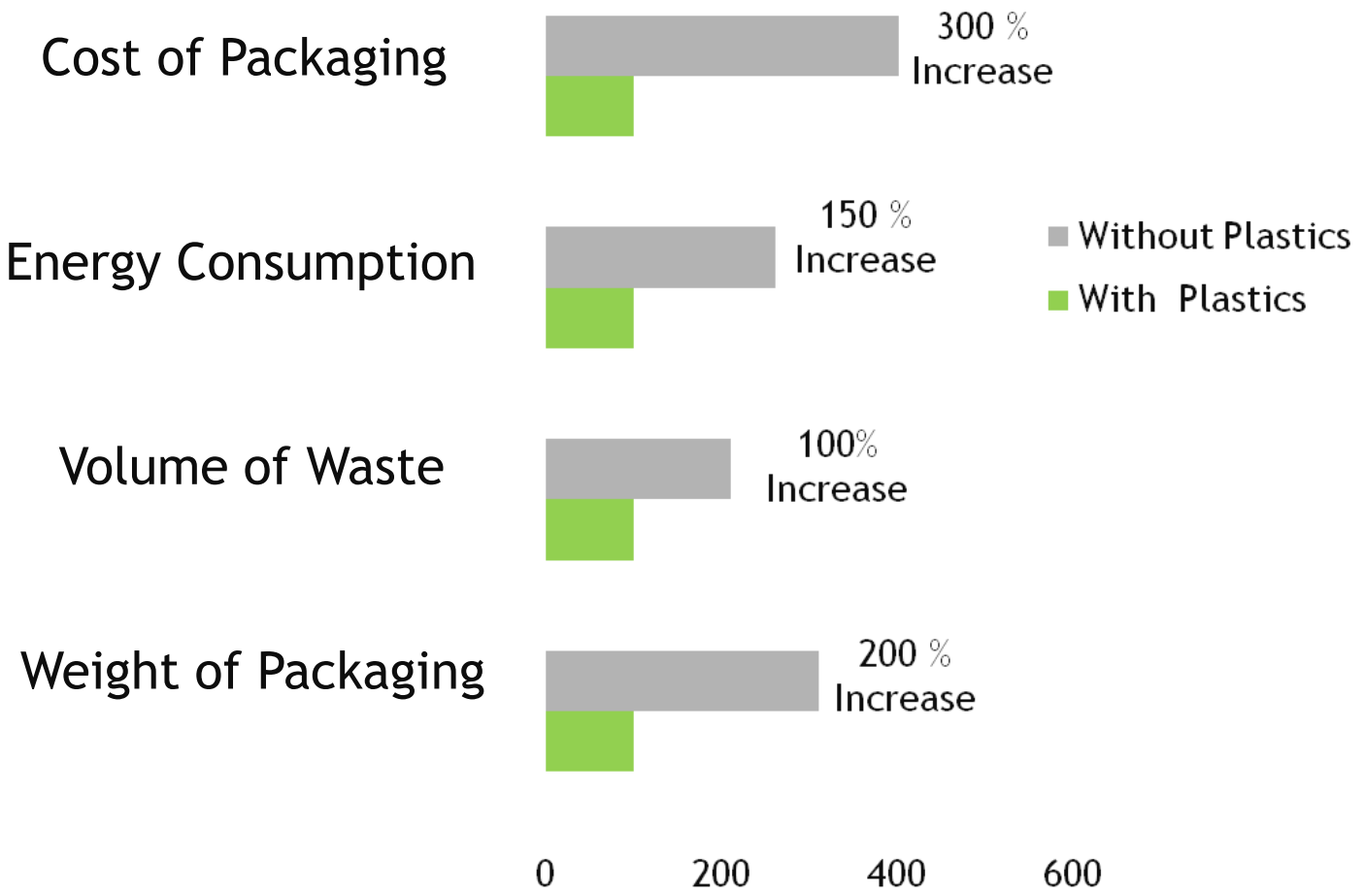
Convertors

Small Scale
50,000 convertors in India

Plastics/Articles

Converting plastic resins into shaped articles is very simple and gentle

Sustainable Packaging: Resource Conservation



Paper & Paperboard

Metal

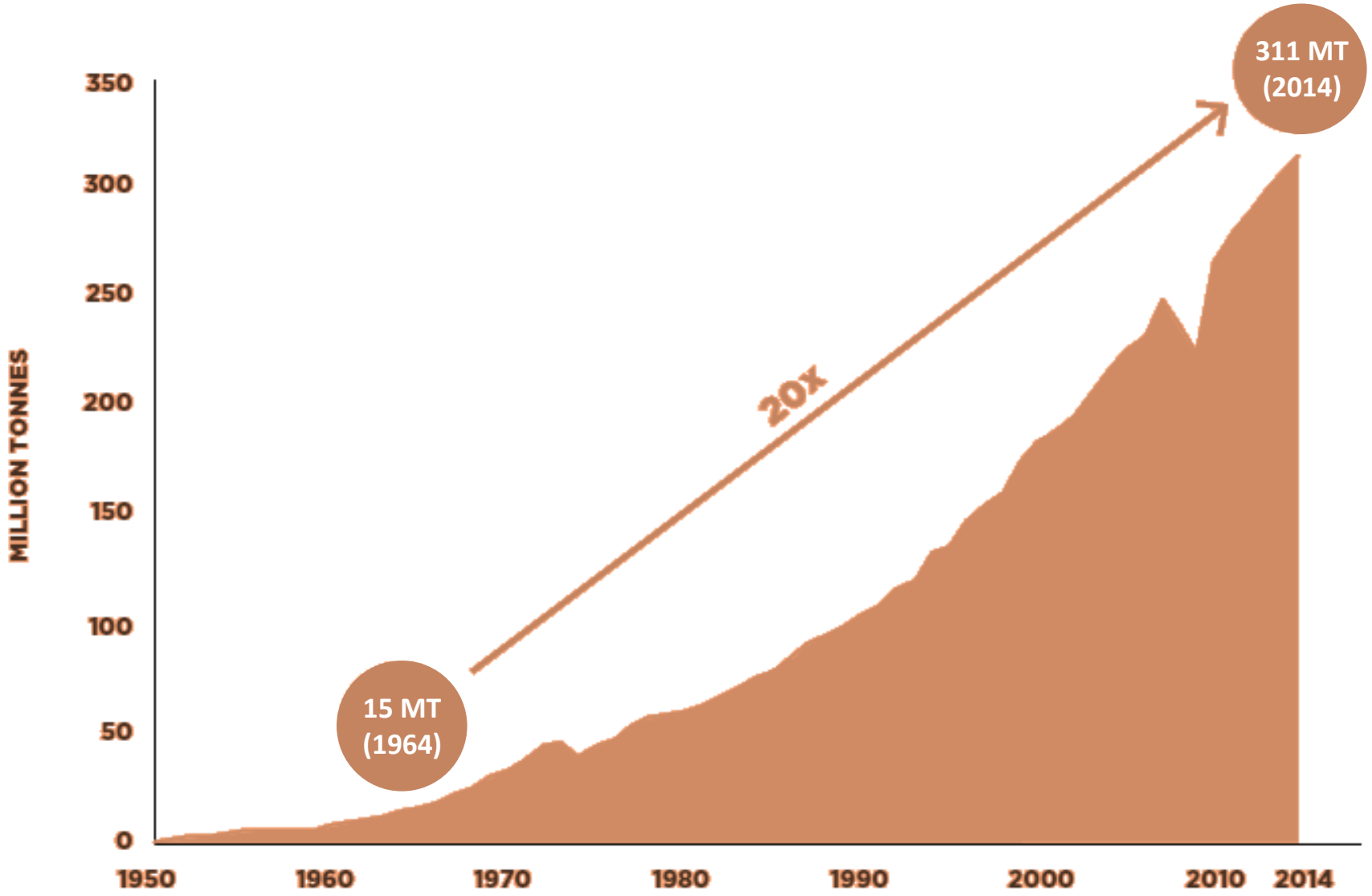
Glass

LCA studies : Plastics are most friendly to the environment and consumers

Plastics in Various Fields

Plastics are replacing traditional materials in all areas.
This Evolution is Natural, Inevitable and Irreversible.

Growth in Global Plastics Production



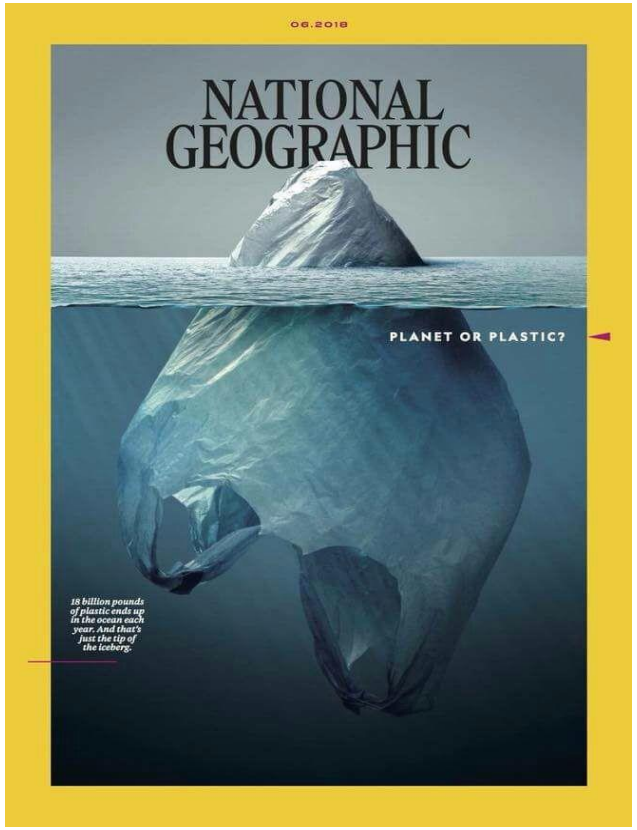
Source: The New Plastics Economy, Rethinking the future of plastics, WEF.

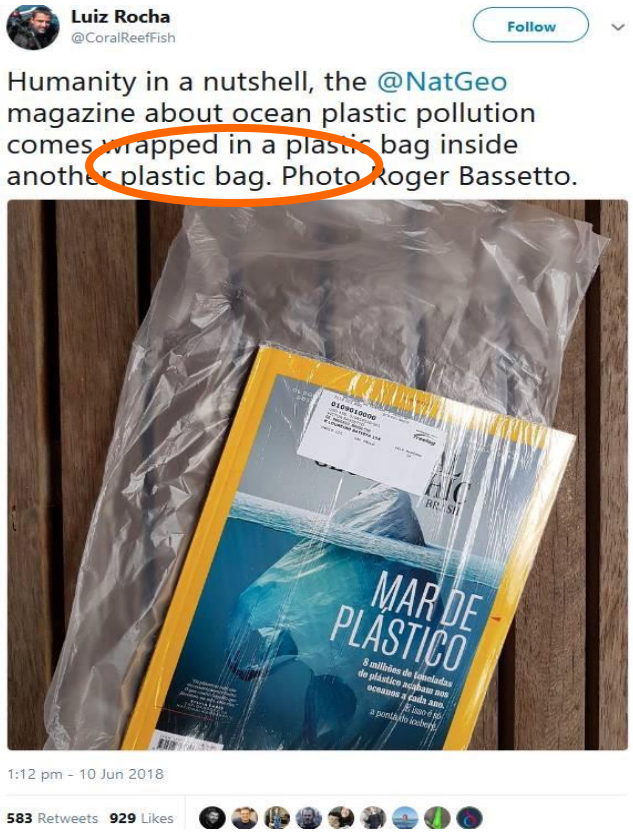
Plastics : a case of advantages becoming the bane

1. Light weight
2. Durability
3. Non-breakable
4. Non-interacting/ non-absorbing
5. Non-wetting
6. Safety (non-hurting/non-rusting)
7. Insulation
   - thermal, electrical
   - Biological (VIRUSES, BACTERIA)
8. Versatility
9. Cost-effective
10. Environmental-friendly

But,
Visibility of its litter is outscreaming the Superiority of its eco-footprint

#BeatPlasticPollution : THE PARADOX

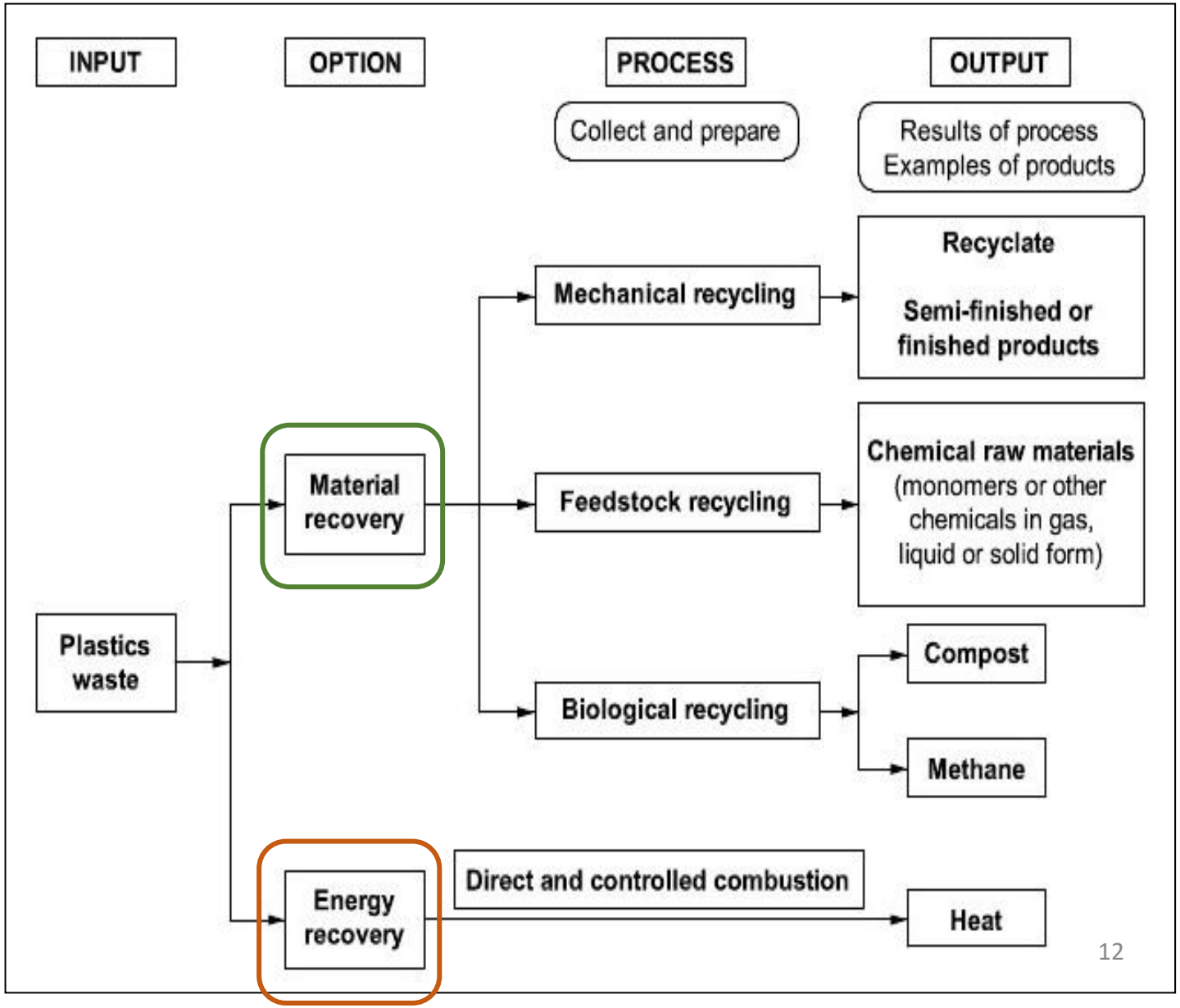




Messages asking
"Say no to plastics"
printed on Plastic banners

THE PARADOX : HAPPENS BECAUSE PLASTICS HAVE NO "FUNCTIONAL EQUIVALENTS"

Recycling : Options for value recovery



Rigid Packaging

Single Polymer packaging ***Water Packaging – PET Bottles*** ***Lube Oils – PE*** ***Health drinks – PP***	**PET** **PE** **PP**	  
Multi Polymer packaging ***Pickles, Mango Pulp,*** ***Flavoured Yoghurt***	**PE + EVOH**	 
Multi Material packaging (MLP) ***Fruit juices, milk, coconut water***	**Paper + Aluminium + PE** ***e.g. Tetrapak***	 

Flexible Packaging

Single Polymer packaging ***Milk Pouch*** ***Water Pouch***	**PET** **PE** **PP**	 
Multi Polymer packaging ***Edible Oil, Standup Pouches***	**PE, EVOH, PET, Nylon, PP**	 
Multi Material packaging (MLP) ***Snack food packaging, Hair Dye, medicines***	**PE, PET, PVC + Aluminium**	  

Plastics litter management : EPR perspective

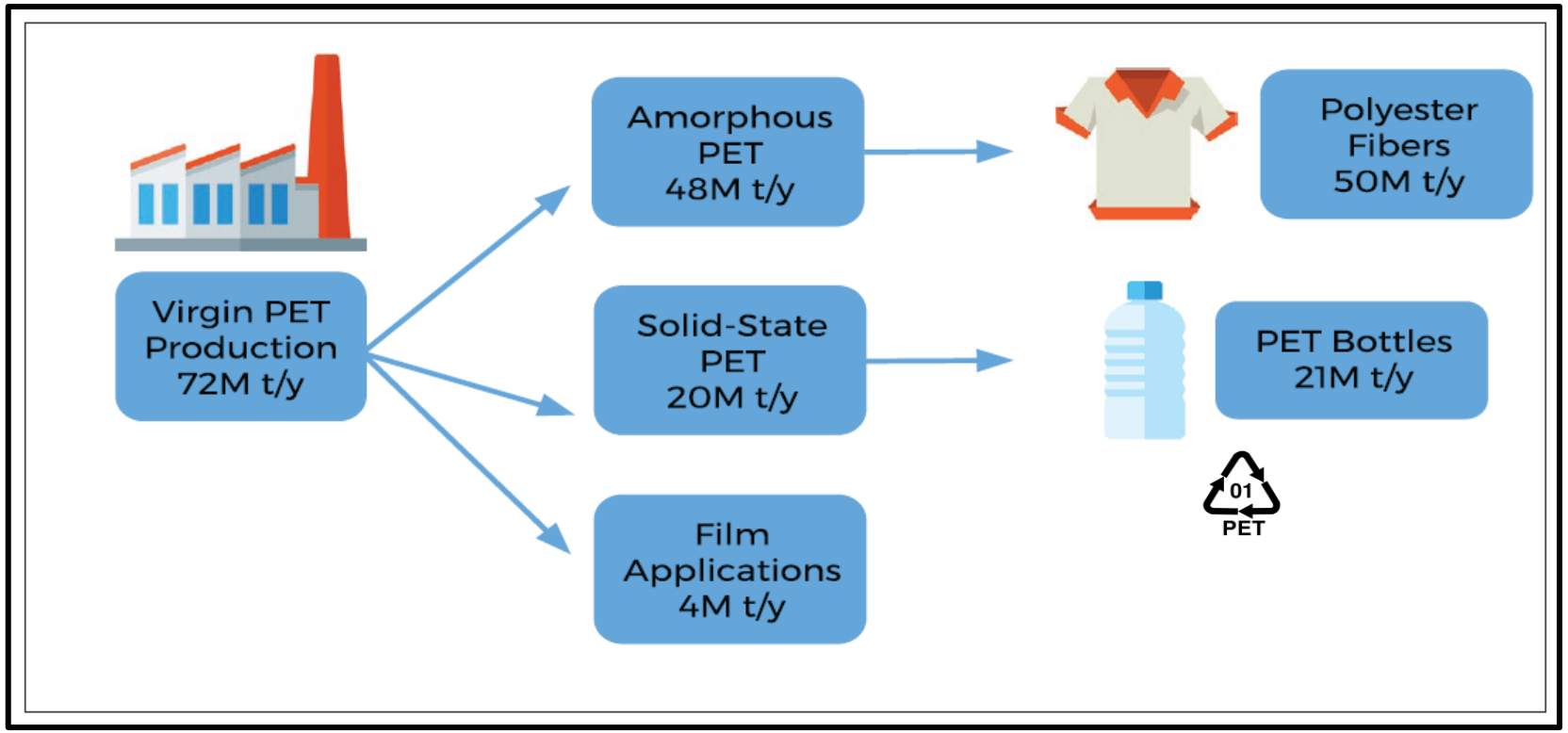
PLASTICS-BASED ARTICLES		EXAMPLES		**Litterability** (instinct to discard) – ***weight/size dependent***	**Collectibility/ Retrievablity** (from the wayside litter)	**Recyclability**		**EPR obligation**
CATEGORY OF PACKAGING	COMPLEXITY OF PACKAGING	**PACKAGING** ***Food, water, personal care, beverages, pharmaceuticals,***	**NON-PACKAGING** ***Personal hygiene, other articles***					
RIGID	**Single Polymer**	Bottles, drums	Large articles (overhead tanks, furniture), crockery, pipes, combs	Low	High	EASY		**Low**
	MLP type-1 = **Multi Polymer**	Pouches with spouts	bangles, frames, cutlery, marker pens, tooth brushes, white goods	Low	High	Medium		**Medium**
	MLP type-2 = **Multi-Material**	Blister packaging, Brick cartons	footwear, razors	Low	High	Difficult		**High**
FLEXIBLE	**Single Polymer**	milk pouches, carry bags, envelope covers, wrappers	cables, wires, dental floss	High	Low	Easy		**Medium - High**
	MLP type-1 = **Multi Polymer**	toothpaste/ointment tubes		High	Medium	Medium		**High**
	MLP type-2 = **Multi-Material**	wafer packets, pouches, shampoo sachets,	Toys	High	Low	Difficult		**Very high**

PLASTICS ARE NOT A MONOLITHIC GROUP – EACH CATEGORY NEEDS A DIFFERENT OUTLOOK

Plastics life-chain

Stakeholders	Generic Output	SPECIFIC OUTPUT	Platforms for Value Recovery
Explorers	Crude Oil	OIL & GAS (Fuels and fractions of chemicals)	
Refineries	Petrochemicals	MONOMERS	PYROLYSIS
Polymer Manufacturers	Polymers	RESINS	CHEMICAL RECYCLING
Convertors	Intermediate Plastic Components (Films, preforms)	BOTTLES, MULTI-LAYER FILMS	MECHANICAL RECYCLING
Producers	Final/Assembled Plastic Packaging	POUCHES, CARTONS	
Brand Owners	Consumer Products	SOFT DRINKS, CHOCOLATES	
Retailers		Vending	ROAD MAKING
CITIZENS	Plastics/Packaging waste	~~Littering~~ SEGREGATION	ENERGY RECOVERY (coprocessing of fuels)

POLYESTER's MANIFESTATIONS



R-PET fibres : bottles to performance

Adidas used 1.8 million plastic ...
amp-cnn-com.cdn.ampproject.org

CNN Live TV

Adidas made a sustainable football field using 1.8 million plastic bottles

By Allen Kim, CNN

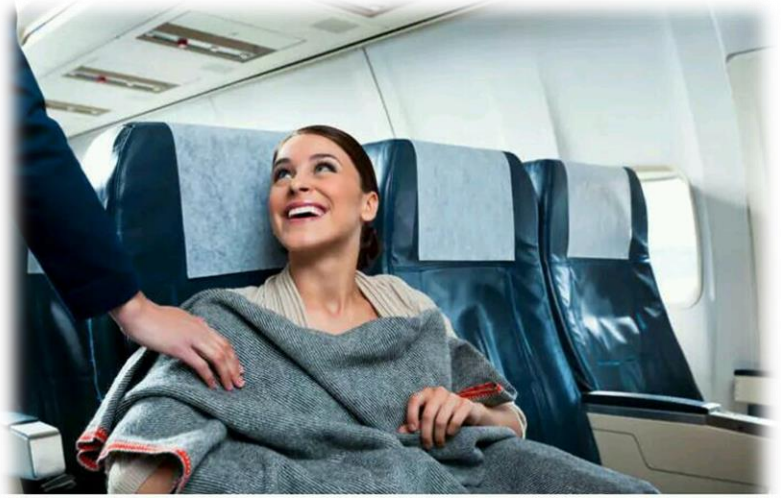
Updated 11:29 AM EST, Mon February 03, 2020

(CNN) — Adidas has taken approximately 1.8 million plastic bottles and turned them into a sustainable football field.

Audiofficial
@AudiOfficial

From a plastic bottle to a seat cover: At the #world #premiere of the new #Audi #A3 at @GimsSwiss, Audi will present #sustainable seat covers made up of 89 % recycled PET bottles. Find out how this sustainable product is manufactured >> di-ri.co/Cuwxs

5:00 PM · 25 Feb 20 · dirico



Emirates launches blankets made of recycled plastic bottles

Aircraft carrier Emirates has introduced new blankets made from recycled plastic bottles on its long-haul flights. Each 'ecothread' blanket is made using 28 recycled plastic bottles, which are turned into plastic chips to create yarn. Emirates has claimed that by the end of 2019 around 8.8 crore plastic bottles will have been recycled through the initiative.

R-PET fibres : boosting performance

Erik Solheim
@ErikSolheim

Noticed an amazing fact about Australian Open 2020?
Ball boys, girls, others are dressed in T-shirts made in Tamil Nadu, India 🇮🇳.
1,88,708 PET bottles used to make 25,000 shirts. Beating Plastic Pollution!
...

6:40 AM · 06 Feb 20 · Hootsuite Inc.

TH

Why pay for news? - Know More

Code green at Australian Open

Akila Kannadasan

JANUARY 30, 2020 16:46 IST
UPDATED: JANUARY 31, 2020 12:37 IST

Ball boys and girls at the ongoing tournament are wearing T-shirts from Tirupur, made from recycled PET bottles

What can 1,88,708 used PET bottles do to the environment? A lot of damage, actually. But thanks to Tennis Australia and Tirupur-based garments company NC John & Sons, they have been given new life as apparel for ball boys, girls, and

PET RECYCLED PRODUCTS - BEYOND APPARELS

P&G Bottle made from 90% recycled PET and 10% ocean plastic . It is finalist in plastic recycling awards Europe

PET is versatile – even in its after life

Valuable Products Made from Plastic Waste

PET Bottles

Milk Pouches

Plastic Woven Sacks

Battery Cases

Plastic Carry Bags

PVC Pipes

Apparels

Barsati Film

Niwar patti

Luggage

Mats

Shoes

Illustrative – Non Exhaustive

Market for recycling plastics in India has emerged – HOWEVER, IS SUSCEPTIBLE TO MULTIPLE CHALLENGES

Plastics Waste in Road-making: The Indian Story

The "Plastic Man" of India

Prof. R. Vasudevan, ***Padmashri awardee***
Dean, Department of Chemistry,
Thiagarajar College of Engineering,
Madurai, TN

Plastics in Roads

- All plastics (non-PET) can be shredded to the right size and incorporated in the aggregate + tar where it melts.
- The plastic lends its qualities to the road.
- The entire process is eco-friendly.

Plastone Blocks

- Made from a mixture of waste plastic and stones/granite waste/ceramic waste
- Withstands more pressure and resist water percolation
- Many advantages over conventional blocks of cement

GoI has now mandated the use of 8% plastics-waste in road construction

MICROPLASTICS -

THE NEW CHALLENGE

Microplastics : what are those really?

FACTS:

1. Formation of smaller particles ***(<5mm)*** in the disintegration process
2. Happens when plastics reside in landfills, oceans, in washing machines
3. Have been happening for as long back as plastics have been littered
4. Recently reported – so not much is known
5. W.H.O. has advised no cause for alarm, more studies needed
6. Analytical protocols not standardized, toxicological effects not proven
7. No epidemiological or histopathological evidence of harm in any population
8. Quantum is grossly exaggerated

   - Credit card/week, i.e. about 5g per week.
   - 5g per week means about 5kg inside a 40 year old person - really?

Particles /microparticles are generated from all materials that see any friction/impacts:

- *Wooden (e.g. furniture)*
- *Metals (e.g. hammer)*
- *Tyres*
- *Ceramics, marble (e.g. floor tiles)*

PLASTICS GAP -

UTILITY vs HANDLING THE NEW AGE MATERIAL

Plastics Consumption : in perspective

2019

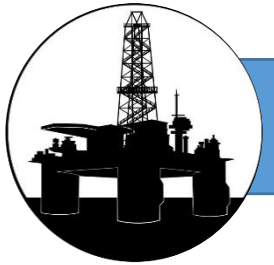
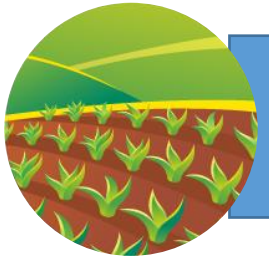
		Global	INDIAN
polymer prodn.	(Million MT)	300	15
population	(billion)	7.75	1.35
Avg. consumpn.	(kg/person/yr)	40	12

INDIAN UNIQUENESS ON PLASTICS

- per capita consumption of plastics (low) — Poor people's food holders/carriers
- recycling rate (high, @ 60% as per CPCB, and >85% for PET)
- Informal "waste-picking" network (high) — usage of small sachets (high)

India has a unique socio-economic trajectory

Plastics vs Bio-Plastics vs modified polymers

Beginning-of-life routes	Consequences	End-of-life concerns
 • Off-shore Reserves (Petrochemical based)	Oil Depletion	LITTERING …????
 • On-shore Reserves (Bio-based monomers or bio-polymers)	Land Blockage	Biodegradability…????
• Incorporating - RECYCLED monomers or - Biodegradable additives	Spoiling the virgin recycling chain	Recyclability…????

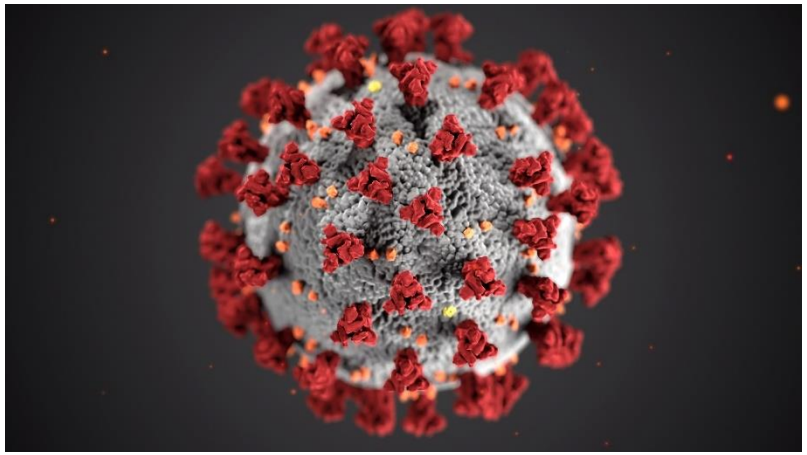
Consequences are just getting shifted, not ELIMINATED

Concerns remain UNMITIGATED

IN THE SERVICE OF NATION -

PLASTICS IN THE TIMES OF COVID-19

Plastics in the war against SARS-CoV-2 and COVID-19



SEGREGATE YOUR WASTE (in designated-colour bins/bags)

Wet waste

(Bio waste)

Vegetables,
Kitchen waste,
Leftover Food

SWM – 2016

Dry waste

(<u>Recyclable</u> waste = plastics, paper, glass)

PLASTIC
bags /wrappers/ packaging
For

- Grains, flour
- Take-away food
- vegetables
- water, milk
- medicines
- etc.

PWM – 2016

Bio-Medical waste

Only if infected or home-quarantined persons, not from healthy individuals

- Face masks *(non-woven/cloth)*
- N95
- PPEs
- Face shields
- Shoe-covers

Hand over to

- Hospitals or
- BMW facilities

BMWM – 2016

Plastics in the relief & rescue efforts : battle against COVID-19

Administrations need to ensure arrangements for collection of Plastics Waste

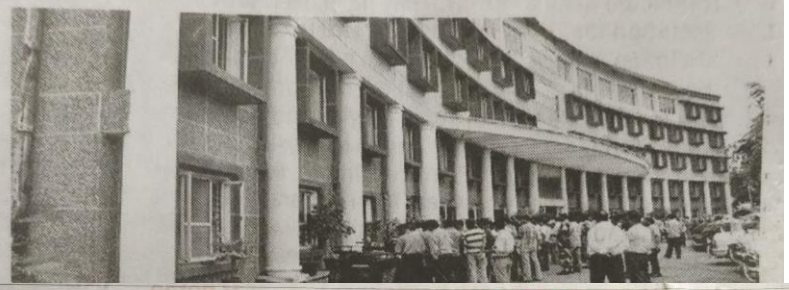
Plastics in distress management in India

Can there be a non-disruptive way to prevent littering?

Realisation of importance of SUPs : COVID-19

Plastic ban in secretariat removed

The Uttarakhand government has stalled its previous order, which banned the use of plastic products such as plastic water bottles in meeting and workshops inside the secretariat due to the need of personal hygiene in the fight against COVID-19. A letter in this regard written by chief secretary Utpal Kumar Singh was circulated last week. In August last year, additional chief secretary Radha Raturi had passed directions, through a circular, to all senior officials that no plastic products should be used inside the secretariat. But now, the state government decided that the order will be put on hold for the time being.



TIMES TRENDS

Why virus may bring plastic back in favour

People Worried About Germs May Be Tempted To Trade Their Reusable Mugs And Bags For Single-Use Plastics

It took one week after the first US case of Covid-19 with no overseas connection for Starbucks Corp to ban customers from bringing in reusable coffee mugs.

Judith Enck, a former regional administrator for the Environmental Protection Agency, was disappointed. Public health comes first, of course, but as the founder of the grassroots Beyond Plastics project, Enck had her doubts that returning to disposable cups would make anyone safer. Currency, for instance, is a notorious germ-carrier. "Will Starbucks now stop accepting cash?" she says.

These are nervous times for activists working to wean the world off plastics. Until the novel coronavirus started its spread across the globe, 2020 appeared to be a year when meaningful plastic-use restrictions would finally take hold. A growing list of consumer firms had set targets to reduce their reliance on plastic packaging. The virus plays right into the industry's strong suits: disposability and hygiene. A new report released by BloombergNEF last week found that, in the short run at least, the fears of plastics opponents might be valid. "Concerns around food hygiene due to Covid-19 could increase plastic packaging intensity, undoing some of the early progress made by firms," it stated.

Getty Images/iStockphoto

The virus plays right into the industry's strong suits: disposability & hygiene

As consumer taste started to shift against the $40 billion plastics industry, manufacturers added an additional argument to their arsenal: that their products are actually a boon to overall sustainability, despite being petroleum-based, non-biodegradable, and difficult to recycle. Most of these claims are based on a handful of studies, the most significant of which was done for ACC by Franklin Associates in 2018. It looked at the life cycle of products like water bottles, shrink wrap, and retail shopping bags and concluded that if they were made of alternative materials — say glass or aluminum or textiles — they would require five times the amount energy to manufacture and use more water in the process.

While BNEF said it was too early to know for sure that Covid-19 is affecting plastic demand overall, it did predict that any spike would likely be temporary, and that industry revenues would be flat or even up in the midst of a sharp economic downturn. "In the long term, we do not expect this increased demand to have a significant impact on either plastic demand or circular economy goals," the report said, referring to a future in which all items are either reused or recycled. A study published in the Journal of Hospital Infection said the virus behind Covid-19 can survive for nine days on plastic surfaces at room temperature.

The plastics industry is seizing the moment. In February, Plastics Industry Association head Tony Radoszewski issued a statement: "As new coronavirus cases are confirmed around the globe, the plastics industry stands ready to assist authorities and public health advocates in making sure our materials and products are on the frontline of combating the spread of coronavirus." BLOOMBERG

Breathing polluted

प्लास्टिक पर लगाया गया प्रतिबंध हटा

देहरादून। सरकार ने लॉकडाउन की अवधि के दौरान प्लास्टिक की वस्तुओं के इस्तेमाल पर प्रतिबंध हटा दिया है। सचिवालय प्रशासन ने पिछले वर्ष पर्यावरणीय दुष्प्रभाव के चलते किसी भी स्तर पर बैठकों व अन्य कार्यक्रमों में प्लास्टिक से निर्मित वस्तुओं के इस्तेमाल पर रोक लगा दी थी।

मुख्य सचिव उत्पल कुमार

मुख्य सचिव उत्पल कुमार सिंह ने शुक्रवार को प्रतिबंध स्थगित करने का आदेश जारी किया है। नए आदेश के बाद एक अगस्त 2019 को जारी आदेश अनिश्चितकाल के लिए स्थगित हो गया। सरकार के सामने कोरोना वायरस की रोकथाम और बचाव कार्य में कई तरह की चुनौतियां आ रही हैं। प्लास्टिक के स्थान पर वैकल्पिक साधनों की आपूर्ति पर्याप्त नहीं है। जिला प्रशासन राहत सामग्री, भोजन वितरण, पीने का पानी उपलब्ध करवाने के लिए प्लास्टिक की वस्तुएं इस्तेमाल नहीं कर पा रहा हैं। ब्यूरो

livemint

HOME LATEST TRENDING MY READS

Coronavirus Mint Covid Tracker #WFHLife Market Dashboa

Workers preparing the PPE suits at a private manufacturing unit amid the ongoing nationwide lockdown, to curb the spread of coronavirus, in Vijayawada. (ANI)

Single-use plastic turns out to be an unlikely hero in corona battle

1 min read . Updated: 13 Apr 2020, 01:59 AM IST

Kalpana Pathak

- Polypropylene, a non-woven material that can be used only once, is largely used in making PPE

इंडिया टीवी .in

पर्यावरण के लिए खतरा बताए गए प्लास्टिक ने Coronavirus से बचाई करोड़ों जानें

जरा सोचिए कि अगर हमारे पास प्लास्टिक से बनी कोई वस्तु मौजूद नहीं होती, तो क्या हम सभी कोविड-19 के घातक हमले से जिंदा बच पाते? आज तक कोरोना वायरस से जिंदगी बचाने वाली कोई भी दवा उपलब्ध नहीं हो पाई है।

RECOMMENDATIONS –

HANDLING OF THE NEW AGE MATERIAL

Sustainability matrix for plastics

GOVERNMENT/ADMINISTRATION

1. Education
   - Know Plastics
   - Say Yes to Plastics, No Littering
   - Two-bin segregation

2. Facilities
   - Standardise the 2-bin colours
   - Provide bins and ensure their clearing
   - Set up waste collection networks locally

3. Enforce
   - Polluter pays
   - Segregation at source

4. Policy
   - Give industry status to the recycling chain

CITIZENS

1. Source segregation in two-bins
2. Reduce
3. Reuse

INDUSTRY

1. Design for Collectibility
   - Size, shape, weight

2. Design for Recycling
   - Reduce complexity of packaging material
   - Use Recyclable chemistries

3. Design for prevention of Litter-generation
   - no need for cutting edges

Sustainability *mantras* for plastics

3Rs for CONSUMER (BEHAVIOUR)

- ✓ REDUCE
- ✓ REUSE
- ✓ RESPONSIBLY DISPOSE USED PLASTICS
  - – Segregate, Collect

3Rs for INDUSTRY (ACTIVITIES)

- ✓ RECYCLE (THE USED PLASTICS)
- ✓ REUTILISE (THE USED PLASTICS)
- ✓ RECOVER (ENERGY FROM THE USED PLASTICS)

R-Elan : making recycled plastics into a chic fashion

ABOUT THE WINNERS
Poornima Pande & Stefano Funari, Mumbai
I was a Sari - an eco-ethical lifestyle fashion brand.

An underprivileged community of women in Mumbai make the products
with the up-cycled pre-loved saris.
Their designs utilize existing resources - fabrics & materials - and reinvent them into unique pieces.

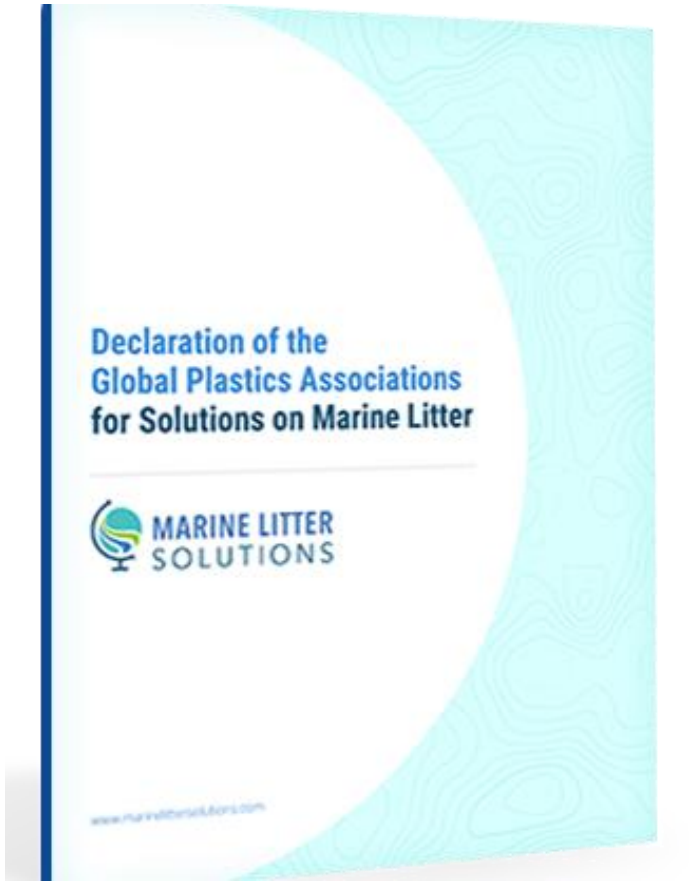
The winning collection comprised recycling of plastic tarpaulin into a raincoat, bag and umbrella,
a 3D appliquéd garment, bags and shoes as well as
a men's wear creation, long T-shirt with funky logo and carry bag.

Collaborative BUSINESS models

Novel LITTER-PREVENTION mechanisms:

- At-source collection/segregation methodologies
- Collect-back mechanisms

Collaborations for ACTIONS



Global Plastics Associations for Solutions on Marine Litter

- conserving our oceans and combatting ocean pollution

Since 2011,

- a total of 69 world plastics organizations
- in 35 countries
- have voluntarily committed to help

More on: www.marinelittersolutions.com

INTERNATIONAL ALLIANCE TO END PLASTIC WASTE

- Jan 2019

- 30 global companies that have formed a non-profit

- Goal is to commit $1.5 billion over the next 5 years to fighting plastic waste

INDIA-NORWAY MARINE POLLUTION INITIATIVE

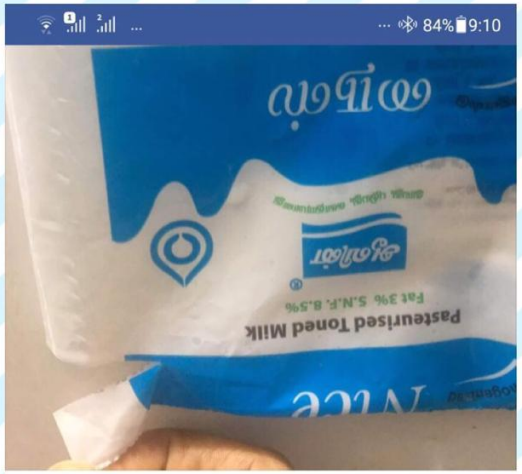
- 11th Feb 2019

Collaborations for IDEATIONS

DORNBIRN MFC
Man-made Fibers Congress

Workshop on Circular Economy
at 2017 Dornbirn (Austria) MMF Congress
13-15 September 2017

Plastic waste – in common conversation



Indubala Ashok Yesterday at 6:23 AM ·

For those who still consume milk and for those who are not doing this yet, please do not snip off and throw away the corners of milk sachets. These small plastic particles are the most dangerous as they escape even sophisticated filters and enter the food chain, earth,waterbodies. Your daily milk sachets triangular miniscule corner may have killed a few sea creatures and blocked easy flow of water somewhere. It will take a 1000 years or more to disintegrate. Would you want that? Cut plastic sachets as shown in the pic . Milk CAN be poured out without spillage and these sachets ARE recyclable if done responsibly. This applies to ALL plastic sachets. It is never too late. Start today.

PACKAGING REDESIGNING IS THE NEED OF THE HOUR

Sustainability solutions – utilizing the USPs of Polymers

Physical routes

Unique Tools to design properties in polymers:

- Transition temperatures
- Molecular weight
- Rheology
- **Morphology**
  Barrier properties without a need for multi layers

Chemical routes

Development of new features

- ~~Bio-degradable plastics~~
- ~~**Oxo-degradable plastics**~~
- **Bio-compostable**
- ~~Bio-polymers~~ **Bio-monomers**
- **Recycling (CARBIOS)**

Biological routes

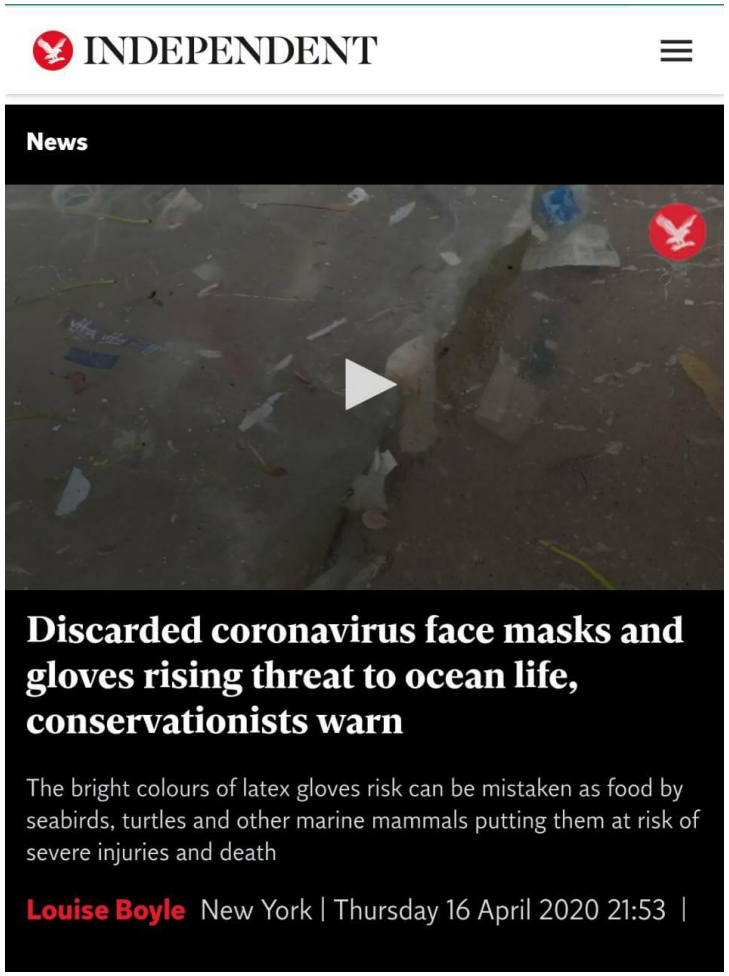
Built-in features for post-disposal dissipation

- **Bacterium that eats PET**
  Ideonella sakaiensis 201-F6, Kyoto Univ, 11 May 2016
  Y. Kimura, K. Oda, et al.
  - Science 351, 1196-1199 (2016)
  - Science 353, 759-c (2016)

Post-disposal Treatments

- **Enzyme-based dissipation of plastic waste**

Plastics are helping us : are we responsible users?



Plastics to the rescue : COVID-19 and beyond

Dr. Vijay G. Habbu

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Thank you