

# Plastic Pollution

## Case Study- 4



- Check out the top picture: Clean, serene seashore with a large ship.
- Fast Forward: Dirty disposal of plastic into Seashore which is polluting the ocean.
- Compare the contrasting views of the seashore
- Reference:
  1. Plastics Europe, Plastics—the Facts 2014/2015: an analysis of European plastics production, demand and waste data. (Retrieved from) [http://issuu.com/plasticseuropeebook/docs/final\\_plastics\\_the\\_facts\\_2014\\_19122/1?e=5245759/13757977](http://issuu.com/plasticseuropeebook/docs/final_plastics_the_facts_2014_19122/1?e=5245759/13757977), 2014
  2. Subhankar Chatterjee and Shivika Sharma, “Microplastics in our oceans and marine health”, Field Actions Science Reports [Online], Special Issue 19 | 2019, Online since 01 March 2019, connection on 21 September 2021. URL: <http://journals.openedition.org/factsreports/5257>
  3. Vaid, M., Mehra, K. & Gupta, A. Microplastics as contaminants in Indian environment: a review. *Environ Sci Pollut Res* **28**, 68025–68052 (2021). <https://doi.org/10.1007/s11356-021-16827-6>
  4. <https://timesofindia.indiatimes.com/city/goa/microplastic-hits-marine-life-enters-human-foodmicroplastics-in-fish-at-keri-galgibaga-experts/articleshow/65329255.cms>
  5. <https://www.statista.com/chart/18299/how-we-eat-drink-and-breathe-microplastics/>

# TYPES OF PLASTIC

- Based on Chemical Properties & BIS Classification (Notified under PWM Rules, 2016), there are seven categories of plastics) :-

Symbol	Polymer Name	Product Examples		Recyclable Curbside?
 PETE	Polyethylene Terephthalate (PETE or PET)	<ul style="list-style-type: none"> <li>Soft drink bottles</li> <li>Water bottles</li> <li>Sports drink bottles</li> <li>Salad dressing bottles</li> <li>Vegetable oil bottles</li> </ul>	<ul style="list-style-type: none"> <li>Peanut butter jars</li> <li>Pickle jars</li> <li>Jelly jars</li> <li>Prepared food trays</li> <li>Mouthwash bottles</li> </ul> 	Yes
 HDPE	High-density Polyethylene (HDPE)	<ul style="list-style-type: none"> <li>Milk jugs</li> <li>Juice bottles</li> <li>Yogurt tubs</li> <li>Butter tubs</li> <li>Cereal box liners</li> </ul>	<ul style="list-style-type: none"> <li>Shampoo bottles</li> <li>Motor oil bottles</li> <li>Bleach/detergent bottles</li> <li>Household cleaner bottles</li> <li>Grocery bags</li> </ul> 	Yes <i>*Plastic grocery bags not accepted</i>
 V	Polyvinyl Chloride (PVC or V)	<ul style="list-style-type: none"> <li>Clear food packaging</li> <li>Wire/cable insulation</li> <li>Pipes/fittings</li> <li>Siding</li> <li>Flooring</li> </ul>	<ul style="list-style-type: none"> <li>Fencing</li> <li>Window frames</li> <li>Shower curtains</li> <li>Lawn chairs</li> <li>Children's toys</li> </ul> 	Not accepted through most curbside recycling programs.

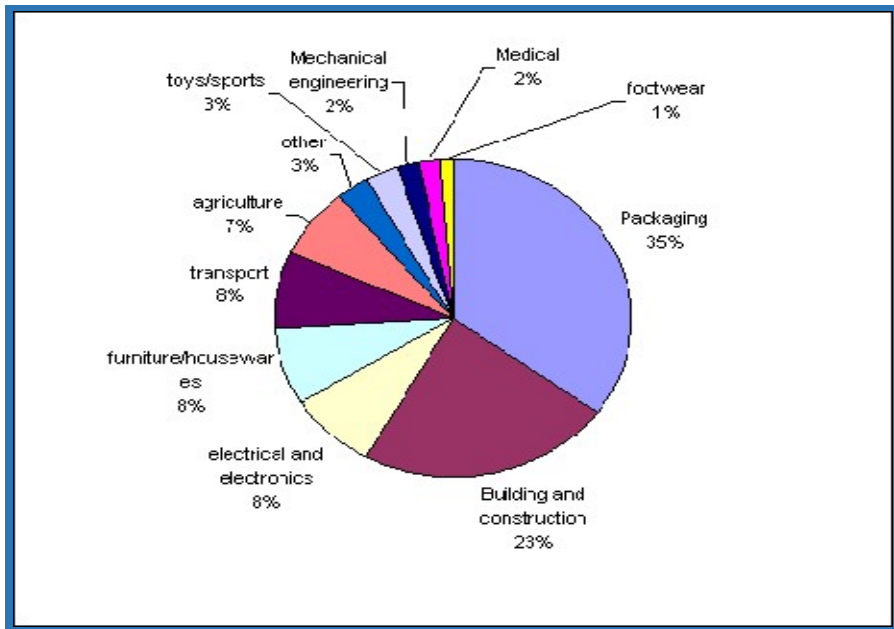
# TYPES OF PLASTIC

- Based on Chemical Properties & BIS Classification (Notified under PWM Rules, 2016), there are seven categories of plastics) :-

	<b>Low-density Polyethylene (LDPE)</b>	<ul style="list-style-type: none"> <li>Dry cleaning bags</li> <li>Bread bags</li> <li>Frozen food bags</li> <li>Squeezable bottles</li> <li>Wash bottles</li> </ul>	<ul style="list-style-type: none"> <li>Dispensing bottles</li> <li>6 pack rings</li> <li>Various molded laboratory equipment</li> </ul> 	<b>Yes</b>
	<b>Polypropylene (PP)</b>	<ul style="list-style-type: none"> <li>Ketchup bottles</li> <li>Most yogurt tubs</li> <li>Syrup bottles</li> <li>Bottle caps</li> <li>Straws</li> </ul>	<ul style="list-style-type: none"> <li>Dishware</li> <li>Medicine bottles</li> <li>Some auto parts</li> <li>Pails</li> <li>Packing tape</li> </ul> 	<b>Yes</b>
	<b>Polystyrene (PS)</b>	<ul style="list-style-type: none"> <li>Disposable plates</li> <li>Disposable cutlery</li> <li>Cafeteria trays</li> <li>Meat trays</li> <li>Egg cartons</li> </ul>	<ul style="list-style-type: none"> <li>Carry out containers</li> <li>Aspirin bottles</li> <li>CD/video cases</li> <li>Packaging peanuts</li> <li>Other Styrofoam products</li> </ul> 	<b>Not accepted through most curbside recycling programs.</b>
	<b>Other Plastics (OTHER or O)</b>	<ul style="list-style-type: none"> <li>3/5 gallon water jugs</li> <li>Citrus juice bottles</li> <li>Plastic lumber</li> <li>Headlight lenses</li> <li>Safety glasses</li> </ul>	<ul style="list-style-type: none"> <li>Gas containers</li> <li>Bullet proof materials</li> <li>Acrylic, nylon, polycarbonate</li> <li>Poly lactic acid (a bioplastic)</li> <li>Combinations of different plastics</li> </ul> 	<b>Yes</b>

# Plastic Waste Generation and Issues in India

- As per the 2015 study conducted by Central Pollution Control Board (CPCB) in 60 major cities of India: **4,059 tonnes per day** of plastic waste was generated by these cities.
- Extrapolating the data from these 60 cities, an estimated **25,940 tonnes per day** of plastic waste is generated in India
- Out of the plastic waste generated, **94%** comprises of **thermoplastic** content which is **recyclable**.



## Top 5 Plastic Waste Producing States Of India



Figures in tonnes per annum  
Source: Central Pollution Control Board Annual Report 2015-16

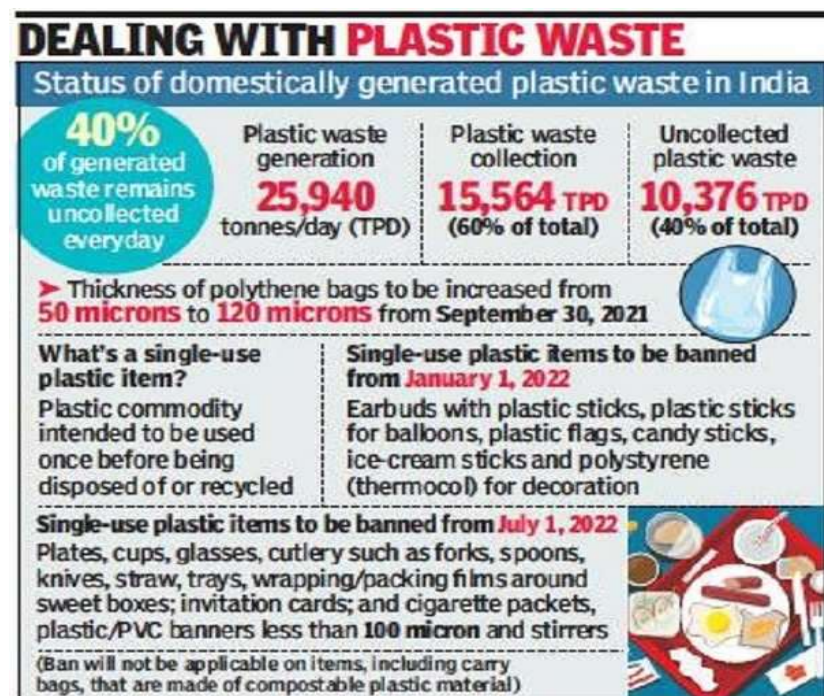
NDTV.com

- Urban India fares worse than its rural counterpart in generating plastic waste. Of India's annual waste generation of 62 million tonnes, 5 million is plastic waste generated by India's cities. The national capital Delhi generates over 689 tonnes of plastic waste in a day, followed by Chennai at 429.30 tonnes and [Mumbai](#) at 408 tonnes. Among states, [Maharashtra](#) tops the list of plastic waste producers, with 4.6 lakh (4,69,098) tonnes per year, followed by [Gujarat](#) at 2.6 lakh (2,69,000) and [Tamil Nadu](#) at 1.5 lakh (1,50,323) tonnes.
- Maharashtra tops the list of India's largest plastic waste producing state, followed by Gujarat and Tamil Nadu
- <https://swachhindia.ndtv.com/world-environment-day-plastic-ban-india-20774/>



# Plastic Waste Generation and Issues in India

- According to world bank, current per capita per day global waste production is 0.74 kg and there will be increase of 70% by 2050.
- Various factors on which the characteristics of waste depends are food habits, economy, lifestyle, climate, urbanisation etc.
- India's plastic consumption set to cross 20 million metric tonnes by 2020



Indian Government has proposed a ban on use of single use plastic items in two phases beginning Jan 1 2022.

In order to deal with the menace of huge uncollected waste across the country, the Centre has also decided to increase thickness of polythene bags from 50 microns to 120 microns from September 30 2021. Currently, polythene bags of less than 50 microns are banned in the country.

Manufacture, import, stocking, distribution, sale and use of all single-use plastic commodities will be prohibited under amended rules ahead of the celebration of 75 years of India's independence on August 15 2022.

Read more at:

[http://timesofindia.indiatimes.com/articleshow/81475753.cms?utm\\_source=contentofinterest&utm\\_medium=text&utm\\_campaign=cppst](http://timesofindia.indiatimes.com/articleshow/81475753.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst)



# Generation of Microplastics

Text: Paul Fernandes; Design: Sharmila Coutinho & C Joy Theophilus

## HARD TO DIGEST

- Water pollution is being aggravated by plastic particles, including nurdles (microplastic pellets about the size of a pea), microbeads from cosmetics and disintegration of plastic litter
- It circulates in the ocean and into the gyre by currents and winds. Most of it is washed back ashore
- Microplastics and chemicals are ingested by animals, affecting their movement and reproductive output. They even cause lacerations, ulcers and, eventually, death
- Plastic particle pollution in water is also referred to as 'Mermaids' tears'
- Styrofoam cups, plastic bags and caps of ballpoint pens form a part of a huge torrent of litter that enters stormwater drains and is swept into streams, rivers and the ocean

Hundreds of sea turtles, birds and mammals die either due to ingestion or getting themselves entangled with plastic litter

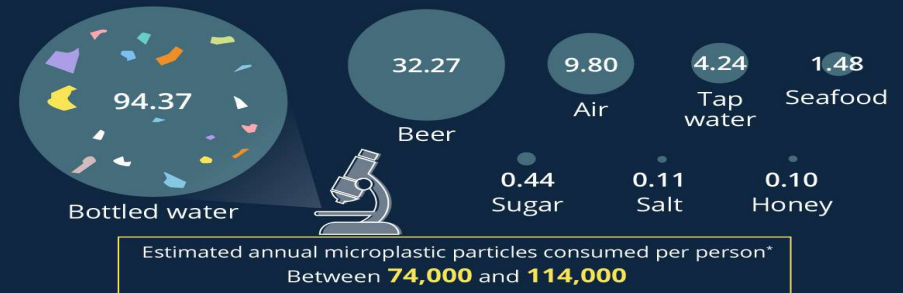
An estimated 20% of plastic waste off Goa's coast may be discarded from ships and other vessels

The Great Pacific garbage patch, also described as the 'Pacific trash vortex', is among the five biggest marine debris patches in the world's oceans

Plastic floats, but it may sink to the sea bed due to marine fouling, which is essentially an accumulation of microorganisms, plants, algae or animals on wet surfaces

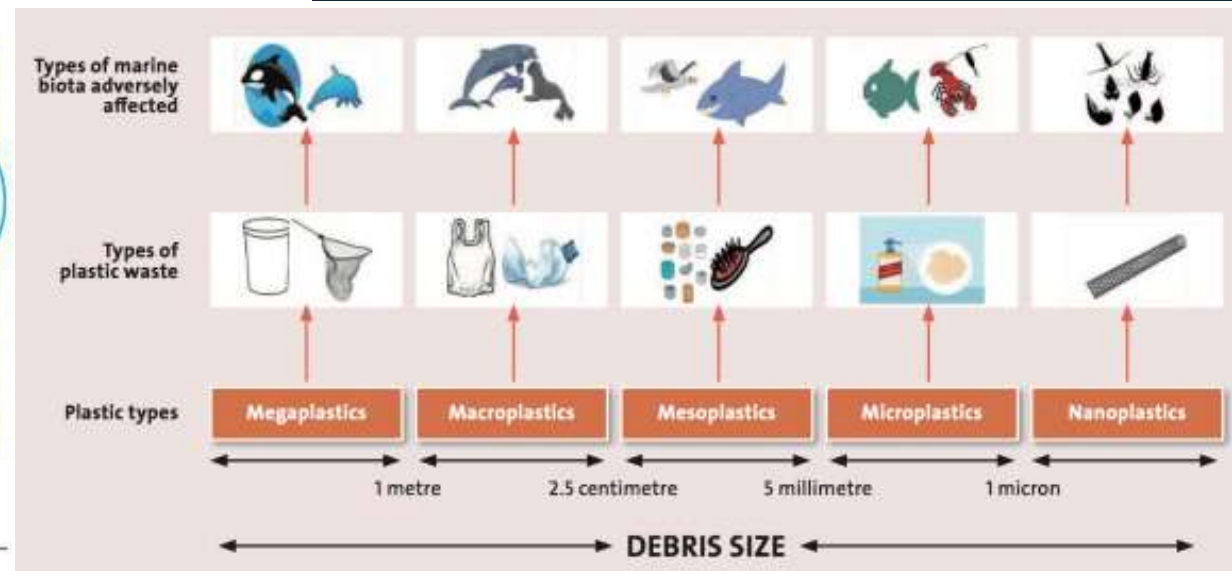
## How We Eat, Drink and Breathe Microplastics

Average number of microplastic particles found per gram/liter/m<sup>3</sup> of selected consumables



\* Including via inhalation. Estimates are "subject to large amounts of variation" and "likely underestimates".

Source: 'Human Consumption of Microplastics', Cox et al. in Environmental Science & Technology (2019)



Microplastics, which are derived from the consequent breakdown of larger debris, are less than 5mm in length, facilitating their ingestion by marine species and, ultimately, by human beings at the end of the food chain. Studies conducted at Keri and Galgibaga near to Goa beach shows high concentrations of microplastics laced with chemical pollutants found in fish tissue.

Read more at:

[http://timesofindia.indiatimes.com/articleshow/65329255.cms?utm\\_source=contentofinterest&utm\\_medium=text&utm\\_campaign=cppst](http://timesofindia.indiatimes.com/articleshow/65329255.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst)

- Microplastic are also found in our everyday usable products, in air, water and food. The average person eats, drinks and breathes between 74,000 and 114,000 [microplastic](#) particles every year - and that is considered an underestimate.
- <https://www.statista.com/chart/18299/how-we-eat-drink-and-breathe-microplastics/>

- Primary microplastics are micro-sized synthetic polymers and used as exfoliates of various processes such as chemical formulations, sandblasting media, maintenance of various plastic products and also in the manufacturing of synthetic clothes. Secondary microplastics are the fragmented product of macro or meso plastics and mostly generated under the effect of various environmental processes such as biodegradation, photodegradation, thermo-oxidative degradation, thermal degradation and hydrolysis. Further nanoplastics are plastic fragments with  $< 1 \mu\text{m}$  size, and all these microplastics and nanoplastics have potential implications for the bioamplification and bioaccumulation of various chemicals and pollutants.
- Reference: Subhankar Chatterjee and Shivika Sharma, “Microplastics in our oceans and marine health”, Field Actions Science Reports [Online], Special Issue 19 | 2019, Online since 01 March 2019, connection on 21 September 2021. URL: <http://journals.openedition.org/factsreports/5257>

# The pathway by which plastic enters the world's oceans

Estimates of global plastics entering the oceans from land-based sources in 2010 based on the pathway from primary production through to marine plastic inputs.

Our World  
in Data

**Global primary plastic production:**  
270 million tonnes per year

**Global plastic**  
275 million tonnes  
It can exceed primary production from previous years

**Where does plastic accumulate in the ocean?**

Macroplastics are greater than 0.5cm in diameter  
Microplastics are smaller than 0.5cm

Our World  
in Data

**Shoreline**  
Dry lands

Total from 1950 to 2015:  
82M tonnes macroplastic  
40M tonnes microplastic

Two-thirds of buoyant macroplastic released into the marine environment since 1950 is stored close to the oceans' shorelines.

A large part of the 'missing plastic' problem is explained by plastic accumulation, burial and resurfacing along shorelines.

Coastal

99.5 million tonnes  
This is the annual sum of inadequately managed and littered plastic waste from coastal populations. Inadequately managed waste is that which is stored in open or insecure landfills (and therefore at risk of leakage or loss).

Data source: Lebreton et al. (2019). A global mass budget for positively buoyant macroplastic debris in the ocean. This is a visualization from OurWorldinData.org, where you find data and research on the world's largest problems.

This is the annual sum of inadequately managed and littered plastic waste from coastal populations. Inadequately managed waste is that which is stored in open or insecure landfills (and therefore at risk of leakage or loss).

**Plastic inputs to the oceans:**  
8 million tonnes per year

2 billion people living within 50km of coastline

**Coastal**  
Shallow waters (<200m)

Total from 1950 to 2015:  
150,000 tonnes macroplastic  
80,000 tonnes microplastic

Most macroplastic (79%) in the coastal environment is less than 5 years old.

**Offshore**  
Deeper waters (>200m)

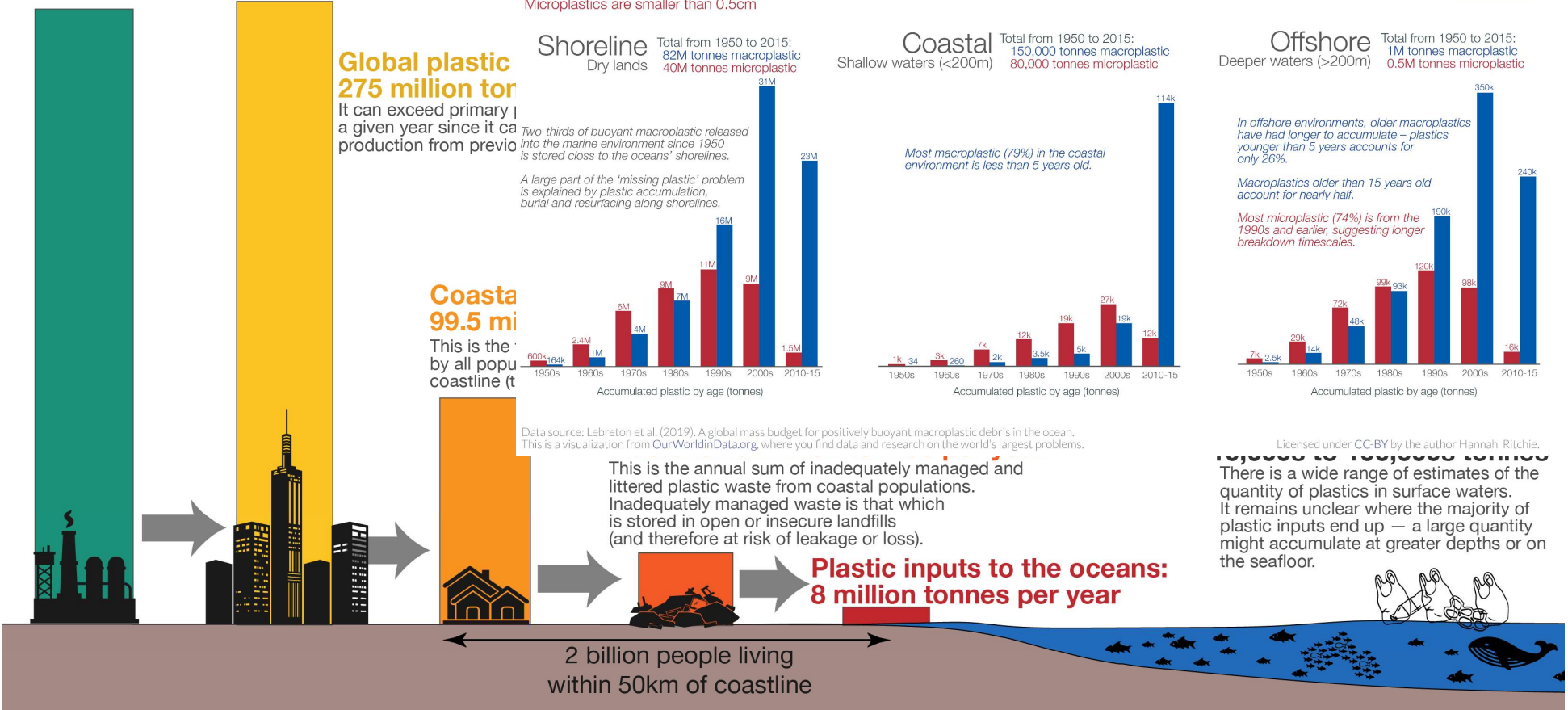
Total from 1950 to 2015:  
1M tonnes macroplastic  
0.5M tonnes microplastic

In offshore environments, older macroplastics have had longer to accumulate – plastics younger than 5 years accounts for only 26%.

Macroplastics older than 15 years old account for nearly half.

Most microplastic (74%) is from the 1990s and earlier, suggesting longer breakdown timescales.

Licensed under CC-BY by the author Hannah Ritchie.  
There is a wide range of estimates of the quantity of plastics in surface waters. It remains unclear where the majority of plastic inputs end up — a large quantity might accumulate at greater depths or on the seafloor.



Source: based on Jambeck et al. (2015) and Eriksen et al. (2014). Icon graphics from Noun Project.

Data is based on global estimates from Jambeck et al. (2015) based on plastic waste generation rates, coastal population sizes, and waste management practices by country

This is a visualization from OurWorldinData.org, where you will find data and research on how the world is changing.

Licensed under CC-BY-SA by the authors.

Plastic waste generated in coastal regions is most at risk of entering the oceans; in 2010 coastal plastic waste – generated within 50 kilometres of the coastline – amounted to 99.5 million tonnes;

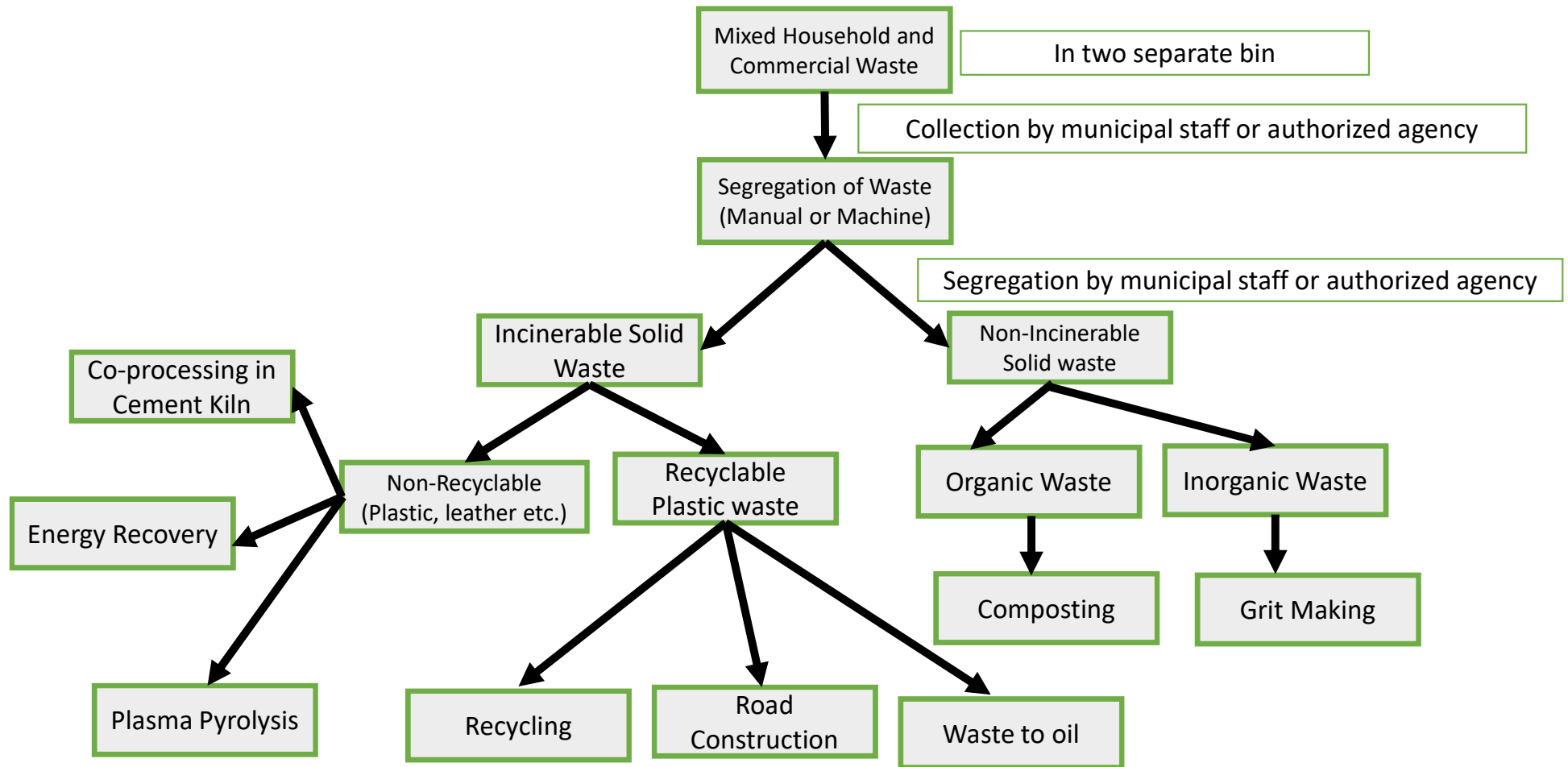
Plastic waste which is improperly managed (mismanaged) is at significant risk of leakage to the environment; in 2010 this amounted to 31.9 million tonnes;

of this, 8 million tonnes – 3% of global annual plastics waste – entered the ocean (through multiple outlets, including rivers)



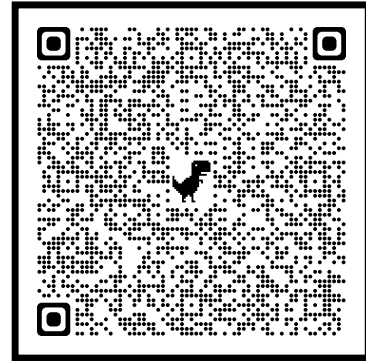
- To try to understand what happens to plastic waste when it enters the ocean, Slat et al. (2019) created a global model of ocean plastics from 1950 to 2015. The authors aimed to quantify where plastic accumulates in the ocean across three environments: the shoreline (defined as dry land bordering the ocean), coastal areas (defined as waters with a depth less than 200 meters) and offshore (waters with a depth greater than 200 meters).
- Their results suggest that macroplastics can persist for decades; can be buried and resurfaced along shorelines; and end up in offshore regions years later. This study challenges the previous hypotheses that plastics in the surface ocean have a very short lifetime, quickly degrade into microplastics and sink to greater depths.
- For more Information Check:
- <https://ourworldindata.org/ocean-plastics>

# PLASTIC WASTE MANAGEMENT - TECHNOLOGY



# APPLICATION OF RECYCLED PLASTIC

## Use of Plastic Waste for Pavement Blocks (Hyderabad)

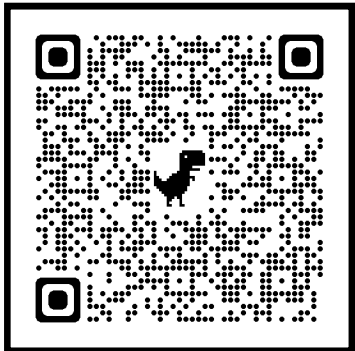


- The tiles made from 30,000 plastic carry bags were procured last month from a Delhi-based company Shayna EcoUnified India Pvt. Ltd. The work on installing paver tiles has already started. With expert advise from Bamboo House India, the civic corporation is likely to complete the project in a few days.
- The tiles will be used to cover 1,500 square feet of area in Shilparamam and 3,500 square feet in a pet park. Since Shilparamam is located right in the middle of the city and many software companies are in the same area, the paver tiled walkway made from plastic is likely to draw attention.
- The paver tiles from plastic come with twin benefits. It will solve the problem of road digging. Usually, when a water connection pipe is to be repaired or a telephone wire is to be installed the civic corporation digs a portion of road and the road has to be made again.
- As opposed to regular cemented roads, the paver tiles cost much less. While an average road construction costs up to Rs 10 lakhs, the paver tiles purchased by the GHMC cost around Rs 3 lakhs. Besides, the tiles can take approximately 20 tonnes of weight so the possibility of cracks is eliminated.
- Check Website:
- <https://swachhindia.ndtv.com/plastic-waste-management-hyderabad-to-roads-to-get-paver-tiles-from-waste-plastic-24689/#:~:text=The%20paver%20tiles%20from%20plastic,has%20to%20be%20made%20again.>



# APPLICATION OF RECYCLED PLASTIC

## Use of Plastic Waste for Road construction (Bangalore)



### HOW PLASTIC IS USED FOR ROADS

**1.** The plastic waste plant cleans raw plastic and shreds it into 4mm pieces

**2.** The shredded plastic is transported to a hot-mix plant, where it is sprinkled over heated stone chips

**3.** This mix is combined with tar and coal and used to build roads



A road was built using plastic waste in Noida last year

**8 tonnes** of shredded plastic waste is needed to build a **6km, 12ft-wide road**

**800kg/hr:** Processing capacity of the Begumpur Khatola plant



- There are approximately 56 lakh kilometres of roads in India, and if we can use plastic waste to relay them with around 2 tonnes of plastic waste per kilometre, we would need around 1 crore 20 lakh tonnes of plastic. But the country produces only 10 lakh tonnes of plastic every year. K.K Plastic Waste Management Ltd has patented a technology known as **K K Polyblend**, which is made out of plastic bags and packing material, and acts as a bitumen binder which can be used in laying roads.
- A study by the Central Pollution Control Board (CPCB) titled **Performance Evaluation of Polymer Coated Bitumen Built Road** in 2008 claimed that such roads are performing much better than regular bitumen roads under similar conditions, with better resistance toward rain, increase in strength by 100 percent, and no development of potholes in the years monitored.
- **The Plastic Waste Management Rules 2016** recommend local bodies to encourage the usage of plastic waste in construction of roads as per the **Indian Road Congress guidelines. Reports** have pointed to developers being mandated to use plastic waste in construction of roads within 50 kms of the periphery of any city.
- Check Website:
- <https://citizenmatters.in/road-construction-plastic-waste-management-environment-pollution-8804>

# APPLICATION OF RECYCLED PLASTIC

## Use of Plastic Waste for Road Construction



**Gurugram**



**United Kingdom**

- **Picture 1:** In a move aimed at dealing with tonnes of [plastic waste](#) generated in the city daily, Municipal corporation Gurugram ([MCG](#)) has made the use of such trash mandatory for the construction of all bitumen roads under its jurisdiction.
- Source: <https://timesofindia.indiatimes.com/city/gurgaon/mcg-makes-use-of-plastic-waste-in-road-construction-a-must/articleshow/74017084.cms>
- **Picture 2:** Enfield Council in North London became the latest authority to use asphalt mixes modified with waste plastic on its roads.
- Source: <https://www.worldhighways.com/wh6/feature/bangalore-dumfries-plastic-waste-technology-reinforcing-our-roads>