

Marine Plastic

Rushabh T. Shende¹, Dr. V.M. Athawale²

Abstract: *Plastic surrounds us. It is not just the obvious places like water bottles and straws. It is also used to build our cars and is found in our face washes and fabrics. With the invention of plastic in the early 20th century, we became a world that relished the privilege of cheap, easy-to-produce plastic pieces. Plastic has many benefits, but it also has left a legacy of trash. Depending on the type of plastic and where it lands, items can take days to hundreds of years to break down into very small pieces, which likely never biodegrade. Because of these traits and our intensive use of it, plastic trash is now found in essentially every ecosystem on the planet including throughout the ocean. Plastic waste is also believed to cost up to \$33,000 per ton in reduced environmental value, the study found. An estimated 8m tons of plastic pollution enters the world's oceans every year. This plastic waste can be reused in many different ways. If this plastic is reused we can save our ecosystem. This marine plastic has lot of beneficial properties such it does not get corrode and, been in ocean for long period of time have been exposed to extreme cold, heat and pressure, didn't get any change in its property. This plastic might be a type of pollution but this is one of the best and cheapest ways to manufacture a product and fight against the plastic. This paper will provides a brief introduction to plastic waste, marine plastic pollution, reuse of marine plastic its characteristics and properties and, some of its future scope. We will also discuss some of its processes of manufacture of the material from marine plastic and its use in manufacturing of car and its part.*

Keywords: Plastic, marine plastic, synthetic polymers

1. Introduction

Plastic

Plastic is a synthetic organic polymer made from petroleum with properties ideally suited for a wide variety of applications, including packaging, building and construction, household and sports equipment, vehicles, electronics and agriculture. Plastic is cheap, lightweight, strong and malleable. Over 300 million tons of plastic are produced every year, half of which is used to design single-use items such as shopping bags, cups and straws. At least 8 million tons of plastic end up in our oceans every year. Floating plastic debris are currently the most abundant items of marine litter. Waste plastic makes up 80% of all marine debris from surface waters to deep-sea sediments. Plastic has been detected on shorelines of all the continents, with more plastic materials found near popular tourist destinations and densely populated areas.

Marine Plastic

Marine plastic is human-created waste that has deliberately or accidentally been released in a sea or ocean. Floating oceanic debris tends to accumulate at the centres of gyres and on coastlines frequently washing aground, when it is known as beach litter or tidewrack. Deliberate disposal of wastes at sea is called ocean dumping. Naturally occurring debris, such as driftwood, are also present.

With the increasing use of plastic, human influence has become an issue as many types of (petrochemical) plastics do not biodegrade. Waterborne plastic poses a serious threat to fish, seabirds, marine reptiles, and marine mammals, as well as to boats and coasts. Dumping, container spillages, litter washed into storm drains and waterways and wind-blown landfill waste all contribute to this problem.

In efforts to prevent and mediate marine plastic and pollutants, laws and policies have been adopted internationally. Depending on relevance to the issues and various levels of contribution, some countries have introduced more specified protection policies.

Types of plastics

Plastic is an essential component of many items, including water bottles, combs, and beverage containers.

The seven types of plastic include:

- 1) Polyethylene Terephthalate (PETE or PET)
- 2) High-Density Polyethylene (HDPE)
- 3) Polyvinyl Chloride (PVC)
- 4) Low-Density Polyethylene (LDPE)
- 5) Polypropylene (PP)
- 6) Polystyrene or Styrofoam (PS)
- 7) Miscellaneous plastics (includes: polycarbonate, polylactide, acrylic, acrylonitrile butadiene, styrene, fiberglass, and nylon)





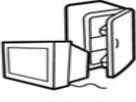


1 PETE	2 HDPE	3 PVC	4 LDPE	5 PP	6 PS	7 OTHER
polyethylene terephthalate	high-density polyethylene	polyvinyl chloride	low-density polyethylene	polypropylene	polystyrene	other plastics, including acrylic, polycarbonate, polyactic fibers, nylon, fiberglass
soft drink bottles, mineral water, fruit juice containers and cooking oil	milk jugs, cleaning agents, laundry detergents, bleaching agents, shampoo bottles, washing and shower soaps	trays for sweets, fruit, plastic packing (bubble foil) and food foils to wrap the foodstuff	crushed bottles, shopping bags, highly-resistant sacks and most of the wrappings	furniture, consumers, luggage, toys as well as bumpers, lining and external borders of the cars	toys, hard packing, refrigerator trays, cosmetic bags, costume jewellery, audio cassettes, CD cases, vending cups	an example of one type is a polycarbonate used for CD production and baby feeding bottles
						

Figure: The figure shows the code number of plastic material

Uses & Benefits of Plastics:

- 1) Plastics enable sustainable, durable, long-lasting design and construction in homes, buildings, and infrastructure like bridges.
- 2) In automotive design, plastics have contributed to a multitude of innovations in safety, performance and fuel efficiency.
- 3) Plastic packaging helps protect and preserve goods, while reducing weight in transportation, which saves fuel and reduces greenhouse gas emissions.
- 4) From computers and cell phones to televisions and microwaves, durable, lightweight and affordable plastics have helped revolutionize the electronics we rely on every day.
- 5) Plastics help make sports safety gear – such as plastic helmets, mouth guards, goggles and protective padding – lighter and stronger to help keep sports enthusiasts of all ages safe. Moulded, shock-absorbent plastic foam helps keep feet stable and supported, while rugged plastics shells covering helmets and pads help protect heads, joints and bones.

Plastic as Pollution

Plastic pollution is the accumulation of plastic objects and particles (e.g. plastic bottles, bags and microbeads) in the Earth's environment that adversely affects wildlife, wildlife habitat, and humans. Plastics that act as pollutants are categorized into micro-, meso-, or macro debris, based on size. Plastics are inexpensive and durable, and as a result levels of plastic production by humans are high. However, the chemical structure of most plastics renders them resistant to many natural processes of degradation and as a result they are slow to degrade. Together, these two factors have led to a high prominence of plastic pollution in the environment.

Plastic pollution can afflict land, waterways and oceans. It is estimated that 1.1 to 8.8 million tonnes of plastic waste enters the ocean from coastal communities each year. Living organisms, particularly marine animals, can be harmed either by mechanical effects, such as entanglement in plastic objects, problems related to ingestion of plastic waste, or through exposure to chemicals within plastics that interfere with their physiology. Effects on humans include disruption of various hormonal mechanisms.

As of 2018, about 380 million tonnes of plastic is produced worldwide each year. From the 1950s up to 2018, an estimated 6.3 billion tonnes of plastic has been produced worldwide, of which an estimated 9% has been recycled and another 12% has been incinerated. This large amount of plastic waste enters the environment, with studies suggesting that the bodies of 90% of seabirds contain plastic debris. In some areas there have been significant efforts to reduce the prominence of free range plastic pollution, through reducing plastic consumption, litter clean-up, and promoting plastic recycling.

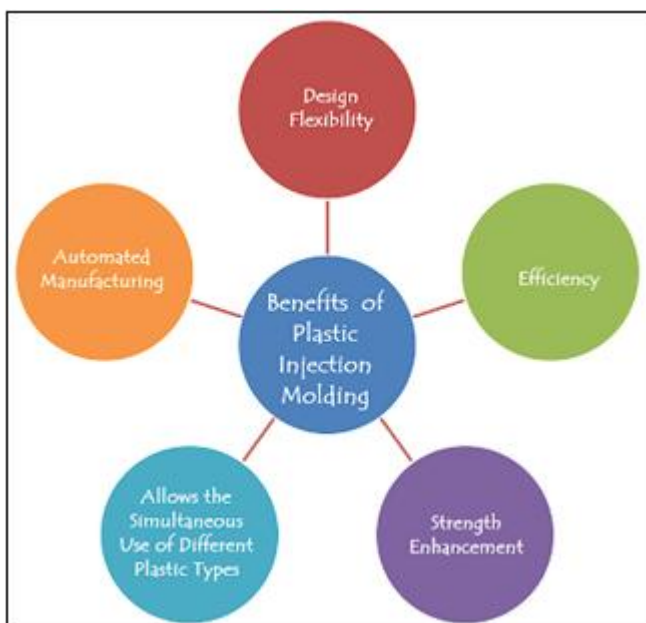


Figure: Benefits of plastics



Figure: By 2050, Mumbai will see more plastic floating than fish

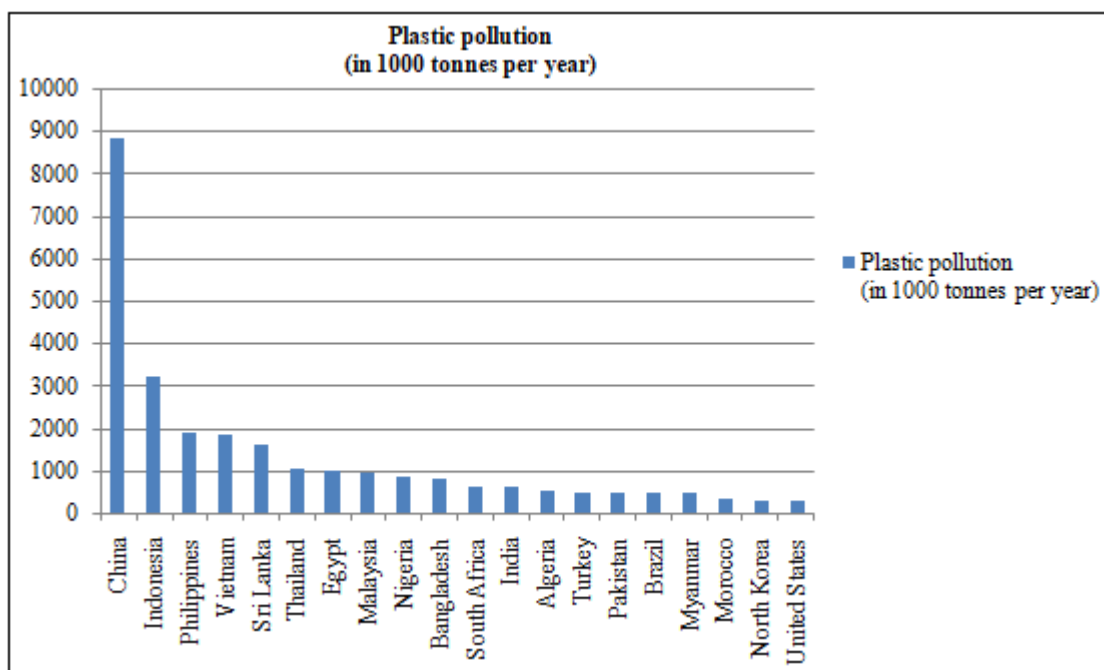
Total plastic waste polluters

Around 275 million tonnes of plastic waste is generated each year around the world; between 4.8 million and 12.7 million tonnes is dumped into the sea. About 60% of the plastic waste in the ocean comes from the following top 5 countries. The table below list the top 20 plastic waste polluting countries in 2010 according to a study published by Science, Jambeck et al (2015).

5	Sri Lanka	1590
6	Thailand	1030
7	Egypt	970
8	Malaysia	940
9	Nigeria	850
10	Bangladesh	790
11	South Africa	630
12	India	600
13	Algeria	520
14	Turkey	490
15	Pakistan	480
16	Brazil	470
17	Myanmar	460
18	Morocco	310
19	North Korea	300
20	United States	280

Top plastic polluters as of 2010

Position	Country	Plastic pollution (in 1000 tonnes per year)
1	China	8820
2	Indonesia	3220
3	Philippines	1880
4	Vietnam	1830



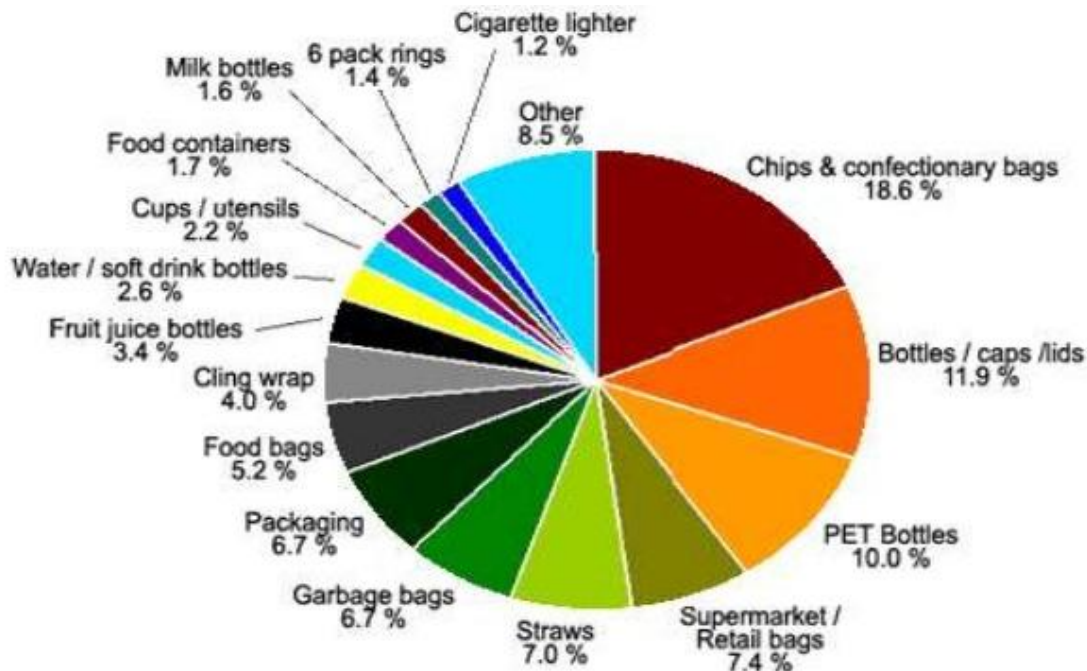


Figure: Things which get useless and leads to plastic pollution

Solution to Plastic Pollution

We cannot stop waste production entirely, but everyone can make a significant contribution. Think before you bin! It saves energy and natural resources, helps to reduce pollution and reduces the need for landfill.

The 'Reduce', 'Reuse' and 'Recycle' elements are referred to as the '3 R's'

1) Reduce

- Reduce: to make something smaller or useless, resulting in a smaller amount of waste.
- "Source reduction" is reducing waste before you purchase it, or by purchasing products that are not wasteful in their packaging or use.
- A key part of waste "reduction" is "conservation" - using natural resources wisely, and using less than usual in order avoid waste.
- You can reduce the amount of waste you create by choosing what rubbish you throwaway. This can be

easy and fun - just follow the simple guidelines to reduce your waste at home, school or work.

2) Reuse

- Reuse: to use again or more than once.
- Reuse materials and items so that they have longer life spans and don't get thrown away after the first use.
- Many items found around the home can be used for different purposes.
- So before you throw those items away, think about how they can be reused.

3) Recycle

- Recycle: to convert materials/waste into reusable material
- Landfills are full of items that could be recycled.
- Recycling puts objects through a process that allows them to be used again.



Marine plastic composite

Why composites?

- Individual polymers not alone satisfy our needs.
- Search for new materials started and composites originated.
- Composite materials are made of more than one phase, in order to achieve combined properties that cannot be met by a single-phase material.
- Composites are able to meet diverse design requirements with significant weight savings as well as high strength-to-weight ratio.

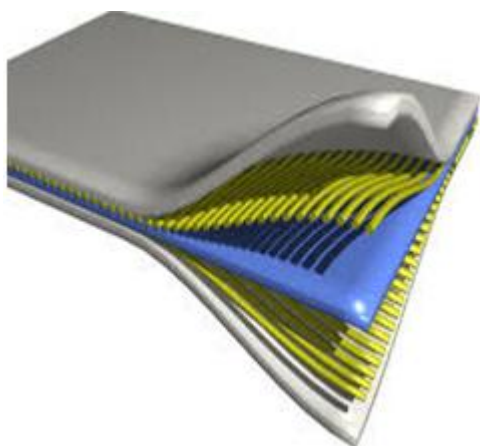


Figure: Composite Material

Fibre Reinforced Polymer Plastics

Fibre reinforced composites (FRP) are composites prepared by the incorporation of fibre's into Plastic material. Combination of polymeric substances with solid fillers gives rise to filled composites.

The reinforcement's function is to enhance the mechanical properties of the composite and is typically the main load bearing element. Reinforcements are usually in the form of either fibres or particles. Matrix and reinforcement materials can be polymers, metals, ceramics, or carbon. The most widely used composite materials are fibres reinforced thermosetting polymers. A composite can be defined as a combination of two or more materials that retain their macro-structure resulting in a material that can be designed to have improved properties than the constituents alone.

Process of Composite Using Marine Plastic:

- Collecting plastic waste
From coastal locations rather than deep in oceans is the most efficient way to clean it up and avoid damaging global ecosystem.
- Sorting and grouping plastic:
Materials according to resin type are an important first step in the recycling process because contamination can render a batch of material un-reusable.
- Plastic material need
To be cut into smaller sizes in order to allow further processing, to provide easier packaging and transportation of recycled stock.
- Float Tanks:
Are the most common wet method, separating material based on density and whether it sinks or floats?
- After Soaking:

Drawing, separating and drying the reclaimed material. The stock is ready to be extruded into pellets.

- The Pellets Are The Melted:
Depends a little bit what kind of technique/machine you are using. The melting temperature is around 260 degrees. However compared to others types of plastic with PET this is very crucial. Some of the additives are added to composite for gaining a particular property.

Characteristics of the composite of marine plastic:

- Tensile strength of composites is four to six times greater than that of steel or aluminium.
- 30-45% lighter than aluminium structures designed to the same functional requirements.
- Composites are versatile than metals.
- Long life offers excellent fatigue, impact, environmental resistance and reduced maintenance.
- Composites enjoy reduced life cycle cost compared to metals.
- Exhibit excellent corrosion resistance and fire retardancy.
- Resistance to chemicals.
- Electrical insulating properties.
- Thermal insulating properties and high strength-to-weight ratio. Since, marine plastic has faced much different weather condition inside the ocean water.

Marine Plastics Benefits

Plastic pollution is one of the greatest threats to ocean health worldwide. With skyrocketing plastic production, low levels of recycling and poor waste management, between 4 and 12 million metric tons of plastic enter the ocean each year—enough to cover every foot of coastline on the planet! And that amount is expected to more than double in the next 10 years. Let that sink in for a moment.

One of the reasons that plastic pollution is such a problem is that it doesn't go away: "plastics are forever." Instead, plastic debris simply breaks down into ever-smaller particles, known as microplastics, whose environmental impacts are still being determined.

So, what can you do about ocean plastic pollution?

Everyone can do something to reduce the amount of plastic that enters the ocean. Here are seven ways you can make a difference.

- Reduce Your Use of Single-Use Plastics:
Wherever you live, the easiest and most direct way that you can get started is by reducing your own use of single-use plastics. Single-use plastics include plastic bags, water bottles, straws, cups, utensils, dry cleaning bags, take-out containers, and any other plastic items that are used once and then discarded. The best way to do this is by a) refusing any single-use plastics that you do not need (e.g. straws, plastic bags, takeout utensils, takeout containers), and b) purchasing, and carrying with you, reusable versions of those products, including reusable grocery bags, produce bags, bottles, utensils, coffee cups, and dry cleaning garment bags. And when you refuse single-use plastic items, help businesses by letting them know that you would like them to offer alternatives.

- 2) **Recycle Properly:**
This should go without saying, but when you use single-use (and other) plastics that can be recycled, always be sure to recycle them. At present, just 9% of plastic is recycled worldwide. Recycling helps keep plastics out of the ocean and reduces the amount of “new” plastic in circulation. If you need help finding a place to recycle plastic waste near you, check Earth911’s recycling directory. It’s also important to check with your local recycling center about the types of plastic they accept.
- 3) **Participate in (or Organize) a Beach or River Clean up:**
Help remove plastics from the ocean and prevent them from getting there in the first place by participating in, or organizing a clean-up of your local beach or waterway. This is one of the most direct and rewarding ways to fight ocean plastic pollution. You can simply go to the beach or waterway and collect plastic waste on your own or with friends or family, or you can join a local organization’s clean-up or an international event like the International Coastal Clean-up.
- 4) **Support Bans:**
Many municipalities around the world have enacted bans on single use plastic bags, takeout containers, and bottles. You can support the adoption of such policies in your community. Here is a list of resources for legislative bodies considering limiting the use of plastic bags.
- 5) **Avoid Products Containing Microbeads:**
Tiny plastic particles, called “microbeads,” have become a growing source of ocean plastic pollution in recent years. Microbeads are found in some face scrubs, toothpastes, and body washes, and they readily enter our

oceans and waterways through our sewer systems, and affect hundreds of marine species. Avoid products containing plastic microbeads by looking for “polythelene” and “polypropylene” on the ingredient labels of your cosmetic products (find a list of products containing microbeads here).

- 6) **Spread the Word:**
Stay informed on issues related to plastic pollution and help make others aware of the problem. Tell your friends and family about how they can be part of the solution, or host a viewing party for one of the many plastic pollution focused documentaries, like Bag It, Addicted to Plastic, Plasticized, or Garbage Island.
- 7) **Support Organizations Addressing Plastic Pollution:**
There are many non-profit organizations working to reduce and eliminate ocean plastic pollution in a variety of different ways, including Oceanic Society, Plastic Pollution Coalition, 5 Gyres, Algalita, Plastic Soup Foundation, and others. These organizations rely on donations from people like you to continue their important work. Even small donations can make a big difference!

2. Application

- 1) Marine plastic when composed with aluminium can be used to make the main body of spacecraft .The best example of this Mangalyaan spacecraft (the main body is a roughly 1.5 m cube constructed of aluminium and composite fibre reinforced plastic sandwich material).

India’s Mars mission

India is set to launch its own Mars probe on Tuesday, the country’s first attempt at an interplanetary mission.

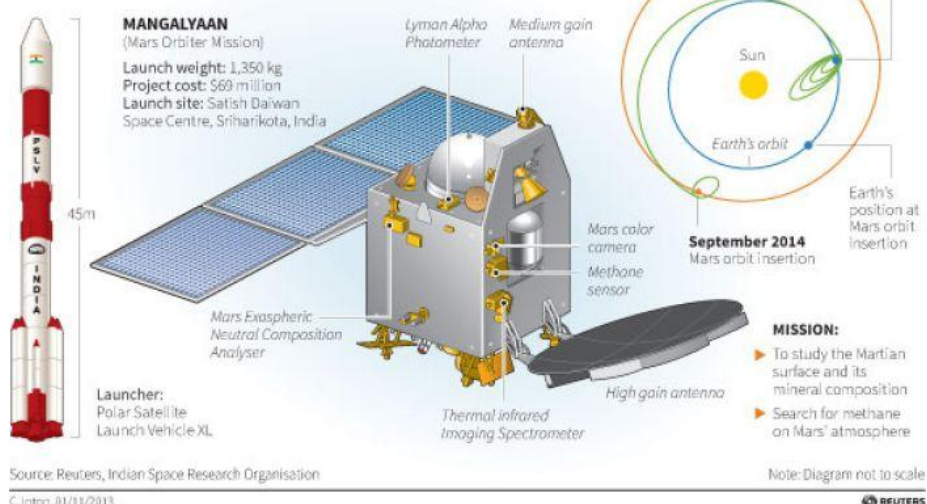


Figure: Mangalyaan Spacecraft

- 2) It can be used in helmet for the safety of the rider.
- 3) These can be used in industries.



Figure: Marine plastic used in industries.

4) The parts of motor bikes can be manufactured at lower price with good quality of product.



Figure: Motor bike parts which can be made from marine plastic.

5) Marine plastic compost can be used in speed boats, for making the main frame.



Figure: Speed boat frame made of marine plastic and aluminium composite.

6) Plane parts which can be made by using marine plastic and its composite.

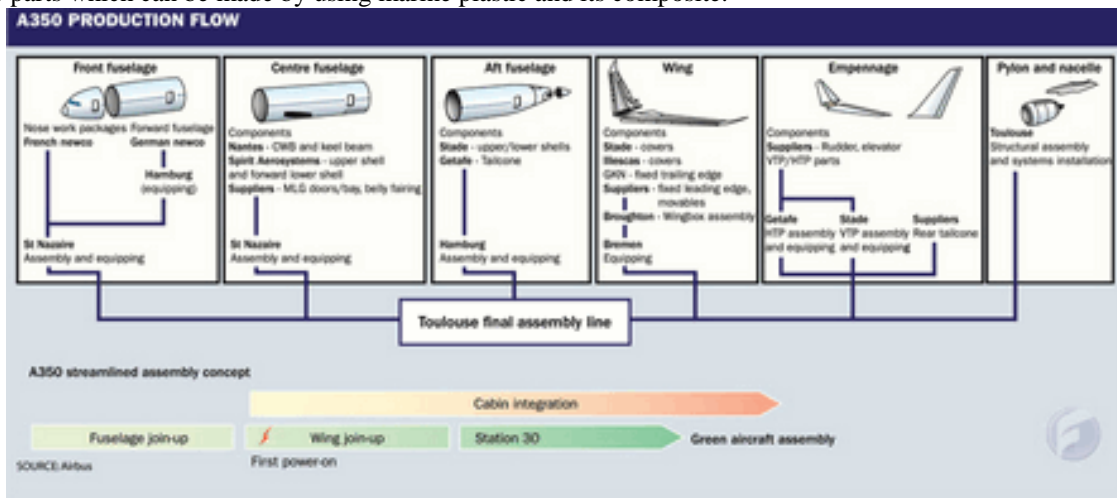


Figure: Plane parts that can be manufactured by marine plastic and its composite to make it light and strong.

7) Marine plastic can be used in automotive industries

Engineered Thermoplastic Solutions

<p>Instrument Panels</p> <ul style="list-style-type: none"> > Retainers > Center Stacks > Back-lit Buttons & Switches 	<p>Sunroofs</p> <ul style="list-style-type: none"> > Rails > Slides > Housings 	<p>Seating</p> <ul style="list-style-type: none"> > Arm Rests > Seat Pans > Slides > Handles 	<p>Airbag Retainers</p> <ul style="list-style-type: none"> > Housings > Brackets
<p>Door Systems</p> <ul style="list-style-type: none"> > Lift Components > Module Carriers > Latches > Handles 			<p>Shifter Bases</p> <ul style="list-style-type: none"> > Housings > Levers > Frames
<p>Fuel Systems</p> <ul style="list-style-type: none"> > Gas Caps > Clips > Connectors > Filler Tubes 			<p>Drivetrain</p> <ul style="list-style-type: none"> > Seal Rings > Thrust Washers > Bushings
<p>Pedal Boxes</p> <ul style="list-style-type: none"> > Housings > Brackets > Wear Components 	<p>Sensor Housings</p> <ul style="list-style-type: none"> > Drivetrain > Emission > Safety & Security 	<p>Front End Modules</p> <ul style="list-style-type: none"> > Carriers > GOR's > Cooling Modules 	

3. Future Scope

With so much research and innovation surrounding the reduction of single-use plastic products, and recycling our used plastic for further use, there is much hope for a future with less plastic waste in our oceans. The reduction will likely be caused by a mixture of solutions, all working together, as there is no silver bullet that can fix our global trash problem.

The Ocean Plastics Lab, a traveling outdoor exhibit, highlights some of this mixture of solutions with interactive spread throughout four shipping-container “rooms”. The global exhibit is an initiative of the German Federal Ministry of Education and Research. Sponsors include a variety of government organizations from around the world such as the European Commission and the National Oceanic and Atmospheric Administration (NOAA) in the United States. Many of the solutions featured in the exhibit show how the behaviour of citizens can make a difference—forgoing plastic drinking straws, using cloth grocery bags rather than plastic ones, buying cosmetics that do not include microbeads, and recycling are just some of the changes any person can make. The exhibit encourages visitors to get involved in the battle against plastic with science too. One example is to download and use apps to help track marine debris in order to better inform scientists of the distribution and abundance of ocean plastic. Ocean Plastics Lab’s goal is to increase public knowledge about the plastics problem and encourage active engagement with the issue.

In short marine plastic has the following future scope as:

- a) For the entrepreneurs the industries of plastic items made from marine plastic. This would reduce the cost of production and reuse the plastic.
- b) For small case business the marine plastic collection and making its composite sheets and selling to the bigger companies for their need.
- c) Marine plastic can use in cosmetics.
- d) Since these plastics have faced different weather condition so used in spacecraft. This reduce the overall costing of the project
- e) We can use this for defence purpose. As soldier can wear this as jackets for protection from bullet when composite with some other material.
- f) These can use in making the main frame of drone.
- g) These also used by Adidas to make their shoe fabric.
- h) Apple Company is also trying to use these plastic in laptops for making the laptop light in weight with high tensile strength.
- i) ISRO is using these plastic. One of the examples of this is Mangalyaan Spacecraft.

4. Conclusion

In reality, we cannot eliminate plastic use from our day-to-day activities. However, we should not allow plastic to reach the soil or water. The government should restrict plastic production and encourage recycling through appropriate policies. The Plastic Waste Management Rules 2016’ need to be strictly followed. We clean our house and get rid of all the waste, thinking we are working towards Clean India Mission but cleaning is just a visible removal of the waste of

your house and sending it to some other place. We don’t have all the answers, but solutions are on the horizon.

References

- [1] <https://ocean.si.edu/conservation/pollution/marine-plastics>
- [2] <https://www.iucn.org/resources/issues-briefs/marine-plastics>
- [3] https://en.wikipedia.org/wiki/Marine_debris
- [4] <https://www.qualitylogoproducts.com/promo-university/different-types-of-plastic.htm>
- [5] https://www.google.co.in/search?q=plastics+use+benefits&hl=en-GB&tbm=isch&source=lnms&sa=X&ved=0ahUKEwiO65Lwme_oAhU0zTgGHUQQA0cQ_AUIDygC&biw=1366&bih=608&dpr=1#imgrc=urTDZf8kojMlXm
- [6] https://en.wikipedia.org/wiki/Plastic_pollution
- [7] <https://gtr.ukri.org/projects?ref=ES%20FS002448%20F1>
- [8] <https://solarimpulse.com/plastic-pollution-solutions>
- [9] <https://www.oceanicsociety.org/blog/1720/7-ways-to-reduce-ocean-plastic-pollution-today>
- [10] <https://www.youtube.com/watch?v=P8PNFFsJ9Us>
- [11] <https://www.plastivision.org/blog/5-types-of-plastic-used-in-the-aerospace-industry/>
- [12] <https://nssdc.gsfc.nasa.gov/nmc/spacecraft/display.action?id=2013-060A>
- [13] <http://www.matweb.com/reference/composites.aspx>
- [14] <https://www.sciencedirect.com/science/article/pii/S0261306914000041>
- [15] <https://www.youtube.com/watch?v=P8PNFFsJ9Us>
- [16] https://www.google.co.in/search?source=hp&ei=itSaXvO4PPfjz7sPgruKsAg&q=3r+concept&oq=3r+&gs_lcp=CgZwc3ktYWIQAxBGMgIIADICCAAYAggAMgIIADICCAAYAggAMgIIADICCAAYAggAMgIIADoFCAAQgWfQz0xYkGdx39oAXAAeACAACyCiAG0B5IBBzAuMS4yLjGYAQCgAQGgAQdnd3Mtd2l6&scclient=psy-ab
- [17] <https://www.oceanicsociety.org/blog/1720/7-ways-to-reduce-ocean-plastic-pollution-today>
- [18] https://www.google.co.in/search?ei=EH-ZXqKyK8769QOltaHIDg&q=marine+plastic+benefit&oq=marine+plastic+benefit&gs_lcp=CgZwc3ktYWIQAzIFCCEQoAE6BAGAEec6DggAEOoCELQCEJoBEOUCOgUIABCRAjoFCAAQgWfQz0xYkGdx39oAXAAeACAACyCiAG0B5IBBzAuMS4yLjGYAQCgAQGgAQdnd3Mtd2l6sAEG&scclient=psy-ab&ved=0ahUKEwii-vLYmu_oAhVOfX0KHaVaCoKQ4dUDCAw&uact=5