PLASTIC POLLUTION: A HUMAN-MADE CRISIS

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Plastics are the most pervasive material on the planet. Plastic items are affordable, lightweight, easy to make, resist decay and may persist for centuries in the environment. These versatile qualities have made plastics a notorious villain of the global environment. Birds, crabs, fish and other animals get trapped in plastic litter, restrict their movement and may die eventually from starvation. Often plastic waste is mistaken for food by cattle and other animals, affecting them adversely. Over time plastic waste breaks down into small size particles of 5 millimetres and less are called microplastics. Fish and other aquatic organisms ingest microplastics as they cannot differentiate between food and plastic particles. Microplastics move along food chains and reach up to the top predator. Presence of miroplastics has been reported in human blood and different organs. Plastic waste has become a significant source of pollution in India requiring urgent attention and action. Use of single use plastic has been banned in the country and the government have notified Plastic Waste Management (Amendment) Rules 2021 and also issued detailed guidelines on Extended Producer Responsibility (EPR) whereby producers are held responsible for the entire lifecycle of their plastic products and packaging toward controlling the menace of plastic pollution.

Keywords: Extended Producer Responsibility (EPR), Great Pacific Garbage Patch, Microbeads, Microplastics, Plastic Pollution, Single Use Plastic, Plastic Waste Management Rules.

Introduction

Plastics are one of the most pervasive materials on the planet. The benefits of plastic are undeniable. Being low cost, versatile, durable, high strength-weight ratio and ease of making, led to a boom in plastics production over the past century. From 1950s to 1970s, only a small amount of plastic was produced. Since 1970s, the rate of plastic production has grown faster than that of any other material. If historic growth trends continue, global production of primary plastic is forecasted to reach 1,100 million tonnes by 2050.

Plastic items are affordable, lightweight, easy to produce and long lasting. The same properties that make plastics so useful — durability and strength — also make it impossible for nature to decompose it completely. The versatile qualities of plastics have made them a notorious villain of the global environment. Plastic waste — whether in a river, the ocean or on land — can persist in the environment for centuries. Plastic pollution has grown into an epidemic and has become one of the most important global environmental challenges to modern society. Evidence of plastic pollution has been found even in the most remote places, including Mount Everest, the deep sea Mariana Trench, the Arctic and the Antarctica. Plastic particles have been found in sea ice, surface water, sea floor and possibly also in the outer space, including moon surface, where waste and

obsolete items are left behind by various space missions.

Globally, since the early 1950s, over nine billion tonnes of plastic has been produced and about 60 per cent of that has ended up in landfills or in the natural environment. About 6.5 million tonnes of plastic is used annually in the country, of which, a large amount is used for packaging. India generates 9.46 million tonnes of plastic waste, of which, about 40 per cent remains uncollected. Plastic waste disturbs land and its dwellers in a multiple ways. However, the negative fall-out of plastic waste often gets masked by the accelerating economic growth and material affluence.

Reckless dumping of plastic waste is one of the main causes of urban flooding as many plastic items like carry bags, wrappers *gutkha* sachets and packets block waterways and exacerbate the natural water-related disasters. Sewers are often clogged, providing breeding grounds for mosquitoes and pests, thus encouraging the spread of vector-borne diseases like malaria, dengue and chikungunya. The animals get trapped and injured by plastic waste. Plastic litter is often mistaken for food by foraging animals that accidentally eat plastic, suffer and often die as a result of it. The swallowed plastic fills the stomach and not surprisingly this reduces the feeling of hunger. Plastic waste consumption by milking cows reduces milk yield and affects their health adversely. Plastic bags can choke the respiratory and digestive systems, posing serious existential threat to animals. Plastic waste strangles birds, crabs, fish and other animals, restricts movement and hinders their normal life. Plastic debris disrupts habitats, making it hard for some species to live and breed normally. Plastic affects all life forms, microscopic animals, right up the foodchain to large predators, even human being.

Much of the plastic waste disposed of on land is transported to the ocean by sewage systems and rivers, serving as express highways for off-loading plastic litter into the seas. Plastic waste spoils beaches and clogs harbours. In the ocean, plastic waste often gathers forming 'garbage patches' formed by sea currents. The largest Great Pacific Garbage Patch that revolves between California and Hawaii consists of trillions of floating pieces of plastic and still growing (Thomson, et al, 2004). Apart from this, there are four other plastic patches, one more in the Pacific, two in the Atlantic and one in the Indian Ocean. A study by Ellen MacArthur Foundation (2016) claimed that at the current rate of primary plastic production and disposal, by 2050, there could be more plastic in the ocean than fish (by weight). A report titled, 'Breaking the Plastic Wave', shows that by 2040, if we fail to act, the volume of plastic on the market will double, the annual volume of plastic entering the ocean will almost triple (from 11m tonnes in 2016 to 29m tonnes in 2040), and ocean plastic stocks will quadruple (reaching over 600m tonnes Ellen MacArthur Foundation, 2020).

Small plastic particles soak up toxic chemicals from the seawater, poisoning the creatures that swallow them. Because plastic pellets absorb toxic chemicals like DDT and PCBs, they effectively become poison pills. Plastic objects themselves can leach endocrine-disrupting chemicals like BPA (bisphenol A) phthalates. In general, plastic debris reduces marine biodiversity and degrades marine ecosystem.

Plastics contribute to climate change. Plastics are made from petroleum, a non-renewable resource. Greenhouse gas (GHG) emissions exacerbate climate change problems. Plastics are made from fossil fuels. Plastic industry accounts for about six per cent of the global oil consumption. Petroleum production and oil distillation are energy intensive processes, generating enormous amounts of GHG emissions which exacerbate climate change. Plastic pollution has also wide-ranging economic implications. Plastic waste creates aesthetic blight, giving rise to unhygienic conditions. Having indiscriminately disposed of plastic litter around adversely affects the tourist-based economy of hill resorts, river fronts and coastal sites, including impacting employment, businesses and livelihoods of the local communities.

Microplastics

Plastic waste never disappears, but breaks down into smaller pieces and tiny particles, which are called microplastics. The term 'microplastics' was coined by Thompson, et al. (2004), and the United Nations Environment Programme (UNEP) defines microplastics as plastic particles smaller than five millimetres. In general, small plastic particles are classified according to their size into the following four categories:

Macroplastics: →2.5 cm

Mesoplastics: 5 mm – 2.5 cm

Microplastics: ←5 mm (← 000 µm)

Nanoplastics: 1 – 1000 nm (0.001 – 1 µm)

Microplastics originate from a variety of sources and are found in growing quantities in the oceans. According to the UN, there are as many as 51 trillion microplastic particles in the seas, 500 times more than the stars in our galaxy. Depending on their source, microplastics are categorised into primary and secondary microplastics. Primary microplastics, also called microbeads are solid particles made of synthetic polymers, used in personal care products, toiletries and cosmetics. Primary microplastics enter the environment directly through any of the various channels—for example, product use, spills during manufacturing and transport, as well as microfibres shed from clothing and other textiles such as fishing nets. In addition, tyre wear and tear is another source of microplastics, since tyres are made of rubber, which is also a polymer. Secondary microplastics, on the other hand, are formed from the breakdown of discarded water bottles and larger plastic debris. Weathering and breakdown of plastic debris results from the combined action of physical, chemical, biological factors, wave action, wind abrasion and exposure to ultra-violet radiation.

Microplastics are now ubiquitously found just about everywhere in our environment. Microplastics are transported from the land by air and rivers into the sea and back out of the sea. When it is raining on the land microplastics are blown back up into the air again, to move somewhere else (Zhang, et al., 2020). They appear to be moving in the biosphere through air-land-water endlessly. The scale of the problem is devastating.

In India, microplastics have been found in air, water, lakes, rivers, estuaries (Unnikrishnan, 2023) soils and various living organisms. A study carried out by the State University of New York in 2018, involving 19 global cites, including Chennai, Mumbai and New Delhi found that 90 per cent of the bottled water

sold worldwide contained tiny pieces of plastic (Times of India, 2018).

Microbeads and other microplastics are mistaken as food and ingested by all kinds of organisms, thus, easily entering the foodchain of aquatic organisms, undergoing bioaccumulation in their tissues, gradually working their way upto the trophic levels through zooplankton, small fish, larger fish and other organisms that consume them. Blue whales may swallow roughly 10 million microplastic pieces daily or up to about 43.5 kg (95 pounds) of plastic.

Many organisms in the oceans remain starved due to the presence of such particles in their digestive tracts or because of a damaged stomach lining. Apart from microplastics being non-nutritive and indigestible, they are able to concentrate toxic pollutants from the surrounding aquatic medium and organisms that ingest them also get a toxic dose of pollutants (Osman, et al., 2023).

Microplastics can enter the human body through inhalation and absorption, and accumulate in organs. Microplastics have been found in our lungs, livers, spleens, kidneys, sputum, saliva and blood. A study recently detected microplastics in placenta of new born babies, Ragusa, et al. (2021). The full extent of the impact of this on the human health is still unknown. There is, however, substantial evidence that plastics-associated chemicals such as methyl mercury, plasticisers and flame retardants, can enter the body and are linked to health concerns.

These small particles pollute waterways, soil, plants, animals and humans. Microplastics have been shown to affect the soil quality, the microbes that live in it and the tiny insects responsible for decomposition.

Microplastics also affect larger animals in many ways, stunting their growth, damaging reproductive organs and more. The effects of microplastics are being studied. The economic, environmental and health cost of plastic pollution remains to be assessed, but it is likely to be staggering with serious implications.

Plastic Policy in India

The plastic waste has become a significant source of pollution in India. The country produces around 3.4 million tonnes (MT) of plastic waste, out of which, only 30 per cent of it is recycled according to the Ministry of Environment, Forest and Climate Change (MoEFCC). The per capita plastic consumption in India reached 15 kg per person in 2021. The demand for polymers has been steadily growing over the past three decades; rising from just one kg per capita in 1990. Overall, plastic consumption in India reached almost 21 million tonnes in 2021. Nearly half of all the plastic produced around the world is deployed for single-use purposes. However, due to poor segregation of waste and disposal of plastic waste, a significant amount of single-use plastic ends up in rivers, lakes, oceans and landfills. According to the UN Environment Programme (UNEP), single-use plastic products are defined as "an umbrella term for different types of products that are typically used once before being thrown away or recycled", which include food packaging, bottles, straws, containers, cups, cutlery and shopping bags.

The Honourable Prime Minister Shri Narendra Modi, in his Independence Day speech in 2019, gave a clarion call to make India free from single-use plastic. The Ministry of

Environment, Forest and Climate Change have notified the Plastic Waste Management (Amendment) Rules, 2021 on 12 August 2021, prohibiting manufacture, import, stocking, distribution, sale and use of the identified single-use plastic items (including polystyrene and expanded polystyrene), with effect from 1 July 2022.

To curb pollution caused by littered and unmanaged plastic waste, MoEFCC, Government of India, has adopted the following strategy with two pillars:

- Ban on the identified single-use plastic items, viz., ear buds with plastic sticks, plastic sticks for balloons, plastic flags, candy stick, ice-cream sticks, polystyrene thermocol for decoration, plates, cups, glasses, cutlery such as forks, spoons, knives, straw, trays, wrapping or packing films around sweet boxes, invitation cards, cigarette packets, plastic or PVC banners less than 100 microns and stirrers.
- Extended Producer Responsibility (EPR) for managing plastic packaging waste. The Government has issued detailed guidelines for EPR in February 2022. Extended producer responsibility refers to a waste and pollution management concept that encourages companies to design more sustainable and recyclable products and manufacturing processes. EPR makes producers responsible for environmentally sound waste management. EPR promotes the minimum level of recycling of plastic packaging waste. Single-use plastic products, with low utility and high littering potential, should be phased out and replaced by reusable products based on a circular economy approach.

Public participation and active co-operation by policy makers, industry, businesses, regulators, NGOs and the media is necessary for the successful elimination of single-use plastic products in the country.

Global Governance of Plastic Pollution

Plastic governance needs to strengthen across the fulllife cycle of plastics and associated chemicals. To be effective and impactful, efforts should be made to identify opportunities for promoting safe and non-toxic circularity for plastics, including global elimination of leakage or discharge of plastics, thus preventing harmful plastic pollution (UNEP, 2023). In March 2022, the United Nations Environmental Assembly (UNEA) adopted resolution 5/14 entitled 'End plastic pollution towards an international legally binding instrument'. In accordance with this resolution, an Intergovernmental Negotiating Committee (INC) has been formed to develop an international legally binding instrument on plastic pollution, including in the marine environment. The G20 New Delhi Leaders' Declaration has expressed support for the resolution UNEP/EA. 5/Res.14, which established INC to develop an international legally binding instrument, with the ambition of completing its work by the end of 2024.

Progress to reduce plastic pollution has been rather slow and the consequent damage to the natural environment, biodiversity and human health is likely to increase further. Global stakeholder alliances as suggested by Lampitt et al. (2023), are essential to reduce the onslaught of plastic pollution.

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