

## Chapter 14

### Plastic pollution, impact and management in India

### Contaminación plástica, efectos y gestión en India

Sahdev

School of Studies in Environmental Science, Pt. Ravishankar Shukla University, Raipur, Chhattisgarh-492010

Email - [sahdevsahurkb@gmail.com](mailto:sahdevsahurkb@gmail.com),

#### ABSTRACT

Plastic being a cheap material is easily available. This can be easily molded into any form like car parts, TV, fridge, toys, bags, household items, pens, computers, electric wire, mobile phones, food items for packing in, etc. Can be molded from small items to large items and is available at a low cost, which is increasing its usefulness. Because it does not decompose easily in nature, due to this it is polluting water, soil, animal, air, agricultural land, etc. With this, it is economically impacting, Tourism, oceans, Invasive Species, groundwater, etc. Plastic pollution has become a problem for the whole world today. Plastic pollution is causing harm to humans and the environment. Human health is suffering from many diseases. This problem can be reduced to some extent by recycling plastic. 2016, 2018, 2021, and 2022, Rules have been made for plastic waste management in India, which have been explained in detail in this review.

Keywords: Plastic pollution, types, impact of plastic waste, management, rules.

#### RESUMEN

El plástico es un material barato y está fácilmente disponible. Que se puede moldear fácilmente en cualquier forma, como productos para automóviles, televisores, refrigeradores, juguetes, bolsos, artículos para el hogar, bolígrafos, computadoras, cables eléctricos, teléfonos móviles, alimentos para empacar, etc. Se puede moldear desde artículos más pequeños hasta artículos más grandes y está disponible a un costo menor, lo que aumenta su utilidad. Debido a que no se descompone fácilmente en la naturaleza, debido a esto está contaminando el agua, el suelo, los animales, el aire, las tierras agrícolas, etc. Junto con esto, se está viendo afectado económicamente, el turismo, el océano, las especies invasoras, las aguas subterráneas, etc. La contaminación plástica se ha convertido en un problema para todo el mundo hoy en día. La contaminación plástica está dañando a los humanos y al medio ambiente. La salud humana es propensa a muchas enfermedades. Este problema se puede reducir en cierta medida mediante el reciclaje de plástico. En 2016, 2018, 2021 y 2022, existen reglas para la gestión de desechos plásticos en India, que se explican en detalle en esta revisión.

Palabras clave: Contaminación plástica, tipos, impacto de los residuos plásticos, gestión, normas.

## INTRODUCTION

Plastics represent one of the most common materials used in our everyday life, as well as, in a larger world scenario (Spokas, 2008). From common household commodities to big industries products, such as vehicles, electronic goods, medical products, and packaging involves the utilization of plastics (Thompson et al., 2009). Most of the plastic, being light-weight, hygienic, and mouldable into different shapes, has a wide range of applications such as in packaging, shopping/garbage bags, bottles, clothing, toys, household items, industrial products, and building materials. It has replaced traditional materials like wood, leather, metal, glass, ceramics, etc. owing to its excellent strength-to-weight ratio, durability, low cost, low maintenance, and corrosion-free characteristics along with the fact that it is easy to manufacture. Plastic production has increased from 1.5 million metric tonnes in 1950 to 367 in 2020 and that is expected to double by 2040 (Chen et al., 2021). Despite these excellent properties, it has become a major cause of pollution just because of its nonbiodegradability and hazardous and toxic effects (Kenyon and Kridler, 1969). It poses a serious threat to the environment in terms of air, water, and soil pollution affecting the vegetation and marine ecosystem, in addition to human health. Awareness about the harmful effects on the general public is also necessitated (Srivastava, 2021). Marine plastic debris is on the rise both in developed and developing countries (Jambeck et al., 2015; Kaladharan et al, 2017; Kirkley, and McConnell, 1997). However, now it is not hidden that too much use of plastic and disposing of plastic is becoming a major threat to the environment of the earth. Unnecessary use of plastic, improper dumping, excessive use of single-use plastics, and lack of awareness are the factors responsible for today's world condition of ecosystems. Plastic pollution not only affects the land and terrestrial animals but also causes harm to marine animals and pollutes our water sources. Even though, the agricultural sector is also not untouched by this plastic pollution (Steinmetz et al., 2016, and Hasan, et al., 2020). On 5th June 2018, as per newspaper reports (Mohan, 2018), on the occasion of World Environment Day, India announced its commitment to abolish all single-use plastics (Excell, 2018). According to reports (Dutta, 2018), more than 20 Indian States have either a complete or partial ban on plastic bags, however, these bans are not being properly implemented (Mohan, 2018) India has also adopted the Plastic Waste Management Rules, 2016 (Government of India, 2016) (Dutta, 2018). The amended Plastic Waste Management Rules of 2018 (Government of India, 2018), laid down that the phasing out of Multi-layered Plastic (MLP) is now applicable to MLPs, which are "non-recyclable, or non-energy recoverable, or with no alternate use" (Government of India, 2018). In addition to proper implementation of laws relating to plastic waste management, the problem of plastic pollution, especially due to the use of single-use plastics can also be addressed by modifying individual consumption behavior. Raising public awareness regarding the scope of plastic pollution, the risks, harmful effects of plastic, and domestic regulatory policies would be effective in promoting attitudes and consumption habits consistent with reducing plastic pollution, and the Government of India must undertake initiatives to raise awareness regarding the same (Singh, K. D., & Mathur, A. 2019).



Figure: 1 Images of plastic pollution on both terrestrial and aquatic environment. (a) Dump site showing plastic pollution. (Source: <https://www.alamy.com/garbage-dump-plastik-bottles-petbottles-image281712766.html>). (b) Plastic pollution of marine environment. Source: Saving Earth Encyclopaedia Britannica, (Idowu, S. A., et al. 2021)

## MATERIAL AND METHODS

The literature is flooded with review articles on plastic pollution in marine and land ecosystems and the atmosphere. Some of these recent reviews are consulted to have the latest information and types of research going on to combat plastic pollution which is one of the biggest global challenges of present times. The UNEP, government websites like CPCB and SPCB websites of India, are accessed to get information about regulations for plastic pollution control in India and the extent to which these are implemented (Srivastava, 2021).

### Use of plastic and plastic pollution

There is a tremendous growth in the world population and the estimated population in 2019 is 7.7 billion will rise to 9.7 billion in 2050. So, having this in mind one can expect the amount of garbage we humans produce will see a sharp increase in the present and as well as in the future. Presently, according to an on-the-go lifestyle, there are lots of disposable items in use and demand such as food packing material, household items, and so on. The easy and cheap accessibility of plastic made it a material, which was utilized everywhere but at the same time, this brings a darker side to this material, every year around the globe 40% of plastic produced is single-use plastic. Now all the countries are concerned about plastic pollution, a condition where plastic accumulates in such a vast amount that it becomes a problem for the environment, humans, plants, and animals. Which were even reported in drinking water and the air we breathe. In the present situation, only 9% of the plastic produced is recycled, 12% incinerated and the remaining 79% either goes to landfill or remains as a pollutant in the environment (Hasan, et al., 2020).

### Plastics and their various types

Plastics are high molecular weight organic polymers that are mainly produced in the petrochemical industry. There are two types of thermoplastics and thermosets. The first synthetic plastic, bakelite, was invented in 1907 and since then many different types of plastic materials have been produced, which today are divided into PET (polyethylene terephthalate), LDPE (low-density polyethylene), HDPE (high-density polyethylene), PVC (polyvinyl chloride), PU (polyurethanes), PP (polypropylene), PS (polystyrene) and PP&A (polyphthalamide fibers) in the category of thermoplastics, accounting for 80% of total plastic consumption.

Bakelite, epoxy, melamine, polyester, polyurethane, etc. represent 20% of all plastics and fall under the thermosetting category (Srivastava, 2021).

#### Types of Plastic Waste

Plastic waste comes in all sizes, from large visible items to small invisible particles, and is broadly categorized into the following.

(a) Macro-plastics

(b) Mesoplastics

(c) Micro-plastics

(i) Primary micro-plastics, and

(ii) Secondary micro-plastics, (Cole et al., 2011; Gall, 2015, and Das, et al., 2020).

#### Impact of Plastic Waste

1. **Economic Losses:** Plastic waste along the shoreline hurts tourism revenue (creates an aesthetic issue). For example, the Andaman and Nicobar Islands, are under the plastic threat and facing the aesthetic issue because of the international dumping of plastic waste on the island (Instapedia, 2022).
2. **Implications for Animals:** Plastic waste has severely affected animals in aquatic, marine, and terrestrial ecosystems. Ingestion of plastic disrupts or fills the digestive system of animals, contributing to their death from intestinal obstruction or starvation. Marine animals can also become trapped in plastic waste, where they are exposed to predators or starve. Plastics can also contain toxic chemicals that can damage vital organs or the biological functions of the animal (Instapedia, 2022).
3. **Implications for Human Health:** The chemicals leached from the plastics contain compounds, like polybrominated diphenyl ether (anti-androgen), bisphenol a (mimics the natural female hormone estrogen), and phthalates (also known as anti-androgens), which impact human health leading to various hormonal and genetic disorders. These chemicals can interfere with the functioning of the endocrine system and thyroid hormones and can be very destructive to women of reproductive age and young children (Instapedia, 2022).
4. **Land Pollution:** Plastics leach hazardous chemicals on land, resulting in the destruction and decline in the quality of the earth's land surfaces in terms of use, landscape, and ability to support life forms (Instapedia, 2022).
5. **Air Pollution:** Plastic burning releases poisonous chemicals into the atmosphere impacting general Well-being and causing respiratory disorders in living beings (Instapedia, 2022).
6. **Groundwater Pollution:** Whenever plastics are dumped in landfills, the hazardous chemicals present in them seep underground when it rains. The leaching chemicals and toxic elements infiltrate into the aquifers and water table, indirectly affecting groundwater quality (Instapedia, 2022).
7. **Water Pollution:** Many lakes and oceans have reported alarming cases of plastic debris floating on water surfaces, affecting a great number of aquatic creatures. It leads to dreadful consequences for marine creatures that swallow the toxic chemicals. In 2014, a United Nations report estimated the annual impact of plastic pollution on oceans at US\$ 13 billion (Instapedia, 2022).

8. **Interference with the Food Chain:** Studies have shown that chemicals affect biological and reproductive processes, leading to a reduction in the number of offspring and thus disrupting the food chain. When small animals (plankton, molluscs, worms, fish, insects, and amphibians) become poisoned by ingesting plastic, it is transmitted to larger animals, breaking the interconnected links within the food chain (Instapedia, 2022).
9. **Poor Drainage:** A drainage system clogged with plastic bags, films, and other plastic items, causes flooding.
10. **Impact on Habitats:** Seafloor plastic waste sheets could act like a blanket, inhibiting gas exchange and leading to anoxia or hypoxia (low oxygen levels) in the aquatic system, which in turn can adversely affect marine life(Instapedia, 2022).
11. **Invasive Species:** Plastic waste can also be a mode of transport for species, potentially increasing the range of certain marine organisms or introducing species into an environment where they were previously absent. This, in turn, can cause subsequent changes in the ecosystem of the region (Instapedia, 2022).
12. **Pollution in oceans:** Pollution in the oceans: The increased presence of plastic on the ocean surface has led to bigger problems. Since most of the plastic waste that reaches the ocean floats for years because it doesn't decompose quickly, it leads to a drop in oxygen levels in the water, which has serious consequences for the survival of marine species. Materials such as plastics are not degradable, which means they are not absorbed and recycled. When ocean creatures and even birds inadvertently consume plastic, they choke on it, causing their population to drop steadily. The effects of plastic on aquatic life are devastating and accelerating. In addition to choking, ingestion, and other microparticulate causes of death in large birds, fish, and mammals, plastic is ingested by smaller and smaller creatures (as it breaks down into smaller and larger particles). smaller) and bioaccumulates to higher and higher concentrations. in the food chain – with humans at the forefront (Mayukh Education, 2020).
13. **Tourism:** Plastic debris along coastal beaches reduces the aesthetic value of the beaches ultimately affecting the recreational experience of the visitors often resulting in a sharp decline in the number of visitors to the beaches (Kirkley & MacConnell 1997; Smith et al. 1997). This results in substantial loss to the coastal tourism industry. Loss to coastal tourism in the U.K was reported to be between £5.49 and £16.46 million (Lee 2015). Similarly, Mcllgorm (2011). Coastal municipalities often face the direct economic cost of clearing the litter to sustain, revive or avoid a loss to the tourism industry. In the U.K., the cost of removing beach debris in all coastal municipalities was estimated to be between €18-19 million with an average cost of € 146,000 per municipality (Newman et al. 2015; and Mouat et al. 2010). Marine tourism in the form of recreational boating, diving, and fishing is also impacted by plastic pollution in two ways. Plastic debris threatens the propulsion and steering system of recreational boats and reduces the natural beauty of the environment (Kirkley & MacConnell 1997, and Das, 2020).

The effect of plastic pollution on the environment:

By now you should know some of the effects that plastic has on the environment, but let's take a particular look at plastic pollution. Plastic pollution causes harm to people, animals and plants through toxic pollutants. It can take hundreds or even thousands of years for plastic to degrade, so the environmental damage is lasting. It affects all organisms in the food chain, from small species such as plankton to whales. Toxins find their way up the food chain when plastic is ingested and may also be present in the fish people eat (Non-plastic Beach, 2019).

#### Biodegradable and bioplastics

Biodegradable plastics are the best option for plastics that degrade/break down when exposed to sunlight /UV radiation, water or dampness, bacteria, enzymes, or wind abrasion. Degradation can be aerobic when plastic be exposed to the surface or anaerobic in landfill or composting systems (Folino et al., 2020). Bioplastics are made substantially from renewable plant materials such as cellulose and starch. Researchers have genetically engineered bacteria to produce completely biodegradable plastics (Kaparapu, 2018). Bioplastics are made from renewable materials such as poly lactic acid from corn or cellulosic from cotton fibers. Now, it has also been discovered that certain bacteria possess enzymes that are capable of degrading and digesting plastics (Maity et al., 2021; and Jahnke, 2020). Researches are on to have more environment-friendly solutions for the degradation of plastics (Srivastava, 2021).

#### Plastic waste management

Nearly 9 billion tonnes of plastic have been produced till now since 1950 when its industrial production began with 1.5 million tonnes per year (Canopoli et al., 2018). As more than 99% of plastic is produced from chemicals derived from oil and natural gas, it would account for one-fifth of the total oil consumption by the year 2050, if plastic production continues at the current rate. Due to the non-biodegradability of the plastic, most of it finds its place in landfills, ocean, seas, beaches, and ocean beds and is also circulating in the marine ecosystem through ocean gyres and polluting the whole environment globally, especially single-use plastics which account for 50% of the total plastic production. Although plastic pollution was noticed nearly 50 years back, its severity was realized nearly 2 decades back. The plastic waste generated during 1990-2000 was more than that during 1950-1990. Bangladesh's flood of 1998 caused by the blockage of waterways due to plastic bags made it the first country to ban plastic bags in 2002 (Ahmed & Gotoh, 2005). Now, around 350 metric tonnes of plastic waste are generated by different sectors annually. These include building and construction materials (4.3%), consumer products (12.1%), electrical & electronics products (4.2%), industrial machinery (0.4%), packaging material (46%), textiles (14.9%), transportation (5.6%) and others (12.5%) (Ncube et al. 2021). The associated effects on the environment, marine ecosystem, and human population have reached such a level that demands globally coordinated efforts for plastic waste management and search for alternative biodegradable solutions along with the steps to reduce its production and uses, to cope with it. During the last 5-6 years, steps are taken in this direction (Srivastava, 2021).

As the packaging sector accounts for nearly half of the total plastic waste, with online shopping may be one of the major contributors, it demands proper and easy solutions/alternatives to reduce the waste generation in this sector. Proper management of plastic waste is the biggest challenge due to a lack of awareness about the proper guidelines for disposal and recycling. Governments are adopting circular economy

policies to reduce the burden of plastic waste on the earth and stress on the environment. Plastic recycling is one such step and companies across the globe are taking initiatives for it to reduce greenhouse gas emissions and turn plastic waste into a resource (Srivastava, 2021).

#### Plastic Waste Management Rules in India

##### Plastic Waste Management Rules, 2016

The Plastic Waste Management Rules, 2016 aim to:

Increase the minimum thickness of plastic bags from 40 to 50 microns and set a minimum thickness of 50 microns for plastic sheets, also to facilitate the collection and recycling of plastic waste. Increase the jurisdiction of applicability from the municipal area to the countryside, because plastic has also reached the countryside. Take responsibility for producers and producers, both in the plastic waste management system and in the implementation of a plastic waste recovery system by manufacturers/brand owners, according to extended producer responsibility (Vikaspedia, 2021). Introduce plastic waste management tax collection through pre-registration of manufacturers, importers of plastic bags/multilayer packaging, and vendors selling the same for the waste management system setup. Promote the use of plastic waste for road construction according to the Indian Road Congress guidelines on energy recovery, petroleum waste, etc. for cost-effective waste recycling and also to process waste disposal; give more responsibilities to waste producers, namely the payment of the user fee prescribed by the local authorities, the collection and delivery of the waste by the institutional producer, organizer. An environmentally friendly product that completely replaces plastic in all uses has not been found to date. Without a suitable alternative, it is impossible and undesirable to ban the use of plastic nationwide. The real challenge is to improve plastic waste management systems (Vikaspedia, 2021).

##### What's New in Plastic Waste Disposal Rules, 2016?

Rural areas have been included in the scope of these rules since plastic reached rural areas. The responsibility for implementing the rules rests with Gram Panchayat (Vikaspedia, 2021). For the first time, the liability of the waste producer is introduced. Individual and mass producers such as offices, commercial establishments, and industries must segregate plastic waste at the source, hand over segregated waste, and pay user fees according to local government statutes (Vikaspedia, 2021). Plastic products are thrown away after public events (wedding ceremonies, religious gatherings, public gatherings, etc.) held outdoors. For the first time, the organizers of such events have been empowered to manage the waste generated by these events (Vikaspedia, 2021). The use of plastic film for packaging, the packaging of goods except for the thickness of the plastic film, which affects the functionality of the product, falls within the scope of this regulation. A large number of goods are wrapped/wrapped in plastic films and these films then remain contaminated. Regulations have been put in place to ensure their collection and delivery to authorized recycling facilities (Vikaspedia, 2021). Extended Producer Responsibility: Previously, EPR was left to the discretion of local authorities. For the first time, manufacturers (i.e. persons engaged in the manufacture or import of carrier bags, multi-layer packaging, and films or the like, and persons who use them to pack or wrap their

products) and brand owners will be held responsible for the waste collection of their products. They should contact local authorities to formulate a plastic waste disposal plan/system within the prescribed time frame (Vikaspedia, 2021). The National Pollution Control Board (SPCB) will not grant/renew the registration of plastic bags or multi-layer packaging unless the manufacturer offers the action plan approved by the state development department concerned (Vikaspedia, 2021). Manufacturers must keep records of their suppliers to whom they have supplied raw materials for the manufacture of carrier bags, plastic films, and multi-layer packaging. This is intended to curb the manufacture of these products in the unorganized sector (Vikaspedia, 2021). The entry points for plastic multi-layer bags/films/packaging into the supply chain of goods are mainly retailers and street vendors. He undertakes not to deliver the goods in plastic bags/plastic films/multilayer packaging that does not comply with these rules. If not, they will have to pay the fine (Vikaspedia, 2021). The plastic bag is only available at retailers/hawkers who are pre-registered with local authorities upon payment of a specific registration fee. The amount collected as a registration fee by the local authorities should be used for waste management. The Central Pollution Control Board (CPCB) is tasked with formulating guidelines for thermosetting plastics (difficult to recycle plastics). There was no specific provision for such a type of plastic in the previous Rules. The production and use of non-recyclable multi-layer plastic are to be phased in over two years (Vikaspedia, 2021).

#### Plastic Waste Disposal Rules (Amendment) 2018

The Department of Environment, Forestry, and Climate Change notified the Plastic Waste Management (Amendment) Rules 2018 on March 27, 2018. Not recyclable or non-energy or other use." (Vikaspedia, 2021). The rules the amended rules also mandate a central registration system for the registration of the manufacturer/importer/trademark owner. The rules also state that each registration mechanism should be automated and should take into account the ease of doing business for producers, recyclers, and manufacturers. The centralized registration system will be developed by the Central Pollution Control Board (CPCB) for the registration of the manufacturer/importer/owner of the brand. Although a national register is required for manufacturers operating in more than two states, a state-level registration is required for smaller brand manufacturers/owners operating in one or two states. Additionally, row 15 of the Plastic Waste Management Rules (Amendment) 2018 on "Explicit Pricing of Shopping Bags" was omitted (Vikaspedia, 2021).

#### Plastic Waste Management (Amendment) Rules, 2021

Under the amended rules, the production, import, storage, distribution, sale, and use of single-use plastics, including polystyrene and expanded polystyrene, will be prohibited from 1 July 2022.

These products include:

- Ear plugs with plastic sticks, plastic balloon sticks, plastic flags, candy sticks, popsicle sticks, and styrofoam for decoration.
- Plates, cups, glasses, cutlery such as forks, spoons, knives, straws, trays, wrapping or wrapping film around candy boxes, invitation cards, cigarette packs, plastic or PVC banners smaller than 100 microns, agitators.



The government has issued national, state, and local guidelines for not supplying raw materials to industries that work with banned products. In addition, as of December 31, 2022, the thickness of plastic shopping bags must be increased from 75 microns to 120 microns to allow for reuse. The MoEFCC previously banned polyethylene bags below 75 microns in September 2021, extending the limit from the previous 50 microns. There is already a general ban on sachets that use plastic to package, store or sell pan masala, gutkha, and tobacco (About India, 2022).

#### Plastic Waste Management Rules (Amendment), 2022

The 2022 rules contain the following provisions:

##### Classification of plastics

- Category 1: Rigid plastic packaging is included in this category.
- Category 2: This category includes flexible plastic packaging with one or more layers (more than one layer with different types of plastic), plastic sheets and bags of plastic sheets, shopping bags, envelopes, or plastic bags.
- Category 3: Multi-layer plastic packaging (at least one layer of plastic and at least one layer of material other than plastic) falls into this category.
- Category 4: This category includes sheets of plastic or similar used for packaging and shopping bags made of compostable plastic (About India, 2022).

##### Plastic waste management in India

4 R'S for a reduction in plastic waste:

###### 1. Reduce

Plastic is a unique problem because it is not biodegradable and therefore lasts much longer than other forms of waste. A few small steps in everyday life would help keep plastic out of the waste stream. Some of these passages may include (Prabhat Singh. 2020).

###### A. Minimize Buying Water

Nearly 20 billion plastic bottles are thrown in the trash every year. Get in the habit of using reusable bagged bottles and using water from the office, home, and work areas where water quality can be trusted (Prabhat Singh. 2020).

###### B. Discourage the use of disposable plastics

Ninety percent of plastic items in our daily lives are used once and then thrown away: grocery bags, plastic wrap, disposable cutlery, straws, and coffee cup lids. Notice how often we rely on these products and replace them with reusable versions. It only takes a few times to bring our bags to the store, cutlery to the office, or travel mugs to the office tea areas before it becomes a habit (Prabhat Singh. 2020).

###### C. Minimize use of Plastics Cutlery

Getting into the habit of using metal utensils instead of plastic cutlery would save a lot of plastic from being thrown away every year (Prabhat Singh., 2020).

###### D. Purchase items Secondhand

Newer items come with lots of packing materials; try using used materials instead until needed (Prabhat Singh., 2020).

#### E. Support a bag Tax or Ban

Support legislation and legislation taxing single-use plastic bans (Prabhat Singh., 2020).

##### 2. Reuse

Reuse is a step up from recycling. It avoids plastic and relieves recycling services. Reuse is the middle ground between reduction and recycling, and some would be surprised at the number of ways to reuse. You can reuse plastic bags for sandwiches, plastic bags for small garbage bags, and plastic cutlery. Most people skip this step and go straight to recycling, but reusing plastic can reduce the demand for virgin plastic. For example, since reusable plastic containers can be reused multiple times, reusing containers can lead to a significant reduction in demand for single-use plastic and a reduction in material and energy consumption, with the consequent reduced environmental impact (Prabhat Singh., 2020).

##### 3. Recycle

Plastic recycling is the process of recovering waste or waste plastics and reprocessing them into useful products. It offers numerous advantages such as:

- Economic benefits thanks to the added value
- Generate employment
- Reduces the depletion of fossil fuel reserves.
- Reduces discharge problems
- Recycling plastic costs less energy (Prabhat Singh., 2020).

##### 4. Recovery

It is the process of converting non-recyclable plastics into a range of useful forms of energy and chemicals for industry. Since plastics mainly contain carbon and hydrogen, with an energy content similar to conventional fuels such as diesel, they can be used as a potential fuel source (Insightsonindia, (2022).

#### Single-use plastics

Recognizing the dangers of plastic waste, India will introduce a nationwide ban on single-use plastics from July 1 in its efforts to control pollution. Single-use plastics are single-use plastic essentials. These items are mainly polythene bags, sachets, shampoo bottles, disposable jars, etc., which are used and discarded immediately. The government has published a list of banned single-use plastic items, including polystyrene foam (Thermocol) for decoration, candy canes, plastic flags, earplugs with plastic sticks, plastic straws, spoons, trays, wrapping paper around candy boxes, invitation cards, plastic or PVC banners less than 100 microns, stirrers, etc. Not only the use and sale but also their manufacture, import, possession, and distribution will be prohibited from July 1 (2022). While all of these discarded items may have been a great help in everyday use, there are many eco-friendly alternatives. Below is a list of some eco-friendly options that will make life worry-free (The economic times/panache, 2022).

1. Alternatives To Single-Use Plastics
2. Stainless steel straws
3. Bamboo stirrers
4. Fluid ear care products

5. Reusable glasses and cups.
6. No more plastic cutlery
7. Eco-friendly containers (The economic times/ panache, 2022).

#### CONCLUSIONS

Plastic waste is harming humans and the environment. Plastic pollution is affecting human health. It has cancer, lung problem, DNA problem, baby health problem, etc. Rules have been made on 2011, 2016, 2018, 2021, and 2022 to control plastic pollution in India. According to the 2016 rule, the use of single-use plastic has been emphasized by the Government of India. This is a good step. But what is worrying was the availability of plastic in these rural and urban areas from 2016 to 2022. To control it again, the government and non-government organizations should run an awareness campaign together. More attention should be paid to reuse.

#### REFERENCES

- Ahmed, S. U., & Gotoh, K. (2005, July). Impact of banning polythene bags on floods of Dhaka City by applying CVM and remote sensing. In Proceedings. 2005 IEEE International Geoscience and Remote Sensing Symposium, 2005. IGARSS'05. (Vol. 2, pp. 1471-1474). IEEE.
- Canopoli, L., Fidalgo, B., Coulon, F., & Wagland, S. T. (2018). Physico-chemical properties of excavated plastic from landfill mining and current recycling routes. *Waste management*, 76, 55-67.
- Chen, Y., Awasthi, A. K., Wei, F., Tan, Q., & Li, J. (2021). Single-use plastics: Production, usage, disposal, and adverse impacts. *Science of the total environment*, 752, 141772.
- Cole, M., Lindeque, P., Halsband, C., & Galloway, T. S. (2011). Microplastics as contaminants in the marine environment: a review. *Marine pollution bulletin*, 62(12), 2588-2597.
- Das, S., Jha, P., & Chatterjee, A. (2020). Assessing marine plastic pollution in India. Institute of Economic Growth, University Enclave, University of Delhi.
- Dutta, S. (2018). World Environment Day: Can India# BeatPlasticPollution With The Current Plastic Bans In Various States. World Environment Day.[online] NDTV-Dettol Banega Swasth Swachh India. Available from <https://swachhindia.ndtv.com/world-environment-day-plastic-ban-india-20774/>[Accessed Jun. 2020].
- Excell, C. (2018). Legal limits on single-use plastics and microplastics: a global review of national laws and regulations. United Nations Environment Programme (UNEP).
- Folino, A., Karageorgiou, A., Calabrò, P. S., & Komilis, D. (2020). Biodegradation of wasted bioplastics in natural and industrial environments: A review. *Sustainability*, 12(15), 6030.
- Gall, S. C., & Thompson, R. C. (2015). The impact of debris on marine life. *Marine pollution bulletin*, 92(1-2), 170-179.
- Government of India, M. o. (2016, March 18). Government Notifies Plastic Waste Management Rules, 2016. Retrieved from Press Information Bureau: <http://pib.nic.in/newsite/printrelease.aspx?relid=138144>
- Hasan, M., Kumar, A., Maheshwari, C., & Mangraj, S. (2020). Biodegradable and edible film: A counter to plastic pollution.

Idowu, S. A., Arotupin, D. J., & Oladejo, S. O. (2021). Plastic Pollution and Climate Change: Role of Bioremediation as a Tool to Achieving Sustainability. In African Handbook of Climate Change Adaptation (pp. 1-10). Cham: Springer International Publishing.

India briefing, India's New Plastic Waste Management Rules Effective from July 1, (2022), <https://www.india-briefing.com/news/india-new-plastic-waste-management-rules-single-use-plastic-ban-effective-from-july-1-2022-25398.html/>

Insights on India, July 16, (2022). Plastic Waste Management – Insights IAS, <https://www.insightsonindia.com/environment/environment-pollution-and-control/waste-management/plastic-waste/>

Instapedia. (2022). Plastic Waste Management, <https://www.insightsonindia.com/environment/environment-pollution-and-control/waste-management/plastic-waste/>

Jahnke, A. (2020). A discussion of single-use plastics in medical settings. Reinforced Plastics, 64(4), 190-192.

Jambeck, J. R., Geyer, R., Wilcox, C., Siegler, T. R., Perryman, M., Andrady, A., ... & Law, K. L. (2015). Plastic waste inputs from land into the ocean. Science, 347(6223), 768-771.

Kaladharan, P., Vijayakumaran, K., Singh, V. V., Prema, D., Asha, P. S., Sulochanan, B., ... & Bhint, H. M. (2017). Prevalence of marine litter along the Indian beaches: A preliminary account on its status and composition. Journal of the Marine Biological Association of India, 59(1), 19-24.

Kaparapu, J. (2018). Polyhydroxyalkanoate (PHA) production by genetically engineered microalgae: a review. J. New Biol. Rep, 7, 68-73.

Kenyon, K. W., & Kridler, E. (1969). Laysan albatrosses swallow indigestible matter. The Auk, 86(2), 339-343.

Kirkley, J., & McConnell, K. E. (1997). Marine debris: benefits, costs, and choices. In Marine Debris (pp. 171-185). Springer, New York, NY.

Lee, J. (2015). Economic valuation of marine litter and microplastic pollution in the marine environment: An initial assessment of the case of the United Kingdom. SOAS-CeFiMS: London, UK, 1-16.

Maity, W., Maity, S., Bera, S., & Roy, A. (2021). Emerging roles of PETase and MHETase in the biodegradation of plastic wastes. Applied Biochemistry and Biotechnology, 193(8), 2699-2716.

Mayukh education, Educating for a changing world, May 5, (2020). Plastic waste: a global concern. <https://mayukhedu.com/plastic-waste-a-global-concern/>

Mohan, V. (2018, June 6). By 2022, India vows to stop single-use plastics. Retrieved from The Economic Times: <https://economictimes.indiatimes.com/news/environment/the-good-earth/by-2022-india-vows-to-stop-single-use-plastics/articleshow/64471467.cms?from=mdr>

Mohan, V. (2018, June 6). By 2022, India vows to stop single-use plastics. Retrieved from The EconomicTimes: <https://economictimes.indiatimes.com/news/environment/the-good-earth/by-2022-india-vows-to-stop-single-use-plastics/articleshow/64471467.cms?from=mdr>

Mouat, J, R L Lozano and H Bateson (2010): "Economic Impacts of marine litter", KIMO International, pp. 105.

Ncube, L. K., Ude, A. U., Ogunmuyiwa, E. N., Zulkifli, R., & Beas, I. N. (2021). An overview of plastic waste generation and management in food packaging industries. Recycling, 6(1), 12.

Sustainability, Agri, Food and Environmental Research, (ISSN: 0719-3726), vol 12, special issue. 2024  
<http://dx.doi.org/>

Newman, S., Watkins, E., Farmer, A., Brink, P. T., & Schweitzer, J. P. (2015). The economics of marine litter. In *Marine anthropogenic litter* (pp. 367-394). Springer, Cham.

Non plastic beach, October 16, (2019).

<https://nonplasticbeach.com/blogs/latest/how-does-plastic-harm-the-environment#:~:text=Plastic%20pollution%20causes%20harm%20to,like%20plankton%20through%20to%20w>  
[hales](#)

Prabhat Singh. May 5, (2020). plastic waste: a global concern, <https://mayukhedu.com/plastic-waste-a-global-concern/>

Singh, K. D., & Mathur, A. (2019). Plastic pollution in India: an evaluation of public awareness and consumption behaviour. *OIDA International Journal of Sustainable Development*, 12(07), 25-40.

Siracusa, V., Rocculi, P., Romani, S., & Dalla Rosa, M. (2008). Biodegradable polymers for food packaging: a review. *Trends in Food Science & Technology*, 19(12), 634-643.

Smith, V. K., Zhang, X., & Palmquist, R. B. (1997). The economic value of controlling marine debris. In *Marine Debris* (pp. 187-202). Springer, New York, NY.

Spokas, K. (2008). Plastics-still young, but having a mature impact. *Waste Management*, 28(3), 473-474.

Srivastava, V. (2021). A Brief Review on Plastic Pollution and Roads Towards its Reduction. *Journal of Mountain Research*, 16, 97-109.

The economic times/ panache, July 01, (2022), Single-use plastic banned in India from today.

Here are some eco-friendly alternatives Read more at:

[https://economictimes.indiatimes.com/magazines/panache/single-use-plastic-is-banned-in-india-from-tomorrow-here-are-some-eco-friendly-alternatives/articleshow/92577797.cms?utm\\_source=contentofinterest&utm\\_medium=text&utm\\_campaign=cppst](https://economictimes.indiatimes.com/magazines/panache/single-use-plastic-is-banned-in-india-from-tomorrow-here-are-some-eco-friendly-alternatives/articleshow/92577797.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst)

Thompson, R. C., Moore, C. J., Vom Saal, F. S., & Swan, S. H. (2009). Plastics, the environment and human health: current consensus and future trends. *Philosophical transactions of the royal society B: biological sciences*, 364(1526), 2153-2166.

Vikaspedia.(2021). Plastic Waste Management Rules,

<https://vikaspedia.in/energy/environment/waste-management/plastic-waste-management-rules>

Received: 11th November 2022; Accepted: 20th April 2023; First distribution: 25th April 2023