

## IMPACT OF PLASTICS ON ENVIRONMENT AND HEALTH – AN OVERVIEW

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### ABSTRACT

Plastic is one of the most widely used materials in the contemporary industrial world, and it presents a significant risk to both the environment and consumer health when used improperly. Plastics have revolutionised daily life; their use is growing, and by 2010, yearly output is probably going to surpass 300 million tonnes. In this final piece for the Theme Issue on Plastics, the Environment, and Human Health, we summarise our knowledge of the advantages and drawbacks of using plastics today and consider the opportunities, difficulties, and priorities that lie ahead. It is clear that plastics offer potential technological and medical advancements as well as several societal benefits. The accumulation of waste in landfills and natural habitats, physical issues for wildlife as a result of ingesting or becoming entangled in plastic, the leaching of chemicals from plastic products, and the possibility that plastics will spread chemicals to humans and wildlife are just a few of the many worries regarding usage and disposal.

**Keywords:** Plastics, Environment, Health, phthalates, waste management

### Introduction:

Polymers are the primary constituent of a broad variety of synthetic or semi-synthetic materials that are referred to as plastics. Plastics may be moulded, extruded, or pressed into solid objects of a variety of shapes thanks to their fluidity. Plastic pollution is the build-up of synthetic plastic items in the environment to the point where they endanger human populations, wildlife, and their environments. A revolution in materials was brought about in 1907 with the introduction of genuinely synthetic plastic resins into global trade through the creation of Bakelite. Plastics were shown to be a persistent polluter of numerous environmental niches by the end of the 20th century, ranging from the bottom of the sea to Mount Everest. Plastics have gained increased attention as a major pollutant, whether it is due to their being mistaken for food by animals, flooding low-lying areas due to clogged drainage systems, or just plain causing severe visual blight.

For all of that, we need plastic. This goes beyond convenience. Plastic packaging, for instance, lowers product weight, transportation costs, and the need for fossil fuels. Without it, modern technological devices would not be conceivable. Furthermore, the majority of medical devices, including the ventilators that helped so many people survive the Covid-19 outbreak, are designed with plastic in mind. Plastic's usefulness keeps increasing due to recent chemical advancements. It can be easily manufactured from common materials, with petroleum serving as the primary ingredient, and is lightweight, robust, affordable, and easy to use. In addition to other specialised varieties, at least ten common types of plastic are widely used. Properties like flexibility and durability are determined by the process of manufacture or by the additions used in the process.

Without a doubt, plastic has benefited humanity, but just like other industrial society benefits like petroleum, pesticides, or antibiotics, our over-reliance on it is endangering both the natural world and humankind. Regretfully, approximately half of the plastics manufactured are single-use products. Even after they get too tiny to be seen under a microscope, plastics do not easily break down into smaller and smaller particles. These

microscopic fragments are easily absorbed into the blood and tissues of living things due to their resemblance to naturally occurring chemicals. They are even able to pass through the blood vessel-brain barrier. Plastic is a by-product of the combustion of fossil fuels, such as natural gas and crude oil. It also contains chemicals that are known to be endocrine disruptors, endangering human health. Plastic does not break down; instead, it breaks down into smaller pieces called micro plastics, which are a deadly problem for wildlife, as too much of them can cause intestinal blockages or punctures in organs. Exposure of humans to plastics containing these chemicals can lead to hormone imbalances, reproduction and even cancer.

In addition, plastics are becoming more and more prevalent in consumer goods and packaging, which increases their share in municipal solid waste streams and presents environmental problems. Because plastics lack the necessary qualities to degrade naturally, environmentalists have harshly criticised them. As is well known, plastic products contaminate the surrounding air and water and take 100–1000 years to decompose in landfills. Limitations are currently being implemented to curb the landfill habit, but if it continues, land availability will become a problem in many countries. Furthermore, a lot of cities are experiencing uncontrollably large floods during the rainy season due to the obstruction of their drains by incredibly thin plastic bags consisting of sheets thinner than 20 microns. An estimated million marine species are thought to perish each year due to plastic waste. The use of thin plastic bags by consumers industries during retail product sales has been outlawed in several countries due to the issue of plastic bag littering.

**Accumulation of plastic waste in the natural environment:**

Large amounts of plastic waste have accumulated in landfills and the natural world. Plastic makes up about 10% of the total weight of municipal garbage. Newspaper reports of plastic litter on even the highest mountains attest to the fact that discarded plastic also contaminates a wide range of natural terrestrial, freshwater, and marine environments. While some data exist on littering in urban areas, there is a conspicuous dearth of information regarding the accumulation of plastic trash in natural terrestrial and freshwater habitats when compared to the maritime environment. There are reports of small plastic fragments unintentionally finding their way into soil from the spreading of sewage sludge, of plastic and glass fragments contaminating compost made from municipal solid waste, and of plastic being carried into rivers and streams by rainwater and floods, eventually ending up in the sea. Further study is obviously needed to determine the amount and impact of plastic waste in freshwaters, agricultural land, and natural terrestrial environments.

Plastics are buoyant materials, but when they get contaminated by dirt and marine life, they sink to the bottom. For instance, Brazil's shallow seabed have higher levels of contamination than the shorelines nearby, suggesting that the seabed might act as a final sink for marine debris that is initially buoyant. The amount of garbage on the seabed has been claimed to be more than 1000 metres below the ocean's surface in several regions across Europe. Accounts of inverted plastic bags passing a deep-sea submersible like a group of ghosts have also been observed.

Although there are currently relatively few quantitative statistics on the amount of trash on the seabed, there are worries that the deep sea's low light and low temperature may lead degradation rates to be particularly sluggish. To determine the rates of accumulation and the efficacy of any clean-up efforts, it is critical to keep an eye on the amount of debris. The majority of research evaluates the quantity of total anthropogenic debris, including information on plastics and/or plastic products as a group. The techniques used by different nations and organisations to track the quantity of anthropogenic waste—including plastics—often differ significantly, making it more challenging to assess trends. Consequently, efforts are currently underway to create standardised protocols by the OSPAR Commission and the United Nations Environment Programme. However, some trends are apparent, usually accompanied by a rise in the

quantity of debris and fragments between the 1960s and the 1990s. In recent times, there have been reports of significant increases in some areas, such the Pacific Gyre, while abundance at the sea surface and along some shorelines appears to be stabilising in other regions.

In the Northern Hemisphere, there is more trash on shorelines than in the Southern Hemisphere, much of it plastic. There is more trash near cities and on beaches that are visited more frequently, and there is proof that plastics are building up and getting buried in sediments. Discarded material from more populated places is thought to be transported to more isolated ecosystems, such as the deep sea and the Polar Regions, where contamination is expected to rise. Despite the fact that different ecosystems and places will always have more debris than others, it appears inevitable that this trend will continue until everyone modifies their behaviour. Plastic waste that is currently present in the ecosystem will continue to exist for a long time despite these modifications. Barnes et al. (2009) poignant illustration of the enduring nature of plastic waste and the environmental risks it poses comes from an airliner that was consumed by an albatross some 60 years after it crashed.

#### **The impact of plastic on climate change:**

Worldwide, more than 300 million tons of plastic is produced every year, and half of this is single-use plastics. Single-use plastic includes water and soda bottles, plastic grocery bags, product packaging, straws, coffee cups and single-use plastic baggies. It takes more than 1,000 years for plastic to decompose. Every plastic bottle, straw and container ever thrown away is still intact and somewhere on earth. The plastic problem affects every part of the planet, from the top of Mount Everest to the bottom of the Marianas Trench.

- An estimated 1.5 to 12.5 million metric tonnes of greenhouse gases are released from the simple process of extracting these fossil fuels and transporting them to plastic manufacturing facilities.
- In addition, more than 1.6 billion metric tonnes of carbon dioxide have been emitted into the environment as a result of clearing forests for pipeline construction and oil extraction. Additionally, the quantity of carbon dioxide extracted from the atmosphere is limited by this land removal.
- An additional 184 to 213 million metric tonnes of greenhouse gases are released annually during the plastics refining process.
- Over fifteen percent of methane emissions originate from landfills, which receive the disposal of single-use plastics. Both the size of the landfill and these emissions increase when more plastics are disposed of in them.
- The Pacific Ocean is home to a massive floating mass of plastic that is twice the size of Texas and is still growing.
- Communities that are most vulnerable are first impacted by plastic waste. Developed nations, like the US, export plastic to developing nations for processing. The quantity of plastic can eventually get so large that these towns run out of means to get rid of it and fill up with plastic waste.

#### **Plastic Pollution Impact on Marine Animals**

- **Plastic pollution from our rivers:** Our rivers discharge 80% of the plastic waste that ends up in the ocean. A recent analysis from Plastic Oceans UK and Earth watch Europe found that plastic drink bottles accounted for a staggering 14% of the recognisable plastic debris found in freshwater environments across Europe, making them the worst offenders. With 12% and 6% of the total, food wrappers and takeaway cups were also very common. These are not recyclable and are all one-time use items.

- **Plastic pollution from our sewage system** : Plastic waste from our sewage system is also dumped into the ocean. Every day, massive numbers of disposable wet wipes and cotton buds with plastic stems are flushed down the toilet, endangering our sewers, our seas, and our marine life. Micro plastics are a substantial additional polluter. It is quite difficult to filter these little, fewer than five millimetre-long pieces of plastic. Their entry into our waterways can be traced back to synthetic clothing that loses fibres in the washing machine and facial cleansers. A single washing cycle has the potential to produce up to 700,000 micro plastic fibres.
- **Plastic pollution from the fishing industry** : The fishing industry's ghost gear is a major contributor to the plastic contamination in our oceans. For instance, abandoned nets are a major hazard to marine life and are to blame for 3,200 reported incidents of animal damage each year in England and Wales. The prevalence of ghost gear in our waters has our crew at Padstow Sealife Safaris very concerned. We will notify the proper authorities of any observations of distressed animals or offer aid as required. We also encourage our personnel to collect any floating rubbish if it is safe to do so.
- **Plastic pollution causes devastating wounds to wildlife** : Plastic garbage entrapment or physical wounds are the main sources of injury to wildlife. Fish and sea birds being wrapped up in plastic drink rings and bags, among other plastic packaging. This may result in excruciating cuts, strangling, or even drowning. Sea creatures such as birds, mammals, and reptiles that require oxygen to breathe can get so tangled that they are unable to surface and end up drowning.
- **Plastic is mistaken for food** : Another significant risk posed by plastic in our oceans is that marine life frequently confuses trash for food and consumes it. These gullible animals eat the plastic, which can strangle them, injure their insides, or slowly starve them to death.
- **Micro plastics in our food chain** : Millions of tiny plastic particles, such as fibres from synthetic clothing or micro beads from cosmetics, find their way into our oceans. However, they can also be produced at sea as the elements degrade bigger plastic objects. Researchers are beginning to discover micro plastics in our food supply. One third of the 504 fish collected off the coast of South West England were found to contain micro plastics, according to a recent Plymouth University study. Micro plastics have been shown to stress the liver and interfere with the small intestine's ability to absorb iron in sea birds alone. Nurdles, sometimes known as "mermaid tears," are tiny plastic pellets used in the manufacturing of plastic. They are typically 3-5 mm long and resemble lentils. They are the primary component of plastic and are utilised in the production of almost all plastic goods, including toys, detergent bottles, food packaging, carrying bags, and more. They contribute significantly to marine pollution as well, with millions of them entering our ocean annually.
- **Plastic kills coral reefs**: Global plastic pollution has been shown to be the primary cause of the death of our ocean's coral reefs, which support hundreds of species and are a vital component of their ecosystems. In addition to containing bacteria, plastics prevent light and oxygen from reaching the coral. There is an 89% higher risk of disease development in coral that has come into touch with plastic.

#### **Effects on Humans:**

Plastics may be hazardous to human health because of the chemical additives employed in their manufacture. It is true that exposure to harmful chemicals found in plastic can result in cancer, birth deformities, weakened immune systems, and other health issues.

### **Management of plastic pollution:**

With human consumption increasing every day it is hard to imagine a world where we don't consume single-use plastics daily. However, research for plastic alternatives is making strides and the increase in circular economy principles being applied to our products means hopefully fewer plastics will be released into our oceans and more will be put back into manufacturing and made into something else.

#### **• Reduce, recycle, reuse**

We recycle much more successfully now than we did in the past. However, we can't recycle all of the plastic garbage we produce. Because we produce so much plastic waste, we are forced to export some 600,000 tonnes of it to other nations annually. Next, this leads to waste problems in the nations of destination, such as Malaysia and China. Actually, China is currently refusing to take any more of our waste plastic. Therefore, in addition to **recycling**, we also need to **reduce and reuse** as much of the waste that we produce.

One important area where we can improve is with regard to the dreaded single-use plastics that are so prevalent in our rivers. One simple strategy to reduce the usage of single-use plastics is to switch to reusable drink bottles and coffee cups. Even though the 2015 plastic bag fee has decreased the quantity we use, you might go one step further and bring reusable canvas or straw bags instead of the sturdy plastic-based ones.

Purchasing fruits and veggies loose from the store rather than pre-packaged in plastic bags is another method to cut down on single-use plastic. More bag less options are starting to be available at many supermarkets and small local businesses. Morrison states 156 tonnes of plastic will be saved annually by their plastic-free fruit and vegetable programme alone. Additionally, a growing number of zero-waste stores are opening up, such as Cornwall's Incredible Bulk, which offers loose food and household goods devoid of packaging. You just need to provide reusable containers of your own.

The government is contributing to the effort to decrease the use of single-use plastic by outlawing some of the major offenders. Single-use plastic straws, drink stirrers, and cotton buds will all be outlawed as of April 2020.

In addition to practicing the 3 Rs and improving trash management, you may take part in a beach clean-up to help eliminate litter from our marine and coastal areas. Every year, volunteers gather for a number of planned events across the nation to clean up plastic and waste from our beaches.

#### **Conclusion:**

In conclusion, plastics have a lot going for them in the future, but it's clear that the ways we currently produce, use, and dispose of them are not sustainable and pose risks to human health and wildlife. Many environmental hazards are well understood, and data on their effects on human health is expanding, but many questions and concerns still need to be answered. Though there are answers, they need concerted effort to implement. Individuals can play a part by using and disposing of materials responsibly, especially through recycling; industry can play a part by implementing green chemistry, reducing material use, and designing products that can be recycled at the end of their useful lives; and governments and policymakers can play a part by establishing guidelines and standards, defining proper product labels that can encourage change, and providing funding for pertinent academic studies and technological advancements. All of the important phases use and disposal, should be taken into account when evaluating these measures within the context of lifecycle analysis. These steps, in our opinion, are long overdue and urgently needed because, despite growing concerns about the effects on human health and a variety of environmental hazards associated with the accumulation of plastic waste, the production of plastics is still growing at a rate of about 9% annually.

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