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Environmental impacts of plastic pollution

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Abstract

Plastic products are easily available everywhere in the world because of its use and affordability. We use plastic products not only in our home and offices. They are also used in educational institutions, industries, research laboratories, hospitals and all other places. The uses of plastic are so common that it's almost impossible to imagine a place without plastics materials. According to an estimate, more than 8.3 billion tonnes of plastic has been produced worldwide since early 1950s. Research studies have also estimated that if the present scenario of usage of the plastic continues, then the plastic industry could account for almost 20% of the world's oil consumption by the year 2050. The use of plastic has become a serious problem mainly because of the natural decomposition of plastics is nearly impossible due to its durable nature and non-degradation characteristics. As a result of which it never completely disappears and its particulates remain in the environment resulting pollution. The more threatening aspect is that only 9% of all the plastic waste ever produced has been recycled. The remaining 81% plastic has either been dumped in landfills, incinerated or burnt resulting into release of many toxic gases in the atmosphere and pollution of ground water. Research studies have also concluded that about 8 million tonnes of plastic goes into the world's ocean annually, which has been drastically affecting the marine life. In order to curb the menace of plastic pollution, various initiatives needs to be taken to reduce, reuse and recycle plastic to minimize or stop usage of plastic products and dispose-off its wastes in an environment friendly manner.

Keywords: Plastic, pollution, non-degradable, environment

Introduction

Since its invention, plastic materials have been used in almost all spheres of our daily life. There are several pollutants that pollutes our environment, plastic is perhaps the most harmful of waste materials dumped by us due to its non-biodegradable nature. In-fact, the plastic wastes that goes into the marine environment today, may still be around for hundreds of years to foul up our environment and sea beaches of future generations.

A very casual attitude and carelessness while dumping the plastic wastes can have serious consequences for our natural environment and living organisms. A colourful plastic bag looks very attractive food like a small aquatic animal such as a jellyfish, to an indiscriminate feeder like the sea turtle or other animals, but it's indigestible. It can choke and block the neck, intestines, or cause infection in those animals that consume it. A plastic material like lost or discarded monofilament fishing net can choke engine propellers, destroying oil seals and lower units of engines, clog an outboard engine's cooling system or it can become an entangling web for fishes, seabirds, and marine mammals.

According to the Centre for Marine Conservation (CMC), over 25,000 pieces of fishing line were collected from U.S. beaches during the 1996 Annual beach clean-up campaign and at least 40% of all animal entanglements reported during the clean-ups involved fishing line.

Due to increasing disposal of plastic waste, more and more plastic material is being accumulating in our drainage system, ponds, river, sea and oceans. Tourists, beachgoers and recreational boaters very often dispose-off plastic refuse at the beaches improperly. Plastic waste also enters the marine environment from commercial fishing operations, merchant shipping, sewage outfalls and other commercial activities.

Some of the substances that are used in the preparation of plastics materials include urea, formaldehyde, poly ethylene, polystyrene, polyethyl chloride, phenoloic compounds and polyvinyl chloride (P.V.C.). When any food material or blood is stored in such plastic containers then gradually the soluble toxic chemical gets dissolved in them leading to many diseases including death due to cancer.

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Polyvinyl chloride has also been found to affect the respiratory systems and fertility of animals. When mixed with water, it can cause paralysis, damages bones and skin irritation.

As chemicals from plastic gets dissolved in the food items, use of P.V.C. plastic in space apparatus and in food containers have been banned by the USA. In view of the serious health impacts due to plastic containers, Indian govt. should also take such initiatives to ban the use of P.V.C. in water pipes, food and medicine containers to save the lives of millions.

Consequences of Plastic Pollution

In the nature, there is no waste material that does not decompose naturally. However, it takes hundreds to thousands of years to degrade plastics. Making of plastic is inexpensive and there are endless uses of the plastic materials. Plastics materials are mainly used because it's very convenient, cheap, and easily available and are durable in nature. Incidentally, these very useful qualities make it a huge pollution problem due to inadequate waste disposal and non-biodegradable nature. Globally, more than 8 billion metric tons of plastics have been produced since 1950s. About 6.3 billion metric tons of that has been turned into wastes; out of that, nearly 9% was recycled and about 12% was incinerated. The rest of the plastic were disposed into landfills, river and oceans. It has been estimated that by 2050, there would be about 12 billion metric tons of plastic waste, which is a grave concern for the environment.

Indiscriminate disposal of Plastic garbage can enter the drainage lines and choke them resulting into floods in local areas as was experienced in Mumbai, 1998 and Patna, 2020. It has also been reported that eating polythene bags results in the death of about 100 cattle per day in U.P., India. In the stomach of one dead cow, as much as 35 kg of waste plastic was found. Since, plastic does not decompose easily and requires high energy ultra-violet light to break down, the amount of plastic waste in our environment is steadily increasing posing a threat to many animals and is a matter of environmental concern.

Sources of plastic pollution

Single-use plastic: Single-use plastic objects are a matter of great concern. Since, plastic materials are very cheap and easily available, it gets discarded frequently and therefore, its persistence in the environment is a great threat to environment. Increasing urbanization has further added to the problem of plastic pollution in cities. Of all the plastic we use, nearly 40% is used just once (single-use). Every year we use several billion plastic items such as milk or water bottles, carry bags, toys, trays, and food packaging. Supermarkets and even local markets in many urban localities and metros cities are full of it. Some people are extremely careless with packaging and leave it behind as litter, causing a great threat to the environmental conditions. Also there are places where people can't dispose it properly due to lack of waste collection system. Even if, people do their best to minimize single-use plastics, much of that enters the environment had become one of the biggest causes of plastic pollution.

It's not just about single-use plastic. Often people do not realize and understand how regularly they are polluting the environment with plastic materials. For example, vehicle tires are made up of rubber and plastic, which wears out

while driving due to friction. Due to this friction, thousands of micro-plastics get released on the road and in the atmosphere, hence polluting the atmosphere and affecting its conditions.

Our cosmetics, personal care products and paints also contain micro-plastics that go into drainage system along with the wastewater. Due to washing and drying of synthetic clothes in the washing machine millions of microfibers also enters into the drainage system affecting the natural vegetation and atmosphere.

Some kinds of plastic are also contained into cigarette filters and even into chewing gums, which are discarded as waste. Plastic materials carried by drainage water flows downhill to the river and sea causes plastic pollutants to reach the oceans. Rivers, for example, transport a lot of plastic to the sea. But that's not the only way plastic moves around; it can also be transported by the wind. Even in gentle winds, plastic fibers, which is has a very light weight, blows away especially from landfill or waste dumping sites where it is dumped. The plastic ribbons from balloons are often found on beaches – washed up, after landing in the water somewhere at sea. It has been observed that more than 90% of the articles found on the sea beaches contained plastic. Tourists often dispose off plastic wastes at tourist places, mountains, sea beaches, roads and streets.

Concerns of Plastic Pollution

Since the development of plastic earlier in the middle of the last century, due to it's cheapness and durability, it has become very popular and is used in a wide variety of ways. The cheapness means plastic gets discarded easily and its durability makes it survive in the environment for a extremely long periods where it can do great harm. Because plastic does not decompose easily, and requires high energy ultraviolet light to break down, the amount of plastic waste in our environment is steadily increasing leading to environmental problems.

The plastic waste found on beaches near urban areas tends to originate from fishing, shipping, packaging materials used to wrap around other goods and other activities in the nearby areas. On the remote rural beaches the plastic rubbish tends to have come from ships, such as fishing equipment used in the fishing industry. This plastic can affect marine wildlife in two most important ways: by entangling marine creatures or being eaten by them.

It has been reported that near about one lakh animals such as dogs, cows and other mammals die every year by eating plastic wastes. Throughout the world, about 75 marine bird species are known to eat plastic articles. This includes 36 bird species found off in South African coasts. Some of the consequences and effects of plastic pollution on our environment have been discussed below.

Some of the impacts of Plastic Pollution

Petroleum is considered as a vital resource for our modern way of life, to meet our energy requirements for lighting, heating, industries, factories, transportation and so on. Many studies have concluded that natural energy resources such as coal and petroleum are going to be exhausted very soon in the near future because of their extreme usage. Natural sources of petroleum products are diminishing and getting more expensive day by day, since we have been using these non-renewable resources at large. This precious resource

should not be wasted on producing plastic products, since it is also used in producing plastic.

The devastating effect of plastic on marine mammals was first observed in the late 1970s, by the scientists from the National Marine Mammal Laboratory (NMML). They found that plastic entanglement was killing up to 40,000 seals per year. Annually, this amounted to a four to six percent drop in seal population beginning in 1976. In 30 years, a 50% decline in the population of Northern Fur Seals has been reported widely. These seals would often get trapped in fragments of plastic netting or packing straps, catching their necks in the webbing. The plastic harness can constrict the seal's movements, killing the seal through starvation, exhaustion, or infection from deep wounds. While diving for food, both seals and whales can get caught in plastic nets and drown. In the fall of 1982, a humpback whale tangled in 50 to 100 feet of net washed up on a Cape Cod beach. It was starving and its ribs were exposed as a result it died within a couple of hours.

On shorelines seabirds have been seen to pick up plastic items the same way they pick up their food like fishes. It has been found that in the North Sea, almost all the Northern Fulmars (*Fulmarus glacialis*) contain some plastic. Seabirds such as Laysan Albatross chicks are often mistakenly fed plastics by their parents. When these chicks are unable to eject the plastic, it causes death of chicks due to starvation, dehydration or choking. Plastic bottle caps, plastic tubes and other objects were reported inside the decomposed carcasses of some Laysan Albatross on Sand Island, Midway Atoll, North Pacific Ocean. The birds probably mistook the plastics for food and ingested them while foraging.

A research study of blue petrel chicks at Marion Island, South Africa showed that about 90% of chicks examined had plastic in their stomachs. Plastics may remain in the neck or stomachs, affect digestion and possibly cause starvation. South African seabirds are amongst the worst affected in the world due to plastic pollution.

The plastic materials can affect marine wildlife either by entangling them or when it is eaten. It has been reported that the bodies of almost all marine species, ranging from plankton to large marine mammals such as dolphins and whales, including some of the wildest and most vulnerable species who spend nearly their entire life far from human beings, now contain lots of plastic.

According to an analysis of 22 years (from 1986 to 2008) of ship-survey data collected in the Western North Atlantic Ocean and Caribbean Sea reveals that more than Sixty percent of 6,136 surface plankton net tows contained detectable amount of plastic pieces.

Microscopic fragments, in some locations outweighing surface zooplankton, revealed a significant increase in abundance when samples from the 1960s and 1970s were compared with those of 1980s and 1990s. When ingested, such small particles can also be carried from the gut into other body tissues.

Sea turtles indiscriminately feed on pelagic material, large occurrence of plastic is common in the digestive tract of these small sea turtles, often resulting their mortality.

There is great concern about the effect of plastic rubbish on marine mammals sea turtles and fish in particular, because many of these creatures are already under the threat of extinction for a variety of other reasons.

Over 260 species, including invertebrates, turtles, fish, seabirds and mammals, have been reported to consume or

become entangled in plastic debris, resulting in impaired movement and feeding, reduced reproductive output, lacerations, ulcers, and finally death.

Mollusks and crustaceans appear particularly to be sensitive to these compounds. Being an important food item for many species, plastics ingested by smaller animals then have the potential to transfer toxic substances further in the food chain.

The presence of plastic at shallow and greater depths may harm sediment wildlife such as worms, sessile filter feeders, deposit feeders and detritivores, all known to accidentally ingest plastics. The hard surface of pelagic plastics also provides an attractive and alternate substrate to natural floating debris (e.g., seeds, pumice, and wood) for a number of opportunistic colonizers. Plasticizers and organic contaminants typically absorb and concentrate on plastics, have been shown to affect both in the development and reproduction of the marine organisms. The increasing availability of these synthetic and non-biodegradable materials in marine debris may increase the dispersal and prospects for invasion by non-indigenous species.

Turtles get entangled in discarded fishing gear, fishing nets, and many of them have been found dead with plastic bags in their stomachs. Turtles are badly affected by plastic pollution, and all seven of the world's turtle species are already either endangered or threatened for a number of reasons. All sea turtle species are predominantly prone, and may be seriously harmed by 'feeding on' anthropogenic marine debris, particularly plastics. It is believed that plastic materials might have been mistakenly taken for jellyfish and eaten by turtles. Plastic ingestion by sea turtles is relatively a widespread occurrence. However, even in small quantities, plastics can kill sea turtles due to obstruction of the oesophagus, choking or from being unable to eat. One dead turtle found off Hawaii in the Pacific was found to have more than 100 pieces of plastic in its stomach including part of a comb, a toy truck wheel and even a nylon rope.

Fishing line can be particularly dangerous, when, during normal intestinal function, different parts of the digestive tract pull at different ends of the line. This can result in the gut gathering along the length of the line preventing the digest from passing through the digestive tract.

A recent US report concluded that 100,000 marine mammals die every year in the world's oceans by eating or becoming entangled in plastic rubbish, and the position is worsening.

A large number of marine creatures gets trapped and killed in pieces of gill nets which have been lost by fishing vessels. Other pieces of fishing equipment such as lobster pots may also continue in trapping such kind of creatures.

Once used, most plastic bags go into landfill, or rubbish tips. Each year more and more plastic bags are ending up littering the environment. Once they become litter, plastic bags find their way into our streets, parks, beaches and waterways. If burnt, they pollute the air with toxic fumes causing pollution thus leading to health hazards.

About 100,000 animals such as cows, dogs and penguins are killed every year due to plastic bags. Many animals ingest plastic bags, mistaking them for food, and therefore die. And worse, the ingested plastic bag remains intact even after the death and decomposition of the animal. Thus, it lies around in the landscape where another victim may ingest it.

There is a direct relationship between human health and the quality of the air we breathe, the water we drink or bathe,

and the earth in which we grow our food. In a recent study US Centre for Disease Control and Prevention(USCDCP), found that a near about 93 percent of the US population has biphenyl, a chemical that can be found in canned goods and in hard, clear plastic items in their body. Biphenyl A (an endocrine disruptor) is a key monomer in production of polycarbonate plastic and epoxy resins. Polycarbonate plastic, which is clear and nearly shatter-proof, is used to make a variety of common products including baby milk and water bottles, sports equipment, medical and dental devices, dental composite (white) fillings, sealants and lenses.

Endocrine disruptors are ubiquitous in our environment and have deep impact on our health. Endocrine disruptor chemicals (EDC's) are added to plastic products to make them softer and easier to handle. These EDCs are common in our environment and, when absorbed by human beings and wildlife, mimic the action of hormones and have been linked to reproductive problems in animals and human beings are known to affect fat cells.

As the plastic moves up in food chain, its concentration increases and when these fishes with huge amount of plastic are eaten by human, it causes diseases like cancer. Plastic plays the villain right from the stage of its production.

The major chemicals that go into the making of plastic are highly toxic and pose serious threat to living beings of all species on earth. Some of the constituents of plastic such as benzene are known to cause cancer. Recycling of plastic is associated with skin and respiratory problems, resulting from exposure to and inhalation of toxic fumes, especially hydrocarbons.

Plastics materials thrown anywhere as garbage or litters are causing many problems. Some of the problems are:

- i. These plastic materials blocks the open sewage system and results in stagnation of sewage water, grounds for mosquitoes breeding, causing spread of various diseases.
- ii. Plastic dumped on the soil affects the soil structure and prevents recharge of ground water table.
- iii. Water stagnating due to plastics strewn on the land becomes a breeding ground for mosquitoes which, in turn, produce diseases.
- iv. Fishes and turtles mistaking the plastic floating in the water for Jellyfish eat them and then die.
- v. Cattle like cow and buffaloes eat plastic and die as a result thereof.
- vi. Burning of plastics results in release of toxic gases in the atmosphere which, in turn, causes breathing difficulties and even Cancer.
- vii. The plastic problems is becoming perennial as plastic is non-biodegradable.

Control of Plastic Pollution

One of the worst environmental impacts of plastic materials is that they are non-biodegradable; decomposition of plastic bags takes about 1000 years. As we are aware, discarded plastic materials such as plastic net, bags, bottles or any other product, create serious environmental problems and economic burden. In addition to using up fossil fuels and other resources, plastic products create non-biodegradable garbage and litter, seriously affect life of animal, birds, marine life and threaten the basis of life on earth. Some steps that could be taken to control plastic pollution and

reverse effect of toxic, non-biodegradable plastic pollution are suggested below.

Tourists and beachgoers should dispose off plastics and other litter in the dust bins. If these facilities are inadequate, contact the local authority responsible for it and lodge a complaint. Take your litter back home with you if there are no waste disposal facilities on the beach.

We can pick up any plastic litter we see on the beach or in rock pools in the vicinity while sitting or walking. Encourage young children to do likewise.

Fishermen should dispose off plastic nets for recycle and do not throw away as waste.

To minimize use of plastic products, segregate garbage and wastes generated into dry and wet category and keep in separate containers and dispose-off wastes in an eco-friendly manner.

In the street never throw plastic or other litter out of your car and do not drop it on the pavement or in the gutter.

We should never dispose-off plastics materials in the sewage system or drain. We need to practice and promote proper disposal of plastics materials in public places (e.g., office, parks, beach, etc.) and our home. Always remember that litter generates litter.

We can prefer to use stainless steel food containers like Tiffins to store food, it has longer life than Tupper Ware and are more hygienic.

When we go to the markets, we should carry our own bags made up of cloth, paper, canvas or biodegradable-fiber bags to avoid plastic bags.

Whenever the shopkeeper or vendor gives items or goods into a plastic bag, ask him or her to replace it in one of your own cloth bags. You can also response "Why I Don't Use Plastic Bags", they would appreciate it. Give preference to use of cloth napkins, wax paper bags, or re-useable steel boxes.

Packaged plastic bottled water could be contaminated with micro-plastics and also costs over 1000 times more per liter than water from our tap. So, we should carry our own water in glass bottles or cans.

Pre-bagged produce not only uses wasteful packaging, but also tends to come from farther away, consuming more of our dwindling oil supplies in transport.

Prefer to buy greeting cards in paper boxes instead of plastic cover and look for eco-friendly packaging choices. Also we can ask florist for flowers wrapped in paper, not plastic film. Use pens that can be re-filled instead of onetime plastic pens.

Support and promote reuse and recycling schemes in your local area.

Conclusion

Plastics materials are easily available, more economical, durable and easy to make. It is used to make, pack or wrap around, many of the items we buy or use in our daily life. They are useful and popular materials which can be produced with relatively little cost. Plastics products are not themselves a problem. However, the problem is the excessive use of plastics materials and its careless disposal in the environment. Despite its usefulness, unfortunately plastic is creating a huge environmental problem due to its non-biodegradable nature. It takes hundreds of years to get decomposed in the environment. Plastic wastes besides affecting drainage system, polluting our natural environment are also posing threats to animals, birds and marine life.

Several studies have found that plastics are affecting several species of animals, birds and marine animals. Plastic ingestion may also indirectly lead to death of an animal. Therefore, several steps and remedial measures needs to be taken to minimize the use of plastic products and minimize the environmental impacts of plastic pollution.

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