

ADVERSE EFFECTS OF PLASTIC ON ENVIRONMENT AND HUMANBEINGS

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ABSTRACT

"One of the most ubiquitous and long-lasting recent changes to the surface of planet is the accumulation and fragmentation of plastics," Starting from health problems from BPA and phthalates leeching in to water and drinks, to the great plastic patch in the oceans, the impact of plastics on the environment is profound. The present paper made an attempt to analyze the problems concern to plastics and its effects on land, water, terrestrial, aquatic animals and humans. Main focus in this paper is how the ecosystem as a whole is affecting by indiscriminate use of plastics and the health problems cause by plastics to the human beings and also emphasized the reuse of plastic by following various management practices.

1. INTRODUCTION

A heavy significance rests on the use of plastics in today's world. The prominence of plastic pollution is mainly its being inexpensive and durable, which lends to high levels of plastics used by humans. Plastics have been mass produced for 50 years and have transformed our daily lives. Around 8 per cent of world oil production is used to make plastics and plastic production is likely to exceed 300 million tonnes per annum by 2010. Although plastic has enabled advances in the quality of life through advantages in processing, ease of packaging, boom in industry, and overall convenience, it has proved to be harmful to human, animal, and plant health. Plastic also harms habitat in the form of pollution, space-usage, contamination, and especially through its quality of persistence.

2. PLASTICS AS MATERIALS

Plastics are inexpensive, lightweight, strong, durable, corrosion-resistant materials, with high thermal and electrical insulation properties. The diversity of polymers and the versatility of their properties are used to make a vast array of products that bring medical and technological advances, energy savings and numerous other societal benefits. As a consequence, the production of plastics has increased substantially over the last 60 years from around 0.5 million tonnes in 1950 to over 260 million tonnes today. In Europe alone the plastics industry has a turnover in excess of 300 million euros and employs 1.6 million people (Plastics Europe 2008). Almost all aspects of daily life involve plastics, in transport, telecommunications, clothing, footwear and as packaging materials that facilitate the transport of a wide range of food, drink and other goods. There is considerable potential for new applications of plastics that will bring benefits in the future, for example as novel medical applications, in the generation of renewable energy and by reducing energy used in transport (Andrady & Neal 2009).

2.1 Types of plastic: There are many types and forms of plastic pollution that can adversely affect lands, waterways and oceans. They are litter, marine debris, plastic particle water pollution, plastic netting and friendly floaters.

Plastic is frequently discarded as litter. Plastic bags and plastic food containers comes under litter. Marine debris is man-made waste that has been released deliberately or accidentally in a lake, sea, ocean, or waterway. Water pollution is increasingly caused by plastic particles, including nurdles, microbeads from cosmetics and the breakdown products of plastic litter. Plastic particle water pollution is also referred to as mermaids' tears.

2.2. Accumulation of plastic waste in the environment: Substantial quantities of plastic have accumulated in the natural environment and in landfills. Around 10 per cent by weight of the municipal waste stream is plastic. Discarded plastic also contaminates a wide range of natural terrestrial, freshwater and marine habitats, with newspaper accounts of plastic debris on even some of the highest mountains. Plastic debris such as Styrofoam cups, plastic bags, and caps from ballpoint pens – an endless stream of plastic litter is swept down urban storm drains into streams, rivers, and ultimately into the ocean and substantial amount of it accumulates on the sea surface and may also be washed ashore. As a consequence, plastics represent a considerable proportion (50–80%) of shoreline debris. Despite their buoyant nature, plastics can become fouled with marine life and sediment causing items to sink to the seabed. For example, shallow seabeds in Brazil were more heavily contaminated than the neighbouring shorelines (Oigman-Pszczol & Creed 2007), indicating that the seabed may be an ultimate sink even for initially buoyant marine debris (Barnes et al. 2009).

2.3. Effects of plastic on environment

Toxic chemical release during manufacture is another significant source of the negative environmental impact of plastics. A whole host of carcinogenic, neurotoxic, and hormone-disruptive chemicals are standard ingredients and waste products of plastic production, and they inevitably find their way into the ecology through water, land, and air pollution. Some of the more familiar compounds include vinyl chloride (in PVC), dioxins (in PVC), benzene (in polystyrene), phthalates and other plasticizers (in PVC and others), formaldehyde, and bisphenol-A, or BPA (in polycarbonate). Many of these are persistent organic pollutants (POPs)—some of the most damaging toxins on the planet, owing to a combination of their persistence in the environment and their high levels of toxicity and their unmitigated release into the environment affect all terrestrial and aquatic life with which they come into contact. In this context the effect of plastic on land and ocean are discussed in detail here.

2.3.1. Land: Chlorinated plastics can release harmful chemicals into the surrounding soil, which can then seep into groundwater or other surrounding water sources. This can cause serious harm to the species that drink this water.

Landfill areas are constantly piled high with many different types of plastics. In these landfills, there are many microorganisms which speed up the biodegradation of plastics. Regarding biodegradable plastics, as they are broken down, methane is released, which a very powerful greenhouse gas that contributes significantly to global is warming. Release of

methane does not only occur in landfills, biodegradable plastics also degrade if left on the ground, in which case degradation takes longer to occur. Plastic bags are derived from petroleum and polyethylene. Petroleum is a non-renewable natural resource. Extracting petroleum causes damage to the environment while diminishing a natural resource. Polyethylene is extremely hazardous to make. They also take approximately 450 years to decompose in water and 1,000 years to decompose on land.

2.3.2. Ocean: The effect of plastic on the ocean presents an obvious problem to habitat and animal life. As far as plastic entering the ocean, about 20% of the trash comes from ships and platforms that are offshore. The rest sources from litter being blown into the sea, picked up by tides on the beach, or intentional garbage dumping. As, these plastics don't biodegrade, chemicals in them are released into the water as well as the atmosphere and they break up into tiny pieces and then the fish easily become contaminated from the chemicals in the water. This is a direct link of how plastic chemicals enter the food chain. Another example is, as Styrofoam breaks into smaller parts, polystyrene components in it sink lower in the ocean, so that the pollutant spreads throughout the sea column.

Abundance of small plastic fragments or microplastics is an area of particular concern. Fragments as small as 1.6 μm have been identified in some marine habitats, and it seems likely there will be even smaller pieces below current levels of detection. Plastic fragments appear to form by the mechanical and chemical deterioration of larger items. Alternative routes for microplastics to enter the environment include the direct release of small pieces of plastics that are used as abrasives in industrial and domestic cleaning applications (e.g. shot blasting or scrubbers used in proprietary hand cleansers) and spillage of plastic pellets and powders that are used as a feedstock for the manufacture of most plastic products. From the open ocean and from debris ingested by seabirds, all indicate that quantities of plastic fragments are increasing in the environment. Some plastics are produced with the assistance of a substance called Bisphenol, which is a synthetic chemical and can interfere with the regulation of both development and reproduction, through its interaction with estrogen.

In fact, not only do the toxins in plastic affect the ocean, but acting like sponges, they soak up other toxins from outside sources before entering the ocean. As these chemicals are ingested by animals in the ocean, this is not good for humans, as humans ingest contaminated fish and mammals. This is resulting in impaired movement and feeding, reduced reproductive output, lacerations, ulcers and death. Plastic is killing more than 100,000 sea turtles and birds a year from ingestion and entanglement.

3. EFFECTS OF PLASTIC ON HUMANS

The chemical compounds found in plastics are harming and causing biological effects in both humans as well as animals. Two broad classes of plastic-related chemicals are of critical concern for human health-bisphenol-A or BPA, and phthalates.

3.1. Bisphenol A: Bisphenol A (also known as BPA) can leech into the contents/liquids that plastic container is holding. BPA is a basic building block of polycarbonate plastics, such as those used for bottled water, food packaging and other items. BPA has been recognized since the 1940s as an endocrine disrupting chemical that interferes with normal hormonal function. It is a hormone disrupter that is used to make polycarbonate plastic (hard clear plastic). Bisphenol A can be found in baby bottles, water bottles, canned food liners, and sippy cups. Human exposure occurs primarily through ingestion: diet, sucking/mouthing plastics, and skin contact. There have also been studies that showed bisphenol A increases the occurrence of diabetes, heart disease, birth defects, early puberty, low sperm count, hyperactivity, aggressiveness and high levels of certain liver enzymes. Women who have everyday contact with this chemical can have an increase in miscarriages, polycystic ovarian syndrome which is known to cause infertility, baldness in women, prostate cancer, breast cancer and ovarian cysts.

3.2. Phthalates: Phthalates are a class of chemicals that are used to soften plastics, such as PVC (Polyvinyl Chloride), bind fragrances in products, and act as solvents and fixatives, such as nail polishes. Human exposure of this occurs through different ways like: Inhalation i.e., breathing in fragrances, or fumes from solvents and fixatives *Ingestion*- chewing on a plastic toy creates small openings in the plastic, providing an avenue for leaching of chemicals from the toy into a child's mouth *Skin Absorption*- lotion, perfumes, and deodorants.

Adverse health effects include hormone disruption, developmental and reproductive problems, asthma, preterm birth, low sperm count, undescended testes, genital malformations, premature puberty, and development of some cancers. Another important chemical typically found in plastic items with a recyclable symbol number 3, is Polyvinyl Chloride (PVC) leaches the chemical phthalates out into the items/liquids within the containers. The health effects of these chemicals is decreased lung function, increased weight gain, increased resistance to insulin, low sperm count and DNA damage to sperm. There have also been studies that show infant males exposed to this chemical have negative reproductive development.

4. Management practices in controlling plastic usage:

Only 5% of the world's plastic is recycled and the remaining 96% ends up in landfills, or even worse, as litter or in the oceans. But one can and one has to, reduce its use, and reduce the impact it has on the environment. There are several aspects to this effort and can make a good start by following the basic environmental edicts: Reduce, Reuse, and Recycle.

4.1. Reduce: stop purchasing products that are in plastic containers, use less plastic in home, and if the need to buy plastic items make sure it does not contain BPA. Do not microwave food in plastic containers and do not put plastic containers in the dishwasher. Utilize every opportunity one can to reduce the amount of plastic in the lives by rather than buying plastic water bottles, buy reusable stainless steel water bottles, and use them. The use of jute or cloth bag as alternatives to plastic paper bag should be popularized and prompted through fiscal incentives.

4.2. Reuse: Reusing items prevents waste as it delays or avoids an item's entry into the waste stream and potentially the ocean. For example, almost all bread comes in plastic bags. After the bread is done, the bag is almost clean and ready to use. We bring them to the supermarket or farmers market for vegetables, rather than using new bags.

4.3. Recycle: Recycling plastics also prevents excess waste by turning materials that otherwise might become marine debris into valuable resources. Do everything one can to keep plastic out of the landfills, and out of the ocean. Practice and promote proper disposal of plastics in home and at the beach. Always remember that litter generates litter. Never dispose of plastics in the sewage system. Part or recycling successfully is to be vigilant about the type of plastic one get, and look for the most recyclable plastic in all the purchases and insist to manufacturers that they need to consider the entire life cycle of their products, from manufacture to disposal.

In some cases, plastics from household and industrial uses cannot be reused or recycled. Proper disposal and management of these used plastics is necessary to prevent it from being carried into waterways and the ocean. For plastics from household uses this may include ensuring that plastics are properly disposed in a covered receptacle that will not be knocked over. For plastics from industrial uses, controlling plastic includes disposal in appropriately covered receptacles, and ensuring plastics are secured and covered when being transported. Municipalities also play a role in the control of plastics by ensuring that best management practices are followed for waste collection and that landfills are covered and contained.

In conclusion, plastics offer considerable benefits for the future, but it is evident that our current approaches to production, use and disposal are not sustainable and present concerns for wildlife and human health. Set an example to others and encourage them to help. Plastics are not themselves a problem. They are useful and popular materials which can be produced with relatively little damage to the environment. The problem is the excessive use of plastics in one-off applications together with careless disposal.

References:

Andrady A. L., Neal M. A. 2009 Applications and societal benefits of plastics. *Phil. Trans. R. Soc. B* 364, 1977–1984. (doi:10.1098/rstb.2008.0304)

Barnes D. K. A. 2005 Remote islands reveal rapid rise of southern hemisphere sea debris. *Sci. World J.* 5, 915–921.

OSPAR 2007 OSPAR pilot project on monitoring marine beach litter: monitoring of marine litter on beaches in the OSPAR region. London, UK: OSPAR Commission.