

Plastics: Once A Lifesaver, Now A Menace to the Environment

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Abstract

Despite the recent public attention on plastics mainly being on environmental and human health issues, such as long-term pollution and endocrine disruption, plastics continue to serve society in countless ways. The advantages of plastics are especially noticeable in public health and medicine. Plastics are more adaptable, affordable, and require less energy than other materials like metal or glass. They may also be made to have a wide range of qualities. These properties make polymers useful in various medical applications, including tissue engineering, joint replacements, sterile packaging for medical equipment, disposable syringes, and intravenous bags. The widespread, unintended human exposure to endocrine-disrupting bisphenol-A (BPA) and di-(2-ethylhexyl)phthalate (DEHP), issues resulting from the massive amounts of plastic being disposed of, and the depletion of non-renewable petroleum resources due to the ever-increasing mass-production of plastic consumer goods, however, demonstrate that not all current uses of plastics are wise and sustainable. Using the healthcare industry as an example, this topic focuses on the advantages and disadvantages of plastics. It identifies ways to alter their composition and disposal methods for more sustainable usage in the future. To maximize the benefits of polymers without endangering human health or the environment, it highlights ongoing efforts to phase out DEHP and BPA in the food and healthcare industries. It also discusses biodegradable alternatives for plastic packaging, ways to reduce plastic medical waste, and recycling in medical facilities.

Keywords: plastics, health effects, pollution, sustainability, sustainable consumption

Introduction

Since the ancient Mesoamericans first processed natural rubber into balls, figurines, and bands around 1600 BC, humans have profited from using polymers (Hosler et al. 1999). Man has become increasingly dependent on plastics and rubber over the years. He experimented with natural polymers, horn, waxes, natural rubber, and resins before the nineteenth century, when the creation of contemporary thermoplastics started. In 1839 German pharmacist Eduard Simon developed polystyrene (PS), and Goodyear created vulcanized rubber. Throughout the nineteenth century,

research and development on natural and synthetic polymers proceeded, yielding significant products including viscose (rayon) for garments, polyvinyl chloride (PVC), which has numerous uses, and celluloid for pool balls. At least 15 new types of polymers were synthesized during the first half of the 20th century, which saw a significant expansion in the development of contemporary plastics. Since they may be used in various forms and sorts, such as natural polymers, modified natural polymers, thermosetting plastics, thermoplastics, and, more recently, biodegradable plastics, plastics have seen significant success as a material. Among their many special qualities are their versatility in temperature, resistance to light and chemicals, strength, toughness, and ease of workability as a hot melt (PlasticsEurope 2008). Here is a list of the primary plastic types now in use. There are literally hundreds of plastic materials on the market. Still, only a few are considered commodity thermoplastics due to their large production volume and affordable cost. The following lists some plastics along with their fractional usage worldwide. About 90% of the total demand is met by low-density polyethylene (LDPE), high-density polyethylene (HDPE), polypropylene (PP), PVC, PS, and polyethylene terephthalate (PET). These materials will be covered in greater detail in published studies about salinity control under various circumstances.

The Good: Plastics Use in Medical and Public Health Applications

The variety of applications for plastics in medicine alone is astounding. Polymers can create prosthetics, synthetic tissues, and medication delivery microneedle patches. These applications have already been investigated elsewhere. Plastics have supplanted glass, wood, textiles, and metal in many facets of life in various products, such as clothes, food packaging, dishware, personal care items, and more. Due to their low cost and lightweight nature, plastics have found widespread use throughout the previous century, particularly in disposable products (Vert, M. 2011). Syringes are an excellent illustration of how plastics have improved public health through both single-use and subsequently reusable items. Healthcare professionals have historically mentioned ease of use when selecting disposable items.

In addition to being affordable, disposable plastic products like latex gloves, IV bags, and dialysis tubes save time and ensure patient safety by removing the need to

disinfect old equipment. In the early 1980s, disposable syringes in particular were the focus of attention as a means of lowering the risk of injecting people with used needles and spreading blood-borne illnesses like hepatitis B and HIV. Reusable syringes pose a danger of needlesticks during the capping and re-sterilization process, and ineffective sterilization methods can spread infectious diseases. The development of a plastic auto-disposable syringe that locks after a single use was attempted because, despite the clear guidelines, disposable syringes could and still were being reused.

These are more costly than disposable syringes, but they avoid infection and reuse. Sterilized syringes can always be available to provide vitally needed immunizations, and reusable syringes are making a resurgence in developing nations where single-use syringes continue to represent a health risk due to incorrect disposal. However, by creating a sterilizable syringe entirely of plastic, the issues brought up by those who opposed sterilizable syringes—such as their easy breakage and the difficulty of cleaning syringes made of metal and glass—have been resolved. Thus, plastics are making it easier to produce medical syringes that are both disposable and reusable today (Pillai et al. 2010).

The invention of plastics has made other disposable goods, including intravenous (IV) bags and tubing, equally common in hospitals. These are utilized for rapid medicine administration, blood transfusion, electrolyte imbalance correction, and the treatment of dehydrated patients by replacing lost fluids. The quickest way to get treatments into the body is to inject fluids and medications into the bloodstream. Given that they account for 20–25% of hospital waste, the significance of IV bags and tubing in patient care is evident (Lee et al. 2002).

Environmental pollution by plastic wastes

Populations of people are linked to the distribution of plastic garbage. Human population growth has increased demand for plastics and plastic-related items (Andrady et al. 2009). Waste from plastics and plastic products can be disposed of carelessly, leading to environmental pollution in several ways (Hofmeyr et al. 2006). These include the degradation of the natural beauty of the environment, the entanglement and death of aquatic organisms, the blockage of sewage systems in towns and cities, particularly in developing nations, which creates an environment that is favorable for the breeding of mosquitoes and other disease-causing vectors and the production of unpleasant odors (Lithner et al. 2009), the reduction of water percolation and regular agricultural soil aeration and ultimately lowers productivity in these areas ((Njeru, 2006).

Public Health Effects of Plastic Wastes

It is widely accepted that plastic polymers are inert and pose minimal threat to public health; instead, the putative health hazards are caused by various additives and any leftover monomers that may have been retained from these polymers. The majority of plastic additives have the potential to cause cancer and disturb hormones (Araujo et al, 2002). The primary ways that people are exposed to these chemicals are by ingestion, skin contact, and inhalation. Skin contact with some compounds found in plastics has been linked to dermatitis. Microplastics are significant pollutants that concern public health because they can bioaccumulate in the food chain after being consumed by a variety of freshwater and marine organisms. It may be harmful for humans to eat animals exposed to microplastics and plastic additives. By measuring environmental pollutants, biomonitoring investigations on human tissues have demonstrated that plastic materials persist in the human population. The presence of steady-state concentrations of plastics' components in the human body has been shown by biomonitoring studies, even though their components do not have a significant capacity for bioaccumulation (apart from ingestion and entrapment in the gastrointestinal tract). This indicates the continuous balance of constant exposure, metabolism, and excretion of these compounds. This suggests that no control groups are available to examine the health impacts of low-level environmental exposures to plastic constituents in today's plastics-enabled world.

Everyone is exposed to some extent at any given time from conception to death. Ninety-five percent of American adults have detectable levels of bisphenol A in their urine. The health consequences of plastic components like BPA and DEHP have been the subject of several epidemiological studies and controlled animal tests in recent years. Exposure to these substances has been linked to negative health and reproductive outcomes, including aggressive behavior, early sexual development, and lower male fertility.

BPA is currently among the first plastics to be identified as potentially harmful. The U.S. Food and Drug Administration (FDA) decided that there is enough evidence of possible harm to declare that "recent studies provide reason for some concern about the potential effects of BPA." In an attempt to safeguard a particularly vulnerable group, BPA has been prohibited in the United States from being used in baby bottles and toddler spill-proof cups. BPA-based polycarbonate plastics in infant bottles is likewise prohibited in the EU and Canada.

Similar problems exist with di-(2-ethylhexyl) phthalate (DEHP). The plasticizer most commonly found in polyvinyl chloride (PVC) is DEHP. Human exposure is

especially concerning because this addition can easily leak out of the polymers it is put into, because it is not chemically connected to them. DEHP exposure has been linked in several rodent and human studies to detrimental health outcomes, such as altered male and female reproductive systems, increased waist circumference, and insulin resistance.

Recommendations on Reduction and Control of Plastic Wastes

By limiting the production of plastics and plastic products, outlawing excessive packaging, collecting litter, and recycling, several nations are working to reduce environmental damage caused by plastic waste. The following suggestions could be helpful in the fight against plastic pollution:

1. Policy making

Realistic regulations that are appropriately adhered to and implemented are required to battle and reduce the ongoing environmental degradation caused by plastics. This should require plastic manufacturers to disclose all of the components in their goods and warn customers about the possible health risks of these compounds through a global agreement on environmental pollution caused by plastics. It is necessary to implement regulations to categorize some dangerous components in plastic products. The 1989 reclassification of chlorofluorocarbons (CFCs) as harmful (Montreal Protocol) and the 2004 classification of persistent organic pollutants (Stockholm Convention) are successful examples. As a result, in the following seven years, around 200 countries stopped producing CFCs and 30 other harmful compounds (Rochman et al, 2013).

In addition to improving our management of plastic trash, this kind of reclassification may encourage research into safe substitutes and prevent the ongoing accumulation of plastic waste in the environment. Regardless of how dangerous plastics are, the government must impose and enforce laws that will limit their manufacture, use, and final disposal. To avoid zero diversion to landfills and careless disposal to the environment, the 3Rs—Reduce, Reuse, and Recycle must be implemented at every level (Comanita et al, 2016).

2. Plastic waste management and recycling

Waste management is crucial to lowering the harmful impacts of plastic waste on the environment and public health. Improving the appropriate collection, handling, and disposal of plastic waste is necessary to reduce worldwide plastic litter and ocean pollution (Jambeck, et al, 2015). Poor landfill management will allow dangerous chemicals from plastic garbage to seep into the ground,

contaminating the air, soil, and subsurface water. Microplastics from landfills won't enter the ecosystem if wastewater is managed correctly. Since the majority of treated wastewaters are released into rivers or the ocean, regulations like Annex V to the International Convention for Prevention of Pollution from Ships (MARPOL) are necessary to stop the disposal of plastic debris into the ocean (Kershaw et al, 2011).

3. Education and public awareness

The general public needs to be made aware of the possible harm that plastic trash pollution may do to the environment and public health. This will significantly lower the rate of pollution and maintain environmental quality. People must understand the chemical components of plastic products and how they affect their health. Waste management systems and strategies for reducing plastic pollution must be included as informational resources in curricula at all educational levels.

4. Bioplastics as an alternative

In the 1850s, a British chemist created bioplastics, a plastic formed from cellulose derived from wood pulp. These days, various biodegradable and non-biodegradable resources, such as weeds, hemp, plant oil, potato starch, cellulose, maize starch, etc., can be used to make bioplastics. Under typical composting circumstances, sugar-based bioplastics can biodegrade. Bioplastics are more environmentally friendly because they use fewer fossil fuels to produce than conventional plastics (Reddy et al, 2013).

Conclusion

Studies on the global production of plastics and the damage they cause have revealed that plastic waste is a significant environmental problem. People are concerned about how plastic garbage affects humans, marine life, and the environment, emphasizing the need to protect ecosystems and the life they support. Plastics are incredibly helpful in daily life, but to protect the environment and human health, the hazardous chemicals used in their manufacture must be closely regulated. The likelihood of a clean environment and a healthy society will rise if toxicants from plastic trash are reduced in the community. Government organizations and health authorities must act quickly to pass and implement environmental regulations to track the manufacture, use, and disposal of plastics. Additionally, consumer goods and plastic products that come into direct contact with food and drinks and children should be prohibited from containing certain dangerous chemical ingredients utilized in the production of plastics, such as phthalates, BPA, etc.

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