An Overview on Plastic and Its Impact on Health

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ABSTRACT: Plastic pollution, also known as plastic trash, is defined as "the buildup of plastic objects (such as plastic bottles and other items) in the Earth's ecosystem that has a negative impact on animals, wildlife habitat, and humans. Despite this, more than a third of current output is utilized to create packaging, which is subsequently quickly discarded. Plastics will be produced in excess of 300 million tons per year by 2010. Plastics are essential elements in contemporary civilization, and many plastic-based goods are beneficial to public health (e.g., disposable syringes, intravenous bags). Plastics, on the other hand, can be hazardous to one's health. Endocrine disrupting characteristics, such as those caused by bisphenol A and di- (2-ethylhexyl) phthalate, are of particular concern (DEHP). Plastics safety opinions differ greatly, and despite more than five decades of research, scientific consensus on product safety remains elusive. The notion of reduce, reuse, recycle, rethink, restrain for limiting pre- and postnatal exposures to potentially hazardous components of plastics is explored as part of ongoing attempts to guide human civilization toward resource conservation as well as sustainable consumption.

KEYWORDS: Bottles, Health, Material, Plastic, Recycle.

1. INTRODUCTION

This linear use of hydrocarbons via packaging as well as other short-lived applications of plastic is simply not sustainable, given our diminishing fossil fuel sources and constrained capacity for waste disposal to landfill. Material reduction, design for end-of-life recyclability, enhanced recycling capacity, development of bio-based feedstocks, litter-reduction methods, application of green chemistry life-cycle assessments, and updated risk assessment approaches are some of the answers. Such efforts will be most successful if the public, industry, scientists, and legislators all work together. There is a sense of urgency, as the amount of plastics created in the first ten years of this century is projected to surpass the whole amount produced in the previous century.

1.1.Plastics as Materials:

Plastics are low-cost, lightweight, robust, durable, corrosion-resistant, and thermally and electrically insulating materials. Polymers' adaptability and diversity of characteristics are utilized to create a wide range of goods that provide medical and technical advancements, energy savings, and a variety of other social advantages. As a result, plastics output has skyrocketed in the previous 60 years, from about 0.5 million tons in 1950 to over 260 million tons now. The plastics sector in Europe alone generates more than 300 million euros in revenue and employs 1.6 million people. Plastics are used in almost every area of everyday life, including transportation, telecommunications, clothes, footwear, or as packaging materials for the transportation of a wide range of food, drink, as well as other items. Plastics have a lot of promise for new uses that will help people in the future, such as unique medicinal applications, renewable energy generation, and lowering energy consumption in transportation [1].

Plastic polymers are rarely utilized in their pure form; instead, they are combined with different additives to increase performance. Inorganic fillers including such carbon or silica strengthen the material, while plasticizers make it flexible. Other additions include thermal and UV stabilizers, flame retardants, and colorants. Many of these additives are used in large quantities and in a variety of goods. Some addition compounds are potentially hazardous (for example, lead and tributyl tin in polyvinyl chloride, PVC), however the extent to which additives released from plastic goods have negative consequences in animal or human populations is a matter of debate. The main point to consider is the relationship between the types and amounts of chemicals contained in plastics and their absorption and accumulation by live beings[2]. Phthalate plasticizers, BPA, brominated flame retardants, or antimicrobial compounds are among the most dangerous additives. Many mass-produced items, including as medical equipment, food packaging, fragrances, cosmetics, toys, flooring material, computers, and CDs, include BPA and phthalates, which can account for a considerable portion of the plastic content. Phthalates, for example, may make up a significant part of PVC by weight, whereas BPA is a monomer utilized in the manufacturing of polycarbonate plastics as well as a PVC addition.

Due phthalates are not chemically linked to the plastic matrix, they can leak out of goods, and they have gotten a lot of attention because of their huge manufacturing quantities and widespread use. Phthalates and BPA can be found in water, dust, and, due of their volatility, in the air. The negative consequences of these substances on animals and humans are a major source of worry. Aside from worries regarding cumulative effects of various chemicals and the reliance on finite resources for plastic manufacture, present consumption patterns are causing global waste management issues. demonstrate that plastic wastes, such as packaging, electrical equipment, including end-of-life vehicle plastics, are important components of both home and industrial wastes; our capacity for trash disposal to landfill is constrained, and landfills in certain areas are at or near capacity. So, from a variety of angles, it appears that our present usage or disposal of plastics is a source of concern [3].

1.2.The scope and consequences of medical plastics:

Although the exact volume of plastics used in healthcare is unknown, research from a variety of nations and settings have indicated that plastics account for 30% of total healthcare waste including one-third of waste in critical care and anesthesia. Given that the United States generates around 5.9 million tons of medical waste each year6, approximately 1.7 million tons of this will be plastics. Each year, the National Health Service in the United Kingdom is projected to dispose of 133,000 tons of plastic. Plastics make up a varied percentage of hospital waste in different countries; for example, 12 percent in Peru, 27 percent in Jordan, and 46 percent in Italy, and these variances are likely due to disparities in single-use plastic usage.

In addition to the dangers associated with the manufacture and disposal of vast quantities of plastics, the additives Bisphenol A or Di-2-ethylhexylphthalate, which are used to soften polyvinyl chloride, may pose specific health concerns. In newborns and adults in critical care units, moderate serum or urine levels of Bisphenol A or Di-2-ethylhexylphthalate have been linked to the length or frequency of connection to polyvinyl chloride tubing, bags, or even other medical components. 10 Because these chemicals are lipophilic, they easily pass across cellular membranes. The safe limits of Bisphenol A and Di-2-ethylhexylphthalate exposure remain debatable, however greater concentrations of Bisphenol A and Di-2-ethylhexylphthalate have been associated to reproductive or endocrine disruption, as well as behavioral problems, in animal and in vitro investigations. Commercially accessible di-2-ethylhexylphthalate-free blood bags are available, although they are not frequently utilized [4], [5].

1.3.Reduce and recycle to reuse:

Plastics' prevalence and rise in healthcare are worrying. Concerns about infection from contaminated medical equipment, convenience, as well as the expansion of healthcare in emerging nations have all fueled the rise of single-use devices. A single adenotonsillectomy procedure at a UK hospital resulted in 101 different pieces of single-use plastic, according to our findings. The concepts of the circular economy (reduce, recycle, and reuse) must be applied to healthcare. Plastic reduction is linked to broader concepts of sustainable healthcare practice, such as lean service delivery and the use of low-carbon alternatives materials and procedures. For example, previous studies have found that 12 out of 40 disposable items in a prepackaged kit for tonsil surgery were unnecessary.12 An Australian study found that single wrapping of sterilized instruments with plastic was as efficacious as double wrapping in preventing bacterial contamination. Clinicians should only open plastic healthcare products (or anything packaged in plastic) if they are positive they will need them, not just in case. Stopping routine unpacking of saline bags as well as tubing during haemodia filtration was part of a campaign to decrease the environmental effect of renal dialysis.

Plastic substitute materials have also been described. One hospital in the United States saved $51,000 a year by replacing disposable polypropylene wrap with recycled hard metal cases for surgical instruments. A UK hospital replaced plastic harmful waste bins with paper-based bins, resulting in cost savings, reduced transportation and incinerator emissions, as well as a 30-tonne trash reduction. Tissue engineering, orthopedic devices, and wound treatment have all benefited from biodegradable polymers made from maize or molasses feedstock. 16 However, such materials can disrupt food supply systems, and their biodegradation is gradual, and they generate methane, a strong greenhouse gas, unlike non-biodegradable plastic.

1.3.1. Reuse:

Concerns about infection risk have led us to rely on single-use rather than reusable medical goods to a considerable extent. In many situations, the danger of infection is speculative or negligible, with little data to back it up. Although the danger of infection from reprocessing and reuse of an intravenous cannula may be unacceptable, the risk of infection from reusing suction tubing to remove ear wax appears to be low; nonetheless, both items are designated as single-patient use items in certain healthcare institutions. When it comes to avoiding environmental impact, reusing rather than discarding an item is frequently, but not always, the preferable option. Life cycle assessment, a technique that considers all stages of a product's life, including manufacture, sterilization, maintenance, or disposal, can be used to quantify this harm. Reusable plastic an aesthesia trays, for example, offer reduced water needs, carbon footprints, and prices than single-use equivalents, according to life cycle analysis.

In an Australian study, extending the use of an aesthesia breathing circuits from 24 to 7 days had no effect on bacterial contamination and was linked with energy, water, as well as cost savings. Reusable central venous catheter kits, on the other hand, were shown to be less expensive but more ecologically damaging in an Australian study, owing to the fact that the hospital where the trial was performed utilized coal-based energy. To until point, such inquiries have been few and few between. Other contexts should be considered in complete environmental and economic life cycle analyses. The Food or Drug Administration in the United States authorizes reprocessing of many single-use devices since the danger of infection is considered minimal. However, such efforts' visibility and adoption are still lacking, and they are not generally embraced. In the United Kingdom, similar behavior is less encouraged, with the Medicines and Healthcare Products Regulatory Agency stating that anybody who reprocesses or reuses a device designed by the manufacturer for single use has full responsibility for its safety and efficacy. Single-use item reprocessing is illegal in China, although according to survey data, reuse is prevalent in practice, and reprocessing is common in low- and middle-income nations like India and Brazil. Some devices, such as those with tiny channels, shafts inside lumens, seals, and mated articulating surfaces, are difficult to reprocess. In some cases, reprocessing standards may not be followed to the letter.

1.3.2. Recycle:

Plastics can be disposed of in a landfill, incinerated, or recycled in general. The percentage of medical plastics disposed of in various ways varies depending on the facilities available in each health system, location, and nation, as well as the knowledge and attitudes of the people working in such units. In the United Kingdom, less than 5% of plastic healthcare waste gets recycled. Polyethylene (found in plastic bottles for saline solutions and sterile irrigation fluids), polypropylene (found in surgical instrument covers), their co-polymers (found in syringes and suckers), and polyvinyl chloride (found in syringes and suckers) are the most common plastics used in hospitals. Where recycling facilities are available, certain plastics may be recycled.

According to one research, 64 percent of operating room plastics might be recycled. According to a South Korean research, disposable needles, tubing and blood bags account for 40% of hospital waste, all of which may be recycled. Some of these impediments can be surmounted. Although hospital recycling facilities vary widely, excellent recycling systems are, in most cases, both ecologically as well as financially preferable, which should promote growth. There are also specific examples of good practice. Polyvinyl chloride anesthetic masks, oxygen masks, or tubing were down cycled into horticulture goods such as tree ties in the UK as part of a trial program. In contrast to the considerable expenditures associated with traditional disposal, such initiatives typically come at no cost to the institution. In China, hydrometallurgy is being used to extract aluminum from polyvinyl chloride, allowing for the recycling of pharmaceutical blister packs. However, in low-income areas, plastic recycling may be limited or non-existent, while plastic incineration may be low-tech, resulting in incomplete combustion and the release of harmful pollutants such as dioxins and heavy metals.

Figure 1: illustrate image showing the plastic recycle plant [6]**.**

Incineration (59-60%), steam sterilization (20-37%), or other treatment procedures (4-5%) are also options for disposing of regulated medical waste. If steam sterilization is employed, such waste can then be recycled in collaboration with other facilities. An assessment of an aesthetic waste revealed the need for improved segregation: 16 percent of trash disposed of in infectious waste streams was not contaminated, but 7% of waste disposed of in general waste streams was. 26 Manufacturers may help by labelling the type of plastic used in their goods to make recycling easier. They can also reduce the usage of many plastic types in a single device, making recycling that gadget easier.

1.4. The bad: health effects of plastics:

The extensive usage of plastics, on the other hand, allows for constant interaction of these materials with the human body, and therefore everyday exposure to plastics' components. Despite the fact that plastics' components have no significant bioaccumulation potential (except when accidentally swallowed and entrapped in the gastrointestinal system), bio monitoring studies have shown the presence of steady-state concentrations of plastics elements in the human body, reflecting the ongoing balance of constant exposure, metabolism, and excretion of these combustibles. This means that in today's plastics-enabled world, there are no control groups to study the impact of low-level, ambient exposures to plastic components on human health. Everyone is exposed to some degree at some point during their lives, from conception to death. BPA has been detected in the urine of 95 percent of the adult population in the United States. Several epidemiologic research and controlled animal tests on the health consequences of plastic components like BPA and DEHP have been conducted in recent years.

DEHP has a similar set of problems. DEHP is the most often used plasticizer in polyvinyl chloride (PVC). Because this addition is not chemically linked to the polymers in which it is included, it can easily leak out, there are special worries about human exposure. DEHP exposure has been linked to a variety of negative health consequences in rodents and humans, including alterations to the female as well as male reproductive systems, increased waist circumference, or insulin resistance. The "cocktail effect," or the notion that environmental exposures do not occur in isolation but rather in combination, is also a topic that needs to be researched more. Additional component of plastics, such as polyhalogenated flame retardants (e.g., polybrominated diphenyl ethers), polyfluorinated compounds (e.g., polyfluoroalkyl compounds like perfluoro octane sulfonate and perfluorooctanoate), as well as antimicrobials (e.g., triclosan or triclocarban), are being investigated for potential harm [7].

2. LITERATURE REVIEW

Rolf U. Halden studied about Plastics will be produced in excess of 300 million tons per year across the world. Plastics are essential elements in contemporary civilization, and many plastic-based goods are beneficial to public health (e.g., disposable syringes, intravenous bags). Plastics, on the other hand, can be hazardous to one's health. Endocrine disrupting characteristics, such as those caused by bisphenol A and di-(2-ethylhexyl) phthalate, are of particular concern (DEHP). Plastics safety opinions differ greatly, and despite more than five decades of research, scientific consensus on product safety remains elusive. This study compiles data from over 120 peer-reviewed papers on the health consequences of plastics and plasticizers in laboratory animals and people. It looks at hazardous exposures of vulnerable groups and outlines the negative environmental effects of plastic pollution [8].

Emily J. North et al. studied Even though recent public attention on plastics has concentrated mostly on human health or environmental issues, such as their endocrine-disrupting characteristics as well as the long-term pollution they represent, plastics continue to serve society in several ways. Plastics' advantages are especially obvious in medicine as well as public health. Plastics are flexible, cost-effective, and need less energy to manufacture than other materials such as metal or glass. They may also be made to have a wide range of characteristics. However, not all current uses of plastics are prudent or sustainable, as evidenced by widespread, unintended human exposure to endocrine-disrupting bisphenol A (BPA) as well as di-(2-ethylhexyl) phthalate (DEHP), problems arising from large amounts of plastic being discarded, and depletion of non-renewable petroleum resources as a result of the ever-increasing mass production of plastic condensates. It discusses biodegradable options for plastic packaging, opportunities for reducing plastic medical waste, and recycling in medical facilities as part of the ongoing effort to phase out DEHP as well as BPA in the health-care and food industries, and it highlights ongoing efforts to phase out DEHP and BPA in the health-care and food industries [9].

Richard C. Thompson1, et al studied about Plastics have revolutionized daily life; their use is growing, and yearly output is expected to surpass 300 million tons by 2010. We consolidate existing understanding of the advantages and problems surrounding the use of plastics in this closing article to the Theme Issue on Plastics, the Environment, for Human Health, and look ahead to future priorities, challenges, and possibilities. Plastics clearly provide several societal advantages as well as future technical and medical advancements. This linear use of hydrocarbons via packaging as well as other short-lived applications of plastic is simply not sustainable, given our diminishing fossil fuel sources and constrained capacity for waste disposal to landfill. Material reduction, design for end-of-life recyclability, increased recycling capacity, development of bio-based feedstocks, litter reduction strategies, application of green chemistry life-cycle analyses, as well as revised risk assessment approaches are some of the solutions. Such efforts will be most successful if the public, industry, scientists, and legislators all work together [10].

3. DISCUSSION

Plastic pollution, also known as plastic trash, is defined as "the buildup of plastic objects (such as plastic bottles and other items) in the Earth's ecosystem that has a negative impact on animals, wildlife habitat, and humans. We estimate that the healthcare business generates approximately 1.7 million tons of plastic trash each year in the United States alone. Reduce, reuse, as well as recycle are all techniques for reducing such consumption, but they have gotten little scholarly or practical attention to yet. The National Health Service Long Term Plan in the United Kingdom has committed to reducing the use of single-use plastics, 30 but further global public health measures and strong evidence-based policies are needed. Healthcare workers and organizations can help by increasing awareness, utilizing reused goods whenever feasible, and supporting the creation and use of recycling and reprocessing facilities, among other things. The healthcare manufacturing business must also adapt, allowing for simpler reprocessing or recycling of their goods, the elimination or replacement of plastic packaging, and participation in life cycle evaluations (via either voluntary or regulatory modifications). Key research topics, which may be context-specific, should be addressed by the academic community and financial organizations.

4. CONCLUSION

Plastic pollution, also known as plastic trash, is defined as "the buildup of plastic objects (such as plastic bottles and other items) in the Earth's ecosystem that has a negative impact on animals, wildlife habitat, and humans. Healthcare cannot exploit the widespread and rising use of throwaway plastic items to excuse itself from the global drive to reduce reliance on plastics due to possible but mostly unproven infection risk or convenience. This necessitates rethinking the linear paradigm of plastic manufacturing, use, and disposal. Indeed, we would argue that because the demonstrated harms of plastics to human or environmental health are such an urgent problem, such talks should now be part of the healthcare delivery process.

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