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The Adverse Effects of Plastics Pollution on the Environment, Health of Animals and Human Beings

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Abstract-Thousands of factories are producing tons of plastic bags used popularly by people for shopping purposes because of their ease, cheapness, and convenience of use. Still, their adverse effect is never highlighted or, at the very least, openly discussed in a more serious tone. The situation is worsened in Sierra Leone as a developing country. Several nations have banned plastic bags due to public concern over the serious adverse effects on the environment and agriculture, especially in agricultural countries such as Sierra Leone, Bangladesh, India, Pakistan, South Africa, Yemen, etc. In this research paper, the author surveyed the adverse effects of plastic pollution on the environment of Freetown. The survey is vital for formulating rules and regulations for the manufacture and utilization of plastics. Implementing standard regulations for the production and use of plastics will help reduce the toxic effects in our environment and health.

Keywords: Plastic, pollution, Environment, Sierra Leone, Effects

1. Introduction

Plastic bags are commonly used, even though they can damage the environment. People use plastic bags to carry clothes, food, and other items bought from markets or shops. The bulk of the urban waste is plastic bags and is a major item in the litter system. This indeed has caused so many detrimental environmental effects, including pollution, animal choking, blockages of channels, rivers and streams, and disfigurements. Several concerns over the ban of plastic bags have been raised by the public and environmentalists over the failure of the government, prompting some national governments to ban the use of plastic bags to buy goods.

There are so many causes of the problem of plastic waste in Sierra Leone and other countries. For example, the government of South Africa has stopped the usage and manufacture of plastic bags by enacting parliamentary legislation. Other European countries have adopted a fee to limit the use and production [1].

The development of alternatives and prohibitions on plastic bags is a better alternative than pressuring consumers and manufacturers of plastic bags. Although fining people for littering plastic bags in cities and towns will have a positive effect on protecting and conserving the fertility of the land, it would negate the benefits or advantages of the levy.

2. Classification of plastics

2.1 Polyethylene terephthalate plastic

Polyethylene terephthalate plastic is one of the most widely utilized. It is used in various items, from water bottles and product containers to baby wipes, clothing, bedding, and mattresses. For instance, in Western Europe, the consumption of polyethylene terephthalate plastics is 38 million tons per year, primarily utilized to produce plastic packaging, household, and household products, electrical and electronic items[2]. Polyethylene terephthalate plastic is entirely liquid and anti-inflammatory; it is prevalent in plastic water and food packaging. As an anti-air, gastric plastic prevents the penetration of oxygen. Drinks or liquids do not pour quickly into stomach bottles. Polyethylene terephthalate plastic bottle does not contain harmful bacteria or thalates but is used in antimony trioxide. Antimony acts as a potential carcinogen in the human body. In the event of prolonged contact with drinking water, antimony is released from the container.

2.2 High-density polyethylene

High-density polyethylene (HDPE) or high-density polyethylene (PEHD) is a thermoplastic polyethylene made from petroleum. 1.75 kg of oil is needed to produce 1 kg of HDPE. HDPE is often recycled and has the No. "2" recycling symbol[3]. Only was manufactured low-density polyethylene until the 1950s. Low-density polyethylene was manufactured at extremely high pressures. This high-pressure polymerization produced polyethylene with many branches; branches are generated due to intermolecular and intramolecular chain transfer during polymerization. The utility of low-density polyethylene is limited due to the large number of branches that result in poor strength properties and the requirement of extreme pressure conditions for production. HDPE is resistant to numerous solvents and has a wide variety of uses, including telecommunications conduits, containers, detergent bottles, milk jugs, vehicle fuel tanks, plastic lumber, folding tables, folding chairs, storage sheds, Basketball System Portable Pedestals, Plastic Bags, Containment of Certain Chemicals, Chemical Resistant Piping Systems, Heat Resistant Fireworks Mortar, Geothermal Heat Transfer Piping Systems, Distribution Piping Systems natural gas, water pipes for domestic water supply, internal insulators of coaxial cables (dielectric insulators) spacers), root barrier, corrosion protection for steel pipes, etc., bottles suitable as reusable bottles also used for cell liners in landfills, where large HDPE sheets are extruded or wedge welded to form a homogeneous chemical. The strong barrier to keep debris out the use of soil and to prevent water through the liquid constituents of solid waste[3].

2.3 Low-density polyethylene

Low-density polyethylene (LDPE) is used today in a wide variety of applications, including packaging, adhesives, coatings, and sheets[4]. As a bulk polymer, LDPE is mass-produced in continuous tubular reactors or autoclave reactors. A continuous polymerization process is known to have highly non-linear dynamic behavior. It is often operated over a wide operating range to produce polymers with the properties desired by the current market[4]. Low-density Polyethylene constitutes approximately 92% of the synthetic plastics manufactured and is also utilized for plastic bags, disposable containers, bottles, packaging materials, etc.[5]. It is said that more than 500 billion 1 trillion plastic bags in use worldwide disrupt the ecosystem and ultimately cause severe environmental problems when these materials are recycled from the environment [6-8]

2.4 Polypropylene

Polypropylene (pp) was discovered in 1954 and quickly gained popularity, as PP has the lowest density among standard plastics. PP has excellent chemical resistance and can be processed through many processing methods such as injection molding and extrusion. Polypropylene is a polymer produced catalytically from propylene. The great advantage is its resistance to high temperatures, which makes it especially suitable for objects such as bowls, funnels, buckets, bottles, balloons, and Instrumental glasses that must be sterilized (cleaned) frequently for use in clinical settings. Polypropylene is a Free color material with excellent mechanical properties and is better than polyethylene for the reasons above[9]. Polypropylene is a downstream petrochemical derived from the propylene olefin monomer. Polymer is manufactured by the process of a monomer compound called addition polymerization. This process adds heat, high-energy radiation, and an initiator or catalyst to bind the monomers. Propylene molecules polymerize into very long polymer molecules or chains.

2.5 Polystyrene

Polystyrene (PS) consists of styrene monomers obtained from liquid petrochemical products. It consists of a long chain of hydrocarbons with phenyl groups attached to alternate carbon atoms. Currently, most polystyrene waste is disposed of in landfills and is not recycled due to problems encountered in the separation and purification of polystyrene. As a hard, solid plastic, it is often used in products that require clarity, such as food packaging and laboratory items. In combination with various dyes, additives, or other plastics, polystyrene makes home appliances, electronics, auto parts, toys, flower pots, garden tools, and more.

2.6 Polyvinyl Chloride (PVC)

Polyvinyl chloride (PVC), a heat-resistant polymer, is used to pack fruit juices, edible oils, etc. PVC is considered highly toxic due to chemical components such as heavy metals, dioxins, BPA, and phthalates. PVC is flexible depending on the leakage due to the presence of phthalates, and Phthalates are harmful to humans. The entire life cycle of PVC, which includes manufacture, use, and disposal, can pose severe risks to the environment and public health, so its consumption has been significantly reduced. However, due to its economy and versatility, PVC is still very popular in consumer products. PVC has been reported to cause chronic bronchitis, congenital disabilities, genetic changes, cancer, skin diseases,

deafness, visual disturbances, ulcers, liver dysfunction, and indigestion.

3. Effects on the Environment, Health of Animals and Human Beings

The major effects of plastic bags on the environment are that they are dumped indiscriminately into landfills worldwide that occupy tons of hectares of land and release dangerous methane and carbon dioxide gases which are the two leading greenhouse gases that cause global warming and highly toxic leachates from these landfills during their decomposition stage.

In addition, plastic bags take many years to decompose. Also, toxic substances are released into the soil when plastic bags perish under sunlight. Plastic bags when burnt, it releases poisonous substance into the air causing ambient air pollution. Simone [10] suggested that owing to the unregulated accumulation of carcinogenic compounds, the use of plastic bags may allow inroads into cancerous diseases.

Substances coming from plastic bags pose severe ecological effects on human beings. Failing to properly dispose of plastic bags will lead to severe effects on the environment, like littering and even block drainages.

Animals often get confused with the bags for food and consume them, therefore blocking their digestive processes. They can also get tangled and drown in plastic bags. Animals entangled in marine debris, including plastic bags, may cause starvation, choking, laceration, infection, reduced reproductive success, and mortality[11].

There are also instances where endangered tortoises were found to have been suffocated because of swallowing plastic bags combined with seaweed[12].

Plastics have been designated as a major problem in the aquatic environment since the 1970s. Still, the issue of plastic pollution in marine and freshwater environments has only recently been identified as a global problem. Plastics are now omnipresent in the aquatic ecosystem, and this alarming trend needs urgent action. Therefore, marine plastic bags pollution has become a significant environmental concern for governments, scientists, non-governmental establishments, and the international community [13].

There are several challenges posed by plastics in the marine environment that has produced an environmental challenge that has detrimental effects on tourism. Trapped shoreline plastic negatively affects shipping infrastructure, energy production, fishing, and aquaculture[14]. Economic losses are linked to lower tourism earnings, adverse effects on tourist activities, and harm to the maritime environment.

Plastic bags pose a threat not only to marine life but also to agricultural land. Plastic bags disposed of in farming lands affect crop production. They result in the dilapidation of the atmosphere and agricultural land, which has inadvertently used up precious earth resources, particularly oil [15]. This now poses a significant challenge to environmental and agricultural production. The consequence of this would be the ecological deterioration of the so-called developed global society.

Plastic bags in ocean water is a significant and growing global pollution epidemic. It is an increasing source of contaminants, either introduced during processing or absorbed from the atmosphere compounds leaching from plastic bags, responsible for increasing reported toxicity levels. Leaching toxicity from plastic waste should also be considered when regulating the effects of plastic pollution in oceans.

Although plastic bags have been seen to have reduced agricultural production worldwide, it is deplorable that there has raised less awareness to undertake concrete and proactive action. Indeed, international organizations and the international community have made few serious scientific investigations to lower the ever-increasing consumption of plastic bags. Plastic bags should be prohibited globally, and their biodegradable equivalents should be implemented to address these gross and harmful issues.

4. Conclusion

Studies of global plastics production and associated environmental pollution have shown that plastic waste is a major environmental problem. The effects of plastic waste on marine organisms, humans, and the environment, in general, are of public concern and require the need to save ecosystems and the life in them. Even though plastics are very useful in daily life, the toxic chemicals used in their manufacture must be carefully monitored to ensure environmental and health safety. Reducing the community's exposure to toxins from plastic waste increases the chances of a cleaner environment and a healthy society. Therefore, the government needs to take robust strategies to implement environmental laws that will assess plastics' production, usage, and disposal. It is crucial to reduce the rate at which we use plastics to reduce plastic waste.

5. Solutions/Recommendations

- Regulating against the indiscriminate use and recycling of waste from plastic bags is strongly recommended and restricts the free sale of plastic bags by retailers.
- The public should be informed not to use plastic bags but to use eco-friendly alternative bags made from fabric, natural fibers, and paper to reduce the problems associated with plastic bag wastes.
- Covery et al. [16] also explain that the republic of Ireland introduced a levied tax on plastic bags in 2002, which had until now been provided free at points of sale to customers. The consequence of the tax on the use of plastic bags in retail outlets was intense. There was a more significant percentage decrease in use, with a related benefit in reduced littering with adverse effects on the environment.
- In the United States, the single-use plastic bag is a significant worry for local governments. It remains a major source of land-based litter and marine debris, obstructing stormwater management systems due to their tremendously low re-use and recycling rate. In reaction, local governments have taken several steps designed to minimize the store-level use of single-use plastic bags in the following main categories: bans, fees and levying taxes, minimum product size of bags, public awareness requirements, and retailer take-back initiatives.
- To monitor the environmental issues posed by plastic bags, the government of South Africa merged regulatory elements with a 'per-bag tax' like that imposed by the Irish government. Plastic bag charging started with a fixed nominal price per bag across all retailers. With the implementation of the tax, the use of plastic bags dropped dramatically across retailers. However, the paid levy only had short-run success, and as soon as the price was set to a lower rate, the demand picked up. Despite its extensive application at checkout points, the levy's effectiveness has declined, and customers have steadily increased their consumption rates.

.Additional investigation indicates that the legislation's impact may rise over time [17]. They further explained that the single-use plastic bag is one of the leading causes of environmental and socio-economic problems worldwide, which has led to universal calls for use reduction intervention strategies.

References

[1] Jalil, M.A., M.N. Mian, and M.K. Rahman, Using plastic bags and its damaging impact on environment and agriculture: An alternative proposal. International Journal of Learning & Development, 2013. **3**(4): p. 1-14.

[2] Hannequart, J., Good practice guide on waste plastics recycling: a guide by and for local and regional authorities. Association of cities and regions for recycling (ACRR), Belgium, 2004.

[3] Kumar, S., A.K. Panda, and R.K. Singh, A review on tertiary recycling of high-density polyethylene to fuel. Resources, Conservation and Recycling, 2011. **55**(11): p. 893-910.

[4] BenAmor, S., F.J. Doyle III, and R. McFarlane, Polymer grade transition control using advanced real-time optimization software. Journal of Process Control, 2004. **14**(4): p. 349-364.

[5] Lee, B., et al., Biodegradation of degradable plastic polyethylene by Phanerochaete and Streptomyces species. Applied and Environmental Microbiology, 1991. **57**(3): p. 678-685.

[6] Andrews, G.D. and P.M. Subramanian. Emerging technologies in plastic recycling, Philadelphia PA, June 3-5, 1991. in A. C. S. symposium series. American Chemical Society.

[7] Billmeyer, F.W., Textbook of polymer science. 1984: John Wiley & Sons.

[8] Curlee, T.R. and S. Das, Identifying and assessing targets of opportunity for plastics recycling. Resources, conservation, and recycling, 1991. **5**(4): p. 343-363.

[9] Maddah, H.A., Polypropylene as a promising plastic: A review. Am. J. Polym. Sci, 2016. **6**(1): p. 1-11.

[10] Simmons, C., It's in the Bag: An Estimate of the Effect of CO2 Emissions of the Irish Plastic Bag Tax. Website. Accessed November 2005. **22**: p. 2005.

[11] Katsanevakis, S., Marine debris, a growing problem: Sources, distribution, composition, and impacts. Marine Pollution: New Research. Nova Science Publishers, New York, 2008: p. 53-100.

[12] Eriksen, M., et al., Plastic pollution in the South Pacific subtropical gyre. Marine pollution bulletin, 2013. **68**(1-2): p. 71-76.

[13] Dey, A., et al., Challenges and possible solutions to mitigate the problems of single-use plastics used

for packaging food items: a review. Journal of Food Science and Technology, 2021. **58**(9): p. 3251-3269.

[14] Sivan, A., New perspectives in plastic Biodegradation. Current opinion in biotechnology, 2011. **22**(3): p. 422-426.

[15] Matagi, S.V., Some issues of environmental concern in Kampala, the capital city of Uganda. Environmental monitoring and assessment, 2002. **77**(2): p. 121-138.

[16] Gyapomaa, A., Deconstructing the use and disposal of plastic bags in Tema Community One Township in the Tema Metropolis. 2013, University of Ghana.

[17] Gebissa, E., Leaf of Allah: khat & agricultural transformation in Harerge, Ethiopia 1875-1991. 2004: Ohio State University Press.

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