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ABUNDANCE OF PLASTIC: AN IGNORED TOXIN IN FOOD INDUSTRY

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Abstract

Access to sufficient amounts of safe and nutritious food is key to sustaining life and promoting good health. The presence of toxins and chemicals in food is an emerging concern. Food gets contaminated either naturally or through certain unwise activities in the food industry. Contamination by heavy metal in food occurs mainly through pollution of air, water and soil. The continuous use of plastic in food and beverage packaging has exposed the humans to numerous health hazards. We are using the plastics in one or the other form, at homes, offices, functions and at most in the delivery of the food items. All plastic, from macro to nano scale are concerned to leach and adsorb hazardous substances. Single-use plastic is one of the dangerous things used world-wide. The harmful chemicals associated with plastics can be divided into three categories: ingredients of the plastic material, byproducts of manufacturing and chemicals adsorbed from the environment. The possible toxicological responses caused by plastic can thus be a combination of all of these chemicals. Discussing the harmful effects of its use on the human health is an objective of the study. The paper concludes that various kinds of plastic are not only harmful for the environment, but directly affects the human health. The release of toxic compounds has shown to lead to health complications in non-humans as well. It is high time that the policy-makers take strict action at earliest and protect the health of the society.

Keywords: Environment, food, plastic, toxic.

ABUNDANCE OF PLASTIC: AN IGNORED TOXIN IN FOOD INDUSTRY

"Humans may be consuming 39,000 to 52,000 microplastic particles a year. The number reaches 74,000, after adding the amount of inhaled microplastic."[1]

Plastic is a light weighed and resilient material, capable of being shaped in variation and used in a wide array of activities. Plastic is among the most prevalent materials on the planet.[2] Its impact on human health is hardly understood by the common people. The humans are confronting challenges to handle the quantity of plastic waste produced. It calls to rethink the system of manufacture, use and managing plastics. The governments must take actions to control, businesses to become innovative and individuals to act responsibly to confront this enormously growing universal issue. Plastic impends human health on a global gage. Exposure to plastic is mounting into new areas of the environment and food chain. With increase in the production of plastic, this exposure will only escalate. The COVID-19 pandemic has augmented the intricacy of managing the plastics. A sharp call for single-use plastics for personal protective equipment cannot be ignored. To check infection levels, some governments have taken away bans on single-use plastics.[3]

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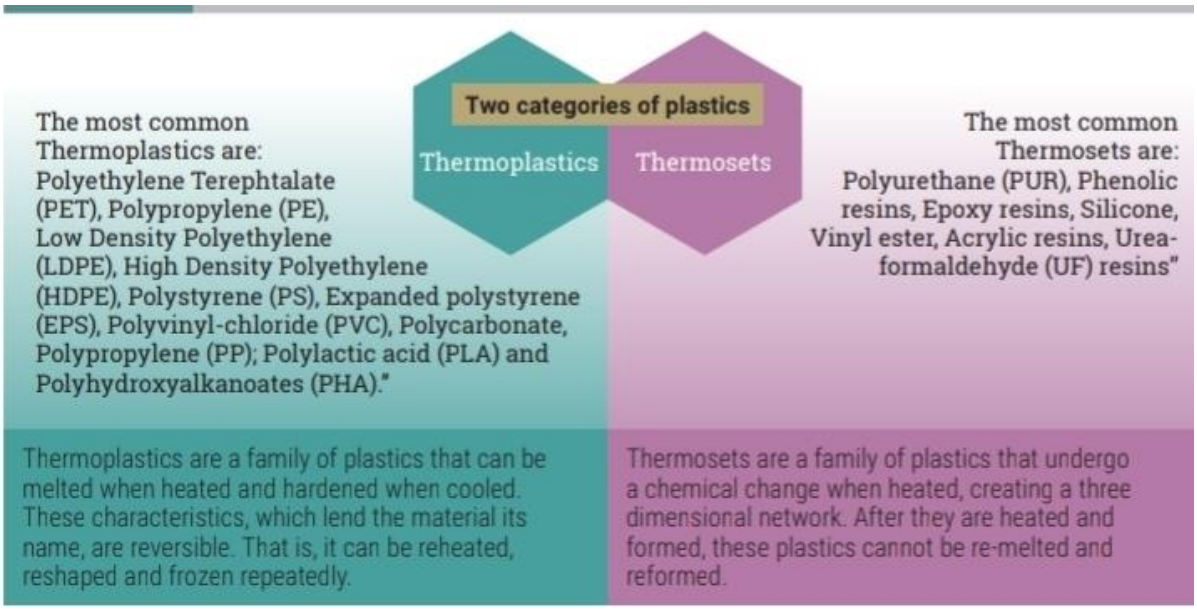
[1] Sarah Gibbens, You eat thousands of bits of plastic every year, June 2019, https://www.nationalgeographic.com/environment/article/you-eat-thousands-of-bits-of-plastic-every-year.

[2] Carl D. Millholland, Polymer Profiles: A Guide to the World's Most Widely Used Plastics, https://www.thermofisher.com/blog/materials/polymer-profiles-a-guide-to-the-worlds-most-widely-used-plastics/.

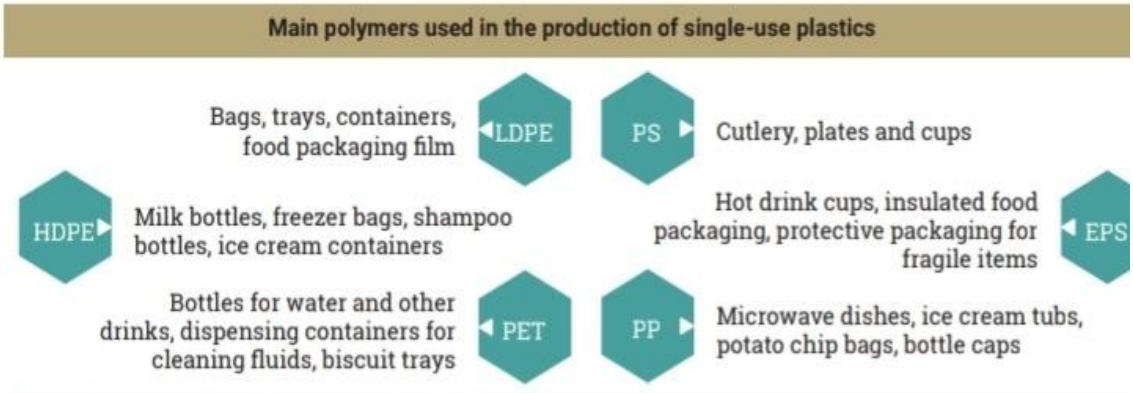
[3] COVID-19 has resurrected single-use plastics - are they back to stay?, July 2020, https://theconversation.com/covid-19-has-resurrected-single-use-plastics-are-they-back-to-stay-140328.

Types of Plastic

Broadly, thermoplastics and thermosets are two broad categories of plastics on the basis of their nature.



Single Use Plastic and PVC fall under the first category of plastics. Single-use plastics or popularly called disposable plastics are the ones employed for packaging purposes. They include items meant to be used once unless recycled such as water-bottles, containers, grocery bags, straws etc. Negligent individual behaviour and poor waste management systems are responsible for spoiling the environment for the entire living species.



Plastics that have not been formerly used or subjected to processing other than for their original production is virgin plastics.

Biodegradable plastic or Bioplastics is made from renewable sources. The sources include cassava roots, sugarcane or fermentation of lipids (PHA) or sugar, corn starch. Many governments have barred commonly used plastic bags and moved towards the use and production of "biodegradable" bags. In reality, these "biodegradable" plastic items can break down entirely only upon exposure to continuous temperature of above 50°C or 122°F.[4]

Plastic and Health

Plastic is considered appropriate in the everyday lives. It is low-priced and abundant. Around partial plastic waste worldwide consists of plastic packaging. It is largely littered away irresponsibly. Most plastics is of non-biodegradable nature. They gradually break-down into minor fragments -microplastics. "Styrofoam" is a polystyrene foam taking upto millenniums for decomposition.[5] Their balloon-shaped design alongwith less weight allow the plastic bags to effortlessly blow in the air. Sooner or later, they reach the land and water-bodies.

Direct Impact on Human Health

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[4] when biodegradable plastic is not biodegradable, https://theconversation.com/when-biodegradable-plastic-is-not-biodegradable-116368.

[5] The State of Plastics -World Environment Day Outlook 2018, http://www.indiaenvironmentportal.org.in/content/455899/the-state-of-plastics-world-environment-day-outlook-2018/.

The plastic itself deliberately breaks down, discharging monomer. Other chemicals may also be put to the plastic to obtain requisite mechanical characteristics.

The fatal elements in Styrofoam containers transmits into the food and drinks upon reheating the food while still in the plastic containers. The toxins present in Styrofoam containers thus leach into our food and beverages. Carcinogenic chemicals like styrene and benzene are present in the Styrofoam products. These are highly deadly if ingested. They can harm the nervous systems, reproductive organs, lungs and so on.

Food storage containers and bottles are usually made from Polycarbonate. Bisphenol A - BPA, a chemical believed to result in grave health problems gets released from such food containers and bottles. PVC is used in making bottles, the seals for screw, cap jars, cling wrap etc. Originally, PVC is hard and rigid, so additional chemicals - plasticisers are required to give it softness and flexibility. BPA and some phthalates are in the nature of endocrine disruptors. They can impersonate or cause the hormonal response of the body. These chemicals are associated with developmental, brain, reproductive, immune problems.[6] Infants and the very young are at higher risks as their development is strongly affected by hormones.

In economically unadvanced countries, plastic waste is often scorched for the purpose of producing heat or cooking. This process also exposes people to toxic emissions. This exposes the people to prolonged toxic emissions like furan and dioxin.

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[6] Kevin Loria, How to Eat Less Plastic, April 2020, https://www.consumerreports.org/health-wellness/how-to-eat-less-plastic-microplastics-in-food-water/.

Plastic in Food Packaging and its Risks[7]

Code	Types of plastic	Use	Risks
1.	Polyethylene terephthalate (PET)	• Bottles used for water and softdrinks • Jars for products such as peanut butter • Lightweight and 'green' wine bottles	No known health hazards.
2.	High density polyethylene (HDPE)	• Bottles used for milk and cream • Yoghurt cups • Bags that line breakfast cereal packets	No known health hazards.

[7] Is plastic food packaging dangerous? , Aug. 2014, https://www.choice.com.au/food-and-drink/food-warnings-and-safety/plastic/articles/plastics-and-food.

3.	Polyvinyl chloride (PVC)	• Shrink and cling wrap • Clear plastic containers for fresh fruit or takeaway sandwiches • Some soft drink bottles • The gaskets that form a seal on screw-cap glass jars	Contains plasticisers such as DEHA or phthalates that can leach into food.
4.	Low density polyethylene (LDPE)	• Take-away containers • Waterproof coating on milk cartons • Bags used for bread and frozen foods • Cling wrap	No known health hazards.

5.	Polypropylene (PP)	• Bottle caps • Yoghurt and margarine containers • Food storage boxes	No known health hazards
6.	Polystyrene (PS)	• Plastic cutlery • Drinking cups and yoghurt cups • Cups for hot coffee (polystyrene foam) • Lightweight trays used by supermarket to package and sometimes vegetables (polystyrene foam)	Researchers have investigated possible health risks from traces of styrene monomer. This risk seems to be low

7.	Polycarbonate	• Bottles for sauces and condiments • Babies' feeding bottles and infants' drinking cups • Reusable water bottles for cyclists and athletes	Polycarbonate can release BPA into food, especially when bottles are washed for reuse.

Food Chain Contamination and Health of Non-Human Species

Presence of plastic materials such as plastic bags in high concentrations may hamper the breathing passages as well as stomachs of large number of different species. Plastic bags entering the ocean look like jellyfish to the marine species. Turtles and dolphins ingest them considering them for food. Similarly, the livestock also consume it directly and indirectly due to its abundant presence in the environment. Even through this way, plastic reaches the food chain. The manufacturing process resulting into wrong disposal of wastes create toxic chemicals in the environment including water-resources. From environment, these chemicals reach the tissues of animals, ultimately entering the food chain for humans at last.

Anti-Plastic Movement

Governments and companies across the world are responding to deal with increasing challenges due to plastic use, disposal and management. More than 130 countries have enacted legislations on plastic bags.[8] Various countries have announced rules putting restrictions single-use plastics.[9] Imposing taxes or fees on waste-disposal by the governments on single-use plastics[10], or putting bans on plastic waste imports[11] are emerging trends. Efforts to reduce plastic pollution at regional as well as international levels continue.[12] Most of the nations have vowed to "meaningfully decrease" use of plastics by the end of 2030.[13] A growing number of governments are making efforts to become global environmental champions. Rwanda is a pioneer in prohibition

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[8] United Nations Environment Programme, Legal limits on single-use plastics and microplastics, Dec 2018, https://www.unep.org/resources/report/legal-limits-single-use-plastics-and-microplastics.

[9] Victoria Masterson, As Canada bans bags and more, this is what's happening with single-use plastics around the world, Oct. 2020, https://www.weforum.org/agenda/2020/10/canada-bans-single-use-plastics/.

[10] The United Kingdom and Ireland provide examples of taxes on single-use plastic bags. For details, see https://www.oecd.org/stories/ocean/taxes-on-single-use-plastics-186a058b.

[11] In 2018, China imposed bans on imports of plastic wastes. Turkey is going to do so in mid-2021.

[12] In October 2018, in collaboration with the UN Environment Programme (UNEP), the New Plastics Economy Global Commitment was launched. More than 450 organisations joined together with a common vision and a set of targets to deal with plastic waste and pollution at its source, by 2025. Signatories include companies representing 20% of all plastic packaging produced globally, governments, NGOs, universities, industry associations, investors, and other organisations. Members of World Trade Organization have used the Committee on Trade and Environment to disseminate information on domestic policies addressing plastic pollution. It also notified some measures affecting trade in plastics for environmental reasons under the WTO Technical Barriers to Trade (TBT) Agreement.

[13] 170 countries pledged in 2019.

of single-use plastic bags and amongst the sparkling nations on earth.[14] Kenya also joins the league.[15]

Policy tools		Features
Regulatory instruments	Ban	Prohibition of a particular **Type** or combination of single-use plastics (including plastic bags, foamed plastic products, etc.). The ban can be total or partial (for those of certain specifications, e.g. plastic bags <30µ thickness).
Economic instruments	Levy on suppliers	Levy paid by suppliers of plastic bags (domestic producers or importers). For such a tax to be effective in inducing behavioural change, it should be fully passed on from suppliers to retailers, enticing the latter to (i) charge consumers for plastic bags or (ii) offer a rebate/reward to consumers who do not ask for plastic bags, promoting the use of reusable ones.
	Levy on retailers	Levy to be paid by the retailer when purchasing plastic bags. The retailers are not obligated to convey the tax to the consumers.
	Levy on consumers	Charge on each bag sold at the point of sale; standard price defined by law.
Combination of regulatory and economic instruments	Ban and levy	Combination of ban and levy (for instance a ban on thin plastic bags and a levy on thicker ones)

Best Practices

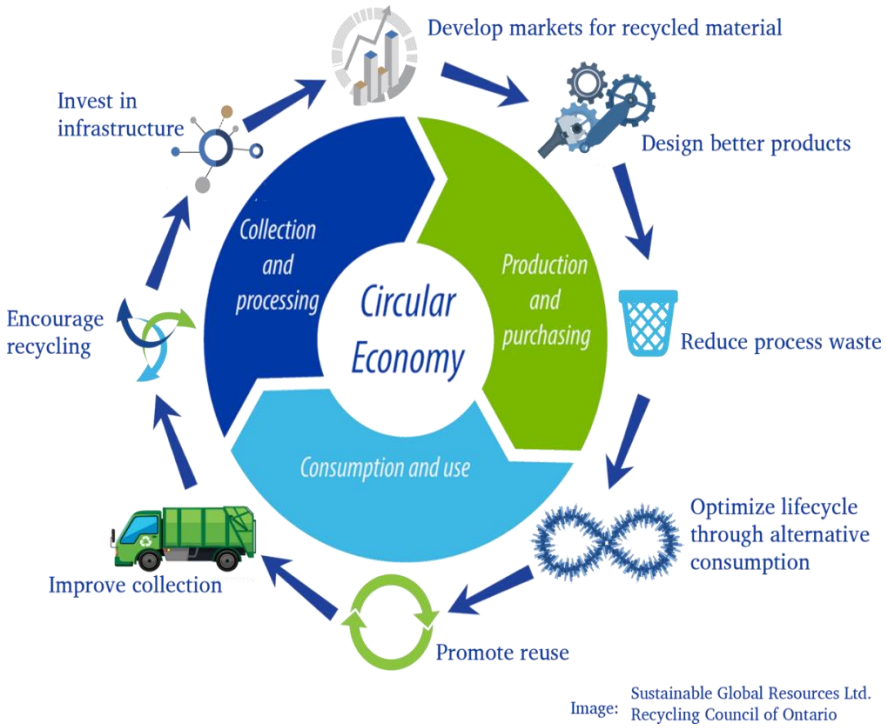
The adoption of Extended Producer Responsibility (EPR) and deposit-return schemes has fought successfully against the PET bottles and given boost to the recycling sector.[16] Japan, Germany and South Africa are among many positive examples where recycling of used PET bottles is

[14] Sunayana Samantaray, How Rwanda is leading the way in the fight against the plastic pollution crisis, January 2021, https://theveganreview.com/rwanda-leading-way-fight-against-plastic-pollution-crisis/.

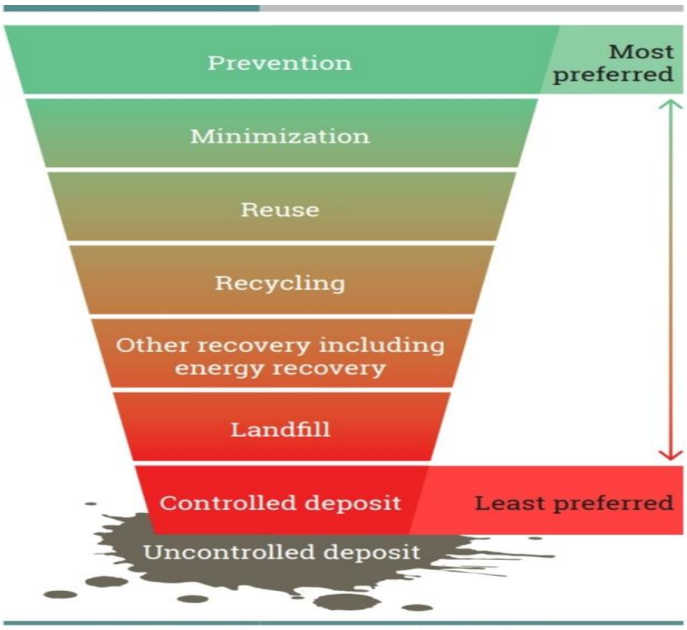
[15] Kenya bans single-use plastics in protected areas, June 2020, https://www.unep.org/news-and-stories/story/kenya-bans-single-use-plastics-protected-areas. It banned single-use plastic in protected natural areas in 2020.

[16] Thomas Parker, From Austria to Wales: The five best recycling countries in the world, Nov. 2020, https://www.nspackaging.com/analysis/best-recycling-countries/.

adopted by manufacturers at their own or under the provisions of laws.[17] In South Africa, the initiative led by the PET Recycling Company ($PETCO_2$) is a learning experience.[18]



[17] https://www.plasticstoday.com/recycling.
[18] For details, see https://petco.co.za/



Source: Global Waste Management Outlook, UNEP, 2015.

The above figures represent two most widely accepted approaches in the plastic pollution – Canada's Circular Economy and Waste Management Hierarchy.

Sum-Up

Humans are intaking the microplastics through food, seafood, inhaling them, and ingesting food with dash of its plastic packaging. The snowballing effect of all this consumption is toxic. Different types of plastic possess varying toxic properties. Accumulation of these toxins hampers the immune system. It is the high time not to treat plastic as a disposable material rather an imminent threat for each one of us. Adopting an all-inclusive approach founded on the "three Rs" – reduce, reuse and recycle is must. Plastic management, recycling and re-use must be emphasised simultaneously.

Suggestions

The most effectual mitigation approach is to start with reducing their input. Measures should be taken in accordance with the circular economy approach waste as well as management

hierarchy in order to lessen generation of plastic waste. This calls for improvement of the state of solid waste collection services, strengthening of the recycling industry. At the same time, safe disposal of waste has to be ensured.

- Governments with industry need to encourage the expansion and advancement of sustainable substitutes in order to move away from single-use plastics gradually.
- Governments can begin by giving economic incentives and support upscaling of single use plastics.
- Reusable bags as an option to plastic bags rests the choice with the consumer. It is capable of altering consumer behaviour and thereby reducing the use of conventional plastic carrier bags.

Plastics replacing the traditionally used materials

Product	Previous typical packaging material		Current typical packaging material	
Milk, edible oil	► Glass, metal		► 3 or 5 layer film pouches	
Toiletries (soap/shampoos)	► Paper, glass		► Plastic pouches or films	
Cement, fertiliser	► Jute		► PP/HDPE woven sack	
Toothpaste	► Metal		► Plastic lamitube	

It is inevitable that all of for us to soon shift from passive consumers to vigorous decision-makers with regard to plastic in our everyday lives.

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