

Plastic Pollution and Possible Solutions to the Overflow of Plastics in the World

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Abstract

Plastic pollution becomes more of a growing concern daily. Recycling is more expensive than making new plastics, and manufacturers require recycling incentives. This paper goes over how plastics graduated from being a resource to becoming a concerning pollutant, and some measures that could be implemented to control the overflow and revert the pollutant status of plastics. The plastics referred to throughout this paper refer to all plastic products.

Keywords: *Sustainability; Earth Sciences; Environmental pollution; Plastic Waste; Plastics*

Introduction

Plastic pollution has grown to become an increasing form of environmental pollution. Plastics have high strength-to-weight ratio, resistance to corrosion, good thermal and electrical insulators, ability to be moulded into various products, and amongst others durability [1]. In all its advantages, its low cost and ease to produce is what makes plastics so lucrative. Its durability and ease to produce, that were once seen as advantages, have quickly become one of the world's biggest problems, because degradation takes years and production continues daily [2]. Plastic pollution is an even bigger problem in developing countries where recycling and waste disposal is not seen as priority. In these countries their negligence to plastic pollution is not usually ignorance, but lack of infrastructure to deal with the issue. This is where developed countries are expected to lead by example, rather than using these countries as dump sites.

How Did Plastics Become a Problem?

Humans have the mindset of "out with the old, in with the new". This can be seen across different industries, and the discovery of plastics is a clear definition. Between 1950-2017 ~7 billion of the 9.2 billion tonnes of plastic produced ended up as waste in landfills or dumped [3]. This is not surprising, because plastic consumption is very evident in our society e.g., food packaging, industrial and household

fittings and fixtures, etc [1]. An assumption can be made that the rate of degradation was not considered when the mass production was going on.

The additives in plastic products are added to improve the plastics quality, and they are usually not chemically bound to the plastic polymer. One of which include the functional additive, plasticizers, responsible for durability of the polymeric films [4]. The plastics destined for landfill disposal still contain this additive which could account for the elongated degradation time.

The concept of residual waste was defined by the United Kingdom's Department for Environment and Rural Affairs, as a mixture of different things that costs the environment or economy more to further recycle them [5]. The economic side of this definition is arguable because on a national scale, resources are spent on things do not necessarily bring in immediate monetary profits, so why does the approach change when it comes to plastic clean up.

Possible Solutions to the Plastic Overflow Problem

Short of turning back the hand of time, some proactive measures could be taken to solve plastic pollution include Recycling plastics. Plasticizers characteristics (low molecular weight), gives them the potential to become food additives [4], and their ability to remain unbound, makes separating and substituting them into the plastics virgin materials

possible, during secondary and then primary recycling [4]. This ensures the residual waste lacks the durability element. This could be particularly useful for the primary recycling of PET (polyethylene terephthalate) plastics, which make up about 90% of plastic demand [1].

Plastics undergo different forms of resource recovery which include energy recovery or quaternary recycling, this is achieved by further recycling the waste products into energy form waste (EfW) [1]. When plastics are burned in the presence of oxygen, they emit carbon monoxide (CO) and carbon dioxide (CO₂). CO₂ can be used to produce fuels by dissociating the carbon and including methane, gasoline, and aviation fuels, making CO₂ derived fuels [6]. CO on its own can be used as fuel or to produce liquid hydrocarbon fuels by the addition of hydrogen, water, or both. By the addition of methanol to CO, automotive fuels could also be made [7].

With an increasing emphasis on a circular economy, plastics ability to be processed into energy form waste, solves the pre-consumer demand issue on plastic raw materials [8]. Through pyrolysis, waste plastic fuel (WPF) is produced, and to further create quaternary fuel blends, oxygenated additives are added, and these fuels possess better brake thermal efficiency, fuel consumption and reduced emissions [8]. This means machinery could be run sustainably on plastic waste, which would be particularly useful in the climate change fight. The machineries involved in the collection, transportation and processing of plastic waste could be run on plastic waste thereby improving the emission standards of recycling. Also, the emitted fumes (CO and other hydrocarbons) could undergo quaternary recycling again [6][7]. An improvement on this process would be engines that run on the plastic waste they directly collect, for instance, the landfill-clean-up machines would have the capacity to turn the plastic they clean up into useable fuels almost immediately and use these fuels to continuously run the engines without stopping the clean-up process, i.e., use the energy you produce, and the excess can be stored.

To control the demand on PET bottles, plastic manufactures could be incentivised into investing in water dispensers with options for the amounts of water to be dispensed after payment. The manufacturers could then divert their focus to the production of these specialised water dispensers and sustainable water bottles. These bottles could be sold

in stores, so in place of pre-filled plastic bottles, the different manufacturers are made to use the same mould to produce their water bottles or to use distinguishing moulds for the sake of branding, but all bottles must be compatible with all dispensers. For hygiene, safeguards can be inbuilt, and for the dispensing, the process could be modelled, how after payment, a compartment on the dispenser opens, and the compatible bottle is placed in, sterilized, and then filled up and sent out. Vending machines could inspire the model of these dispensers.

The plastic industry has the potential for economic benefits, whilst deterring the over production. This could be achieved by making plastic a luxury item, and the government charging the manufacturing companies huge taxes, whilst still leaving them within better profit margins. This should only be done after healthy and sustainable options have been provided to the public, like the dispensers. For example, the cost of making a plastic bottle range between 0.0122GBP – 0.0530GBP [9] and on a global scale the average cost of bottled water is 0.50GBP [10]. So, this price could be inflated based on the availability of plastic bottles. To balance the scales the government charge plastic companies' heavy taxes and set schemes to check corruption. The inflation prompts companies to implement massive recycling schemes, which makes plastic waste a lucrative resource. This is essential because plastic manufacturers have little incentive to recycle because of the cost of recycling in comparison to making new plastic [11]. Plastics could become subsidized as scarcity arises. This solution has a lot of foreseeable problems just like any other lucrative industries, like the inclusion of plastics in the black market, like in Kenya [12], and other plastics related crimes including corruption and theft. Also, treating recycling as an industry worthy of investment, not for direct monetary profit but creating a more habitable planet for all ecosystems.

Conclusion

Plastics have proven to be a very useful resource, but in surplus, a dangerous pollutant. To make significant change in plastic pollution, the use of plastic waste and recycled plastics as alternatives in various industries is to be researched extensively, and people need to be encouraged to be conservative with plastics. Significant victories in the fight against plastic pollution are more possible when the government and plastic manufacturers are incentivised to care.

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