The Impacts of Plastics

Plastic pollution and overproduction have increasingly become driving environmental issues for activists, consumers, and nonprofits over the past several years.

While plastic has many benefits, it's crucial to balance these advantages with efforts to mitigate its negative impacts. Both the production and the littering of plastic are on an upward trajectory. Annual plastic production currently stands at roughly 400 million tons, and this is expected to double by 2040 if action is not taken.[1] Due to the high growth of plastics manufacturing around the globe and the negative impacts on the environment from both the manufacturing of plastics and plastic waste, there is an emerging need for environmentally friendly alternatives, better product design, and efforts to improve waste management.

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Environmental Impact

Increased plastic production has dire implications for climate change. Almost all plastic currently produced—98%—is virgin plastic made from fossil fuels. The production of plastic generates greenhouse gas (GHG) emissions at several stages, from oil drilling to transportation, crude distillation, monomerization, and polymerization processes where high heating temperatures are utilized. According to the OECD Global Plastics Outlook report, in 2019, plastics accounted for 8% to 10% of oil production and generated 1.8 billion tons of GHG emissions—3.4% of global emissions—with 90% of these emissions coming from their production and conversion from fossil fuels.[2] By 2040, it's predicted that lifecycle GHG emissions from plastic will account for 19% of the global carbon budget.[3]

On the other hand, plastics have brought enormous benefits due to their versatility, low weight, and advanced uses in the service of science and technology. Plastic packaging results in better food conservation and longer shelf life, which can help avoid food waste and reduce the release of GHGs from organic decomposition in landfills.
Plastics are integral to many medical devices and instruments, and they are valued for their sterility, durability, and cost-effectiveness.

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A central problem that needs to be addressed to optimize the utility of plastics while minimizing their negative impacts is end-of-life (EOL) treatment. According to the OECD, 19% of plastic waste is incinerated, 50% ends up in landfill, and 22% evade waste management systems and goes into uncontrolled dumpsites, is burned in open pits, or ends up in terrestrial or aquatic environments, especially in low-income countries.[4]

According to the OECD, only 9% of plastics are recycled (another 6% is collected for recycling but discarded as residues).[4] Of all macroplastics (plastics larger than 5 mm in diameter, including common items like water bottles and straws) found in the natural environment, the majority—73.4%—is due to mismanaged waste treatment.[5] Plastics break down into micro-plastics that contaminate soil, water, and air. These microplastics are ingested by wildlife and can enter the food chain, affecting both animal and human health. The accumulation of plastics can disrupt natural processes. For example, plastic debris can smother coral reefs, which are crucial for marine biodiversity.

GHGs and other harmful gases are also generated when plastic waste is burned openly or incinerated. The fossil carbon that has been stored in oil, natural gas, and coal is then released into the atmosphere as carbon dioxide (CO_2). According to a Center for International Environmental Law report, the open burning of one kilogram of plastic waste emits approximately 2.9 kg CO_2eq, and even incineration with energy recovery has a net carbon footprint of 0.9 kg CO_2eq. [6]

Social and Health Impacts

Plastic's negative impact on communities and human health cannot be overstated. Plastics are often single-use and not biodegradable, creating significant challenges for waste management systems.

Many countries struggle with the sheer volume of plastic waste. Most plastic waste management technologies result in the release of metals, organic substances, and other toxins into the air, water, and soil.

Plastics can leach harmful chemicals, such as bisphenol A and phthalates, which are known to have adverse health effects, including endocrine disruption. Exposure to chemicals commonly found in plastic can cause a wide range of health problems, from cardiovascular disease to neurodevelopmental disorders.[3]

Economic Impact

The production of plastic relies on fossil fuels, contributing to resource depletion and environmental degradation. The World Wide Fund for Nature found that the lifecycle costs of plastic—from the costs incurred as a result of plastic production's GHG emissions to the costs of waste management—are eight times higher for low- and middle-income countries (LMIC) than for high-income countries.[7]

At the same time, the per capita consumption of plastic in high-income countries is almost three times higher than in LMIC,[7] and LMIC are often left to deal with plastic waste that washes up onshore or is imported (legally or illegally) from high-income countries. This underscores the need for local waste management solutions. The costs of cleaning up plastic pollution are substantial. Governments and organizations spend billions annually on waste management and cleanup efforts.

Solutions

Given the systemic nature of the problem, addressing the impacts of plastic requires a multi-faceted approach involving policy changes, technological innovations, and shifts in consumer behavior. Negotiations are underway for a global treaty to address the lifecycle impacts of plastic, from design to waste management. Efforts are being made to improve plastic recycling processes and develop biodegradable alternatives, and innovations in materials science are aimed at reducing the environmental footprint of plastics.

Sustainable alternatives such as UBQ™ also have a role to play. This bio-based thermoplastic, made from residual household waste, is an efficient EOL solution that can replace plastics on a one-to-one basis.

Reductions in packaging use, reuse models, and increased (and improved) recycling will all need to be a part of the solution.[8] Many regions are implementing regulations to reduce plastic use, such as bans on single-use plastics and initiatives to promote reusable options.

Extended producer responsibility and minimum recycled content requirements are some of the regulations that are being applied to enhance recycling systems and help reduce plastic production.

Sustainable alternatives such as UBQ™ also have a role to play. This bio-based thermoplastic, made from residual household waste, is an efficient EOL solution that can replace plastics on a one-to-one basis. This addresses two major issues, simultaneously avoiding the GHG emissions associated with virgin plastic production and recovering the untapped value of hard-to-recycle plastic waste. What's more, UBQ's factories can be located near where waste is generated, allowing it to be managed locally—and responsibly—rather than shipped out of sight to become another country's pollution.

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