How is plastics material to different sectors?

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Apparel

How is plastics material to the apparel sector?

The apparel industry faces reputational damage due to its significant consumption of resources and the millions of clothes that end up in landfills every year. Synthetic fibres represent 69% of textiles. This percentage is predicted to rise to 73% by 2030[1]. Synthetic fabrics often use complex textile blends that inhibit circularity. Changing Markets Foundation highlighted the lack of progress that has been made by the fashion industry to reduce its heavy reliance on synthetic fabrics. Apparel companies may also use plastic packaging, the most wasteful and polluting application of plastic[2].

Every time textile garments are used or washed, they shed millions of plastic microfibres which pass through wastewater treatment plants and end up in the ocean. In fact, the apparel sector is one of the major contributors of microplastic pollution in marine ecosystems[3]. Due to microplastics' larger surface area to volume ratio relative to macroplastics, microplastic pollution can absorb persistent, bioaccumulative, toxic chemicals which may be ingested by organisms and accumulate up the food

[1] Changing Markets Foundation (2023). Synthetics Anonymous 2.0: Fashion's persistent plastic problem • Changing Markets

[2] World Economic Forum (2020). How sustainable packaging can reduce plastic waste | World Economic Forum (weforum.org)

[3] Ellen MacArthur Foundation (n.d.). Redesigning the future of fashion.

chain[4]. There is growing evidence that endocrine disrupting chemicals in plastics and other sources pose risks to human health[5].

Biotech, Health Care & Pharma

How is plastics material to the Biotech, Health Care & Pharma sector?

Plastics – usually single-use and disposable – are ubiquitous in the medical sector owing to their high versatility. The COVID-19 pandemic caused a growing demand for single-use plastics, and the environmental presence of plastic personal protective equipment is an emerging source of plastic pollution[6]. Common medical applications of plastics include sterilization wrap, irrigation bottles, basins, pitchers, trays, Tyvek, and flexible clear packaging.

Plastic accounts for at least 20% of medical waste, which is often disposed of in landfills rather than recycled[7]. Medical plastic recycling is challenging due to lack of knowledge about recyclability, poor labelling of plastic products with recycling classification symbols, and difficulties involved in sorting and cleaning[8].

Food, Beverage & Agriculture

How is plastics material for the Food, Beverage & Agriculture sector?

Plastics have become ubiquitous in agrifood systems due to their low cost and adaptability. Examples include mulch films, irrigation pipes, fishing nets, and coatings on fertilizers, pesticides, and seeds. These agricultural plastic products, which are often single-use, can degrade into microplastics and contaminate soil and aquatic ecosystems, posing a threat to human and environmental health and agricultural productivity. Microplastic pollution has the potential for bioaccumulation, as well as the risk of carrying other contaminants, like pesticides, which can also enter the food chain. The FAO has suggested that the land we use to grow our food is contaminated with large quantities of plastic pollutants[9], and the IUCN suggests that macroplastic pollution from lost fishing nets constitutes a significant proportion of yearly marine plastic leakage[10].

Plastic packaging for food and beverage products is a major source of pollution. Packaging is the most

[4] Chemtrust (2015). Chemical pollution and microplastics: a present danger to marine life.
[5] Endocrine Society (2024). Latest Science Shows Endocrine Disrupting Chemicals in Plastics, Pesticides, and Other Sources Pose Health Threats Globally | Endocrine Society
[6] Ammendolia et al (2021). An emerging source of plastic pollution: Environmental presence of plastic personal protective equipment (PPE) debris related to COVID-19 in a metropolitan city.
[7] Azouz et al (2019). Managing barriers to recycling in the operating room - ScienceDirect
[8] Blessy et al (2021). Recycling of medical plastics.
[9] FAO (2021). Assessment of agricultural plastics and their sustainability: A call for action.
[10] IUCN (2020). The marine plastic footprint.

wasteful and polluting application of plastic. Plastic items from take-out food and beverages dominate global litter, followed by those from fishing activities[11]. Plastics Europe reports that agriculture, farming, and gardening products contained only 25.4% post-consumer recycled content in 2021[12]. There is growing evidence that endocrine disrupting chemicals in plastics and other sources pose risks to human health[13].

Awareness campaigns like Client Earth's legal warnings[14] and Break Free from Plastic's (BFFP) Brand Audit Reports pose significant reputational risks to food, beverage, and tobacco companies. BFFP's Branded report[15] summarized the thousands of audit events that took place across the globe from 2018-2022 and found that smoking materials and food and beverage packaging were the most common items of plastic pollution across all regions. The World Health Organization states that tobacco products are the most littered item on the planet[16]. Disposable single-use e-cigarettes/ vapes are made from a mixture of materials and therefore difficult to recycle[17].

Fossil Fuels

How is plastics material for the Fossil Fuels sector?

Petrochemicals that are derived from fossil feedstocks form the building blocks of 90% of all plastics[18]. Currently about 4% of annual total use of oil and gas globally is for plastic production[19]. The global response to climate change will reduce demand for fossil fuels in the transportation and energy generation sectors, which will cause petrochemical companies to invest more in plastics production. This is expected to drive half of oil demand growth between now and 2050[20]. The World Economic Forum predicts plastic production will double in the next 20 years[21]. This move away from transportation and energy generation and towards plastic production has been widely publicized and poses a significant reputational risk to petrochemical companies undertaking this controversial transition. The Minderoo Foundation has published a list of 100 petrochemical companies that produce 90% of all single-use plastic waste generated globally[22].

Minderoo Foundation found that recycling is failing to scale fast enough and remains a marginal activity

[11] Morales-Caselles et al (2021). An inshore–offshore sorting system revealed from global classification of ocean litter.
[12] Plastics Europe (2022). Plastics – the facts 2022.
[13] Endocrine Society (2024). Latest Science Shows Endocrine Disrupting Chemicals in Plastics, Pesticides, and Other Sources Pose Health Threats Globally | Endocrine Society
[14] Client Earth (2022). We've issued legal warnings to Nestlé, Danone and others over plastic.
[15] BFFP (2022). Branded: five years of holding corporate plastic polluters accountable.
[16] WHO (2022). Tobacco: poisoning our planet.
[17] Greenpeace (2024). Are disposable vapes bad for the environment? | Greenpeace UK
[18] Plastics Europe (2022). Plastics – the facts 2022.
[19] British Plastics Federation (2019). Oil Consumption.
[20] Client Earth (2020). Big Oil's Plan B: Plastic.
[21] WEF (2016). The New Plastics Economy: Rethinking the future of plastics.
[22] Minderoo Foundation (2022). Plastic Waste Makers Index: Top 100 Polymer Producers.

for the plastics sector. Minderoo Foundation found that from 2019-21, growth in single-use plastics made from virgin polymers was 15 times that from recycled feedstocks. Across all polymers and technologies, only 3 MMT of additional on par recycling capacity is expected to be brought online by 2027 (0.7 MMT by the petrochemical industry)[23].

'Cancer Alley', is the nickname given to an 85-mile stretch of the Mississippi River, where communities live on the frontlines of 200 fossil fuel and petrochemical operations. Residents of Cancer Alley face severe health consequences including elevated risks of cancer, reproductive, maternal, and newborn health harms, and respiratory ailments[24].

Hospitality

How is plastics material for the Hospitality sector?

Plastic packaging plays a significant role in the hospitality and food service industries and many of the plastic items used in these sectors are single-use[25]. Indeed, plastic packaging is the most wasteful and polluting application of plastic. Examples of single-use plastics in hospitality may include food packaging, water bottles, coffee cups, toiletries, and laundry bags. 'Back of house' uses of plastic include packaging, cling film, plastic cups, single-use wipes, gloves, and masks[26]. These plastic products are generally not captured for recycling and end up in landfill, incineration, or as pollution in the natural environment. The contribution of the hospitality sector to plastic use and pollution is becoming more widely recognized. The UK Plastics Pact urges the hospitality sector, among other sectors, to set ambitious targets for reducing plastics impacts at all levels of the supply chain[27]. Companies connected with the tourism industry may contribute to plastic pollution. Plastic waste damages the aesthetic of tourist destinations, resulting in major economic costs and losses in tourism-related incomes[28]. During peak tourist season, marine litter in the Mediterranean region was found to increase by up to 40%[29]. WWF Tourism Industry Call to Action is a useful resource for tourism companies seeking to reduce their plastics-related environmental impacts.

[23] Minderoo Foundation (2022). Plastic Waste Makers Index - Minderoo Foundation
[24] Human Rights Watch (2024). "We're Dying Here": The Fight for Life in a Louisiana Fossil Fuel Sacrifice Zone | HRW
[25] WRAP (n.d.). Hospitality and food service.
[26] Sustainable Hospitality Alliance (2021). Single-use plastic factsheet.
[27] WRAP (2022). A Roadmap to 2025: The UK Plastics Pact.
[28] WWF (n.d.) Industry Specific Call to Action (worldwildlife.org)
[29] One Planet Network (2024). Tourism's Plastic Pollution Problem | One Planet network

Infrastructure

How is plastics material for the Infrastructure sector?

Well-developed waste management is essential to reducing leakage of plastic into marine, aquatic, and terrestrial environments. Infrastructure companies play an important role in the circulation of materials back to cooperating firms[30]. But at present, conventional grey infrastructure does not adequately address circular economy requirements and plastic pollution issues. Minderoo Foundation states that only 3 MMT of additional on par recycling capacity is expected to be brought online by 2027[31]. Plastics Europe reports that plastic waste recycling rates are 13 times higher when collected separately compared to mixed waste collection schemes[32].

The majority of marine macroplastic pollution comes from coastal mismanaged waste, and an additional 2 MT per year of marine macroplastic pollution comes from inland mismanaged waste[33]. Microplastic leakage is also pervasive and tends to be released through household wastewater and road run-off, passing through treatment systems and ending up in aquatic environments.

Construction was one of the largest applications of plastics globally in 2021. In the construction industry, plastic is used for seals, pipes, cables, flooring, and insulation, as well as plastic films for packaging. Post-consumer recycled plastics accounts for only 18.1% of all building and construction products[34].

Manufacturing

How is plastics material for the Manufacturing sector?

Packaging is the largest applications of plastics globally, using 44% of all plastics. It is the most wasteful and polluting application of plastic. Post-consumer recycled plastics account for only 8.5% of all packaging[35]. Flexible packaging is the fastest growing plastic packaging category and is mostly single-use with very low recycling rates and high leakage rates[36].

Automotives account for 8% of global plastics applications, electrical & electronics account for 7%, and household, leisure, and sports, for 7%[37]. These non-packaging applications of plastics can be challenging to recycle due to mixed materials within complex products and the presence of additives

[30] UNEP (2021). Future-proofing Infrastructure to address the climate, biodiversity and pollution crises.
[31] Minderoo Foundation (2022). Plastic Waste Makers Index - Minderoo Foundation
[32] Plastics Europe (2022). Plastics – the facts 2022.
[33] IUCN (2020). The marine plastic footprint.
[34] Plastics Europe (2022). Plastics – the facts 2022.
[35] Plastics Europe (2022). Plastics – the facts 2022.
[36] Ellen MacArthur Foundation (n.d.). Flexible packaging.
[37] Plastics Europe (2022). Plastics – the facts 2022.

that are hazardous or may reduce the cost-effective reuse of materials[38].

Tire abrasion is estimated to be one of the biggest sources of microplastic pollution[39]. UNECE has agreed on the first-ever methodology to measure tire abrasion[40].

Materials

How is plastics material for the materials sector?

Petrochemicals that are derived from fossil feedstocks form the building blocks of 90% of all plastics, therefore companies that convert fossil feedstocks into polymers, or produce, commercialize, and/ or use plasticizers and other additive chemicals play a significant role in marine plastic pollution. There is growing evidence that plastics and chemical additives have negative impacts on human health. PlastChem report found that over 16,000 chemicals are used or present in plastics and of the 5,800 that have been tested, 73% are hazardous[41].

The global response to climate change will reduce demand for fossil fuels in the transportation and energy generation sectors, which will cause petrochemical companies to invest more in plastics production. The World Economic Forum predicts plastic production will double in the next 20 years[42]. This move away from transportation and energy generation and towards plastic production has been widely publicized and poses a significant reputational risk to petrochemical companies undertaking this controversial transition. Minderoo Foundation has published a list of 100 petrochemical companies that produce 90% of all single-use plastic waste generated globally[43].

Plastic pellets, or nurdles, can be released into the environment from plastic plants or during shipping. This form of plastic pollution can absorb persistent, bioaccumulative, toxic chemicals which may be ingested by organisms and accumulate up the food chain[44]. Each year an estimated 445,970 tonnes of nurdles enter the environment worldwide[45]. Nurdle spills have devastating ecological impacts and pose a reputational risk to organizations involved in the production and/ or transportation of plastic pellets[46].

Plastic ingredients and microbeads are also applied in a variety of personal care and cosmetics products (PCCPs), such as deodorant, shampoo, insect repellent, and baby care products. Plastic ingredients in PCCPs are poured down the drain after use, and therefore cannot be collected for

[38] European Environment Agency (2022). Managing non-packaging plastics in European waste streams – the missing part of the plastic puzzle.
[39] Tamis et al (2021). Environmental risks of car tire microplastic particles and other road runoff pollutants | Microplastics and Nanoplastics | Full Text (springeropen.com)
[40] ETRMA (2024). UNECE agreed on first-ever methodology to measure tyre abrasion - ETRMA
[41] PlastChem (2024). https://plastchem-project.org/
[42] Plastics Europe (2022). Plastics – the facts 2022.
[43] Minderoo Foundation (2022). Plastic Waste Makers Index: Top 100 Polymer Producers.
[44] Chemtrust (2015). Chemical pollution and microplastics: a present danger to marine life.
[45] Galgani and Rangel-Buitrago (2024). White tides: The plastic nurdles problem - ScienceDirect
[46] McVeigh (2021). Nurdles: the worst toxic waste you've probably never heard of.

recycling. These plastic ingredients pass through wastewater treatment systems and are then emitted via raw sewage, treated effluents, landfilled, or dumped at sea[47].

Mineral Extraction

How is plastics material to the mineral extraction sector?

There are many applications of plastics in the mineral extraction/ mining sector, including acrylic, HDPE, and PC sheeting, PVC pipes for waste transfer, and UHMW-PE in sheaves, gears, and other components[48].

Power Generation

How is plastics material to the power generation sector?

Plastics are commonly used the power generation sectors, for example in wind turbines, solar panels and wave booms[49]. Plastics that are difficult or expensive to recycle may go through a process of energy recovery. This is where combined heat and power recovery plants (CHP plants) use plastics waste and other types of waste to generate energy[50]. Waste incineration produces greenhouse gas emissions, for example, in 2016, US waste incinerators released the equivalent of 12 million tons of carbon dioxide, more than half of which came from plastics[51]. The incineration of plastic is a highly carbon-intense source of electricity[52].

Retail

How is plastics material to the retail sector?

Packaging is the most wasteful and polluting application of plastic and has become ubiquitous in retail supply chains due to its low cost and adaptability, e.g. in processing, packaging, distribution, and

[47] UNEP (2015). Plastic in cosmetics: Are we polluting the environment through our personal care? Fact sheet.
[48] A&C Plastics Inc. 5 popular types of plastic for mining applications.
[49] British Plastics Federation. Plastics applications.
[50] Plastics Europe. Recycling and energy recovery.
[51] EPA (2016). Inventory of U.S. Greenhouse Gas Emissions and Sinks.
[52] Greenpeace (2022). The Big Plastic Count Results.

retailing. An estimated 37% of food sold in the EU uses plastic as a packaging material[53], and grocery retailers are especially dependent on single-use plastic packaging. Public concern about the plastic pollution crisis constitutes a significant reputational risk for retailers; a poll found that 85% of people in the UK want the government to make retailers cut the amount of plastic packaging they use[54]. WWF Retail Industry Call to Action encourages retail companies to join plastics-related initiatives, implement reuse systems wherever possible, and eliminate single-use plastic bags and packaging[55].

Services

How is plastics material to the services sector?

Service providers should consider which plastic products they use to deliver their services. For example, a company may use plastic packaging when serving customers or may require plastic furniture as part of their service offering.

Service providers such as accommodation providers, tour operators, and those connected with the tourism industry may contribute to plastic pollution. Plastic waste damages the aesthetic of tourist destinations, resulting in major economic costs and losses in tourism-related incomes[56]. During peak tourist season, marine litter in the Mediterranean region was found to increase by up to 40%[57]. WWF Tourism Industry Call to Action is a useful resource for tourism companies seeking to reduce their plastics-related environmental impacts.

Transportation Services

How is plastics material to the transportation services sector?

Plastic pellets, or nurdles, can be released into the environment from plastic plants or when shipped to factories. Each year an estimated 445,970 tonnes of nurdles enter the environment worldwide[58]. Nurdle spills have devastating ecological impacts and pose a reputational risk to organizations involved in the production and/ or transportation of plastic pellets[59].

Microplastic pollution can absorb persistent, bioaccumulative, toxic chemicals which may be ingested

[53] Rethink Plastic Alliance (2022). What the EU can do to support the grocery retail sector in reducing packaging and plastic pollution: Policy Briefing.
[54] Greenpeace (2021). Trashed: How the UK is still dumping plastic waste on the rest of the world.
[55] WWF (n.d.). Industry Specific Call to Action (worldwildlife.org)
[56] WWF (n.d.) Industry Specific Call to Action (worldwildlife.org)
[57] One Planet Network (2024). Tourism's Plastic Pollution Problem | One Planet network
[58] Galgani and Rangel-Buitrago (2024). White tides: The plastic nurdles problem - ScienceDirect
[59] McVeigh (2021). Nurdles: the worst toxic waste you've probably never heard of.

by organisms and accumulate up the food chain[60].

[60] Chemtrust (2015). Chemical pollution and microplastics: a present danger to marine life.