iJournals: International Journal of Social Relevance & Concern (IJSRC)
ISSN:2347-9698, ijournals.in/ijsrc
Volume 12 Issue 10, October 2024

Sustainable Fashion and Fast Fashion: The Environmental Impact of The Fashion Industry

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Abstract

As the fashion industry develops, naturally, more designs and trends develop. This led to an expansion of the fast fashion industry, and larger environmental impact. Because of the nature of the fast fashion industry, where trend and quantity is prioritized over quality, the fashion industry has evolved into the second largest contributor to environmental pollution. This paper addresses the environmental issues caused by the fashion industry and proposes the newapproach to reduce the negative impact.

Keywords: Sustainable Fashion, Slow Fashion, Fast Fashion, Environment, GovernmentPolicies

1. Introduction

Currently, the entire world is grappling with global warming. According to the report, hot extremes, heavy precipitation, and drought are dramatically increasing all around the globe (IPCC). These are due to the increase in global average surface temperature by 1 degrees Celsius (Lindsey and Dahlman). Although this may seem trivial at the moment, this change has a huge impact on human beings. Increase in the temperature leads to extreme climates, which can lead to severe drought and precipitation as mentioned earlier. Extreme climates result in floods, forest fires, agricultural failures, and habitat losses. Temperature rise also causes the snow cover and ice caps in Antarctica to melt, which raises the sea level, causing habitat and drinking water loss. As such, global warming is creating a lot of changes and issues nowadays. Now the most important part is, humans are the cause of these harms. Four major contributing factors of the greenhouse effect are carbon dioxide, methane, nitrous oxide, and chlorofluorocarbons (NASA).

These greenhouse gas emissions are increasing exponentially due to human activities such as excessive natural consumption, environmental destruction, lack of awareness about the importance of nature, and uninformed waste disposal. Industrial activities are the major cause of the sudden increase in greenhouse gasses: the atmospheric carbon dioxide level has increased by 50% since 1750, after the industrial revolution (Friedlingstein et al.). Consequently, with global warming and climate change being the trending topics, a lot of industries are shifting their gears to sustainability. The fashion industry, which is the second largest polluting industry, is not an exception (Niinimäki et al.). Recently, eco-friendly production, retailing, and manufacturing have become the standard of product selection to many customers. Following this change in consumer behavior, a lot of fashion brands are putting sustainability into consideration during their designing, producing, and selling process. These brands are called sustainable fashion brands.

2. Environmental Impact of Fast Fashion

2.1. Textile Waste

Fast paced fashion trends encourage people to plow over their whole entire wardrobe every other month. Global apparel consumption is estimated at 62 million tons annually, and with this rate, is predicted to reach 102 million tonnes by 2030 (The World Bank). Similarly, clothing production doubled since the 20th

century, which unfortunately contributed to an exponential increase in preproduction and postproduction textile waste (Ellen MacArthur Foundation). Because the trend keeps changing, people purchase clothes more often, leading to an increase in fashion goods purchases by 60% since 2000 (Lang et al.). Unfortunately, this huge amount of clothes purchased are not kept long enough in individuals' closets. About 39 million tons of textile are being wasted annually after the purchase by consumers (Gupta et al.). The fashion industry is considered one of the most polluting industries, emitting 1.2 billion tons of CO2 annually throughout its entire lifecycle (*Ellen MacArthur Foundation)*. It is also one of the most water-intensive sectors. An estimated 73% of produced clothing ends up in landfills or incinerators, with only 15% being recycled into new clothing or downcycled into cleaning cloths or insulation materials(*Ellen MacArthur Foundation)*. Fashion revenue is expected to grow at an annual rate of 8.4% by 2024 ("Fashion - Worldwide | Statista Market Forecast")As fast fashion prioritizes affordability, the average clothing life is shortening continuously. From 2012 to 2017, the average lifespan of a piece of clothing decreased by 36% (Ellen MacArthur Foundation). Hence, more people are frequently disposing of textiles due to unsatisfying quality, infrequent wear, and the lack of room for new purchases (Lang et al.). This data highlights the impact of the fast fashion industry on the waste disposal, and eventually global warming. In addition, pre-consumer textile waste, or the production textile waste, should not be overlooked. These wastes include fabric scraps, offcuts, and defective products that never make it to the consumer market. Approximately 15% of the fabric intended for clothing ends up as residue of textile waste after the pattern cutting process (Niinimäki et al.). Deadstocks, which are unsold clothes, contribute significantly to this problem. For instance, 21 million clothes ended up not being sold in the Netherlands in 2015, Burberry burned over $96 million worth of unsold goods for five years until 2018, and $4.3 billion were unsold in H&M (Niinimäki et al.). Together, the fashion industry globally generates approximately 92 million tons of textile waste every year (Ellen MacArthur Foundation), and 17 million tons of textile waste in the United States alone (EPA).

Out of disposed garments, 57% end up in landfills while only 18% find their new purpose (Gupta et al.). Encouraging sustainable fashion can address these issues effectively. By using sustainable fibers, such as Lyocell or protein fibers, the environmental impact can be reduced as it minimizes the use of chemicals and water during production (Bick et al.). One example of sustainable fabrics is Lyocell, which is made out of bamboo cellulose. Lyocell exemplifies a sustainable approach by using a closed loop production cycle. This cycle recycles 99% of chemicals used in developing fabric fibers (Bick et al.). By utilizing such environmentally friendly textile resources, it is possible to reduce textile waste and mitigate environmental pollution effectively.

2.2. Water Pollution

This outrageously large amount of textile waste is not even the only waste produced in the fashion industry. The production of textiles also creates a significant amount of water pollution. According to the news article, 1.3 trillion gallons of wastewater is generated annually for textile dye (Cairns). All the fabric dyeing, and treatment alone make the fashion industry responsible for discharging approximately 20% of the world's industrial water pollution. (The World Bank). The fashion industry uses around 8000 synthetic chemicals during the manufacture, which are disposed of through water (Nimkar). This wastewater that contains harmful chemicals are then released untreated, which pollute freshwater resources such as rivers and streams. These chemicals containing water may negatively impact the local agriculture by irrigating and contaminating crops with chemicals (Bandera). The fashion industry not only pollutes water but also consumes a substantial amount of water. Annually, it consumes 79 trillion liters of water in total and 200 tons of water for one ton of textile production (Niinimäki et al.). Most of this water usage is from the cotton cultivation, bleaching, dyeing, printing, and finishing the textile (Niinimäki et al.). Surprisingly, this water usage reduces groundwater and drinking water available in the region. Around 7% of the water loss caused by the water use is caused by the textile and fashion industry (Niinimäki et al.). Thus, the importance of ensuring an affordable and stable water supply cannot be overstated. According to the research, methods such as supercritical fluids and ultrasound-assisted processes, plasma technology, laser finishing, UV radiation

treatment, gamma ray irradiation, and ozone application are being researched for textile manufacturing to reduce water usage (Oinam Roselyn Devi and Laimayum Jogeeta Devi).

Several advanced technologies are currently being researched to minimize water usage in fiber manufacturing processes, thereby contributing to the reduction of textile waste. Supercritical fluid technology utilizes fluids such as carbon dioxide under specific temperature and pressure conditions to penetrate dyes into fibers, acting as both liquid and gas. This method significantly reduces water consumption and pollution compared to conventional methods.

Ultrasound-assisted processes treat fibers with ultrasound to reduce water usage and enable more efficient application of dyes and chemicals. Additionally, plasma technology, laser finishing, UV radiation treatment, gamma ray irradiation, and ozone application enhance surface treatments and dye adherence on fibers, further minimizing water usage and improving production efficiency through eco-friendly approaches. These technologies collectively aim to decrease water consumption and mitigate environmental pollution in fiber manufacturing.

2.3. Microplastics

Microfibers or microplastics released from the fabric are one of the major reasons for the water pollution caused by the fashion industry. Given that microplastics are smaller than 5 millimeters in size, it is extremely difficult to filter out through the water treatment plants (Mungiu). Every year, there are as much microplastics getting off of a piece of clothing as 50 billion plastic bottles, which is 30% of the plastics ending up in the ocean (Mungiu). 35% of these microplastics or 500,000 tons of microfibers originated from textile fibers like polyester are released after washing them (Oinam Roselyn Devi and Laimayum Jogeeta Devi). Unfortunately, these microplastics released in the ocean are consumed by marine animals because they are oftenmistaken for food (Mungiu). They have been found in freshwater, marine environments, tap water, beer common salt, and seafood (Oinam Roselyn Devi and Laimayum Jogeeta Devi).

Microplastics consumed have devastating effects ranging from ending up to humans and piling up in our body, to killing those marine animals. This is critical to pay attention to as these microplastics may contain contaminants such as pesticides and industrial chemicals, which has harmful impacts on living organisms (Mungiu). Natural fibers, although biodegradable, can have a negative impact as they still carry harmful chemicals and dyes (Oinam Roselyn Devi and Laimayum Jogeeta Devi). Hence, addressing microfiber pollution and researching its ecological and health impacts is crucial. Researchers are currently developing microplastic detection techniques in wastewater treatment plants. The system detects microplastics by sampling, pretreating samples, and characterizing/quantifying the microplastics (Mungiu). Fortunately, the recent efficiency of the wastewater treatment plants is over 88% without the secondary treatment, and over 97% with the secondary treatment (Mungiu).

2.4. Air Pollution

Manufacturing garments also produce air pollution. Surprisingly, the fashion industry alone accounts for about 10% of the carbon emitted each year in the world (The World Bank), which is approximately 4 to 5 billion tons (Niinimäki et al.). This is more carbon emissions than all international flights and shipping by ocean together. At this rate, by 2030, the fashion industry will be responsible for more than half of all greenhouse gas emissions (The World Bank).

Additionally, according to the research conducted by McKinsey, the fashion industry emitted approximately 2.1 billion metric tons of greenhouse gases in 2018 (Berg et al.). Textile manufacturing, especially in regions with high reliance on coal-based energy such as China, has high energy use and poor energy source. Because of this, China emits 40% more carbon through the textile industry than in Turkey and Europe (Niinimäki et al.). Carbon

dioxide emissions in the fashion industry include shipping, textile manufacturing, consumer use, and more, but the biggest sector of the carbon emission is the initial fiber extraction (Niinimäki et al.). Synthetic fibers such as acrylics, emit a large quantity of carbon during the fiber extraction process as they originate from fossil fuels (Niinimäki et al.). Moreover, because of intensive agricultural practices, conventional cotton emits 3.5 times more carbon dioxide than organic cotton (Niinimäki et al.). The downside is that organic cotton produces more water than conventional cotton production (Niinimäki et al.). Similarly, although natural fibers generally have a lower carbon footprint than synthetic fibers, the energy demands during garment use such as laundering, drying, and ironing can offset the advantage of the natural fibers. As such, there are ups and downs in each material and method choices.

3. Solution to Fast Fashion Industry

3.1. Current System of the Fast Fashion Industry

The fast fashion industry, characterized by its rapid production and distribution of new clothing, entails extremely high energy consumption and resource usage. Due to the industrial scale of these operations, fast fashion brands rely on large-scale boilers, thermal packs, and diesel generators to run their factories, consuming significant amounts of energy. The combustion of fossil fuels in this process releases various air pollutants, including carbon dioxide, carbon monoxide, sulfur dioxide, and nitrogen oxides (Binti Norarmi et al.). Additionally, the nature of fast fashion results in short usage periods for garments and large quantities of discarded clothing. This leads to considerable environmental impact during waste disposal. The waste treatment process can release dust and chemical substances into the atmosphere, exacerbating air pollution. Therefore, the fast fashion industry not only contributes to air pollution through its production processes but also through the environmental consequences of its waste management practices. Addressing environmental issues in the fashion industry can be effectively tackled by embracing sustainable fashion practices. This involves utilizing eco-friendly materials, improving product quality, and fostering consumer awareness.

Bio-based materials play a crucial role in reducing the fashion industry's environmental footprint. These materials, which are derived from renewable resources, significantly reduce carbon emissions and enhance resource efficiency. Some bio-based materials even absorb carbon during their growth, further minimizing their carbon footprint. Additionally, their biodegradability ensures natural decomposition, reducing waste management issues and microplastic pollution.

These materials also require fewer harmful chemicals during production, which helps reduce water and soil contamination and protects workers' health. Therefore, using bio-based materials is essential in addressing environmental pollution in the fashion industry.

3.2. Sustainable Fashion

The ultimate goal of sustainable fashion is to create clothing that is durable, long-lasting, and recyclable. This extends beyond mere environmental protection; it aims to establish a fashion ecosystem that provides long-term benefits for both consumers and producers. Currently, the fast fashion industry is booming due to rapidly changing trends and low prices, which attract high consumer demand. However, this trend results in massive resource consumption and environmental pollution, particularly due to the significant waste generated from clothes that are discarded after a short period of use. To transition to sustainable fashion, the industry must adopt design and production methods that extend the lifespan of clothing, such as using high-quality, durable materials and creating timeless designs. Efforts to minimize production waste are also necessary, including recycling or upcycling defective products and fabric scraps.

3.3. Government Policy

The role of governments and corporations is vital in promoting sustainable fashion.

Governments should implement regulations and policies aimed at environmental protection, such as extended producer responsibility (EPR) policies and tax incentives for companies practicing sustainable fashion. Companies need to increase transparency in their production processes and invest in innovations for sustainable fashion. Raising consumer awareness about the environmental impacts of fast fashion is also crucial. By encouraging consumers to make more informed and conscientious purchasing decisions, brands can help reduce impulsive buying and excessive waste. By adopting these measures, the fashion industry can significantly reduce unnecessary waste, increase recycling rates, and minimize environmental destruction. This transition would decrease resource consumption in the fashion industry and contribute to long-term environmental protection, ultimately paving the way for a sustainable fashionecosystem that benefits everyone.

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