



Innovative sustainability: employing eco-friendly paints and packaging to transform fashion

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Abstract

The fashion industry is one of the primary causes of environmental degradation, characterized by high waste, a significant carbon footprint, and the use of high levels of toxic chemicals in the manufacturing process. With sustainability becoming increasingly important, innovations like green packaging and sustainable paints are emerging as the industry's primary solutions to minimize its environmental footprint. This paper examines the potential of these innovations to reduce the environmental footprint of the fashion industry. Green packaging, composed of biodegradable, recyclable, and low-waste materials, presents a potential alternative to conventional plastic-based packaging that contributes to global pollution. Sustainable paints, developed from non-toxic, natural, or green sources, are replacing the toxic chemicals used in the dyeing and finishing processes. These substitutes have the potential to reduce waste and chemical pollution, while also increasing the industry's focus on sustainability.

Using a mixed-methods approach, the research combines an extensive literature review with case studies of fashion businesses that adopt green packaging and eco-friendly paints. Key findings reveal that while environmentally friendly paints and green packaging are on the rise, cost, scalability, and consumer education remain chief issues. However, businesses using them are reaping improved image, zero environmental damage, and loyal consumers. The implication is that increased adoption of such innovation can potentially reduce the environmental impact of the fashion industry by a considerable amount and trigger more widespread industry-wide reform towards sustainability.

Keywords: Green packaging, Sustainable paints, Fashion industry, Environmental impact, Circular economy, Eco-friendly materials, Sustainable dyes

Introduction

The fashion industry is one of the most significant and most environmentally damaging sectors, contributing significantly to global waste, carbon footprint, and resource consumption. Sustainability is now a driving force in all industries, prompting them to adopt greener practices. The two most essential sectors for change are packaging and the materials used for production.

Moreover, Green packaging and eco-friendly paints are becoming increasingly effective solutions to mitigate the environmental impact of the fashion industry. The biodegradable, recyclable, and low-waste material is a substitute for plastic-based packaging, which is notorious for polluting the environment. Similarly, eco-friendly paints made from natural or non-toxic materials are now popular as an alternative to the toxic chemicals typically used in fabric finishes. These devices have the capability of significantly reducing the carbon footprint of fashion products while enhancing overall environmental sustainability.

This paper explores the potential of green packaging and green paints to transform the environmental strategies of the fashion industry. The two most important areas are now more focused; this helps the individual identify environmental benefits and

issues on a mass scale. Through this, we will explore ways to reduce the carbon footprint in the fashion industry and create a greener, more sustainable future in fashion.

Literature review

Fashion is among the most significant contributors to global environmental pollution, with packaging and production chemicals significantly contributing to its ecological footprint. Green packaging and eco-friendly paints have thus become critical solutions to mitigate these environmental issues. Green packaging refers to the use of materials that are less wasteful and less harmful to the environment, including biodegradable, recyclable, or compostable options that replace regular plastic. As Ritch (2019) ^[9] indicates, green packaging technologies such as plant-based plastics and water-soluble films have become increasingly popular as alternatives to conventional non-biodegradable plastic packaging, which pollutes the world. Companies like Stella McCartney and Patagonia have successfully incorporated these substitutes into their supply chains, underscoring the growing viability of sustainable packaging (Koch, Nussbaumer, & Sutherland, 2021) ^[8]. Similarly, eco-friendly paints, which consist of natural pigments, plant-based dyes, and water-based, non-toxic

formulations, are replacing the hazardous chemical dyes that have long been used in textile finishing. Fletcher and Tham (2014) ^[6] note that conventional synthetic dyes contain toxic chemicals, including formaldehyde and heavy metals, which are detrimental to both human health and the environment. Sustainable paints, however, minimize chemical runoff and water usage, providing a more environmentally friendly choice. Eco Enclose (2020) ^[1] demonstrates how sustainable fashion brands are incorporating plant-based dyes and water-based finishes, which significantly reduce their environmental footprint. However, there are challenges, especially in terms of cost and scalability of the solutions. The high cost of production and scarcity of sustainable packaging and paints often make it difficult to achieve mass adoption. However, increasing consumer demand for sustainability is pushing the pace (Joy, Sherry, Venkatesh, Wang, & Chan, 2012) ^[7]—The Impact of Conventional Paints on the Environment in Fashion.

Green packaging in fashion

Current trends in fashion packaging

The green packaging plays a vital role in mitigating the pollution increase caused by the packaging used in the market for fashion products. As we are all aware, the traditional and classical method of making fashion packaging, which often consists of plastic and non-biodegradable materials, contributes to the accumulation of waste and creates pollution. Nowadays, to achieve sustainable goals, industries are using biodegradable materials to create new packaging, such as leaves, cornstarch, mushrooms, and seaweed. These types of products are biodegradable and help eliminate landfill waste. For example, Stella McCartney's plant-based material is used to create the new packaging, promoting sustainable practices.

However, the new trend is recyclable packaging, in which they may use recycled paper, sun boards, and recycled plastic. They use the term the packaging has come under the recycling and upcycling process. Companies like Patagonia and Adidas are at the forefront of using this process to create their brand packaging, which falls under the categories of recycling and upcycling.

In addition to this, compostable packaging is being used by brands like Puma, which provides packaging that is both safe and considered waste-free. Thus, these kinds of initiatives taken by the big brands for sustainable packaging are the best steps for sustainable practices.

Case studies on sustainable paints and green packaging in the fashion industry

Stella McCartney—Sustainable Paints and Packaging: Brands like Stella McCartney are at the forefront of sustainable fashion. They are working on sustainable packaging and dyes so that they can contribute to reducing pollution at a global level. The company's workers are also giving their 100% effort, proceeding with the development of new products through recycling processes, such as those for paperboard and cardboard. Moreover, MC Cartney avoids using synthetic products to produce new products; instead, they also approach

natural products for dyes, such as turmeric and indigo flower-based colors. They also incorporated biodegradable elements into their design to establish themselves as the label for the most sustainable products, thereby contributing to the achievement of sustainability. (McCartney, 2019) ^[3]. Not only this, but the study of the company also shows that they use water-based colors, dyes, and packaging, and avoid chemical usage. So that they may produce environmentally friendly products, such as clothing, packaging, and dyes, and then come under the marathon to achieve their sustainable goals.

Patagonia - green packaging and natural dyes

In terms of packaging, brands like Patagonia are on the right track to create sustainable products, utilizing natural dyes and eco-friendly materials. The approach to sustainable achievement: Companies' employees also use recycled materials to produce products, such as garment bags. Cutting down the waste. However, the company also utilized biodegradable and recyclable products, including bioplastics. Patagonia is also working on reducing its environmental impact by using sustainable paints, such as natural dyes, in its fabric lines. For example, the Patagonia company uses plant-based dyes to avoid synthetic and toxic paints (Patagonia, 2020) ^[4]. This is the actual company's approach to achieving sustainability and a good environment.

Reformation - plant-based dyes and packaging

To create sustainable and eco-friendly packaging, the Reformation company, which is committed to green efforts, has introduced green packaging and organic paints into its operations. They used sustainable packaging to ship their orders. The use of fruits and vegetables includes making the packaging and dyes sustainable. They are always welcoming to natural-based products to avoid synthetic dyes and materials. These kinds of initiatives, taken by the brand, have only reached the target of sustainability and also aim to secure a spot on the top brand list with sustainable products (Reformation, 2020) ^[5]. Due to this kind of work, Reformation has garnered positive customer reviews, with a focus on sustainability.

Eco enclose

The solution for eco-friendly packaging: The name of a big brand in the packaging that is working for wrapped and packaged in the fashion sector is also taking lots and lots of steps to achieve sustainability through the packaging, as the company knows the packaging plays a vital role in the marketing where they may sell their products process through, also stopping to the polluting the environment. That is the primary reason these types of packaging brands are also working on sustainability and adopting practices such as recyclability and recycling processes. However, it is not the clothing brand. The company Eco Enclose is recognized for manufacturing 100% biodegradable packaging. After offering eco-friendly packaging, they also influence and help big brands like Reformation and Patagonia to adopt more sustainable practices (Eco Enclose, 2020) ^[1].

H&M conscious collection

The brand, like H&M, used water-based and plant-based dyes for its clothing line. The initiatives taken by H&M for their Conscious Collection have utilized sustainable materials and green packaging. Avoiding chemical usage while making conscious choices can make achieving suitability not that tough. The collaboration between Ellen MacArthur and H&M has set the fashion industry on a sustainable path, resulting in a collection that is conscious of its impact. These initiatives taken by big brands may lead to the adoption of sustainable practices. They also encourage the large audience to adopt these practices after using their products, such as eco-friendly packaging and the dyeing methods they employ (H&M Group, 2020) ^[2].

Impact on the fashion industry

Big names and brands like Stella McCartney, Patagonia, and Adidas are competing in the global market, where they are all adopting sustainable practices by creating new eco-friendly packaging and dyes. As they are aware, the fashion industry is the largest producer of pollution, generating massive amounts every day. They follow methodologies known for their sustainable practices, such as recyclability and upcycling, to create biodegradable products—the plant-based dyes and flower colors they use as alternatives to chemical-based ones. Although there are challenges, such as increased costs, these innovations complement the growing demand from consumers for sustainability, enabling brands to reduce their carbon footprint and improve their ethical standards.

Current trends in sustainable paints

Instead of using toxic chemicals, the fashion industry is embracing the adoption of sustainable paints, which continues to gain acceptance. These paints are made from natural pigments, plant extracts, and water-based materials, offering environmentally friendly alternatives to synthetic and heavy metal-based paints. These natural dyes are made with henna and turmeric, which are biodegradable and less damaging to the environment. This type of paint is not only beneficial for production, but also reduces water pollution.

The water bodies are polluted with wastewater, and its solvent mixtures enter the entire water; ultimately, this affects the entire aquatic life and poses difficulties for human survival. The wastage of paints and water is primarily attributed to the textile industry's inability to effectively purify them. This is the most critical aspect of reducing the water level. Instead of these activities, the textile industry focuses on sustainable finishing practices through various methodologies, such as recyclability and up cyclability, while also prioritizing biodegradable materials and products. Due to pressure from consumers and government bodies, a growing focus on sustainable fashion trends suggests adopting green manufacturing methods to achieve sustainable practices.

Challenges of traditional dyeing and painting processes

- **Environmental pollution** – As the population of the country increased day by day, companies became

dependent on chemical products to meet the needs of consumers, and they produced chemical-based materials and products. The chemical-based colors used by industries are disposed of in the drainage system, and such activities pollute the entire water body. Additionally, it damages aquatic life (Fletcher & Tham, 2014) ^[6].

- **High water use**—The textile industry uses vast amounts of water to color the fabric, and once used, they throw the color into the rivers. The high-water use in the industry is that the water required is around 5 liters; instead of using less water, they use 15 liters. These kinds of activists directly reduce the water level, and the industry is unable to purify this kind of colored water for reuse (Allwood et al., 2006).
- **Chemical wastewater disposal:** The disposal of the wastewater from the dyeing procedures is a problem of great importance. The wastewater typically consists of toxic chemicals, dyes, and detergents that, if improperly disposed of, can enter the surrounding water systems, causing permanent ecological harm. Textile businesses also lack the infrastructure to treat the wastewater properly.
- **Energy-intensive processes:** Conventional techniques such as dyeing and painting are energy-intensive, particularly if heated water is used in the process. This adds to the overall carbon footprint of the fashion sector. The processes predominantly use fossil fuels, contributing to the industry's environmental footprint.

Toxicity and health hazards: The chemical substances used in traditional dyeing and painting can be harmful to the health of workers, potentially leading to respiratory issues, skin irritation, and chronic diseases due to prolonged exposure to hazardous chemicals. This raises ethical concerns regarding the safety of workers in the fashion sector.

Green packaging solutions

Green packaging involves the use of sustainable materials and methods that reduce the overall environmental impact.

Key sustainable packaging solutions adopted by fashion brands include:

- **Biodegradable and Compostable Packaging:** Biodegradable and compostable packaging, including cornstarch bags, mushroom packaging, and cellulose film, reduces waste and pollution. Stella McCartney has used biodegradable packaging to minimize landfill waste.
- **Recycled materials:** Most companies today utilize recycled material packaging, i.e., plastic and cardboard, which assists in closing the packaging manufacturing loop. For example, Adidas produces packaging from 100% recycled polyester, which helps in curbing the use of virgin materials.
- **Minimalist packaging:** Another area of sustainable packaging is reducing the quantity of packaging in general. Patagonia and Everlane are two companies that have adopted minimalist packaging models, removing

unnecessary packaging elements to reduce waste significantly.

- **Circular packaging models:** Circular packaging involves models where packaging is reused or recycled and brought back, resulting in a sustainable product lifecycle.

For example, fashion store H&M has a recycling initiative where customers bring used clothes and packaging to receive rewards in the form of discounts and incentives for recycling.

Green paint solutions

- **Low-VOC (Volatile Organic Compounds) and No-VOC paints:** Low-harm-chemical-containing paints that enhance air quality by releasing fewer toxic chemicals. Advantages: Healthier indoor air, improved air quality, and reduced pollution.
- **Water-based paints:** Substituting solvent-based paints with water-based paints minimizes the emission of toxic chemicals.
- **Natural paints:** Constructed from plant or mineral-derived pigments along with organic items such as linseed oil and beeswax. These paints are biodegradable and non-toxic.
- **Recycled paint:** Paint produced from reclaimed or reused paint minimizes waste and saves resources.

Conclusion

The use of green packaging and eco-friendly paints within the fashion sector represents a significant step towards reducing the environmental footprint of clothing production and distribution. In the case studies of Patagonia, Stella McCartney, Reformation, and H&M Conscious Collection, it is evident that top fashion houses are incorporating environmentally friendly packaging and sustainable dyeing technologies into their sustainability initiatives. Patagonia's use of 100% recycled paper and Stella McCartney's implementation of biodegradable packaging demonstrate the potential to minimize waste. Reformation and H&M have also utilized eco-friendly paints and dyes to prevent the use of toxic chemicals in the garment creation process.

Emerging trends indicate a growing shift towards natural colorants, vegetable-based paints, and water-based solutions, which minimize water usage and pollution. With increasing demand from consumers for sustainable and ethical fashion, even more brands are expected to adopt these green options, promoting a circular fashion economy. Nevertheless, the industry remains challenged, specifically regarding the scalability and affordability of such green solutions. The prohibitive costs of natural paints and sustainable packaging, along with the color limitations and technical challenges associated with using natural dyes, currently hinder their mass adoption.

However, green packaging and eco-friendly paint offer real solutions to the environmental issues confronting the fashion sector. Through waste reduction, chemical contamination mitigation, and resource conservation, these technologies help create a greener future while demonstrating the fashion sector's

ability to lead the way in sustainability. As the approach gains popularity, the industry is set for a paradigm shift towards a circular, environmentally friendly model.

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