



A Green Threads Initiative to Advanced Textile Waste Valorisation

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Abstract: Textile waste that is out of control underlines the need for creative solutions to sustainable behaviours by reusing the waste in the supply chain. India generates approximately 7.8 million tons of textile waste annually, making it one of the world's largest producers. Over 50% of this waste originates from post-consumer sources such as worn-out clothing, home textiles, and footwear. The growing prevalence of fast fashion and inadequate recycling infrastructure have exacerbated textile waste as an environmental challenge. This article focuses on the ways to reduce or upcycle textile waste, having the motto of reducing landfill. Growing awareness of environmental problems has led to a rise in consumer recycling of post-consumer product waste. Post-consumer textile waste has significant potential for recycling and reuse, but it is still a largely unexplored resource. One of our study's core values is upcycling, which focuses on turning textile waste into more valuable items. This reduces environmental impact, encourages the use of sustainable materials, and fosters creative design approaches that support the ideas of the circular economy.

Keywords: Down cycling, Textile waste, Upcycling.

1. INTRODUCTION

The textile business, which is well-known for its ability to provide comfort, is changing dramatically in order to reduce its environmental impact where textile waste can be defined as used or undesired materials created by producing and using fibers, textiles, and clothing. It is typically categorized as pre-consumer, post-consumer, or industrial waste, and fashion industry textile waste includes all three categories (Jamshaid et al., 2024a; Wojnowska-Baryła et al., 2024). Textile waste has also grown to be a greater concern to contemporary civilisation because of the continuous increase in the manufacture and consumption of synthetic fibres that are non-biodegradable (Kamble et al., 2021). Textile waste harms the environment, so better recycling and reuse technologies are needed but most textile waste still ends up in landfills or is burned, which pollutes the soil, water and adds to greenhouse gas emissions (Zhou et al., 2022).

There hasn't been much study done on how people in developing countries use and throw away clothes. This gap makes it difficult to deal with fast fashion and weak waste collection systems (Sinha et al., 2022). Given the recent spike in textile consumption, an entirely different approach must be adopted because of the rise in post-consumer waste amount. Post-consumer textile waste has increased as a result of the fast fashion cycle and lower-quality textiles having shorter lifespans (Stanescu, 2021). Prior to the late 1980s, traditional clothing manufacturing focused on creating basic goods with rare modifications to design elements. However, at the end of the 20th century brought about a number of developments, such as the expansion of fast fashion and the collapse of conventional garment manufacture, where customers must keep up with the constantly shifting trends in order to fit in socially (Bertram et al., 2018; Bhardwaj et al., 2010).

Approximately 75% of textile waste worldwide is dumped in landfills, 25% is recycled or repurposed, and less than 1% is turned into new garments (Juanga-Labayen et al., 2022). As a result, efforts to create a more sustainable and



circular system have grown more and more significant. One approach is the idea of a circular economy, which includes eco-friendly production based on textile collecting and recycling as well as eco-design, reuse, and repair (Wojciechowska, 2021). where upcycling, also known as creative reuse, is the act of reusing waste materials, leftovers, unwanted objects, or useless items to create new materials or items that are seen to be of higher quality, such as items with environmental and artistic worth. This paper presents a plethora of innovative strategies for the cascaded use of textile fibrous waste by transforming it into

2. OPERATIONAL PRACTICES IN TEXTILE WASTE MANAGEMENT

In order to minimise the impact on the environment and maximise the use of resources, operational strategies in textile waste management employ a variety of techniques for reducing, reusing, recycling, and recovering textile materials. These procedures involve gathering, classifying, and reusing textile waste for other advantageous use or back into the production cycle (Seolin dos Santos et al., n.d.).

2.1. REDUCE

Reduce is a way of cutting back on waste creation at its source. This may be accomplished by employing sustainable design techniques that put lifespan and durability first, utilising less materials during manufacture, and encouraging conscientious consumer behaviour (Shamsuzzaman et al., 2025).

2.2. REUSE

This refers to repurposing abandoned textiles, either in their original state or with just minor alterations. Examples include upcycling textile waste into new goods like bags or cleaning cloths, selling worn clothing at thrift stores, and giving garments to charitable organisations (Pensupa et al., 2017).

2.3. RECOVERY

Is the process of getting something useful out of textile waste that can't be recycled or used again. This might involve composting organic textile materials or utilising textile waste as fuel to generate electricity (Seolin dos Santos et al., n.d.; Shamsuzzaman et al., 2025). Conversely, recovery refers to any process that primarily results in waste being prepared to serve a specific function in the plant or the larger economy, or waste serving a beneficial purpose by substituting other materials that would have been utilised to complete that function. Since recycling is actually a recovery operation, the term "recovery" refer to recovery activities that are not recycling operations for the purpose of simplicity. Thermal recovery in waste-to-energy power plants is a prime example of a recovery procedure (Piribauer et al., 2019).

2.4. REVERSE LOGISTICS

Managing the movement of textile waste back into the manufacturing chain or other value-added operations is known as reverse logistics. Initiatives like as take-back schemes, in which customers return worn textiles to the manufacturer or store, might fall under this category (Piribauer et al., 2019).

3. UPCYCLING

One strategy to lessen the fashion industry's impact on the environment is upcycling, which in turn use clothing or textile waste into fashionable items with significant aesthetic value. The success of this study led to the development of fashion items that not only increase their aesthetic worth but also support the expansion of the creative sector within the fashion business. In order to generate sustainable designs by recycling old clothes, upcycling aims to provide real-world examples of transforming denim with patchwork, textile composites, new art from waste craft in interiors (Rahmanita et al., n.d.).

3.1. DENIM UPCYCLING

In the context of the sustainability movement, craft art is becoming a more important medium for spreading sustainability messages (Che Ya et al., 2024). Evans have used discarded denim fabric to create creative geometric-structured box furniture that emphasises sustainability and aesthetic appeal (Donkor et al., 2025). Upcycling denim into crafts involves transforming used jeans into brand-new, functional, and stylish objects. With possibilities ranging from easy crafts like coasters and storage baskets to more intricate ones like quilts and carpets, this method saves waste and



produces one-of-a-kind pieces. Because of its durability, denim is perfect for a variety of creative projects and is an environmentally friendly method of repurposing materials.

3.2. TEXTILE BRICK

In order to create bricks for civil construction, Luciana suggests combining clay with wastewater sludge from textile laundry (Herek et al., 2012). Recycling of textile waste sludge to form bricks using clays are novelty as it does not pollute both land and water (Beshah et al., 2021). A new way of utilising consumer waste is by upcycling them to create sustainable bricks. In order to lessen the carbon footprint that the textile and civil/architectural sectors leave behind, this effort aims to emphasise the significance of incorporating textile wastes into materials used in civil engineering and building (Jamshaid et al., 2024a).

3.3. BIOGAS PRODUCTION

Waste textiles that include cellulose fractions and synthetic polymers are regarded as environmentally hazardous, yet their cellulosic portion offers enormous potential for the manufacture of biofuel. About 35–40% of textile waste is made up of cellulose, which may be used as a feedstock to produce biological products like biogas and ethanol. In contrast to the biodegradation of lignocellulose, the biodegradation of waste textiles is not hampered by the presence of lignin and hemicellulose; rather, the main barrier is the extremely high crystallinity of the cellulose in cotton fibres.

4. DOWNCYCLING

Textile waste is another common use for the downcycling process. Although textile materials are once again produced by this technique, the new goods have a lower value. The quality of the original items can no longer be replaced by the new ones that are produced. It is impossible to get new clothing while recycling old, ripped, or worn clothing. They can be reused in other ways, though. In other economic sectors, processed textile raw materials and supplies are utilised as cleaning cloths or for filling (Jamshaid et al., 2024b).

Additionally, the downcycling process helps to safeguard the environment. It gets rid of trash and helps make new things out of old textiles that might otherwise wind up in a landfill (Kuzmanović, n.d.).

5. KEY CHALLENGES AND OBSTACLES

The construction, automotive, food packaging, and particleboard sectors use composite materials made of textile waste, including tire and carpet trash, worn clothing, gloves, masks, and fabric scraps. These composite materials are burnt or landfilled following their usage, damaging water, land, and air. Fish and birds are negatively impacted by synthetic fibres included in these composite materials made from textile waste. When humans consume these fish, they become infected (Rashid et al., 2023). Growing populations and rising living standards have led to a rise in textile manufacturing worldwide in recent years. However, it is quite concerning that textile-related companies have produced such a large volume of hazardous waste. Human health is directly impacted by improper management and irregular disposal of textile waste, which pollutes the environment (landfill, water, and air) (Pervez et al., 2021).

6. FUTURE RESEARCH DIRECTION

Composite goods have recently been made from discarded textile fibre. Reusable textile fibres include nylon and polypropylene fibres from carpet waste, polyamide fibre from tire waste, cotton, polyester, wool, silk and other textile fibres from fabric (woven, non-woven, knit) waste. These composites are used extensively in the building sector for sound absorption, as well as in the automotive, furniture, polymer concrete, food packaging, and many other fields (Burgada et al., 2021; Khan et al., 2020; Özkal et al., 2020; Sandin et al., 2018). One of the most durable methods of prolonging the life cycle of textiles or of long-term recycling is the reuse of textile waste in build tech or construction. In order to enhance the environmental circumstances in major metropolitan agglomerations, methods based on textile waste may be used to drastically minimise the ecological imprint of the building industry. Textiles can be used in constructions that have a resistance function, such as plates, blocks, or linear elements; a thermal insulation function,



such as cotton, wool, hemp, polyesters acrylics, nylon, and polypropylene; or a thermal insulation function, such as insulating panels or blankets; or both (Nistorac et al., 2023).

7. CONCLUSION

This article concludes with an overview of textile waste management where the textile ends as landfill or incinerated. Where the study focuses on the ways to reduce or upcycle textile waste having the motto of reducing land fill by promoting them into value added products by upcycling process. Textile waste has been a major issue with an estimated yearly production of 7.8 million tonnes of textile waste, India plays a major role in the worldwide issue of textile waste. Both pre-consumer (production) and post-consumer (discarded apparel) sources contribute to this waste. Even though India is a major producer and recycler of textiles, a significant amount of its waste is either downcycled or ends up in landfills, underscoring the need for better waste management and circular economy.

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