

## ACHIEVING SUSTAINABILITY IN FASHION: SCOPE OF RECYCLED FABRIC WASTE IN SUSTAINABLE PRODUCTION OF FASHION APPAREL

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### **ABSTRACT:**

One of the sectors of the global economy that releases the most pollutants is the textile industry. Textile waste can be divided into pre-consumer waste and post-consumer waste. During the cutting and manufacturing processes, factory pre-consumer waste is produced. Used clothing and other used textiles create post-consumer trash. Studies reveal that textile waste takes up almost 5% of total landfill space. About 84% of all waste is made up of clothing, and that waste is dumped in landfills where it takes up about 5% of the available space. Since only 10 to 25% of these end up as industrial waste, up to 95% of them can be recycled. The lifetime of clothing is thought to last three years on average. They are left on the land after that time. It is estimated one million metric tons of textiles are condemned annually. Instead of being recycled and reused, a lot of old clothes end up in landfills. This article focuses on different fabric wastes, their processing, the properties of recycled yarn, and the fabrics produced subsequently. There is a special focus on brands that have taken initiative to reduce textile waste by converting them into different products.

### **INTRODUCTION**

Textile industries have a major negative impact on the environment during their lifecycle. One of the world's most polluting and waste-producing businesses is the global textile industry, which uses a lot of water, energy, pesticides, and fertilizers. The apparel business may become more sustainable by recycling and reusing textiles, fibres, and waste materials. On average, consumers throw away 60% of their garments in the first year of their use. In 2020, 18.6 million tons of textile waste has been dumped in landfill. The Ellen Macarthur Foundation reviews that if this fashion continues, over a hundred and fifty million tons of apparel waste will clog landfills in 2050. There are several reasons for waste generation and the following are a few:

- i) Attitude towards textiles,
- ii) Fast fashion,

- iii) Frequency of shopping,
- iv) Lack of awareness of sustainability,
- v) Lack of eco-friendly practices,
- vi) No strict government policies,
- vii) Lack of quality materials,
- viii) Less popular second-hand clothing, etc.

Technology is presently being evolved to permit our garments to be regenerated into new fibre and made into new garments. For the recycling of textiles to end up a characteristic of our lives, all of us should work together - brands, consumers, charities, and governments to construct a sustainable fabric recycling industry

Textile production is not something that can be limited; it has a higher amount of post-industrial and post-consumer fibre waste. Recycling is the most advantageous method of waste management and Fabric waste recycling is a key aspect to move towards a circular economy. Through a proper recycling methodology, textile waste can be raw materials for new value-added products. Systems for managing textile waste are currently moving through a vital phase that attempts to create products with value addition using recycling concepts and techniques.

### **FABRIC RECYCLING PROCESS: FABRIC TO FIBRE**

Fabric scrap waste and cutting department waste contribute to a higher percentage of fabric waste. Cutting department trash accounts for a sizeable portion of industrial waste, and recycling it is the greatest option to utilise it. Cutting waste from the knitwear industry was collected and used in the recycling process. The fabric was found to exhibit a reasonable number of physical properties including dimensional stability, burst strength, pilling resistance and abrasion resistance.

For recycling fabric, a variety of techniques and procedures are employed[1]. The method chosen for fabric recycling is determined by the type of fabric waste. The difficulties encountered while recycling fabric waste are examined, and an appropriate approach is chosen. By recycling the fabric, the raw materials needed for fabric production are obtained.

The use of recycled fibre in yarn manufacture often involves blending it with virgin fibres. The low-quality characteristics of recycled fibre derived from fabric scrap wastes include an inhomogeneous fibre type and

an uneven distribution of short fibre lengths, both of which have a detrimental impact on the manufacturing process and the quality of the recycled yarns produced from it. Hence, the characteristics of recycled fabric and virgin fabric are different.

The quality of the open-end spun recycled yarns created using various materials and spinning settings from mixtures of recycled fabric scrap wastes and virgin polyester fibres has already been reported[2]. According to statistical findings, the mix ratio, yarn count, and twist coefficient have a substantial impact on the quality parameters. In general, adding virgin polyester fibre to recycled fibre tends to improve the quality of yarn[2].

### **ACRYLIC WASTE**

After cotton wastes, acrylic textile wastes are one of the most often recycled waste categories. Covered and polybutylene terephthalate (PBT) elastic yarns are mixed into the recycled acrylic yarn, which is spun from waste 100% acrylic that has undergone garneting, to add value to the recycled acrylic fabric. The experimental and statistical findings show that all the performance characteristics of the fabrics are significantly influenced by the fibre type and the elastic properties of the yarn. Comparative research is done on the performance characteristics of plain knitted fabrics manufactured from open-end recycled and virgin acrylic yarns, as well as the effects of additional covered and PBT elastic yarns. The abrasion results of the recycled acrylic fabrics with covered yarn and the PBT yarn do not statistically differ from one another [3].

### **POLYESTER WASTE**

Polyester waste is a major part of the apparel industry's waste stream, but its recycling is rarely addressed in this industry. Various techniques have been used to convert cut waste polyester webs into fibres without opening them. Thermal insulation, sound insulation, fire resistance, and biological degradation of new insulation structures were investigated and compared with commercially available insulation[4].

### **DENIM-CUT WASTE**

Denim, which plays a vital role in the fashion industry and is in high demand, contributes to the high percentage of industrial offcuts. After many efforts, mechanically extracted recycled cotton fibre from denim scraps was blended with fresh cotton to create recycled cotton yarns in various blend ratios. Since the fibres are already coloured, the dyeing process is omitted, and the fabric is finished with a denim-like finish using

recycled blended yarn for the weft and 100% white cotton yarn for the warp. Fabrics are tested for physical, mechanical, and comfort tests recommended as raw materials for garment manufacturing[5].

There are fabrics which cannot be separated based on fibre due to the mixture of blends. They are combined and fed to the garning process and converted into yarn, and subsequently fabrics by various processes depending upon the yarn count and characteristics. The fabric was turned into casual clothing, and the created items also conducted a cost-effectiveness assessment[6]. The cost of clothing made from recycled fibres is lower than that of clothing made from conventional raw materials. To examine the wearability of garments manufactured from recycled waste, the quality and durability of those made from recycled fabric are compared to those made from virgin fabric [7].

## **FABRIC MANUFACTURE USING RECYCLED YARNS**

Single jersey fabrics were knitted with these yarns and garments were sewn with these fabrics in the same production conditions. When the physical characteristics of recycled and virgin fabric were evaluated, the findings showed that there was no discernible difference between recycled and virgin garments. The test results revealed that the yarn unevenness and thick places values of recycled yarn were lower. But it was found that hairiness was higher in recycled yarn compared to virgin yarn[8]. Hence it is concluded that recycled garments produced from fabric scraps can be knitted and used in the apparel manufacturing industry.

All the yarns produced from recycled fabric cannot be used for the knitting process due to yarn characteristics. Various counts of yarns are produced after recycling the fabric scraps. After verifying the yarn's characteristics, the yarns of various counts are used for making handloom fabrics[9]. Hence it is proved that recycled yarns from fabric waste can be used to make handloom fabrics.

It is not possible to make handloom and knitted garments using all recycled yarns. Some yarns are used to create various mixtures of non-woven (these are fabric-like materials made from fibres). The strength of the fibres varies which affects the above-mentioned process of nonwoven production. A nonwoven fabric has been made up of recycled cotton fibre (RCF) and recycled polyester fibre (RPF) blend which gives an innovative approach to recycled fibre application[10]. Various properties of developed nonwoven fabrics are tested to analyse the best proportion[10].

## **SUSTAINABILITY AMONG APPAREL BRANDS**

Utilizing recycled raw materials is consistent with the greater shifts occurring in the world's industries toward a circular economy (as opposed to a linear one) and efforts to establish a closed-loop manufacturing cycle. Several well-known businesses that are moving toward the production of sustainable products have identified the textile and garment industry as having elements that have influenced the generation, usage, and recycling of trash. Here are some names of brands that have recycled content programmes and goods [11]. Pre-consumer, post-consumer, and post-industrial textile wastes are recycled and utilised to make home furnishings, branded clothing and accessories, concrete, and composites, as well as other speciality items including cleanroom clothing, heating elements, and mountaineering gear [12]. To collect waste fibres and keep them out of landfills, numerous solutions have been considered and, in some cases, implemented by different companies. By reporting on several recent studies involving the uses of recycled textile waste fibres embedded in various matrices, including thermoplastic polymer, thermosetting resins, natural constituents, and concrete taking into consideration specific applications, the alternatives of fibre recycling for composite realisation have been presented [12]. Companies mainly focus on recycling fabric scrap waste to keep them out of landfills.

## **BRANDS THAT PRODUCE PRODUCTS BY RECYCLING METHOD**

The damage caused due to the dumping of textile waste into the dumping yard is slowly being rectified by certain people and brands in the past years. These small steps make a difference as people become more aware that sustainability is essential for a better environment. H&M had launched a Garment Recycling Programme under which old clothes are reused or recycled or re-sold. Recyclable textiles and clothes are shredded and are used to make for example insulation materials [13].

By using fabric made from recycled synthetic materials it bypasses the extra consumption of fossil fuels and carbon used in the manufacturing process and potentially rules out the need to dye, this is done by a brand known as Patagonia [14]. It is said that 94% of Patagonia's lines use recycled materials. Patagonia uses this recycled plastic to create fleeces, shorts, and jackets in their collections.

Ecoalf brand uses plastic waste from oceans and fishing nets to produce fashion fibre. Ecoalf, with its recycled plastic fashion, has reused over 70,000,000 plastic bottles and 60 tonnes of fishing nets. They claim that with 70 plastic bottles and with 135 grams of nets it is possible to create one meter of fabric [15].

Girlfriend collective's Recycle Reuse ReGirlfriend initiative encourages its customers to use recycled athletic apparel. All its products are all derived from recycled plastics and redesigned for comfortable athletic apparel [16].

Wolven is a brand that makes activewear from two lines of fabrics, modal fabric (made from trees) and Recycled PET fabric (made from bottles). They also make clothing from post-consumer waste which helps with reducing plastic pollution [17].

Designer brand Gucci was one of the first luxury fashion houses to use ECONYL® – a 100 per cent regenerated nylon yarn made from recycled fishing nets in their men's outerwear. To support the circular economy Gucci has incorporated recycled and regenerated materials into their collection. The brand has made a conscious decision to increase the use of fibres and materials that are originally derived from post-industrial textile waste, like yarn and unused fabrics [18].

VEJA is the first sneaker brand to use fabric entirely made from recycled plastic bottles and recycled polyester-mesh is a fabric made entirely out of 100% recycled polyester, coming from recycled plastic bottles shredded into flakes and then transformed into fibres [19].

## CONCLUSION

Textile supplies are crucial material which is important for survival. Even though the manufacturing of textile materials causes pollution, it is more crucial to shift to a circular economic system in place of a linear economic system. Nowadays recycling, redesigning, upcycling, downcycling, restoring, repairing, reusing, and reducing are a few of the strategies utilized by the brands to produce fashion apparel. The steps taken by the mentioned brands might be a small initiative but this might lead to a bigger change in the future. The applied waste management technique in this study not only reduces textile waste but also helps in providing a sustainable environment.

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