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Opinion

Recent Sustainable Development and Innovations in Textile Industry

Gajendra Kumar Tyagia* and Nagender Singh

The Technological Institute of Textile & Sciences, Bhiwani 127 021, India

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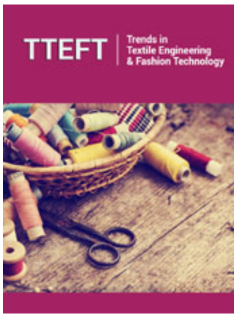

***Corresponding author:** Gajendra Kumar Tyagi, The Technological Institute of Textile & Sciences, Bhiwani 127 021, India

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Introduction

The textile industry has a long supply chain comprising various production stages from fibre to garment production. With a market valuation of over $1.5 trillion and over 75 million workers, the textile industry is a vital component of our economy [1,2]. However, the supply chain does not strictly follow the sustainable development goals (SDGs) stated by United Nations in 2016 under the new sustainable development agenda for 2030, which initiates 17 sustainable development goals (SDGs). The SDGs effectively illustrate the new goals of economic, social, and environmental advancements, including eradicating poverty, promoting economic growth, preserving the environment, and so forth [3-6].

The textile industry is one of the most polluting sectors in the world, which is responsible for 20% of all commercial water resource contamination. The use of toxic chemicals, high water, and energy usage, significant waste production, heavy transportation, and an abundance of packaging materials make the life cycles of textile products unsustainable. There are presently more than 8000 distinct chemicals used in the textile industry to produce clothing, totaling 5 billion kg of dyes, pigments, and finishing chemicals. Additionally, excessive resource use (such as that of fossil fuels, compounds used in manufacturing, water, etc.) combined with unhealthy, exploitative working circumstances present a variety of sustainability-related challenges [7-10]. According to the UN, 85% of textiles are disposed of in landfills each year [11] and washing some kinds of clothing releases a sizable quantity of microplastics into the water. Similarly, washing clothes contributes to the annual discharge of 50 billion plastic bottles' value of microfibers into the water. A synthetic substance called polyester, which makes up about 60% of clothing, is used in its production. Despite emitting almost three times as much CO_2 as cotton does, polyester does not decompose in water [12]. The Soil Association (SA) claims that 30 percent of cotton globally is genetically modified, and that non-organic cotton employs compounds with acute toxicity, like heavy metals, formaldehyde, and aromatic solvents [13]. Global production benefits from the cheap labour cost in developing nations from an economic as well as social perspective. The Bangladesh factory mishap highlights the significant societal issues concealed in the textile industry and raises public knowledge of workers' rights, health and safety, compensation, and other issues [3,14].

The goals of the UN are being successfully addressed by some enormous fashion brands in the interim [3]. For instance, Inditex closely adheres to the Code of Conduct, monitors its conformance, and assesses these aspects through monitoring to ensure the health and welfare of its employees [15]. In pursuit of responsible manufacturing, H&M will only use recycled or sustainably obtained materials in its merchandise by 2030 [16]. To decrease water usage and environmental pollution during the dyeing of denim, Levi's introduced a "Waterless Dyeing Process" in 2016 [17]. To make ripped and cleaned denim more environmentally friendly in 2018, Levi's Eureka Lab has developed a new laser technology [18].

In recent years, sustainable textile production has also been facilitated by cutting-edge technologies (such as nanotechnology, enzyme processing, ultrasonic treatments, ozone bleaching for cotton fabrics, electrochemical dyeing, supercritical CO2 dyeing, laser technology, digital printing, plasma technology, and foam technology for textile finishing), advanced materials (such as renewable and biodegradable materials), and environmentally friendly production techniques [19-22]. Additionally, to lessen the overall environmental effect, the textile industry has adopted sustainable practices at every stage of the supply chain. For instance, the goal should be to select raw materials that are reusable (natural fibres like cotton, flax, wool, and silk) and recyclable for the manufacturing of clothing and textiles (fibers such as recyclable polyester and nylon) [19]. On the other hand, the overall energy used in the textile industry can be broken down into four categories: spinning (34%), weaving (23%), chemical processing (38%), and other unspecified processes (5%). However, new techniques such as open-end rotor and air-jet spinning, rapier, projectile, air jet, multiphase, and water jet looms, as well as high-speed circular knitting, computerized flatbed knitting machines, and seamless knitting, have been introduced in spinning, weaving, and knitting to reduce the energy consumption [23].

Similarly, by adopting enzymatic technology in fibre retting, de-sizing, and wet processing the water and chemical consumption has been significantly reduced [24]. A novel membrane bioreactor (MBR) technology has been recently introduced which combines a biological cell and a membrane separation device for wastewater treatment [25]. Apart from that, lean manufacturing can be implemented at the garments manufacturing stage to develop an integrated system using a multifaceted approach that incorporates the use of management techniques like total quality management (TQM), pull strategy, Kanban, cellular manufacturing, electronic data interchange (EDI), and just-in-time (JIT). According to Yang et al. [26], reducing various losses in a lean culture will also help manage environmental waste by improving environmental performance [26]. Nonetheless, a circular economy could be another approach to achieve sustainability in the process, which follows a cradle-to-cradle model where the textile product will be reused, repaired, or recycled at the end of the life cycle [27,28]. The acceptance of upcycling, downcycling, or reusing textile material, however, is altering the pattern because textiles have the potential to be completely recyclable [29]. The circular economy approach could be followed to reduce textile waste by reuse (donating, reselling), recycling (fibre, polymer, fabric), incineration (recovering energy), and the landfill (safe disposal) [30-32]. Moreover, the textile industry offers enormous potential for innovation at every step to support the growth of a sustainable economy. It is crucial for business stakeholders and lawmakers to jointly develop sustainable innovation in the textile industry because customer demand for eco-friendly goods is rising and laws are becoming more strict.

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