

ENVIRONMENTAL IMPACT OF THE TEXTILE INDUSTRY AND THEIR MITIGATION SOLUTIONS

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Abstract. This article analyzes the negative impact of the textile industry on the environment, including water and air pollution, soil degradation, and the problem of solid waste. It also presents proposals and solutions for establishing environmentally sustainable production.

The textile industry constitutes a pivotal segment of the global economic landscape. Driven by the burgeoning consumer demand for clothing, manufacturing outputs exhibit a consistent year-on-year growth. Notably, the 'fast fashion' paradigm has expedited the product lifecycle, significantly escalating environmental strain. As a result, this sector has emerged as a primary contributor to global environmental concerns [1].

Globally, significant importance is being attached to the comprehensive utilization and rational management of natural raw materials, particularly fibers and various types of waste. In developed nations, the collection and recycling of textile waste are dictated by the steadily expanding demand for textile fibers and the raw materials required for their production. According to analytical forecasts, the production volumes of cotton, wool, artificial, and synthetic fibers are expected to grow further in the future. In the cotton fabric manufacturing industry, more than 20 types of production waste have been identified [2].

In recent years, textile enterprises have introduced a diverse array of sustainably manufactured and recycled fabrics, fibers, yarns, and dyes. Ensuring sustainability in textile fabrics and prioritizing fibers derived from organic agriculture has gained paramount importance. Fabrics produced from organic cotton, wool, hemp, flax, or silk constitute the foundation of eco-friendly textile products. These ecological textiles are manufactured in accordance with strict standards and are certified from both environmental and social responsibility perspectives. Such standards guarantee that the raw materials used for fabrics or yarns are genuinely organic and ensure compliance with rigorous eco-friendly production protocols throughout the entire manufacturing chain. Certification is only granted if standards are upheld at every stage of the value chain. Within the textile industry, the most significant environmental challenges remain excessive water consumption and water pollution. The cotton cultivation

process requires intensive irrigation; on average, the production of a single cotton T-shirt consumes between 2,500 and 3,000 liters of water [3].

Various chemical substances are utilized in the processes of fabric dyeing and bleaching. If bleaching agents, synthetic dyes, and heavy metal residues are discharged into water bodies without adequate treatment, they degrade the quality of drinking water and severely damage aquatic ecosystems. Furthermore, energy consumption in textile manufacturing remains excessively high. Many factories still employ coal or petroleum products as primary fuel sources, leading to the emission of carbon dioxide (CO₂) and other hazardous gases. The production process of synthetic fibers, particularly polyester, is directly linked to the petrochemical industry, further contributing to the increase in greenhouse gas emissions [4].

The cultivation of cotton involves the extensive application of pesticides and mineral fertilizers. This practice diminishes soil fertility, reduces beneficial microorganisms, and severely compromises biological diversity. Furthermore, prolonged chemical exposure leads to progressive soil degradation. Solid waste and the microplastic crisis: due to the 'fast fashion' phenomenon, apparel is utilized for a short duration before being discarded as waste. Synthetic fabrics do not decompose in natural environments for hundreds of years. Furthermore, microplastic fibers shed during the laundering process enter water bodies, exerting a detrimental impact on marine life.

Solutions to the problem:

Organic raw cotton production reduces the use of pesticides and chemical fertilizers. Furthermore, the use of natural fibers such as bamboo and flax reduces environmental risks.

Water-saving technologies: The implementation of closed water circulation systems in modern production significantly reduces water consumption. Water treatment technologies must be applied during the bleaching and dyeing processes.

Recycling system - The recycling of clothing and its use as secondary raw materials reduces the amount of waste. Using recycled fibers reduces the pressure on natural resources.

Energy efficiency - The use of renewable energy sources such as solar and wind in enterprises reduces greenhouse gas emissions.

Conscious consumer culture: It is important to develop a culture of choosing high-quality and durable clothing among the population. Buying less and using existing clothing for longer reduces environmental pressure.

Conclusion: The textile industry is economically important, but its environmental impact poses serious problems. Water pollution, atmospheric gases, soil degradation, and waste management are pressing issues. These problems can be reduced through

the introduction of modern technologies, the use of environmentally friendly raw materials, and the formation of a culture of conscious consumption. Production based on sustainable development principles serves to create a healthy environment for future generations.

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