



**INNOVATIVE SOLUTIONS AND THE ROLE OF SUSTAINABLE
DEVELOPMENT IN THE CHEMICAL FIBER INDUSTRY OF UZBEKISTAN**

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Abstract

Since the late 20th century, the chemical fibers industry has been surpassing natural fibers in terms of production volume and growth rate. The majority of global chemical fiber production is concentrated in Asia. Recent research in the textile industry has focused on improving the sustainability of synthetic fibers, reducing their environmental impact, and enhancing recycling processes. However, this industry also contributes to ecological issues such as microplastic waste and greenhouse gas emissions. Synthetic fibers are widely used in high-quality consumer products, the automotive industry, construction, and various other sectors. Based on the strategies set by the President of the Republic of Uzbekistan, measures are being taken to increase the production of synthetic fibers, create new types, and strengthen the competitiveness of the textile industry. This article analyzes the innovative solutions in the chemical fiber industry, the role of sustainable development, and the initiatives aimed at developing this sector in Uzbekistan.

Keywords

chemical fibers, synthetic fibers, textile industry, sustainability, innovation, Uzbekistan, microplastics, environmental impact, global market, fiber production.

Since the late 20th century, the production volume and growth rate of chemical fibers have been surpassing that of natural fibers globally. According to a study by Data Bridge Market Research, the global textile chemicals market, valued at \$27.88 billion in 2022, is expected to reach \$41.82 billion by 2030, with an average growth rate of 5.2% during the forecast period from 2023 to 2030. [1] The global chemical fibers and yarn industry is characterized by a high concentration of production, with nearly 89% of global production coming from Asia. In recent years, most research and developments in the global textile industry have focused on improving the sustainability of synthetic fibers, reducing their environmental impact, and addressing recycling issues.



The use of chemical fibers as textile resources, along with the emission of greenhouse gases and pollutants, impacts the environment and climate throughout their life cycle. Additionally, every year, between 200,000 to 500,000 tons of microplastics from textiles enter marine environments. Despite this, plastic-based or "synthetic" textiles are regarded as essential consumer goods in everyday life. Clothing, towels, and bedding made from synthetic fibers are regularly used by people. Beyond consumer goods, synthetic textiles are widely used in manufacturing home and office furniture, shipbuilding, the automotive industry, and construction.

However, due to their extensive consumption, regulating and limiting their use is challenging. Therefore, utilizing economic instruments in this field to achieve sustainable development goals in the chemical fibers market and implementing value-adding mechanisms to develop the industry through innovation is a priority research area.

On September 11, 2023, the President of Uzbekistan issued a decree (PF-158) on the "Uzbekistan - 2030" strategy, which aims to "increase the level of yarn processing to 100% and produce 400,000 tons of artificial and blended fibers to meet the demand for high-quality fabric." [2]

To achieve this goal, there is a focus on increasing synthetic fiber production, developing new types, creating raw material sources for the textile industry in Uzbekistan, analyzing production capabilities and efficiency, identifying competitive advantages of fiber-recycling enterprises, and developing digital passporing mechanisms for alternative solutions and products using synthetic fibers. Expanding the export opportunities of textile enterprises based on diversification and setting the prospects for creating higher added value are also critical.

One of the key directions in the development of Uzbekistan's textile industry is not only the export of cotton fibers but also increasing the production of competitive yarn fabrics and finished products to gain a global competitive edge. In this context, expanding the raw material base of the textile industry, mastering new types of fibers, and developing innovative products are identified as priority objectives.

Moreover, the Presidential Decree of January 28, 2022 (PF-60) on the "Development Strategy of New Uzbekistan 2022-2026" sets the goal of increasing artificial fiber processing volumes to 200,000 tons. Achieving this goal requires a focus on increasing the production of synthetic fibers and developing new types, which is an urgent task today.



The textile industry can be classified into two categories: directly obtained natural fibers and entirely synthetic (chemical, synthetic) fibers. Chemical fibers are materials produced either naturally or synthetically and are used in the textile industry to manufacture yarn, fabrics, knitwear, and other products. Chemical fibers are divided into natural and chemical groups, and there are significant differences in the production processes, characteristics, and applications of these two types of fibers.

Natural fibers derived from plants, animals, or minerals have a certain degree of naturalness. Examples of natural fibers include cotton and wool. Natural fabrics are widely recognized for their excellent comfort as they maintain their natural color and hydrophilic properties. Natural fibers are derived from high molecular organic substances—such as plant parts and animal fibers—from plant seeds (cotton), stems (flax), leaves (jute), fruits (coir), and silkworm cocoons.

Modern chemical fibers and yarns are almost similar to natural materials in terms of hygiene and comfort. However, thanks to properties such as elasticity, strength, resistance to deformation, adaptability to various climatic conditions, and resistance to aggressive and biological substances, synthetic textiles can compete with natural fibers. Furthermore, synthetic fibers offer broad opportunities for integration into other industrial sectors, creating new areas of application and providing new quality characteristics for textile products.

On the other hand, synthetic fibers are produced from synthetic and natural polymers. Materials like polyester and nylon are examples of synthetic fibers. Depending on the raw materials used, synthetic fibers (made from synthetic polymers like polyester, polyamide, and polyacrylonitrile) and artificial fibers (made from natural polymers like cellulose and its ethers) are distinguished. Inorganic compounds, such as glass, basalt, and quartz fibers, are also sometimes considered chemical fibers. Types of industrial chemical fibers include long filaments, staple fibers (shorter pieces of fine fibers), and filament yarns (a bundle of many fine and very long fibers twisted together).

Chemical fibers are categorized into textile and technical yarns, depending on their intended use. Most chemical fibers are durable, wrinkle-resistant, and resistant to light, moisture, fungi, bacteria, chemicals, and heat. Chemical fibers can also be blended with natural fibers for certain applications.

Unlike natural fibers, the length of synthetic fibers can be controlled by humans. The spinning process plays an important role in the production of filament yarn, which requires the use of chemical solutions. Although natural fibers are less durable compared to synthetic fibers, they are more environmentally



friendly. Synthetic fibers, though not environmentally optimal, are superior in terms of durability.

Chemical fibers play a significant role in the textile industry, offering numerous advantages such as durability, versatility, and economic efficiency. The textile industry greatly benefits from the use of chemical fibers like viscose, acetate, polypropylene, acrylic, nylon, and polyester. These chemical fibers are used in a variety of sectors including clothing, automotive, construction, and medicine. Chemical fiber production has surpassed natural cotton production, with its volume more than doubling in the last two decades, indicating its increasing importance in the textile industry. [3]

Chemical fibers, classified as synthetic fibers, are synthesized from raw materials such as petroleum. These fibers have unique characteristics and are specifically developed for particular purposes. For example, polypropylene fibers are specially designed for use in coated textiles. In various sectors, products like textiles, knitwear, garments, gloves, and carpets are made from a combination of natural fibers and chemical fibers like viscose, acrylic, and polyester. In Uzbekistan, the Navoi Azot plant produces nylon fibers, and the Fergana Chemical Fiber Plant produces acetate fibers, along with other chemical fibers. [4]

The advantages of using chemical fibers in textiles are numerous. First, chemical fibers are well-known for their exceptional strength and durability. These fibers are highly versatile and can be effectively used in a wide range of textile products, including clothing, home textiles, and industrial applications. Furthermore, chemical fibers are often more economically beneficial compared to natural fibers, making them a cost-effective option in textile manufacturing. Additionally, the lower cost of chemical fibers ensures that they are widely accessible to consumers. Chemical fibers are also highly resistant to wrinkles, which eliminates the need for ironing and enhances their durability, making them valuable in industrial applications. Finally, the large-scale production of chemical fibers is another advantage, ensuring a reliable and sustainable supply to meet market demand. [5]

Conclusion: Uzbekistan's chemical fiber industry has been rapidly developing in recent years, aligning with global trends and government development strategies. This article analyzes the significance of the chemical fiber industry and its role in sustainable development. Specifically, the growth rate of synthetic fiber production has surpassed that of natural fibers. Under the "Uzbekistan-2030" strategy, various measures are being implemented to increase the production of synthetic and blended fibers, develop new fiber types, and strengthen competitiveness. However, addressing environmental concerns, such as the impact



of synthetic fibers on the ecosystem, microplastic waste, and greenhouse gas emissions, is also crucial. Therefore, alongside innovation, applying sustainable development principles will play a key role in ensuring the future growth of Uzbekistan's chemical fiber industry.

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