IMPROVING THE TECHNOLOGY OF PRODUCING HIGH-QUALITY SPUN YARN BY PARTIALLY BLENDING COTTON FIBER WITH POLYESTER FIBER

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Abstract: *This article analyzes the technological process of producing high-quality spun yarn by blending cotton and polyester fibers in specific proportions. The study examines the physical–mechanical properties of blended fibers, the sequence of technological operations, the capabilities of modern spinning equipment, the key factors influencing yarn quality, economic efficiency, and prospects for industrial development. Additional emphasis is placed on recent innovations, including AI-based control systems and sustainable polyester production.*

Keywords: *spinning, fibers, blended yarn, hygroscopicity, polyester, compact spinning, fiber synergy.*

Introduction

In recent years, the textile industry has witnessed increasing demands for raw-material quality and production efficiency. Blending natural cotton fibers with synthetic polyester (PES) fibers has become one of the most effective approaches to enhancing yarn quality, reducing production costs, and developing fabrics with additional functional properties. The creation of advanced technological solutions based on cotton–PES blends is considered an innovative direction that provides both performance and sustainability benefits.

Main Part

1. Physical–Mechanical Properties of Cotton and Polyester Fibers

Cotton is a natural fiber well known for its high hygroscopicity, softness, comfort, and biodegradability. However, it is prone to tearing, shrinkage, and creasing. Polyester fibers, on the other hand, exhibit high tensile strength, elasticity, excellent moisture resistance, low abrasion, and rapid drying. When blended, these fibers compensate for one another's shortcomings and create a synergistic effect.

Scientific studies indicate several optimal blend ratios:

65% cotton / 35% PES — balanced hygroscopicity and strength

0% cotton / 50% PES — universal application

35% cotton / 65% PES — technical and sportswear fabrics

The resulting yarn demonstrates improved dimensional stability, surface smoothness, and enhanced durability.

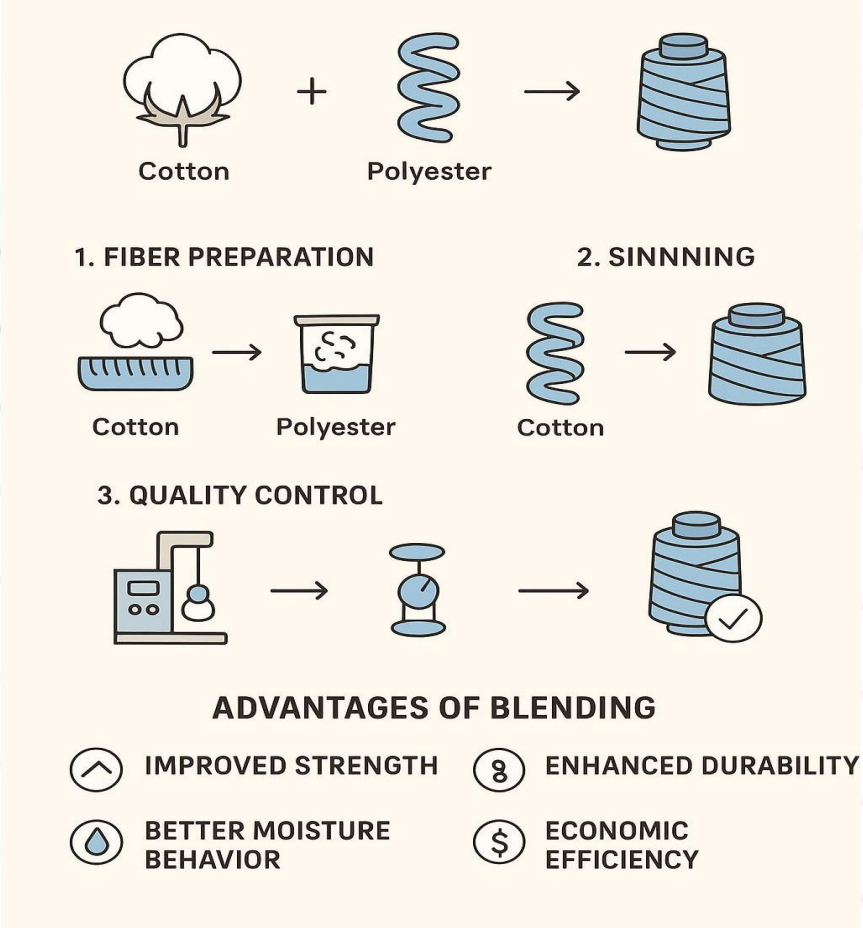


Fig.1

2. Stages of the Technological Process

2.1 Fiber Preparation

Cotton and PES fibers are cleaned separately, freed from dust and short fibers, then blended in precise proportions using automated mixers. Achieving homogeneous distribution is crucial, as it directly affects yarn uniformity and spinning efficiency.

2.2 Carding and Pre-spinning

The mixed fibers undergo carding and combing processes on advanced card and comber machines. This creates a parallel alignment of fibers and removes neps. The resulting sliver is converted into roving during the pre-spinning stage.

2.3 Final Spinning

Modern spinning technologies—ring spinning, compact spinning, and open-end spinning—are widely used. Among them, compact spinning produces the smoothest and strongest yarn due to its reduced hairiness and increased fiber packing density.

Critical parameters such as twist level, count, yarn diameter, and packing density are monitored through automated control systems.

2.4 Quality Control and Winding

Finished yarn is tested in accredited laboratories for tensile strength, elongation, moisture behavior, hairiness, and irregularity (U% and CV%). Only yarns that meet international standards are wound into packages for subsequent weaving or knitting operations.

3. Advantages of Cotton–Polyester Blended Yarns

Mechanical properties: Strength increases by up to 20%, with enhanced elasticity and reduced pilling.

Moisture behavior: Cotton retains its hygroscopic nature while PES ensures faster drying.

Aesthetic and practical features: Fabrics maintain shape, resist wrinkling, and exhibit a smooth surface.

Economic efficiency: Polyester is less expensive than cotton, significantly lowering overall production costs and improving competitiveness.

4. Innovative Approaches and Future Prospects

Leading enterprises are implementing AI-based fiber-blending control, automated fault detection systems, and optimized drafting mechanisms. Another important trend is the use of eco-friendly polyester derived from recycled PET bottles, contributing to sustainable textile production.

Future applications of cotton–PES blended yarn include:

antibacterial and antimicrobial fabrics,

UV-resistant and flame-retardant textiles,

high-performance technical fabrics for industrial use, smart textiles with embedded sensors.

Conclusion

Producing yarn by blending cotton and polyester fibers is one of the most efficient modern approaches to achieving high quality, reduced production costs, and versatility in textile applications. This technology supports the creation of innovative textile products, enhances export potential, and contributes to environmental sustainability. As manufacturing technologies evolve, incorporating advanced quality-control systems and scientific research will further improve production efficiency and yarn performance.

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