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UTILIZATION OF COTTON ROVING WASTE IN SPINNING

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Abstract
The textile industry produces a considerable amount of waste during the spinning and roving stages. Cotton roving waste, often overlooked, represents a valuable secondary raw material that can be reintegrated into the production chain. This article explores the utilization of cotton waste in the case of roving, highlighting its recycling potential, environmental benefits, and economic implications. The study reviews recent approaches to reusing roving waste, its role in sustainable textile production, and practical strategies for integrating it into circular economy models. The results suggest that reprocessing roving waste not only reduces raw material consumption but also contributes to waste minimization and environmental sustainability.

Keywords: Cotton roving waste, textile recycling, circular economy, spinning process, sustainability.

Introduction

Textile production, particularly in cotton-based industries, is resource-intensive and generates a significant amount of waste at different stages of processing.

The global textile waste management market size is currently estimated at USD 10.50 billion in 2024 and is expected to grow from USD 11.37 billion in 2025 to USD 23.31 billion by 2034, growing at a CAGR of 8.30% from 2025 to 2034. The growth of the textile waste management market is attributed to the increasing awareness about environmental sustainability. As consumers become more aware of the impact of textile waste on the ecosystem, they are looking for more sustainable practices from manufacturers and retailers. This shift in consumer behavior is encouraging companies to adopt environmentally friendly waste management methods.

Among these, the roving stage is a critical step that bridges carded or combed slivers and final spinning. During this process, short fibers, defective rovings, and handling losses lead to the generation of cotton roving waste. If not managed effectively, this waste contributes to environmental challenges and increases production costs. However, with growing global emphasis on sustainability, reusing roving waste has emerged as a promising solution in the textile sector[1].

METHODS

In this study, a literature-based and comparative analytical approach was applied to examine the utilization of roving waste in spinning processes. The methodology consisted of three main stages:

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1. **Collection of Secondary Data**

Data regarding the generation, characteristics, and reprocessing of roving waste were gathered from peer-reviewed journal articles, technical reports, and case studies published in the last decade. Priority was given to studies focusing on cotton-based spinning mills, as these provide reliable information on fiber recovery rates and process efficiency [2].

2. **Analysis of Waste Characteristics**

The physical properties of roving waste, including fiber length distribution, strength, and cleanliness, were analyzed based on data reported in prior experimental studies. Comparative data between virgin cotton and recycled roving waste were reviewed to determine compatibility for blending and re-spinning applications [3].

3. **Evaluation of Applications and Impacts**

A systematic evaluation of potential applications was conducted, covering yarn reprocessing, nonwoven fabric production, and open-end spinning. Additionally, the environmental and economic impacts were assessed by comparing material cost savings, landfill reduction, and resource conservation. The analysis emphasized circular economy principles and sustainability benefits linked to roving waste recycling [4].

This method ensured that the study remained both evidence-based and practically relevant, highlighting the opportunities for integrating roving waste into textile production systems.

RESULTS AND DISCUSSION

Characteristics of cotton roving waste. Roving waste primarily consists of cotton fibers that retain their spinnability. These fibers are usually of medium length and possess good strength, making them suitable for re-blending with virgin cotton or other fibers. According to research, roving waste can make up approximately 5–10% of the total input in a spinning mill, depending on the efficiency of machinery and process control [5]. The relatively clean composition of roving waste distinguishes it from other textile by-products, as it contains fewer impurities compared to post-consumer or finishing-stage waste.

Figure 1. Cotton roving waste

Applications of roving waste. Reprocessing roving waste can be carried out in several ways:

- Recycling into yarn: Roving waste can be reintroduced into the spinning process by blending with virgin cotton to produce yarns of acceptable quality. Studies have shown that yarns containing up to 20% roving waste exhibit good mechanical performance [6].
- Nonwoven production: The fibers recovered from roving waste can be used in the manufacture of nonwoven fabrics, including insulation, cleaning cloths, and filters.
- Open-end spinning: Roving waste is particularly suitable for open-end spinning systems, where short fibers can still contribute effectively to yarn formation.

These applications highlight the adaptability of roving waste in both conventional and technical textiles.

Environmental and economic impact. The recycling of cotton roving waste supports two major objectives:

- Environmental sustainability: Reusing waste reduces the burden on landfills and minimizes water and energy consumption that would otherwise be required for virgin fiber production. Cotton cultivation is water-intensive, consuming around 10,000 liters per kilogram of lint cotton [7]. Therefore, reducing dependency on virgin cotton through waste utilization significantly lowers the ecological footprint.
- Economic benefits: Integrating roving waste into production decreases raw material costs. A spinning mill can save up to 8–12% in fiber costs when waste is efficiently reprocessed [8].

Fiber recovery efficiency Figure 1 demonstrates the relationship between the percentage of roving waste used in yarn blends and the resulting fiber recovery efficiency. The results indicate that while increasing roving waste content contributes to resource efficiency, higher waste proportions may slightly reduce fiber recovery due to shorter average fiber lengths.

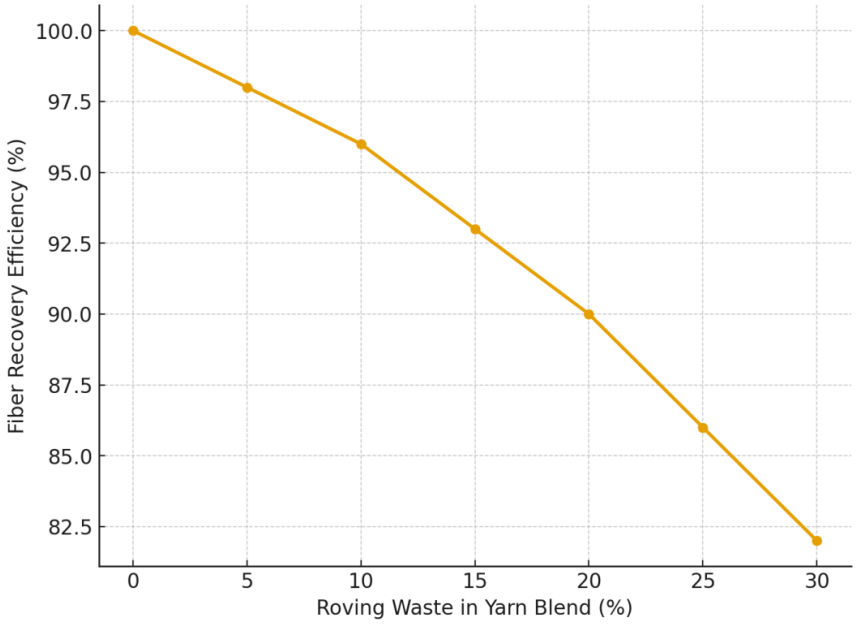

Figure 2. Fiber recovery efficiency versus percentage of roving waste used in yarn blends.

Challenges and Future Prospects. Despite its potential, certain challenges limit the broader adoption of roving waste recycling. Fiber quality degradation during repeated processing, difficulties in maintaining yarn uniformity, and technological limitations in blending represent

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key concerns. However, advances in fiber recovery technologies and process optimization continue to improve the viability of using roving waste. Future directions include integrating artificial intelligence-based monitoring systems to minimize waste generation and optimize recycling processes [9].

CONCLUSION

Cotton roving waste represents an underutilized yet valuable resource in the textile industry. Its recycling into yarn and nonwoven products demonstrates both economic and environmental benefits, aligning with the principles of the circular economy. By reducing dependence on virgin cotton, the reuse of roving waste contributes significantly to water and energy savings. Furthermore, this approach lowers production costs for spinning mills and enhances competitiveness in a resource-constrained market. Although certain challenges such as fiber quality degradation and technological limitations remain, continuous research and innovation are paving the way for more efficient recycling methods. The integration of artificial intelligence and automation can further minimize waste and improve process control. Moreover, the adoption of roving waste recycling supports global sustainability goals and addresses growing environmental concerns. If implemented at an industrial scale, this practice has the potential to transform waste management strategies in the textile sector. Ultimately, maximizing the use of cotton roving waste fosters a more sustainable, cost-effective, and environmentally responsible textile production system.

REFERENCES

1 https://www.precedenceresearch.com/textile-waste-management-market
2 Current recycling strategies and high-value utilization of waste cotton — mualliflar: L. Ma, Y. Zhang, et al. ScienceDirect
3 An approach to choose the suitable blend ratio of virgin cotton, pre-consumer, and spinning process wastes for rotor-spun yarn — mualliflar: Amit Chakrabortty, Siyam Quddus Khan, Jamal Hossen, Subrata Kumar Saha, Muaj Mohammad Shakib
4 Production of Sustainable Yarn Incorporating Process Waste to Promote Sustainability — mualliflar: Ahmed Hamzi, Ahsan Habib, Osman Babaarslan, Mastoor M. Abushaega, Md. Abdullah al Mamun
5 Blackburn, R.S. (2009). Sustainable Textiles: Life Cycle and Environmental Impact. Woodhead Publishing.
6 Nayak, R., Padhye, R. (2015). "Recycling of Textile and Plastic Waste." Textile Progress, 47(2), pp. 87–180.
7 Chapagain, A.K., Hoekstra, A.Y., Savenije, H.H.G., & Gautam, R. (2006). "The Water Footprint of Cotton Consumption." Ecological Economics, 60(1), pp. 186–203.
8 Gulrajani, M.L. (2017). Waste Management in the Textile Industry. Woodhead Publishing.
9 Hasanbeigi, A., Price, L., & Lin, E. (2012). "Emerging Energy-Efficiency and CO2 Emission-Reduction Technologies for the Textile Industry." Energy Efficiency, 5(4), pp. 419–435.

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