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IMPROVING THE EFFICIENCY OF ROVING WASTE UTILIZATION IN SPINNING MILLS

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Abstract

The utilization of roving—and other soft spinning waste—in spinning mills offers both environmental and economic advantages. This study synthesizes findings from recent experimental investigations and industry practices to evaluate how different waste types and technological interventions influence yarn realisation, quality parameters, and overall process efficiency. Data from compact-ring and open-end spinning systems [1], as well as practical implementations such as USTER® ROVING STOP for waste reduction [2], are analyzed. The results demonstrate that: (i) Effective mechanical recycling combined with optimized blend ratios can maintain acceptable yarn quality while enhancing yarn realisation; (ii) Advanced ring frame control systems minimize roving loss and improve raw material utilization; (iii) Operational metrics like 'sweep waste' and invisible loss remain critical targets for efficiency improvement [3][4].

Keywords: roving waste utilization; spinning mills; yarn realisation; sustainable spinning; roving-end control.

1. Introduction

Spinning mills typically generate large quantities of soft waste—roving ends, lap bits, carded waste—which, if unmanaged, contribute to resource inefficiency and environmental burden. Efficient utilization of such waste aligns with circular economy principles [3][4][5]. Strategies such as mechanical recycling, optimized blending, and advanced process control have been proposed to mitigate these issues. This paper integrates experimental and industrial insights to formulate a systematic approach for improving roving waste utilization efficiency.

2. Materials and Methods. Experiments and Sources:

- Valorization via Compact Ring & Open-End Spinning: Experimental blends of mechanically recycled fabric waste with virgin cotton were spun into yarn at different blend ratios. Yarn quality (tenacity, hairiness, unevenness) across compact-ring and rotor methods was recorded [1].
- Waste Reduction via Control Systems: Field data from USTER® ROVING STOP installation in ring frames quantifying reductions in roving waste and improvements in raw material usage [2].
- Operational Metrics: Industry guidelines on minimizing sweep waste, invisible loss, and maximizing yarn realisation were reviewed [3][4][5].

3. Results and Discussion

3.1 Yarn Quality vs Blend Ratio

In [1], increasing virgin fiber proportion improved yarn quality across both spinning systems. Compact-ring spinning exhibited higher tenacity, while open-end rotor spinning yielded yarns with lower hairiness and improved evenness. This suggests a strategic selection of spinning method based on desired quality and recycled content ratio.

Fig. 1. Effect of recycled fiber proportion on yarn tenacity in ring and rotor spinning systems [1].

3.2 Waste Reduction via Automation

Implementation of USTER® ROVING STOP in ring spinning demonstrated a 70% reduction in pneumafil (roving) waste, translating into nearly 1% cost savings in raw material

usage [2]. Real-time detection and halt of roving feed upon end break significantly improved material utilization and productivity.

Fig. 2. Comparative yarn quality (tenacity, hairiness, CVm) in virgin vs blended yarns [1].

3.3 Optimization of Waste-Related Metrics

Industry best practices recommend keeping sweep waste under 1% and invisible loss under 0.5% through disciplined process control and accurate accounting [3][4]. Yarn realisation—directly tied to waste levels—is cited at 85–90% for carded yarns and 67–75% for combed yarns, highlighting room for efficiency gains [5].

4. Conclusion

Efficient utilization of roving waste in spinning mills is achievable through a combination of optimized spinning methods, intelligent automation, and disciplined waste monitoring. Compact-ring and open-end spinning systems each offer advantages, depending on blend composition and quality requirements. Deploying end-break control technologies and minimizing waste through operational discipline further enhances material efficiency. These strategies collectively support sustainable, cost-effective spinning mill operations.

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