IMPROVING THE DESIGN OF PRIMARY COTTON CLEANING MACHINES TO ENHANCE ROVING QUALITY

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Abstract:
The efficiency of primary cotton fiber cleaning significantly impacts the quality of the final textile product. This study examines the effect of modifying the second drum's teeth configuration in the CL-P cleaning machine to optimize roving quality. Experimental analysis using the Uster AFIS PRO-2 device revealed improvements in short fiber content, dust removal, and foreign matter reduction. The modified CL-P machine demonstrated enhanced cleaning efficiency, aligning with Uster 25% standards. However, minor adjustments are needed to optimize neps content. Implementing these improvements in industrial applications can enhance fiber processing efficiency and product quality.

The primary cleaning stage in cotton fiber processing plays a crucial role in determining the quality of the final textile product [1]. The efficiency of this stage directly affects fiber length, impurity removal, and overall spinning performance. Traditional cleaning machines often struggle to balance impurity removal and fiber preservation, leading to quality losses [2-4]. Therefore, improving the design of primary cleaning machines is essential for optimizing fiber quality and reducing waste. This study investigates the impact of modifying the number and size of teeth on the second drum of the CL-P primary cotton cleaning machine and evaluates its effect on roving quality [5-7].

In this study, an improved version of the CL-P primary cleaning machine was tested. The key modification involved adjusting the number and size of the teeth on the second drum to enhance fiber cleaning efficiency while minimizing fiber damage. Cotton roving samples were tested using the Uster AFIS PRO-2 device to evaluate key parameters such as short fiber content, dust levels, and neps formation. The results were compared with standard factory settings and Uster Statistics at the 5%, 25%, and 50% levels to determine the effectiveness of the modifications.

The experimental results indicate that the improved CL-P cleaning machine significantly enhances fiber quality. The most notable improvements were observed in the reduction of short fiber content, dust, and foreign impurities. The comparison of results is presented in Table 1.

The results demonstrate that the modified CL-P machine achieves a slight but meaningful reduction in short fiber content.

Table 1. Fiber Quality Indicators after Cleaning.

Parameter	Standard Machine	Modified CL-P Machine	Uster 25%	Uster 50%
Short fiber content (SFC(n), %)	23.2	22.8	21.7	24.0
Short fiber content (SFC(w), %)	8.1	7.7	7.8	8.9
Total neps count (/g)	47	45	46	60
Dust content (/g)	28	23	26	51
Visible foreign matter (%)	0.05	0.04	0.05	0.09

The reduction in dust and visible foreign matter suggests improved cleaning efficiency, which aligns closely with Uster 25% standards. However, the neps content remains similar to the factory variant, indicating that further optimization may be required in this area.

CONCLUSION

This study confirms that modifying the second drum of the CL-P cleaning machine leads to measurable improvements in cotton fiber quality. The reduction in short fibers, dust, and impurities suggests that this innovation can contribute to better processing efficiency and higher-quality end products. Future research should explore further optimizations in neps reduction and evaluate the long-term durability of the modified components. Implementing these findings in industrial settings can enhance productivity and reduce fiber waste, making the cotton cleaning process more efficient and sustainable.

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