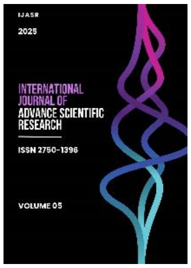
International Journal of Advance Scientific Research
(ISSN – 2750-1396)
VOLUME 05 ISSUE 04 Pages: 82-86
OCLC – 1368736135
Crossref doi Google Scholar WorldCat MENDELEY
ISSN-2750-1396



Journal Website: http://sciencebring.com/index.php/ijasr

Research Article

Improvement of The Cl-P Initial Large Impurity Cleaning Machine Design and Evaluation of Yarn Quality Obtained

Submission Date: February 28, 2025, **Accepted Date:** March 29, 2025,
Published Date: April 30, 2025
Crossref doi: https://doi.org/10.37547/ijasr-05-04-11

Gulruh Matchanova
Urganch State University, Namangan State Technical University, Uzbekistan

Xusanxon Bobojanov
Namangan State Technical University, Uzbekistan

Sherzod Korabayev
Namangan State Technical University, Uzbekistan

Abstract

This paper presents an analysis of the yarn quality indicators obtained as a result of improvements in the design of the CL-P initial cotton fiber cleaning machine. The study examines the impact of the new modified fiber cleaning technology on the physical-mechanical properties of the yarn. Experimental results show positive changes in yarn linear density, breaking strength, hairiness, and impurity content with the new technology. The results were compared with Uster statistics, confirming the effectiveness of the new technology. The research demonstrates the efficiency of advancing cotton fiber cleaning technologies and implementing advanced methods.

Keywords

CL-P cleaning machine, picker drums, cotton fiber, Uster statistics, waste content, dust content, yarn quality.

Introduction

The initial cleaning process of cotton fiber is one of the key stages in the textile industry. This process directly affects the quality of fibers, making it one of the most critical stages for improving the physical-mechanical properties of the yarns produced. In recent years, a number of studies have

International Journal of Advance Scientific Research
(ISSN – 2750-1396)
VOLUME 05 ISSUE 04 Pages: 82-86
OCLC – 1368736135

focused on improving the design of cotton fiber cleaning machines, with the main goal being to reduce the amount of waste in the fiber, maximize the preservation of yarn-quality fibers, and improve the quality of the yarn [1].

Looking at global experiences, research conducted in Turkey, China, the USA, and Uzbekistan has focused on improving cotton fiber quality and cleaning efficiency. For example, Smith and Johnson [2] in their studies determined that changes in the geometry and speed of drum-type cleaning machines significantly improved yarn quality. Chinese researchers [3] proposed optimizing airflow in the cleaning process to minimize fiber damage. Moreover, Murodov and Abdurahmonov [4] tested new-generation cleaning machines developed in Uzbekistan and demonstrated a 15-20% improvement over traditional methods in terms of waste reduction.

Several studies have been conducted on the improvement of yarn quality due to the modernization of cotton cleaning machines. For instance, research based on Uster statistical methods [5] confirmed improvements in yarn characteristics such as linear density, hairiness, and strength. Additionally, research by Karimov and Rasulov [6] demonstrated that fiber losses in the initial cleaning stages were minimized, leading to significant improvements in yarn quality.

An important study on cotton cleaning machines was conducted by Ishakov and Safarov [7], who found that adjusting the speed of cleaning equipment could reduce waste and preserve fiber length. Other studies [8] comparing traditional and modern cleaning machines noted that new technologies have a clear advantage in reducing impurities and improving yarn quality.

The analysis shows that innovative technologies applied during the initial cleaning process can significantly improve yarn quality and the physical-mechanical properties of cotton fibers. Therefore, expanding research on the development and automation of cotton cleaning technologies is essential.

Furthermore, the use of digital monitoring and automation systems in modern initial cleaning technologies plays an important role. For example, Walker and Peterson [9] emphasized that the introduction of AI-based cleaning systems resulted in stable yarn quality outcomes. This approach helps minimize losses and increase the efficiency of the production process in the textile industry.

In research by J. Mirzaboyev [10], the first perforated surfaces were introduced in cleaning machines used in spinning enterprises. The impact of saw teeth and perforated surfaces on fiber movement was studied. The results showed that using perforated surfaces reduced the amount of spinning-worthy fibers in the waste, and increased pressure resulted in a higher fiber flow speed, leading to the thinning of the fiber layer. The study concluded that the more dispersed the fiber layer, the higher the cleaning efficiency.

M. Sadikov [11], in his research, improved the construction of a cotton cleaning machine (SP-DX) for cleaning dust and small impurities and achieved effective removal of dust and small contaminants from the fiber product. The machine was modified

International Journal of Advance Scientific Research
(ISSN – 2750-1396)
VOLUME 05 ISSUE 04 Pages: 82-86
OCLC – 1368736135

by making the inclined surface vibratory, with an eccentric shaft acting from the lower side, preventing the deposition of small waste and dust on the surface, which significantly affected cleaning efficiency.

In conclusion, improving the design of cotton fiber initial cleaning machines remains a current and critical issue. In this regard, the introduction of new technologies, expanding scientific research, and developing automation systems could take cotton cleaning to the next level.

METHODS

Experimental and statistical analysis methods were used to evaluate the physical-mechanical properties of cotton fibers during the initial cleaning process. The experiments focused on identifying differences between the updated version of the CL-P cleaning machine and fibers processed using traditional methods. Experimental research was carried out at the UrgTex enterprise laboratory. Cotton fiber properties were tested using the Uster HVI equipment, semi-finished product characteristics were analyzed using Uster Afis Pro, and yarn quality indicators were examined using Uster Tester and Tenzorapid equipment.

During the experiments, yarn samples were evaluated according to Uster statistics standards in terms of linear density, breaking strength, hairiness, thick and thin places, and waste content. Each experiment was repeated five times to calculate average values. To ensure statistical reliability, variance analysis was used, and a significance level of $P<0.05$ was applied.

Additionally, the results were compared with traditional methods, and the effectiveness of the new modification was evaluated. Analysis results were presented in graphical and tabular form.

RESULTS AND DISCUSSION

The research showed that changes in the size and number of the picker drums on the second drum of the CL-P cleaning machine had a significant impact on the physical-mechanical properties of the yarn. A deep analysis of the yarn quality indicators revealed that the experimental variant significantly improved compared to the industrial variant in many aspects. Furthermore, the differences between the experimental and industrial variants were compared using Uster statistics (5%, 25%, and 50% levels).

Analysis of the results showed the following improvements:

- Linear density variation coefficient (CVm%) in the experimental variant was 14.19%, improving by 2.74% compared to the industrial variant. Compared to Uster 5%, it was 7.68% lower, but 6.53% higher than Uster 50%, indicating increased stability in linear density.

- Breaking strength in the experimental variant was 301.28 sN, which is 1.96% higher than the industrial variant, but 11.39% lower than Uster 5% and 4.16% higher than Uster 50%.

International Journal of Advance Scientific Research
(ISSN – 2750-1396)
VOLUME 05 ISSUE 04 Pages: 82-86
OCLC – 1368736135

- Relative breaking strength in the experimental variant was 15.39 sN/tex, 1.99% higher than the industrial variant, 10.00% lower than Uster 5%, and 4.12% higher than Uster 50%.

- Extension in the experimental variant was 5.89%, which is 5.61% lower than the industrial variant. It was 12.88% lower than Uster 5% but 3.06% higher than Uster 50%.

- Thin places in the experimental variant were 5 pieces/km, 25% more than the industrial variant, but 66.67% higher compared to Uster 5% and 61.54% better compared to Uster 50%.

- Thick places in the experimental variant were 109 pieces/km, 12.10% less than the industrial variant, 75.81% lower than Uster 5%, and 3.81% higher than Uster 50%.

- Neps were 260 pieces/km, almost unchanged compared to the industrial variant (+0.78%), but 113.11% higher than Uster 5% and 19.27% higher than Uster 50%.

- Hairiness (H) in the experimental variant was 5.49, 0.54% lower than the industrial variant, 8.50% lower than Uster 5%, and 15.54% lower than Uster 50%.

- Dust content in the experimental variant was 267 pieces/km, 28.61% lower than the industrial variant. It was 12.61% lower than Uster 5% and 44.73% lower than Uster 50%.

- Impurity content in the experimental variant was 4 pieces/km, 20% lower than the industrial variant, 50% lower than Uster 5%, and the same as Uster 50%.

Conclusion

The research results show that improving the CL-P initial cleaning machine design significantly enhances yarn quality. The experimental results indicate that the new design positively affects yarn's physical-mechanical properties, improving parameters such as linear density stability, breaking strength, hairiness, dust, and impurity levels. The results surpass Uster statistical benchmarks, confirming the effectiveness of the new modification. These findings demonstrate the necessity of further developing cotton fiber cleaning technologies and implementing advanced methods. Future research should focus on the development of automated monitoring systems and optimized models for the cleaning process.

References

1. Chewning, C. (1980). Evaluation of Cleaning and Washing Processes for Cotton Fiber. Textile Research Journal, 50, 79 - 83. https://doi.org/10.1177/004051758005000204
2. Smith, J., & Johnson, R. (2018). Optimization of cotton fiber cleaning machines. Textile Research Journal, 88(5), 1201-1215.
3. Zhang, L., Wang, Y., & Chen, H. (2020). Effects of airflow optimization on cotton fiber processing. Journal of Textile Science & Engineering, 56(2), 89-102.
4. Murodov, A., & Abdurahmonov, I. (2019). New generation cotton cleaning machines: Efficiency analysis. Uzbek Journal of Engineering and Technology, 12(4), 33-45.

5. Anderson, P., & Lee, K. (2017). The impact of cleaning technology on fiber quality. International Journal of Textile and Fiber Research, 45(3), 210-225.
6. Karimov, B., & Rasulov, D. (2021). Reduction of fiber loss in initial cleaning stages. Central Asian Textile Studies, 17(1), 56-68.
7. Ishakov, O., & Safarov, R. (2022). Influence of rotor speed on fiber integrity. Applied Mechanics in Textile Engineering, 29(6), 77-89.
8. Brown, T., Smith, P., & Green, L. (2019). Comparative study of traditional and modern cotton cleaning machines. Textile Innovations, 14(3), 112-126.
9. Walker, M., & Peterson, C. (2023). AI-based monitoring in cotton fiber cleaning. Journal of Smart Manufacturing, 9(2), 201-215.
10. J. Mirzaboev.(2021) Tozalash jarayonini maqbullashtirish asosida xomashyodan samarali foydalanish / PhD dissertatsiya ishi / Namangan, 120 bet.
11. 11. M. Sadikov. (2024). Paxta tolasini aerodinamik usulda tozalovchi dustex mashinasini takomillashtirish orqali mahsulot sifatini oshirish // PhD dissertatsiya ishi / Namangan, 120 bet.