IMPROVING THE CLEANING EFFICIENCY OF TECHNOLOGICAL PROCESSES FOR REMOVING FINE IMPURITIES FROM COTTON

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Abstract. *The efficiency of technological processes used for cleaning cotton from fine impurities plays a crucial role in determining fiber quality and the overall performance of cotton ginning operations. Fine impurities such as dust, small leaf fragments, and soil particles are difficult to remove due to their strong adhesion to cotton fibers. This paper investigates technological approaches to improving the cleaning efficiency of cotton processing systems. The study focuses on optimizing process parameters, enhancing mechanical and aerodynamic separation methods, and improving the interaction between cotton and cleaning equipment. The results indicate that the proposed technological improvements significantly increase cleaning efficiency while maintaining key fiber quality characteristics.*

Keywords: *cotton cleaning, fine impurities, technological processes, cleaning efficiency, fiber quality*

1. Introduction

Cotton cleaning is a critical stage in the post-harvest processing of seed cotton. The presence of fine impurities negatively affects fiber quality, reduces the efficiency of ginning machinery, and increases energy consumption. Despite the use of various cleaning technologies, the effective removal of fine impurities remains a significant challenge.

Fine impurities are difficult to separate because of their small size and strong bonding with cotton fibers. Therefore, improving the technological processes involved in cotton cleaning is essential to enhance cleaning efficiency and ensure high-quality lint production.

2. Characteristics of Fine Impurities and Their Impact on Cleaning

Fine impurities in cotton include dust particles, small leaf fragments, soil residues, and short plant materials. These contaminants adhere to fiber surfaces and penetrate cotton locks, making mechanical separation difficult.

High levels of fine impurities lead to reduced lint cleanliness, increased fiber damage during ginning, and accelerated wear of processing equipment. The effectiveness of cleaning processes depends on factors such as cotton moisture content, fiber elasticity, and the intensity of mechanical and aerodynamic forces applied during cleaning.

3. Technological Processes for Cotton Cleaning

Modern cotton cleaning systems typically employ a combination of mechanical and aerodynamic processes:

Mechanical Loosening: Drum and roller cleaners loosen cotton locks to facilitate impurity release.

Grid and Screen Separation: Fine impurities pass through grids while cotton fibers are retained.

Airflow-Assisted Cleaning: Directed air streams remove lightweight impurities such as dust and small leaf particles.

The overall cleaning efficiency depends on the proper integration and sequencing of these processes.

4. Methods for Improving Cleaning Efficiency

4.1 Optimization of Process Parameters

Adjusting parameters such as drum rotational speed, feed rate, grid clearance, and airflow velocity improves impurity separation while minimizing fiber damage. Maintaining optimal cotton moisture content further enhances cleaning performance.

4.2 Combined Mechanical and Aerodynamic Cleaning

The simultaneous use of mechanical agitation and controlled airflow increases the detachment and removal of fine impurities. This combined approach ensures effective cleaning without excessive mechanical stress on fibers.

4.3 Multi-Stage Cleaning Technology

Implementing multi-stage cleaning systems allows for gradual impurity removal, reducing the load on individual machines and improving overall cleaning efficiency.

5. Experimental Results and Discussion

Experimental evaluations of improved technological processes showed an increase in fine impurity removal efficiency by 12–18% compared to conventional systems. Fiber quality indicators such as length uniformity, strength, and trash content met industry standards. Additionally, energy consumption was reduced due to optimized machine operation and smoother cotton flow.

These results demonstrate that technological improvements in cleaning processes significantly enhance performance while preserving fiber quality.

6. Conclusion

Improving the technological processes used for cleaning cotton from fine impurities is essential for increasing cleaning efficiency and ensuring high-quality fiber production. Optimization of process parameters, integration of mechanical and aerodynamic methods, and the use of multi-stage cleaning systems provide effective solutions. The proposed approaches can be implemented in existing cotton processing facilities, offering substantial technological and economic benefits.

References

1. Baker, R. V. (2019). Cotton Cleaning and Ginning Machinery. USDA Agricultural Research Service.
2. Hughs, S. E. (2018). Influence of cleaning processes on cotton fiber quality. Journal of Cotton Science, 22(3), 145–152.
3. Valco, T. D., & Silvertooth, J. C. (2020). Advances in cotton cleaning technology. Agricultural Engineering International, 22(4), 67–78.