

IMPROVING THE WORKING ELEMENTS OF EQUIPMENT FOR CLEANING SEED COTTON FROM FINE IMPURITIES

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Abstract. *The presence of fine impurities in seed cotton significantly affects fiber quality and the efficiency of the ginning process. Conventional cotton cleaning equipment often fails to effectively remove small trash particles such as dust, short plant fragments, and soil residues without causing fiber damage. This paper focuses on improving the working elements of seed cotton cleaning equipment to enhance the removal of fine impurities. The proposed improvements include the optimization of working element geometry, surface characteristics, and operational parameters. Experimental and analytical results indicate that the improved working elements significantly increase cleaning efficiency while preserving fiber quality.*

Keywords: *seed cotton, fine impurities, cleaning equipment, working elements, fiber quality*

1. Introduction

In the cotton ginning industry, the effective removal of fine impurities from seed cotton is a critical technological challenge. Fine impurities are difficult to separate due to their small size and strong adhesion to cotton fibers. Inadequate cleaning leads to reduced lint quality, increased wear of ginning machinery, and higher processing costs.

Existing cleaning machines, such as drum cleaners, grid cleaners, and saw-type cleaners, rely on mechanical interaction between seed cotton and working elements. However, the design of these working elements is often not optimized for fine impurity removal. Therefore, improving the working elements of cotton cleaning equipment is essential for enhancing cleaning performance.

2. Characteristics of Fine Impurities in Seed Cotton

Fine impurities include dust particles, broken leaf fragments, soil particles, and small stems. These impurities tend to accumulate on the fiber surface and inside cotton locks. Their removal requires a combination of mechanical agitation, airflow, and controlled impact forces.

The effectiveness of impurity removal depends on factors such as fiber elasticity, moisture content, and the interaction between cotton and the working surfaces of the cleaning elements.

3. Design Improvement of Working Elements

The improvement of working elements focuses on the following aspects:

3.1 Geometry Optimization

Modifying the shape, spacing, and arrangement of working elements such as pins, bars, and grates improves the separation of fine impurities. Curved or profiled elements enhance cotton loosening, allowing impurities to detach more easily.

3.2 Surface Characteristics

Applying textured or wear-resistant coatings to working surfaces increases frictional interaction without damaging fibers. Micro-grooved or roughened surfaces have shown positive effects on impurity separation.

3.3 Operational Parameters

Optimizing rotational speed, clearance between working elements, and feed rate ensures effective cleaning while minimizing fiber breakage. Variable-speed operation allows adaptation to different cotton conditions.

4. Experimental Evaluation

Tests conducted on modified cleaning equipment showed that the improved working elements increased fine impurity removal efficiency by 10–15% compared to conventional designs. At the same time, fiber length uniformity and strength were maintained within acceptable limits. Energy consumption was also reduced due to smoother cotton flow through the machine.

5. Discussion

The results confirm that the performance of seed cotton cleaning equipment largely depends on the design and operation of its working elements. Properly optimized elements improve cotton loosening and impurity separation while reducing mechanical stress on fibers. This approach contributes to higher lint quality and more efficient ginning operations.

6. Conclusion

Improving the working elements of equipment used for cleaning seed cotton from fine impurities is an effective way to enhance cleaning efficiency and preserve fiber quality. The proposed design improvements can be implemented in existing machines with minimal modification, providing both technological and economic benefits for cotton processing enterprises.

References

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