ISSN 2181-8622

Manufacturing technology problems

Scientific and Technical Journal Namangan Institute of Engineering and Technology

INDEX COPERNICUS INTERNATIONAL

Volume 9
Issue 4
2024

Google Scholar Crossref doi SLIB.UZ Scientific library of Uzbekistan

SEPARATION OF COTTON FROM AIRFLOW IN PNEUMATIC TRANSPORT SYSTEMS OF THE COTTON INDUSTRY

SHARIBAEV NOSIR

Professor of Namangan Institute of Engineering and Technology, Namangan, Uzbekistan
Phone.: (0893) 677-0329, E-mail.: sharibayev.niti@gmail.com

MAKHMUDOV AZIMJON

PhD student of Namangan Engineering Construction Institute, Namangan, Uzbekistan
Phone.: (0897) 250-0703, E-mail.: azimboy702@gmail.com
**Corresponding author*

Abstract: This research focuses on enhancing the efficiency of cotton separation from airflow in pneumatic transport systems within the cotton industry. The study investigates the aerodynamic properties of separators, material characteristics, and challenges faced in the separation process. By introducing advanced technologies and optimizing separator designs, it becomes possible to regulate airflow, separate cotton without causing damage, and minimize energy consumption. The findings demonstrate that these improvements can enhance factory productivity and elevate the quality of cotton fiber. The outcomes of this research hold potential for fostering sustainable development in the cotton industry.

Keywords: cotton industry, pneumatic transport system, separator, aerodynamic properties, airflow, efficiency, separation process, separator design, energy optimization.

Introduction. In pneumatic conveying systems, the process of separating cotton from the air flow is often a very complex and important technological operation. This process is one of the first stages of raw material processing in the cotton industry, and its efficiency directly affects the quality of cotton fiber and seeds produced later. Unfortunately, existing pneumatic separator systems often suffer from problems such as aerodynamic resistance and excessive damage to cotton pieces. Such unfavorable phenomena lead to a decrease in the quantity and quality of cotton fiber, which leads to large economic losses in the textile industry.

Research and development aimed at increasing the efficiency of pneumatic separators while protecting cotton pieces from damage are becoming increasingly important today. By eliminating these problems, it is possible to optimize the processing of raw materials in the cotton industry and produce high-quality products. This approach can also contribute to the environmentally friendly and sustainable development of the cotton industry, since effective separators reduce a large amount of waste and optimize energy consumption.

Research conducted by Academician of the Academy of Sciences of Uzbekistan H.Rakhmatulin and his colleagues showed that cotton can be separated more efficiently by balancing aerodynamic and inertial forces in pneumatic separators. Their developments allow us to better understand the laws of motion of cotton pieces and, on this basis, create new types of separators. These separators can work more accurately and with fewer errors when separating cotton from the air flow. At the same time, the work of G.B. Bakhriev is also of great importance in this area. His research shows that the

efficiency of the cotton separation process can be increased by improving the design of the working parts of the separator. Bakhriev's work offers new approaches to making separators more flexible depending on the flow rate and aerodynamic properties of cotton pieces. These approaches, by controlling the force and direction of the air flow, allow for more efficient separation of cotton fibers and play an important role in reducing production costs in the cotton industry.

Literature Analysis. The article considers the possibilities of increasing the efficiency of the cotton separation process by reducing the aerodynamic resistance of the separator working parts [1]. The authors provide a scientific basis for the optimization of the separator operating parameters. This study provides a theoretical basis for the aerodynamic optimization of the separator design and is directly related to the methodology of this work. The importance of using environmentally sustainable technologies [2] in the cotton industry is analyzed. Approaches to increasing energy efficiency and reducing separator waste are presented. The study emphasizes the importance of environmental sustainability, which will help to minimize the impact of events on the environment. Modern technologies and methods for separating cotton from the air flow are discussed. The advantages of new designs [3] are demonstrated by practical experiments. This article considers new approaches to aerodynamic optimization and practical application of separators. The article [4] is about the role and advantages of automated separator systems in increasing production efficiency at cotton factories. The use of automated systems ensures the operation of separators with high accuracy, which affects the results. This article is devoted to the development of mathematical models and algorithms for the operation of separators. Contains information on the models used in calculating the aerodynamic parameters [5]. The mathematical models in the article complement the mathematical foundations of this study. New approaches to optimizing energy consumption of enterprises and the use of separator technologies are analyzed [6]. Information on increasing energy efficiency in the article is combined with modern developments of separators.

Methods. In this study, the main method chosen was a deep analysis of the physical and aerodynamic characteristics of the cotton separation process in the pneumatic transport system. This method allows assessing the current state of the separators and identifying problem areas, and also helps to collect the necessary scientific basis for creating new improved designs. As a first stage of research, it is planned to determine the aerodynamic characteristics of existing pneumatic separator systems by studying their operating parameters. This process includes measuring the speed, pressure and direction of air flow in the separators. Also, special aerodynamic experimental devices are used to analyze the interaction of the air flow with pieces of cotton wool.

The first stage of the study examines the aerodynamic drag calculation formulas developed by Rakhmatulin and Bakhriev and evaluates their practical application. In doing so, the aerodynamic forces acting on various elements of the separator structure are determined and their impact on the efficiency of cotton fiber separation is analyzed. The second stage will involve experiments and tests necessary for the practical

implementation of Rakhmatulin and Bakhriev's theories. These tests will seek ways to increase the ability of cotton products to withstand aerodynamic drag forces. The information obtained from the tests will enable the creation of new technical solutions that can be used to reduce aerodynamic drag.

The third stage involves developing a method for accurately calculating aerodynamic drag forces under changing conditions. This method is used to predict the movement of cotton pieces under different conditions and optimize their aerodynamic properties. This stage includes collecting important data for developing new separator designs aimed at reducing aerodynamic drag. The fourth stage is aimed at updating and expanding the developments of Rakhmatulin and Bakhriev using modern technologies. At this stage, mathematical models and algorithms used to calculate aerodynamic drag forces are improved. These works are carried out in order to increase the efficiency of pneumatic separator systems used in the cotton industry.

The laboratory conditions for experimental studies are equipped with special equipment. These devices include special optical and video systems for air flow control, pressure and speed measurement, and control over the movement of cotton pieces. Before each experiment, these devices are carefully checked and calibrated, which guarantees the accuracy and reliability of the results obtained. During the experimental studies, the main operating parameters of the separator are strictly controlled. These include factors such as air flow speed, pressure inside the separator, temperature and air humidity. These parameters are constantly monitored during the experiments and adjusted if necessary, which creates the necessary conditions for increasing the efficiency of cotton separation.

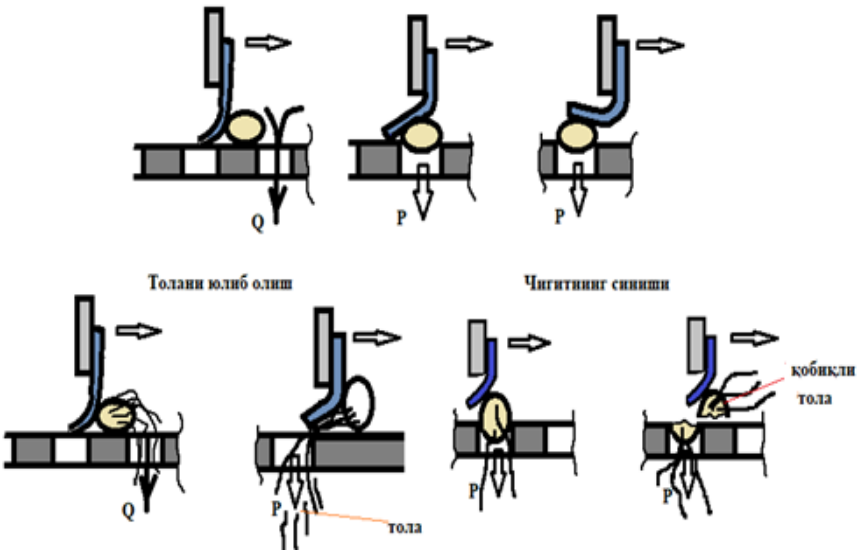

Fig. 1 Negative situations arising during the separation process

The research focused on the efficiency of the mesh surface and the filter in separating cotton particles from the air flow. The mesh surface geometry and its air flow resistance properties play an important role in shaping the trajectory of the cotton pieces.

The wiper is the main mechanism that regulates the interaction of the cotton pieces with the mesh surface. Optimizing the performance of these two components allows for more efficient separation of cotton pieces. Experimental studies are conducted in special laboratory conditions. The laboratory equipment includes high-resolution video systems and speed sensors that allow for precise monitoring of the mesh surface and the operation of the dryer. Before each experiment, these devices are checked and calibrated, which ensures the reliability and accuracy of the data obtained.

Results. The results of the study show that the air flow speed and direction have a great impact on the efficiency of the pneumatic separator. During the experimental work, it was possible to evaluate the effect of air flows of different speeds and directions on the operation of the separator. The results showed that the optimized air flow speed allows for quick and efficient separation of cotton pieces, which improves the efficiency of the entire production process. The aerodynamic design of the separator is very sensitive to the air flow direction. The studies have shown that by precisely controlling the air flow direction, it is possible to more effectively control the movement of cotton particles inside the separator. This reduces the likelihood of damage to cotton pieces during the separation process and makes it possible to obtain a high-quality product. It can also be seen that the efficiency of the separator increases with the increase in air flow. However, when this increase reaches a certain limit, increasing the speed can lead to excessive damage to cotton pieces, which will adversely affect the quality of the product. Therefore, maintaining the air flow at an optimal level is necessary to maximize the efficiency of the separator.

It has been established that the aerodynamic settings of the separator are of great importance. Thanks to the optimal speed and direction of the air flow, the cotton pieces can be separated quickly and efficiently without damaging them. These results are achieved by flexibly adjusting the speed and direction of the air flow depending on the various design elements of the separator. During the experimental studies, the influence of the air flow pressure on the process of separating the pieces of cotton wool was also observed. An optimized pressure level reduces the likelihood of damage when separating the cotton pieces and increases the overall efficiency of the process. This contributes to improving the quality of cotton and increasing the efficiency of production.

The first problem was the rapid fouling of the screen surface. Clogging is caused by cotton particles and fibers adhering to the screen surface, which restricts proper air flow and reduces efficiency. The figures show the various stages of fouling and its effect on the performance of the separator. As a proposed solution, it is shown that fouling can be reduced by changing the material and design of the screen surface. The second major problem was the uneven operation of the juicer. The doctor blade is designed to clean the dirty screen surface, and its uneven operation results in incomplete cleaning of the screen surface. The figures and diagrams show the modifications needed to improve the performance of the dryer, including the ability to adjust the speed and pressure of the dryer.

The third problem was that the unfavorable air flow direction created "sixth zones" inside the separator, which slowed down the separation of the cotton pieces. The pictures explain these zones and their causes. The proposed solution was to develop updated aerodynamic designs to control the direction and strength of the air flow. The fourth problem was the excessive concentration of the air flow force, which in some cases led to damage to the cotton pieces. Using diagrams, it was analyzed how the air pressure could be overly concentrated in certain places and what problems this caused. The proposed solution was to improve the aerodynamic design of the separator to distribute the air flow evenly.

Discussion. The results of the study offer new approaches to reducing aerodynamic drag and optimizing material concentration compared to previous studies. While previous studies mainly focused on improving the overall performance of the separator, this study aims to improve the efficiency of the cotton separation process by precisely controlling the aerodynamic drag and taking into account the physical properties of the material. These changes allow for more precise control of the aerodynamic settings, which is a major step forward in the cotton industry. Technological aspects of improving separator designs include the use of new design elements and modernization of production processes. These changes allow for more precise control of the speed and direction of the air flow, which significantly improves the efficiency of separating cotton pieces. Also, the use of new materials and technologies extends the service life of the separators and reduces maintenance costs.

New separator designs also contribute to improving the quality of cotton fibre.These designs reduce the possibility of damage to cotton pieces and minimize the amount of impurities between the fibers. These changes not only improve product quality, but also optimize the amount of raw material used in the fiber production process, resulting in lower production costs. New separator designs also help reduce energy consumption in cotton mills. New technologies and control systems improve energy efficiency, which reduces energy costs for the mills. These changes also help improve the overall operational efficiency of the plants, as more products can be produced with less energy.

Summary. The data and observations obtained in this study demonstrate how improvements in air separator designs can positively impact the cotton industry. has clearly demonstrated that this is possible. The results of the study confirmed that by optimizing the air flow speed and direction, as well as the k-factor and material concentration, cotton pieces can be separated more efficiently. These changes can improve production efficiency and fiber quality. Recently developed separator designs can significantly improve the efficiency of cotton mills. These designs make the cotton separation process faster and more efficient by precisely controlling the air flow and adapting to the physical properties of the material. As a result, mills can produce more product using less time and resources.

Improvements in separator design are also cost-effective. New technologies and automated control systems reduce energy consumption and make production processes

cost-effective. These changes help reduce cotton mill costs and increase overall profits. From an environmental perspective, new separator designs help reduce the environmental impact of the cotton industry. These innovations reduce the environmental impact by reducing waste and minimizing the amount of harmful substances released into the air. In this way, cotton mills can operate in an environmentally sustainable manner.

Reference

1. Rakhmatulin Kh.A., Bakhriev G.B.Aerodynamic forces and separator designs. Publishing House of the Academy of Sciences of Uzbekistan, 2023.
2. Gasanov, R.Technological development of cotton mills and environmental sustainability. "Scientific journal on cotton and textiles", 2022, 3 (15), pp. 25-30.
3. Tashmurodov, F.New separation technologies in the process of cotton separation. Scientific journal "Technologies and Innovations", 2023, 5(22), pp. 45-50.
4. Karimov, Yu.Automated separator systems in the cotton industry. Cotton Industry and Technology, 2021, 7(18), pp. 60-67.
5. Abduganov, D.Development of aerodynamic mathematical models of separators. Science and Practice, 2024, 2(8), pp. 33-40.
6. Yuldashev, I.Improving energy efficiency in cotton mills. "Technologies and Mechanical Engineering", 2023, 4(11), pp. 55-60.

CONTENTS

PRIMARY PROCESSING OF COTTON, TEXTILE AND LIGHT INDUSTRY

GROWING, STORAGE, PROCESSING AND AGRICULTURAL PRODUCTS AND FOOD TECHNOLOGIES

CHEMICAL TECHNOLOGIES