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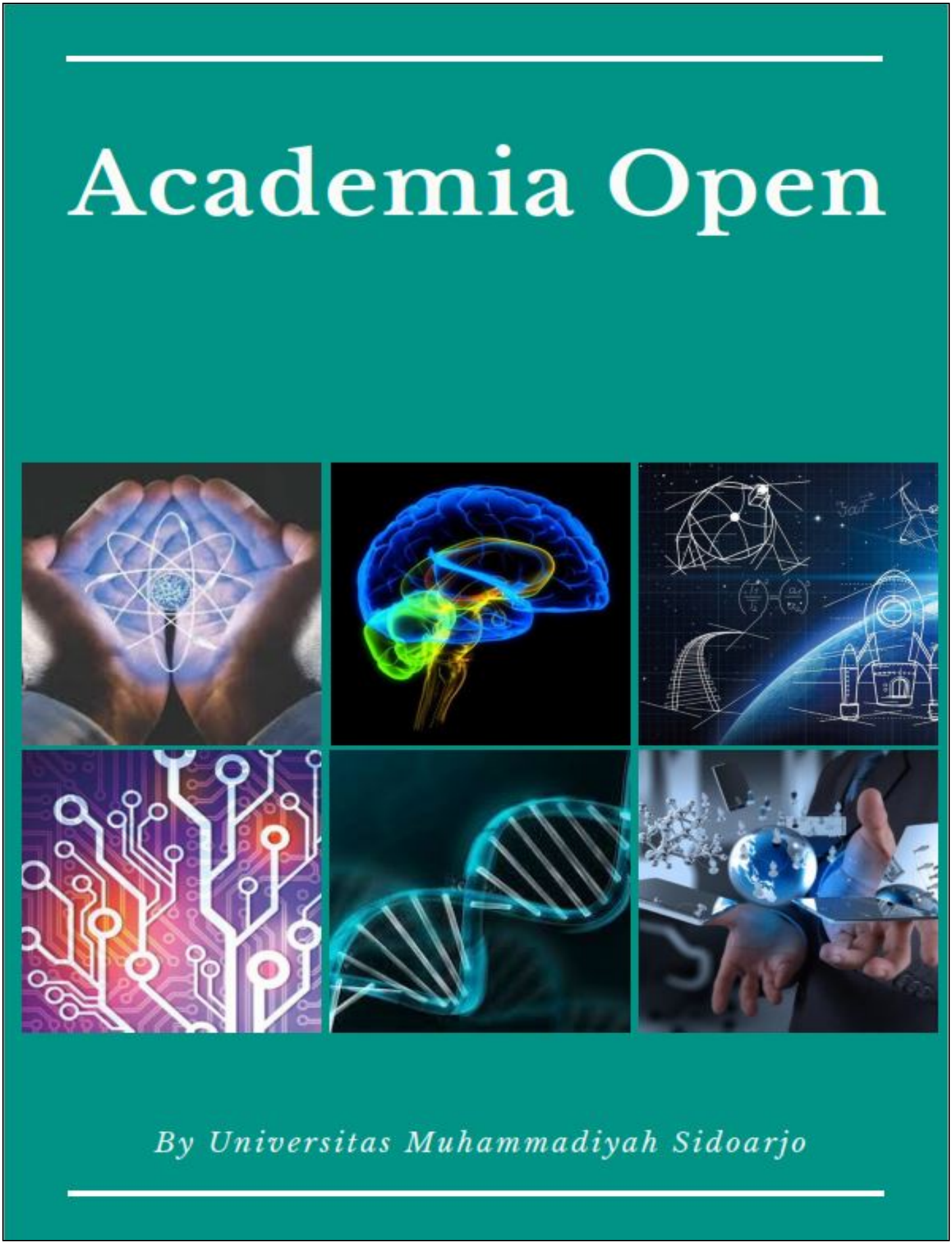

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Determine Effectiveness of cotton Seed Cleaning and Sorting Machines

Menentukan Efektivitas Mesin Pembersih dan Sortasi Benih Kapas

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Abstract

This scientific article presents a comprehensive exploration of seed cleaning techniques, emphasizing the incorporation of aerodynamic sorting and multi-factional sorting as means to achieve optimal seed purity and prevent seed damage while enhancing fiber yield for textile industry applications. The study outlines the goals, methods, results, and implications of scientific research conducted to improve seed cleaning technology. By employing advanced cleaning methods, complete elimination of impurities from ginnated seeds is made possible, thereby ensuring a productive and high-quality seed yield suitable for spinning in the textile industry. The findings and recommendations of this research offer valuable insights for global scientists and industry professionals seeking to enhance seed cleaning processes, maximize productivity, and meet the demands of the textile industry.

Highlights:

- Improved Seed Quality: Incorporating aerodynamic sorting and multi-factional sorting techniques enhances seed cleaning, resulting in impurity-free seeds suitable for high-quality fiber production in the textile industry.
- Preventing Seed Damage: Advanced seed cleaning technology minimizes the risk of seed damage during the cleaning process, ensuring optimal seed integrity and viability for improved germination and yield.
- Increased Fiber Productivity: Efficient seed cleaning methods increase fiber yield, providing a sustainable source of high-quality fibers for the textile industry, thereby meeting the growing demand for textile materials.

Keywords: seed cleaning, aerodynamic sorting, multi-factional sorting, impurity-free seeds, fiber yield.

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Introduction

In connection with the transition of the Republic to a new form of management, the demand for the quality of manufactured products has increased. This set new tasks for the workers-employees and scientists of the cotton gin industry. As a result of a critical analysis of the research work devoted to the cleaning and sorting of cotton seeds, this article examined the condition of crushed seeds, the causes of the violation of the quality of thistles and thistles. Many theoretical and practical studies have been conducted on cleaning and sorting during processing, but now the issue of technology and technology that can fully meet modern requirements remains relevant. Because a patented technology has not been developed to prevent their damage during sorting, to completely clean the impurities contained in them, to obtain a fiber-rich bag suitable for spinning, and to increase the yield of fiber by re-grinding.

It is known from experience that sorting devices for seeds that work at cotton gins, in principle, are no longer able to perfectly separate cotton seeds and effectively separate the various impurities contained in it. After grinding at a cotton gin plant, the grass is sent to processes such as cleaning, lintering, and removal of various impurities. as for the seeds intended for planting, the seeds are sent to the sorting process. Some of the dirty impurities contained in cotton do not come out with the fiber during harvesting, but are added to the contents of the seeds and pollute them.

Seeds after germination may contain sand, small impurities, leaves, metal objects. In addition, in the seed mass there are also poorly developed seeds, small ones. They are crushed and pulverized during various processes and result in increased fluff, lint and seed contamination. The seeds also have short fibers.

Research purpose :

- analysis of research works carried out prior to this period to preserve the natural properties of cotton with seeds in the process of seed sorting.

- to create a new efficient aerodynamic sorting device for identified defects.

- it consists in testing an aerodynamic sorting device in production conditions, based on the practical and theoretical side.

The aerodynamic separator for sorting cotton seeds is mainly used in cotton processing technology, in the process of sorting cotton seeds.

For cleaning cotton as a device similar to the proposed device for preparing seeds of seeds installed in the technological process of enterprises, a separator of the SPS brand has been developed. [7] This device consists of a feeder, a camera, a sequentially placed maintenance, a seed lamp and a mower with a washer. The device works according to the following principle: seeds are transferred to the same norm with the help of a feeder and are ejected in the direction of the incoming horizontal air flow in a pneumatic transport. In the separation chamber, Grasshoppers are influenced by their aerodynamic properties and weight strength divided into fractions. The main disadvantage of this separator is that due to the low level of the sorting process, the direction of the air flow does not change, and due to the low level of the sorting and cleaning effect, it is observed that the fractions are joined together.

The second similar device, a device for sorting sawdust in a vertical way, is considered. The main parts of this equipment are fan, supplier, distribute chamber, light weight and cyclone for removing washers. Although the sorting and cleaning efficiency of this device is higher than that of SPS, but the energy consumption is higher and the work piece size is larger.

The new proposed device is equipped with a rectifier regulator that changes the flow rate and velocity of directed air and seeds in the range of the input cartridge and separation chamber, depending on the efficiency of the sorting process, the direction of the airflow, as well as the speed, to achieve an optimal sorting process. The working chamber consists of two sections that differ from the previous separators.[8]

The following main elements of the proposed aerodynamic seed wrapper are the inlet cartridge (1), the seed feeder (6), two sectional separation chamber (2), cartridge for removing dust and fine mixture (3), sequentially arranged bit clamps (4), vacuum valve (5), flexible plate regulator (7), which changes the direction of air flow between the bit feeder and the inlet cartridge (8) screw, which changes the direction of the plate (9) upper and lower sectional seats (10). Important characteristics of the utility model for the purpose of high-quality sorting of cotton seeds before feeding, a flexible plate regulator is installed at the entrance to the working chamber to change the direction of the air flow. And in order to enhance the sorting effect in the separation chamber, the chamber was designed in such a way that the two sectors differ from each other in volume. In sectors, an increase in internal volumes optimizes the fractionation process, helping to reduce the speed of avalanches entering the chamber. Performance seal of the aerodynamic worm wrapper: a two-section separator (6) enters the chamber through a spiral worm airflow (2).[9]

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As a result, the seeds, whose speed decreases in sequences, under the influence of their weight fall into the clamps (4), which are placed under the separation chamber, and the sorting process is formed. As a result of the decrease in air velocity due to the fact that the size of the separation chamber is variable, a separation into fractions is formed under the influence of gravity on the aerodynamic properties of crushed seeds. Dust and impurities from full-grain grasshoppers fall into the first sector of the mower, while dust and impurities from full-grain grasshoppers fall into the last mower on the mower with feathers, the air flow enters the second mower when air flows from the separation chamber through the exhaust cartridge (3). Depending on the efficiency of the sorting process, the direction and speed of the air flow the flow is reduced or increased by the position of the plate (7), the screw (9) and the conductor (7) of the regulator. Given that the volume of the cross section is slightly different, the air train is changed. [10]

The device for sorting new cotton seeds by an aerodynamic method consists of the following working bodies: an input cartridge (1), a seed feeder (6), a sectional separation chamber (2), a cartridge for removing dust and small impurities (3), sequentially arranged seed connectors (4), a vacuum valve (5), a flow air between the inlet cartridge and the seed supply with a direction controller (7), a regulator (8), a screw replaceable plate transmission (9).

1. The working device consists of an input cartridge, a supplier, a separation chamber, a series of plug-in clamping clamps and a vacuum valve. [11] This device differs from others in that a screw regulator with an input cartridge is installed in the line of separation chambers to achieve optimal sorting. It changes the direction and speed of the air flow, performs a highly efficient sorting process.

2. The device offers a two-section aerodynamic device for sorting seeds, which, depending on the weight of the seeds and the degree of hardness, ensures the separation process into effective fractions.

1-picture. Aerodynamic device for sorting cotton seeds

Currently, one of the main requirements for the technological process of cotton gins is to increase the efficiency of the technology of seed preparation, preparation of Sarah seeds while preserving the natural physical and mechanical properties of seeds. In the technological process of sorting a cotton gin plant, various impurities and immature seeds are added to the seeds. As a result, seed preparation leads to a decrease in quality indicators. In the final qualifying work, a new sorting device was proposed that effectively removes cotton seeds, reduces damage. The principle of operation of the new device is sorting under the influence of horizontal airflow. By changing the air velocity in the sorting chamber, sorting is carried out in accordance with the aerodynamic parameters.

The proposed bag filling machine with horizontal airflow control on the device:

a) reduce energy consumption;

b) divide the air velocity into optimal fractions by calculating the selection;

C) depending on the weight, create opportunities for the separation of seeds of the highest quality.

The issue of the mathematical m odel:

In the mathematical model representing the laws of motion under the influence of an air flow in a horizontal chamber, the following simplifications were adopted:

- spikes moving in the air flow do not affect each other.

- seeds of mass m1 and m2, moving under the influence of air flow, have a certain elastic connection with each other.

- in both cases, the beams were obtained in the form of a material point having a certain flight coefficient - Cp and aerodynamic drag coefficients - Cк.

We check the movement of seeds in the sorting chamber relative to the XOY-Descartes coordinate system (Fig. 2). The velocity of the air flow entering the chamber is equal to υ0 the velocity inside the chamber is equal to υx, the law of motion inside the chamber is equal to x (t), y(t).

2-picture. The movement of seeds in the sorting chamber and the influence of forces on it .

Seed masses differ from each other in the degree of completeness, quality, immaturity and degree of hairiness. [12] When seeds move, they are affected by P_{ix}, P_{iy} - air resistance forces and G - gravitational forces in the corresponding directions.

Conclusion

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The physic-mechanical properties of seeds according to the degree of fibrousness and hairiness are thoroughly analyzed and the main factors affecting the selection process are identified.

The existing scientific studies of the process of sorting cotton seeds are analyzed. The existing mechanical, electrical and liquid methods of sorting cotton seeds have a number of disadvantages and require additional technological and design developments.

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