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An Effective Cleaner of Raw Cotton from Fine Trash Particles

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ABSTRACT

The article under discussion depicts a study on the effective cleaner of raw cotton from fine trash particles. The purpose of the study is not only to obtain specific information about the raw cotton cleaning process for the selected processing combination but also to obtain some generalization about the desiccation circuit. The authors of the article consider that proposed in the research CCD-10M cleaner allows to achieve high cleaning effect with little damage to the seeds.

KEYWORDS

Cotton, methods of cleaning, operating principles, trash impurities, reel-plate, reel height, radius, frequency of reel rotation, canopy, drum.

INTRODUCTION

Quality parameters of cotton harvested by harvesters do not satisfy the industry yet because of the high clogging of raw cotton [8]. The process of desiccation from raw cotton, development of improved designs, search for new methods of cleaning raw cotton from trash impurities and selection of cleaners modes, which are favourable to high-quality indicators of cotton fibre, remain a very actual problem for the cotton-cleaning industry [7].The purpose of this work is to study the operating principles of existing cleaners and to achieve intensification of impurities disposal process with a minimum number of flaking drums and to implement: searching for methods of finding the optimal variant of cotton cleaning from trash impurities, selection of type and design of raw cotton cleaner from small trash impurities and influence of working bodies design on

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qualitative parameters of cotton fibre. We consider the principle of interaction between the reel and the grid of impurities disposal; a theoretical dependence of the influence of reel height, radius, and frequency of reel rotation on the speed of raw cotton flying on the surface of the reel and in the area from the reel top to the guiding canopy has been obtained. The shape of guiding and the mote-removing surface was justified and selected, a type of reel with a new shape of reel strip working in combination with a mote-removing grid was determined.

MATERIALS AND METHODS

The types of drums, the contours of mote nets and flail bars were selected taking into account theoretical considerations and operating conditions of cotton cleaning plants [3]. In all experiments, the cleaning effect and seed damage were the basic indicators. All experiments to optimize the parameters of the flip-flap drum and the grid of impurities disposal were carried out by methods of mathematical planning of experiments [9].

The results of machine processing showed that the relative flying velocity of raw cotton ranged from 2.15 to 10.83 m/s, the transfer velocity of the flying drum ranged from 5.0 to 16.23 m/s. To optimize the parameters of the drum radius and the height of the crank, we conducted a series of experiments. Tests of rotor-plate drums with rotational speeds from 5.0 to 16.23 m/s for medium- and fine-fibre sorts showed that the best cleaning effect is achieved in the zone of 7.95÷9.46 m/s. At speeds, less than 7.95 m/s decreases rapidly cleaning effect, and at speeds above 9.46 m/s occurs and increased seed crushing. Since the proposed cleaner is designed to clean the thin-fibered varieties, and the greatest increase in the fragmentation of the seeds, in this case, is observed at a speed of more than 9 m/s, so we recommend taking the peripheral speed of drums in the range of 8-9 m/s [1]. To optimize the shape of the reflecting canopy necessary for normal transfer of raw cotton to the drum for further shaking, obviously, it is necessary to study the character of cotton fly movement in the zone from the top of the pick to the moment of impact with the reflecting canopy.

In order to determine theoretically the shape of the guiding canopy, a differential equation was made, after solving which the values of point coordinates, time, velocity and acceleration during the impact of cotton against the reflecting canopy were revealed. Thus, the contour of the grid of impurities disposal, type and speed of the drum, geometric parameters of the spike were justified and selected, as well as the projections of the response surface were built to optimize the experiments. Since the main working bodies of raw cotton cleaners from fine debris are colling-plate drums, working in combination with meshes, the task of identifying their optimal parameters and choosing the most effective mode of operation was set [8]. With this purpose, the process of cleaning raw cotton from fine debris was studied depending on the type and frequency of rotation of drums, the contour of the grid of impurities disposal, as well as the shape of the bar of the drum [5]. Analysis of experimental results and comparison of calculated and tabulated values of Fisher's criteria confirmed that the factors "drums", "the grid of impurities disposal" and "speed" have exceptional influence on the raw cotton

cleaning process [4]. The purpose of the study is not only to obtain specific information about the raw cotton cleaning process for the selected processing combination but also to obtain some generalization about the grid of impurities disposal. The selected configurations of the grid of impurities disposal in the study will, in this interpretation, be the node points of the series. The same can apply to all types of drums, where the quantitative relationship characterizes the types of drums under study. Proceeding from this, the graph of the response surface projections was constructed and the conditional distribution of the experience results by their groups was given [2]. The study showed that increasing the number of spike drums from 1 to 12 increased the cleaning effect from 20 to 98%. With increasing the number of spike drums to 8, with this cleaner design, seed damage is negligible (i.e. 0.06 to 0.80%), but further with increasing them from 8 to 12 increased sharply (1.12 to 1.89%). In this regard, the optimal number can be recommended as 8 drums. Therefore, as the experiments have shown, the cleaning effect will be 35-40% higher than that of the serial cleaner CCD-10M (Cleaning Cotton Drum). Using the extended mesh allows getting effective cleaning with less number of reels and 2,5 times better than cleaning on the cleaner CCD-10M. The cleaner allows reaching a high cleaning effect with little damage to the seeds.

CONCLUSION

The usage of extended mesh surface allows getting effective cleaning with less number peeling drums and 2 times better cleaning than it was on the cleaning machine CCD-10M. Our proposed cleaner allows achieving a high cleaning effect with little damage to the seeds.

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