ANALYSIS OF IMPROVED PILE PLANK DRUMS PLACED IN VARIOUS COMBINATIONS

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Abstract. The article presents the results of research conducted to study the effect of cleaning efficiency of a cleaner with four different designs of peg-slat drums on the cleaning efficiency of cotton of various selection varieties and industrial varieties.

When the productivity of the improved cleaner is 7 tons/hour, the cleaning efficiency of the Nam-77 selection is 6.35% and 6.86% compared to the existing cleaner in the industrial type I and the industrial type III , and the S65-24 selection is 6.43% and 7.54% compared to the existing cleaner in the industrial type I and the industrial type III . The main factor behind the decrease in the amount of passive impurities in the cotton composition after the cleaning process in the improved cleaner and the increase in cleaning efficiency is explained by the fact that the different design of the peg-slatted drum increases the air flow and accelerates the exit of the separated impurities through the mesh surface holes.

Key words: industrial type, mesh, hole, cotton, air.

Introduction. After the cotton drying equipment, it is transferred to the cleaning technology using air or belt conveyors. It is known that due to the high density of cotton in the bundle, the cotton pieces are firmly connected to each other and are sent for cleaning without being completely cleaned during the drying process. This, in turn, leads to the cotton being scratched in the first pile-plank drums after the supply rollers, which reduces cleaning efficiency. Also, the raw material consisting of large pieces increases the mechanical damage caused by the pile-plank drum and the mesh surface, which causes defects in the fiber composition in the subsequent stages of the process. Ultimately, this leads to a decrease in the grade of the fiber and a decrease in the purchase price of the fiber.

Research methodology. In the research, the pile-and-slat drums were installed on the 1XK cleaner in the following sequence: after the supply rollers, the pile-and-slat drum of the existing version, then a pile-and-slat drum with a pile and a plank height of 65 mm and a coating diameter of 270 mm, then a pile-and-slat drum with a pile and a plank height of 80 mm and a coating diameter of 240 mm, and pile-and-slat drums with a pile and a plank height of 95 mm and a coating diameter of 210 mm.

The cleaning process is carried out as follows: the cotton is fed by the supply rollers between the existing version of the pile-slat drums located below them and

with a pile and plank height of 65 mm and a coating diameter of 270 mm. The cotton raw material is first screened in the upper part of the pile-slat drums, separated into separate pieces and passivated from firmly bound impurities. Then it is cleaned between the pile-slat drum with a pile and plank height of 95 mm and a coating diameter of 210 mm and a mesh surface. It is cleaned in the second row of pile-slat drums with a pile and plank height of 80 mm and a coating diameter of 240 mm. In this way, the cotton raw material was cleaned on all pile drums and mesh surfaces.

Research results. The results of the research are presented in Tables 1-2 and Figures 1-2. The research used cotton raw materials of the Nam-77 and S65-24 selection varieties with pre-cleaning moisture contents of 8.05; 8.50% and 8.11; 8.6% and impurities of 8.2; 11.5% and 7.5; 10.3%, respectively.

Table 1.

Results of a study conducted on an existing pile-and-slat drum cleaner.

t/r	Indicators	Nam-77 selection variety		S65-24 selection variety	
		Grade I	Grade III	Grade I	Grade III
1.	Cotton moisture, %	8, 05	8, 50	8.11	8.6
2.	Cotton impurity, %	8 , 2	1 1 , 5	7.5	10.3
productivity 3 tons/hour					
3.	Contamination after cleaning, %	4.59	5.98	4.22	5.53
4.	The amount of passive impurities in cotton after cleaning, %	26.9	32.06	28.43	34.5
5.	Cleaning efficiency, %	44.06	47.96	43.8	46.28
6.	Increase in seed damage after cleaning, %	0.3 0	0.33	0.28	0.22
productivity 5 tons/hour					
7.	Contamination after cleaning, %	4.81	6.37	4.42	5.87
8.	The amount of passive impurities in cotton after cleaning, %	33.65	39.25	35.1 0	41.35
9.	Cleaning efficiency, %	41.35	44.57	41.12	43.04
10.	Increase in seed damage after cleaning, %	0.55	0.62	0.6 0	0.59
productivity 7 tons/hour					
11.	Contamination after cleaning, %	4.98	6.69	4.58	6.12

12.	The amount of passive impurities in cotton after cleaning, %	38.5 0	45.4	39.45	46.83
13.	Cleaning efficiency, %	39.25	41.84	38.97	40.56
14.	Increase in seed damage after cleaning, %	0.68	0.78	0.8 0	0.86

When the productivity of the existing cleaner with pile-plank drums was 3 tons/hour, after processing the cotton raw material of the Namangan-77 selection in the cleaner of the I industrial grade of the research variant, the cotton impurity was 4.59%, the amount of passive impurities was 26.9%, the cleaning efficiency was 44.06%, and the increase in mechanical damage to the seed was 0.30%. After processing the cotton raw material of the III industrial grade of the cleaner, the cotton impurity was 5.98%, the amount of passive impurities was 32.06%, the cleaning efficiency was 47.96%, and the increase in mechanical damage to the seed was 0.33%.

After processing the cotton raw material of the I industrial grade of the S65-24 selection in the cleaner of the research variant, the cotton impurity was 4.22%, the amount of passive impurities was 28.43%, the cleaning efficiency was 43.80%, and the increase in mechanical damage to the seed was 0.28%. After processing the cotton raw material of the III industrial grade of the cleaner, the cotton impurity was 5.53%, the amount of passive impurities was 34.50%, the cleaning efficiency was 46.28%, and the increase in mechanical damage to the seed was 0.22%.

When the cleaning efficiency was 5 tons/hour, the cotton raw material of the Namangan-77 selection, industrial grade I , after processing in the cleaning variant of the research option, the cotton impurity was 4.81%, the amount of passive impurities was 33.65%, the cleaning efficiency was 41.35%, and the increase in mechanical damage to the seed was 0.55%. After processing in the industrial grade III cleaning machine, the cotton impurity was 6.37 % , the amount of passive impurities was 39.25%, the cleaning efficiency was 44.57%, and the increase in mechanical damage to the seed was 0.62%.

I cotton raw material of the S65-24 selection, the cotton impurity was 4.42%, the amount of passive impurities was 35.10%, the cleaning efficiency was 41.12%, and the increase in mechanical damage to the seed was 0.60%. After processing in the industrial grade III cotton raw material, the cotton impurity was 5.87%, the amount of passive impurities was 41.35%, the cleaning efficiency was 43.04%, and the increase in mechanical damage to the seed was 0.59 %.

When the productivity of the cleaner was 7 tons/hour, after processing the cotton raw material of the Namangan-77 selection of the I industrial grade in the cleaner of the research variant, the cotton impurity was 4.98%, the amount of passive impurities was 38.50%, the cleaning efficiency was 39.25%, and the increase in mechanical damage to the seed was 0.68%. After processing the cotton raw material of the III industrial grade in the cleaner, the cotton impurity was 6.69%, the amount of passive impurities was 45.4%, the cleaning efficiency was 41.84%, and the increase in mechanical damage to the seed was 0.78% .

After processing the cotton raw material of the I industrial grade of the S65-24 selection in the cleaner of the research variant, the cotton impurity was 4.58%, the amount of passive impurities was 39.45%, the cleaning efficiency was 38.97 %, and the increase in mechanical damage to the seed was 0.80%. After processing the cotton raw material of the III industrial grade of the cleaner, the cotton impurity was 6.12%, the amount of passive impurities was 46.83%, the cleaning efficiency was 40.56%, and the increase in mechanical damage to the seed was 0.86% .

Analyzing the data presented in Table 2, when the productivity of the cleaner was 3 tons/hour, after processing the industrial grade I cotton raw material of the Namangan-77 selection in the cleaner of the research variant, the cotton impurity was 4.06%, the amount of passive impurities was 15.3%, the cleaning efficiency was 50.47%, and the increase in mechanical damage to the seed was 0.25%. After processing the industrial grade III cotton raw material in the cleaner, the cotton impurity was 5.18%, the amount of passive impurities was 19.5%, the cleaning efficiency was 54.99%, and the increase in mechanical damage to the seed was 0.24% .

Table 2.

Results of research conducted on an improved cleaner with pile-and-slat drums.

t/r	Indicators	Nam-77 selection variety		S65-24 selection variety	
		Grade I	Grade III	Grade I	Grade III
1.	Cotton moisture, %	8, 05	8, 50	8.11	8.6
2.	Cotton impurity, %	8 , 2	1 1 , 5	7.5	10.3
productivity 3 tons/hour					
3.	Contamination after cleaning, %	4.06	5.18	3.74	4.75
4.	The amount of passive impurities in cotton after cleaning, %	1 5 ,3	19.5	1 7 , 67	22.72
5.	Cleaning efficiency, %	50.47	54.99	50.11	53.84

6.	Increase in seed damage after cleaning, %	0.25	0, 24	0.2 0	0, 17
productivity 5 tons/hour					
7.	Contamination after cleaning, %	4.28	5.57	3.94	5.08
8.	The amount of passive impurities in cotton after cleaning, %	2 1 .8	2 5 ,9	2 3 .65	2 8 .32
9.	Cleaning efficiency, %	47.8	51.55	47.5	50.7
10.	Increase in seed damage after cleaning, %	0.48	0.5 0	0.50	0.52
productivity 7 tons/hour					
11.	Contamination after cleaning, %	4.46	5.90	4.10	5.35
12.	The amount of passive impurities in cotton after cleaning, %	2 5 .5	3 0 .8	2 6 .9	3 2 .5
13.	Cleaning efficiency, %	45.6	48.7	45.4	48.1
14.	Increase in seed damage after cleaning, %	0.5 9	0.65	0.68	0.75

After processing the industrial grade I cotton raw material of the S65-24 selection in the cleaner of the research variant, the cotton impurity was 3.74%, the amount of passive impurities was 17.67%, the cleaning efficiency was 50.11%, and the increase in mechanical damage to the seed was 0.20 %. After processing the industrial grade III cotton raw material in the cleaner, the cotton impurity was 4.75%, the amount of passive impurities was 22.72%, the cleaning efficiency was 53.84%, and the increase in mechanical damage to the seed was 0.17 %.

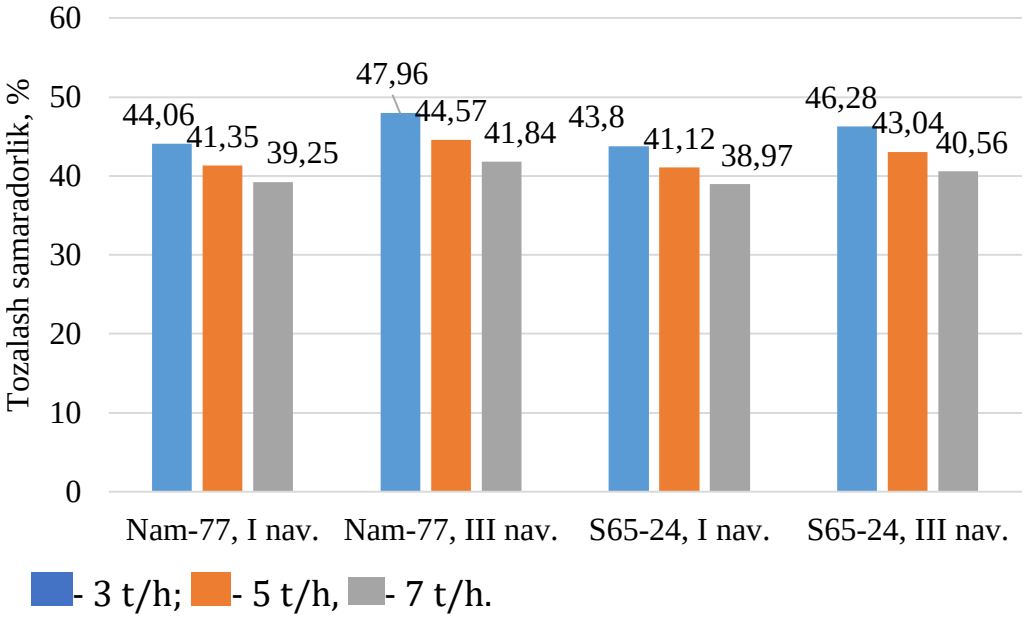
When the cleaning efficiency was 5 tons/hour, the cotton raw material of the Namangan-77 selection of industrial grade I was processed in the cleaning device of the research variant, the cotton impurity was 4.28%, the amount of passive impurities was 21.8%, the cleaning efficiency was 47.8%, and the increase in mechanical damage to the seed was 0.48%. After processing the cotton raw material of the industrial grade III in the cleaning device, the cotton impurity was 5.57%, the amount of passive impurities was 25.9%, the cleaning efficiency was 51.55%, and the increase in mechanical damage to the seed was 0.50% .

I cotton raw material of the S65-24 selection, the cotton impurity content was 3.94%, the amount of passive impurities was 23.65%, the cleaning efficiency was 47.5%, and the increase in mechanical damage to the seed was 0.50%. After processing in the industrial grade III cotton raw material, the cotton impurity content was 5.8%, the amount of passive impurities was 28.32%, the cleaning efficiency was 50.7%, and the increase in mechanical damage to the seed was 0.52 %.

When the cleaning efficiency was 7 tons/hour, the cotton raw material of the Namangan-77 selection of industrial grade I was processed in the cleaning device of the research variant, the cotton impurity was 4.46%, the amount of passive impurities was 25.5%, the cleaning efficiency was 45.6%, and the increase in mechanical damage to the seed was 0.5 9%. After processing the cotton raw material of the industrial grade III in the cleaning device, the cotton impurity was 5.90%, the amount of passive impurities was 30.8%, the cleaning efficiency was 48.7%, and the increase in mechanical damage to the seed was 0.65 % .

After processing the industrial grade I cotton raw material of the S65-24 selection in the cleaner of the research variant, the cotton impurity was 4.10%, the amount of passive impurities was 26.9%, the cleaning efficiency was 45.4 %, and the increase in mechanical damage to the seed was 0.68%. After processing the industrial grade III cotton raw material in the cleaner, the cotton impurity was 5.35%, the amount of passive impurities was 32.5%, the cleaning efficiency was 48.1%, and the increase in mechanical damage to the seed was 0.75 % .

The improved pile drums have a productivity of 3 tons/hour, reducing the amount of passive impurities by 11.6% when processing industrial grade I of the Nam-77 selection variety and by 12.56% when processing industrial grade III . The amount of passive impurities by 10.76% when processing industrial grade I of the S65-24 selection variety and by 11.78% when processing industrial grade III was achieved. The productivity of the cleaner is 5 tons/hour, reducing the amount of Nam-77 selection variety and by 11.85% when processing industrial grade I of the Nam-77 selection variety and by 13.35% when processing industrial grade III . When processing industrial grade I of the S65-24 selection, the amount of passive impurities was reduced by 11.45%, and when processing industrial grade III, by 13.03%. The productivity of the purifier was 7 tons/hour, and when processing industrial grade I of the Nam-77 selection, the amount of passive impurities was reduced by 13.0%, and when processing industrial grade III , by 14.60%. When processing industrial grade I of the S65-24 selection, the amount of passive impurities was reduced by 12.55%, and when processing industrial grade III , by 14.3 3%.



1. Effect of different cleaning performance of the existing pile drum on cleaning efficiency of different selection and industrial varieties of cotton.

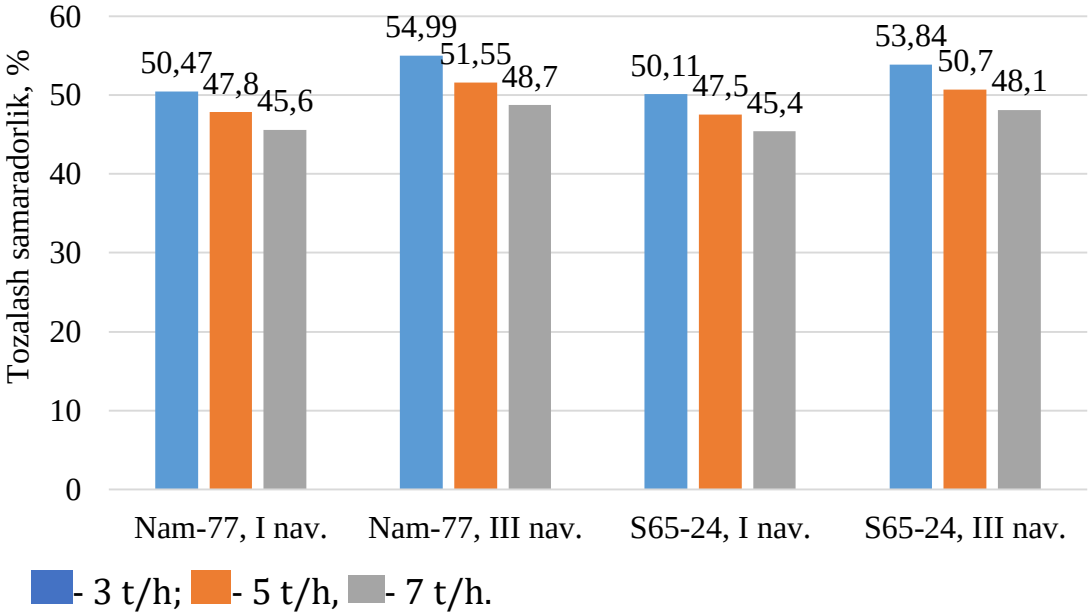


Figure 2. Effect of improved drum cleaning efficiency on different cleaning performance of different cotton selections and industrial grades.

When the purifier's productivity was 7 tons/hour, the purification efficiency of the Nam-77 selection in industrial type I was 45.6%, and in industrial type III it was 48.7%, which is 6.35% higher in industrial type I and 6.86% higher in industrial type III than in the existing purifier.

When the purifier's productivity was 7 tons/hour, the purification efficiency of the S65-24 selection in industrial type I was 45.4%, and in industrial type III it

was 48.1%, which is 6.43% higher in industrial type I and 7.54% higher in industrial type III than in the existing purifier.

Conclusion . The installation of an improved design of a peg-and-slat drum in the cleaning equipment resulted in a decrease in the amount of passive impurities in the cotton composition after the cleaning process and a higher cleaning efficiency, which is explained by the fact that the different design of the peg-and-slat drum increases the air flow and accelerates the exit of separated impurities from the mesh surface holes.

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