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SAFETY STUDIES IN SOYBEAN OIL PRODUCTION PROCESS

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Abstract: Strictly following the specific procedures for each operation is crucial to producing top-quality soybeans. Achieving this quality necessitates on-farm quality control during post-harvest processing. To enhance the soybean aspiration process, employing a grid with slanted holes in the aspiration zone and a specialised fan can effectively remove both light and heavy impurities.

Keywords: aspiration, separation, equipment, oil content, combined aspiration-separator, process.

Introduction. Today, all over the world, special attention is paid to the processing of agricultural raw materials, the development of food production, and ensuring their safety. In this regard, the creation of energy- and resource-saving techniques and technologies for processes and equipment for the purification and separation of plant materials, in particular soybean seeds, from various impurities is of particular importance.

Research is being conducted around the world to prepare crop seeds for processing, improve existing equipment that meets modern requirements, and create processes and installations for the aspiration and separation of seeds based on their size and weight. In the production of high-quality oil necessary for the food industry, special attention is paid to improving the separation units for soybean seeds, purified from various impurities, with increased oil content and an intact shell.

In recent years, our republic has achieved certain results in the creation of highly energy-saving equipment and technologies for processing, high-quality sorting, and cleaning of seeds of local crops grown in the country's agriculture.

Results and discussion. Based on the above, we conducted an analytical review of the current state of the aspiration system for cleaning seeds and grains and analysed the physical, mechanical, and biochemical properties of seeds and grains of soybean varieties zoned in Uzbekistan. The efficiency of the functioning of modern devices designed for fractionation and separation of seeds (grains) from legumes and grain crops is analysed. The main factors influencing the technological performance of this equipment have been identified. An analysis was made of the degree of purification of soybean seeds from impurities using the aspiration method; the elements of the theory of aspiration were described, and appropriate conclusions were drawn.

In variety testing, the physical characteristics of soybean varieties and their seed properties were studied. The results of the study are shown in Table 1.

Table 1. Physico-chemical quality indicators of domestic soybean varieties

№	Seed (grain) quality indicators	Soybean variety			
		Nena	Tumaris	Ustoz	Baraka
Seed sizes, mm:					
1.	- length	6,79±0,09	7,10±0,06	6,79±0,09	7,60±0,09
	- width	4,83±0,05	5,91±0,05	4,83±0,05	6,36±0,07
	- thickness	4,56±0,09	4,77±0,06	4,22±0,09	4,85±0,06
2.	Humidity, %	8,0	9,2	9,6	9,6
3.	Dirtiness, %	5,3	3,2	7,3	4,2
4.	Mass fraction of fat, %	23,50	23,50	22,71	14,85
5.	Mass fraction of protein, %	42,52	42,48	39,86	36,90

The purpose of this work is to improve a combined aspiration-separator installation designed for fractional separation of soybean seeds and other crops.

Based on the results obtained, below are the results of a study of the processes of aspiration cleaning of soybean seeds (grains) in the developed experimental installation. The design of a modernized combined separator with an optimal aspiration system is described. The results of planning experiments to study the processes of aspiration purification and fractionation of soybean seeds (grains) are presented, and corresponding conclusions are drawn.

Based on the analysis of the designs of aspiration systems for purifying impurities and the conclusions drawn from the analysis results, the aspirator of the combined separator for grain legumes and oilseeds was modernized.

A general view of the combined separator with an optimal aspiration system is shown in Fig. 1. The combined separator consists of a raw material (grain) receiving hopper 1, perforated shelves 2, a primary aspiration channel 3, an aspiration electric motor 4, a cyclone 5, a frame 6, a sieve for separating large impurities 7, a feed roller 8 and an electric motor 9.

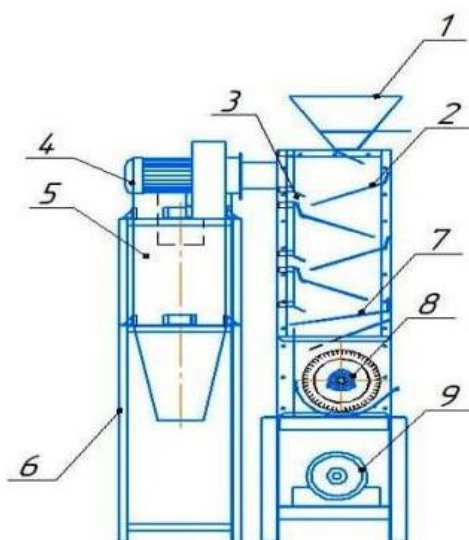


Figure 1. Aspiration unit of the combined separator:

1 - feeder hopper, 2 - perforated shelves, 3 - preliminary aspiration channel, 4 - electric motor, 5 - cyclone, 6 - frame, 7 - sieve for separating large impurities, 8 - feed roller.

The experiment was planned using the method of complete factorial experiment of type 2k (FFE 23).

When separating soybean grains from impurities by weight:

supply air speed: lower value $z_1^- = 3,5$ m/s; upper value $z_1^+ = 5,5$ m/s; angle of inclination of the mesh partitions in the aspiration working area: $z_2^- = 100$; $z_2^+ = 180$; volumetric flow rate of soybean grains: $z_3^- = 0,004$ m³/s; $z_3^+ = 0,008$ m³/s.

The lower and upper values of these factors were determined during preliminary experiments.

The degree of purification of the mixture is taken as the output factor - y (in %).

The results of calculating the coefficients resulted in the following regression equation (1):

$$b_j = t_{cr} \cdot S_{coef} \tag{1}$$

$$b_0 = 94,250; b_1 = -0,750; b_2 = 0,833; b_3 = 1,833; b_{12} = -0,167; b_{13} = -0,167; b_{23} = 0,083$$

The calculated value of the Fisher criterion $F_{calc} = 0,148$. Consequently, $F_{calc} = 0,148 < F_{tab} = 2,8$, which also confirms the adequacy of the obtained regression equation for the studied soybean seed (grain) cleaning process.

By converting the values of the influencing factors into natural dimensions, we obtained a mathematical model in natural values of the influencing factors:

$$Y = 89,2105 - 0,75z_1 + 0,20825z_2 + 366,6z_3 \tag{2}$$

Using this equation, you can find the optimal values of the factors at which the output value of the seed (grain) aspiration process y will be maximum (Fig. 2, 3, 4).

$$X_1 = 4,5$$

$$f(y, z) = 89,2105 - 0,075x_1 + 0,20825y + 366,6z$$

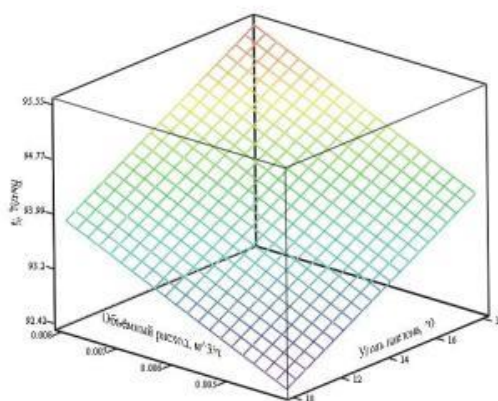


Figure 2. Graph of the dependence of the level of soybean purification on volumetric flow and the installation angle of the sieve shelf.

$$y_1 = 14,0$$

$$f(x, z) = 89,2105 - 0,075x + 0,20825y_1 + 366,6z$$

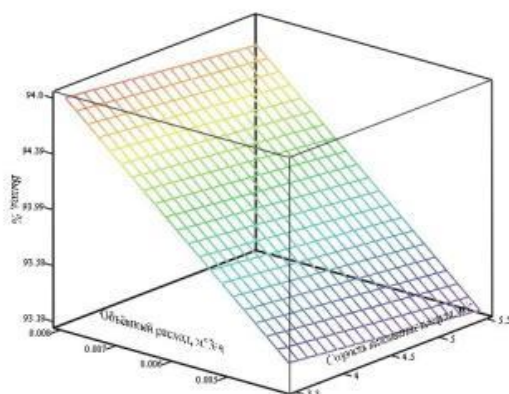


Figure 3. Graph of the dependence of the level of soybean purification on volumetric flow and air suction speed.

$$z_1 := 0,006$$

$$f(x,y) = 89,2105 - 0,075x + 0,20825y + 366,6z_1$$

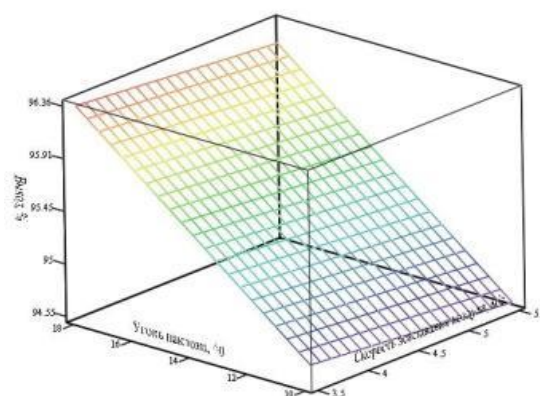


Figure 4. Graph of the dependence of the level of soybean purification on the installation angle of the sieve shelf and air suction speed

Our goal in improving the design of the separator was to improve the quality and achieve more stable and independent processes of purification and fractionation of legumes and oilseeds to the planned number of fractions by mass.

The following describes the improved design of a combined separator for bulk materials, in which the grain material is simultaneously purified from various impurities and fractionated depending on the mass and speed of the grain, and its technical and economic characteristics are also given. The results of calculating the expected economic effect from the introduction of an improved separator into production are presented.

As a result, it was found that with the above parameters, the maximum flight length of seeds (grain) is 4.5 m, and the lifting height is 1.25 m; at 370 rpm - 4.0 and 0.91 m, respectively (Table 2).

Table 2. Distribution of rotation speed along the flight length, lifting height and plant seed feed roller in the working chamber of the combined separator.

№	Feed roller rotation speed, rpm.	Grain lifting height, h,	Grain flight length, L,
		m	m.
1	420	1,25	4,5
2	370	0,91	4,0
3	320	0,77	3,5
4	270	0,65	3,0

An analysis of the distribution of grain along the length of the chamber of the combined separator showed that at an angle of inclination of the guide tray $\alpha = 45^\circ$ and a rotation speed of the feed roller of more than $n=420$ rpm, soybean seeds are cleared of various impurities and fractionated by weight (Tables 3 and 4).

Table 3. Dependence of the change in the mass of 1000 seeds along the length of the chamber of the combined separator on the rotation speed of the feed roller at $\alpha = 45^\circ$.

№	Частота вращения питающего валика, об/мин.	Участки и длина камеры комбинированного сепаратора, в метрах								
		9	8	7	6	5	4	3	2	1
		0,1-0,5	0,5-1,0	1,0-1,5	1,5-2,0	2,0-2,5	2,5-3,0	3,0-3,5	3,5-4	4-4,5
1	420			72,6	111,2	114,3	116,7	118,1	120,8	122,3
2	370		82,7	91,6	113,7	115,4	117,5	119,3	121,2	
3	320	78,2	105	111,7	115,2	116,9	118,8	120,3		
4	270	103,8	110,9	114,7	116,3	117,8	119,2			

Table 4. Dependence of changes in flight length and grain lifting height depending on the rotation speed of the feed roller and the angle of inclination of the guide tray.

№	Feed roller rotation speed, rpm.	Guide tray angle α , degree.	Grain lifting height, h, m	Grain flight length L, m.
1	420	45°	1,25	4,5
2	370		0,91	4
3	320		0,77	3,5
4	270		0,65	3

Conclusion. And so, based on the study of physical and mechanical properties, local soybean varieties were studied in the regions of the republic. The design and technological modes of improved devices for aspiration and separation of soybean seeds (grains) have been determined. Based on the research results, a combined separator installation equipped with an aspiration system was developed and put into production, designed for cleaning soybean seeds (grain).

References

1. Пашкеевич М. Обзор производства соевых семян и продуктов их переработки // Масложировая промышленность. - М., 1994. - № 10. - С. 32.
2. Кузибеков С. Совершенствование установки для аспирационной очистки и сепарации семян сои. // Автореферат диссертации доктора философии (PhD) по техническим наукам, 2022 г., Бухара, - 49 с.
3. Rajabovich, B. N., Nusratillayevich, R. A., Tashpulatovich, K. M., & Komilovich, K. S. (2020). Improvement of the design of mobile equipment for post-harvest processing of agricultural crops. *Journal of critical reviews*, 7(14), 306-309.
4. Kuzibekov, S. (2023). Analytical and theoretical studies of the aspiration and fractionation process of local soybean seeds. *Science and innovation*, 2(A1), 222-231.
5. Barakaev, N. R., & Kuzibekov, S. K. (2022). Investigation of flow hydrodynamics in the process of aspiration cleaning of soybean seeds (grain) on a computer model. *Harvard Educational and Scientific Review*, 2(2).
6. Kuzibekov, S., Uzaydullayev, A., & Miyassarov, Z. (2023). Analysis of research methods conducted on the composition and fractionation process of indigenous soybean seeds. *International Bulletin of Engineering and Technology*, 3(4), 119-126.

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