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The Results of the Theoretical Study of the Movement of Mung Beed Seeds of Different Masses on the Surface of the Working Body by Basing the Electric Field Strength

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ABSTRACT

The article presents the results of theoretical research and experimental studies on the possibility of sorting mung beed seeds of different masses in an uneven electric field based on the strength of the electric field.

Introduction. It is known from scientific sources that to obtain high-quality seeds of crops, whose biological properties are close to each other, with high fertility and potential yield in laboratory and field conditions, electrotechnological influence on them, including all important physical sorting by mechanical properties is necessary [1,2]. Sorting of seeds of crops in the electric field fully meets this requirement. Because the electric field affects the seeds with the power of the electric field directed to them, taking into account all their important physical and mechanical properties [3]. As a result, crops are sorted by mass, geometric dimensions, density, electrical resistance, dielectric absorption and other properties in the electric field of seeds.

The essence of sorting the seeds of crops in the electric field is that the seeds are affected by the strength of the electric field of different values, taking into account all their important physical and mechanical properties. As a result, the seeds are sorted in the electric field according to all

important physical and mechanical properties, mass, geometric dimensions, density, dielectric absorption, electrical resistance and other similar important properties. In addition to the force of the electric field, the seeds are affected by mechanical forces, and the technological process of sorting depends on the mutual ratio of these forces [4]. Based on this, we put forward the scientific idea that it is possible to improve the efficiency of mung beed seed sorting by improving the design of electric sorter devices. To implement the scientific idea that we had previously put forward, the principle scheme and working body of the electric sorter device were developed and a copy of the model was prepared [3].

The optimum electric field strength can be established by applying a voltage of about 4000 V to the electrodes of two different diameters wrapped around the working body of the electric sorting device. For this, we introduce the term of the smallest seed mass of mash seeds $m=m_s$, taking this value as $m_s=50\ mg$, and it should be cut off when α_4 is mostly around 120^0 [5,6].

Taking into account the forces acting on the seed falling on the surface of the working body of the electric sorting device combining the uneven electric field created between electrodes of two different diameters [7,8], we formulate the following differential equation of motion (see fig. 1)

$$\frac{mdV_y}{dt} = mR\frac{d^2\alpha}{dt^2} = G\sin\alpha \pm fN; \quad (1)$$

$$\frac{mV_y^2}{R} + N = G\cos\alpha + F_э, \quad (2)$$

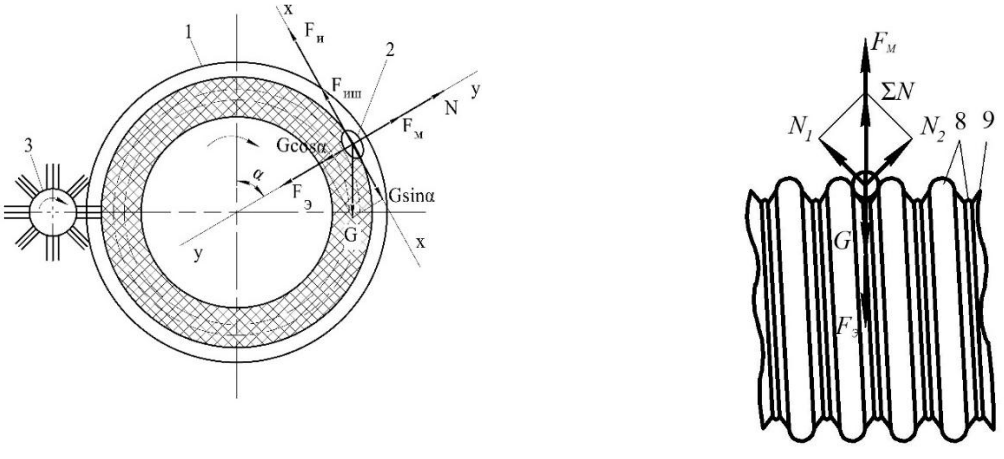
"+" – for the condition where the seeds slide and move behind;

"–" – for the state of the seeds sliding forward;

F_e – electric force affecting the seeds, N.

The angle at which the seeds move together with the working body α_b can be found by the difference between the starting angle α_3 and the starting angle α_2 of their sliding forward movement, i.e.

$$\alpha_б = \alpha_3 - \alpha_2. \quad (3)$$



a) b)

Figure 1. Scheme of forces affecting seeds

[9,10] $\alpha=\alpha_3$ and $V_u=V_b$ under the initial conditions, when the advancement of seeds from the linear speed of the body of work begins, the integration constant will have the following view:

$$C=\left\{\frac{V_б^2}{gR}-\frac{F_Э}{mg}+\frac{2}{4f^2+1}\left[3f\sin\alpha_3+\left(1-2f^2\right)\cos\alpha_3\right]\right\}e^{-2f\alpha_3}=C_2. \quad (4)$$

[11] For seeds to be disconnected from the body of work (2) based on expression N=0, i.e.

$$mg\cos\alpha+F_Э-\left(mV_y^2/R\right)=0$$

the condition must be met.

From the last expression

$$\left(V_y^2/gR\right)=\cos\alpha+\left(F_Э/mg\right) \quad (5)$$

it comes from.

(5) Taking into account the expression $\alpha=\alpha_4$ and $(V_y^2/gR)=\cos\alpha_4+(F_Э/mg)$ the fact that it is $S=S_2$, we get the following expression to find the disconnect angles of the seeds from the surface of the body

$$\cos\alpha_4+\frac{2}{4f^2+1}\left[3f\sin\alpha_4+\left(1-2f^2\right)\cos\alpha_4\right]-C_2e^{2f\alpha_4}=0. \quad (6)$$

Therefore, using (1), (4) and (6) formulas, we make some changes to them, inserting the values $\alpha_4=\pi$ and $m=m_s$ into the following equation.

$$\frac{3}{4f^2+1}+\left\{\frac{V_б^2}{gR}-\frac{F_э}{m_cg}+\frac{2}{4f^2+1}\left[3f\sin\alpha_3+\left(1-2f^2\right)\cos\alpha_3\right]\right\}e^{2f(\pi-\alpha_3)}=0.$$

According to the calculation results, the optimal electric field strength was $F_э = 857\cdot10^{-6}$ N.

Using the above-mentioned expressions, we study the movement of the mung beed seed on the surface of the work organ of the electrical switching device and establish their speed and disconnect angles. Mass of the movement of the mung beed seeds on the surface of the working organ of the electrical appliance m = 20; 30; 40; 50; 60; When the angle of friction is 70 and 80 mg and the angle of friction is φ = 22°36′, we will consider it at the following sizes: R = 0,155 m; g = 9,81 m/s^2; V_b = 0,65 m/s; f = 0,416 and $F_э = 857\cdot10^{-6}$ N.

Table 1 presents the results of a study of the angle of friction the same, mass of different mung beed seeds on the surface of the work organ of an electrical appliance.

The results in the table show that depending on the mass of the mung beed seed, the characteristics of the movement of the work organ of an uneven electrical field wrapper device are also changing. For example, if the speed of a mung beed seed with a mass of 20 mg is equal when the linear speed of the work organ is turned to an angle of 3°37′, The speed of mung beed seeds with a mass of 40 mg and 80 mg is equal to the linear speed of the work organ, respectively, when turning at an angle of 6°18′ and 8°57′ (Figures 1.2. α_2-y1,y_2).

Table 1. The movement of various mass mung beed seeds on the surface of the work organ results of theoretical study

T/r	Seed mass m, mg	Value of total electrical power $F_э$, N	Syringe lags behind the angle of movement α_2, degrees	The beginning angle of the syringe advancement is α_3, degrees	The angle of action with the body of work α_b, degree	Disconnect angle from the body of work α_4, degrees	The speed at time of disconnection from the body of work V_u, m/h
1	20	$857 \cdot 10^{-6}$	3°37′	0	0	0	0
2	30	$857 \cdot 10^{-6}$	4°56′	0	0	0	0
3	40	$857 \cdot 10^{-6}$	6°18′	69°42′	63°40′	150°50′	1,152
4	50	$857 \cdot 10^{-6}$	6°57′	56°59′	50°18′	118°18′	1,391
5	60	$857 \cdot 10^{-6}$	7°43′	49°31′	41°48′	104°24′	1,509
6	70	$857 \cdot 10^{-6}$	8°23′	44°29′	36°07′	95°41′	1,583
7	80	$857 \cdot 10^{-6}$	8°57′	40°50′	31°53′	89°31′	1,633

That is, the movement of the moss seed, which is small in mass, along with the organ of work, begins earlier than that of the larger mass of the mung beed seed. at the same time, a mung beed seed with a mass of less than 40 mg moves in conjunction with the body of work, the division from its surface is disconnected after passing through the plains arrow, which is equal to $\alpha_4=0$ because it is $\alpha_3=0$, the mass of the mung beed seed, which is 40 mg and 80 mg, moves together with the body of work, 63°40′ and 31°53′, when rotated at an angle of 150°50′ and 89°31′, it is disconnected at a speed of 1,152 and 1,633 m/s (figures 3, 4. α_4-y_3, y_4).

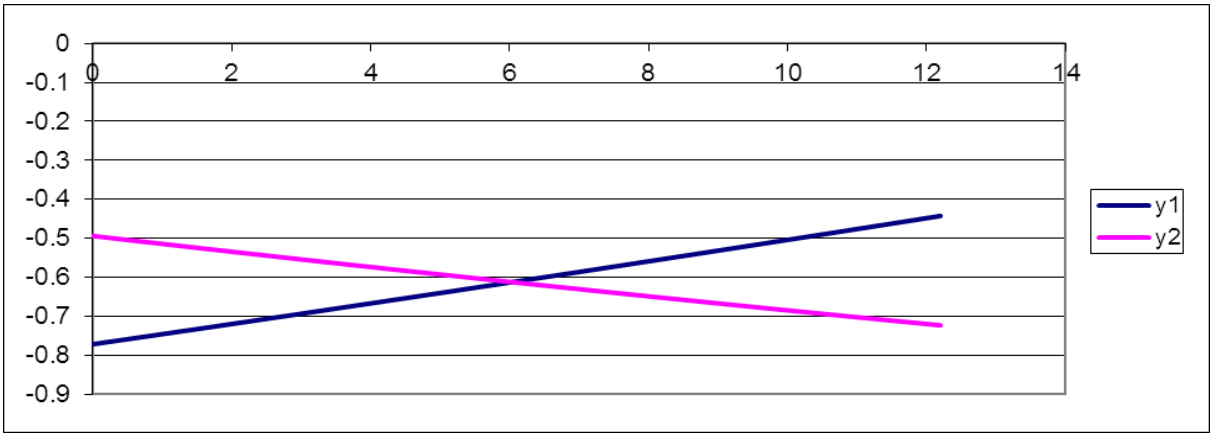


Figure 1. The intersection point α_2-y_1,y_2 is 40 mg.

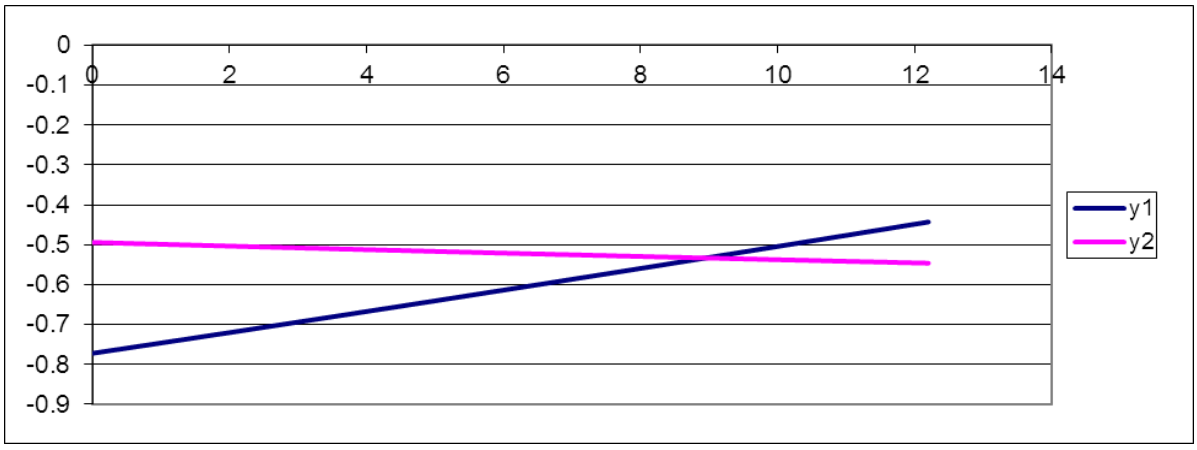


Figure 2. α_2-y_1,y_2-intersection point 80 mg.

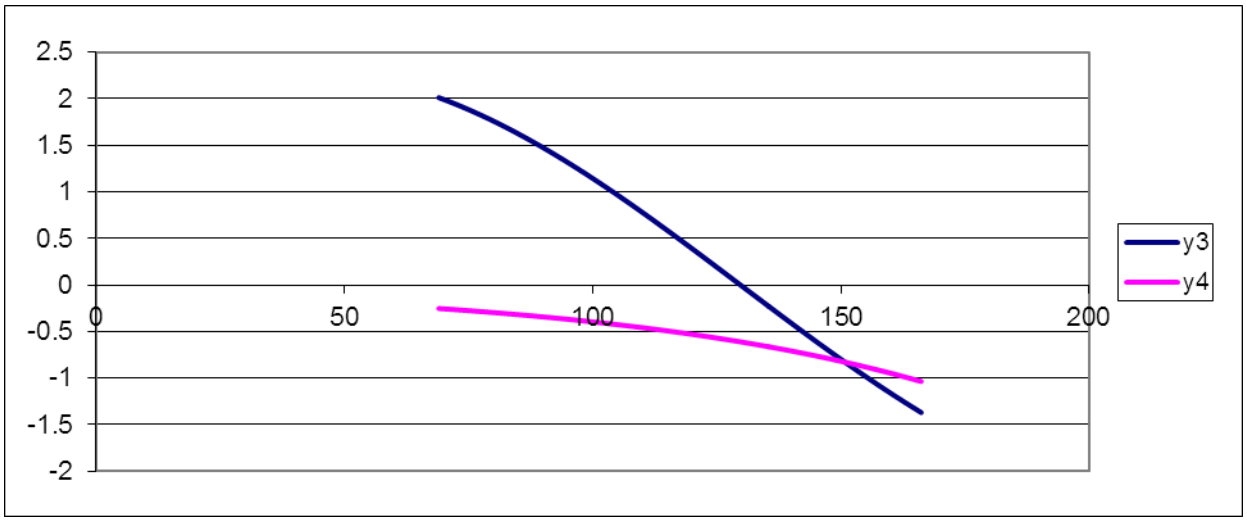


Figure 3. α_4-y_3, y_4-intersection point 40 mg.

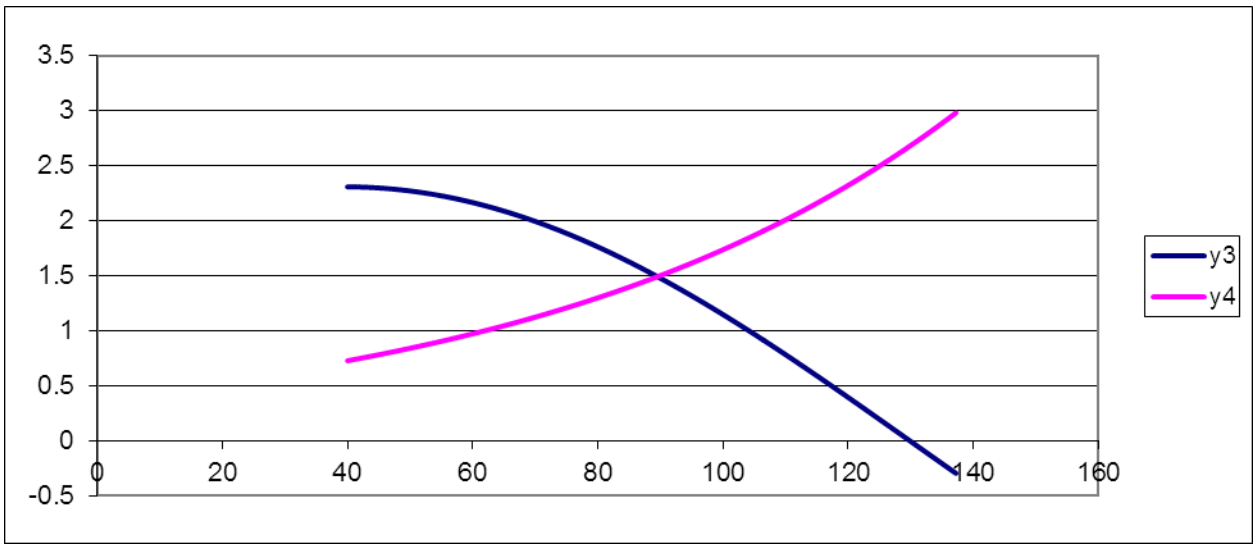


Figure 4. α_4-y_3, y_4-intersection point 80 mg.

The results show that the movement of the mung beed seeds with different masses on the surface of the organ of the electrical appliance is fundamentally different. Therefore, they are also disconnected from the surface of the body, and they are disconnected from different angles. Depending on the mass of the mung beed seed, knowing the disconnection angles, you can install a bunker for acceptance under the body and correctly select the coordinates of the division alignment arrow and divide the mung beed seeds that have been disconnected from the surface of the work organ into two factions, or seeds and a technical faction.

Based on an analysis of the results presented in the charts, the table can be concluded that the movement and disconnect angles of the working body of an electrical circuit electrical appliance with uneven electrical appliances in terms of physical and mechanical properties of mung beed seeds vary, clearly divide them into seeds and technical factions, and obtain seeds with high-quality, biological properties close to each other.

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