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Determining The Breaking Angles Of Mung Bean From The Surface Of The Working Organ By Basing The Voltage Applied To The Electrodes

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Annotation: The article presents the results of experimental studies conducted on the theoretical justification of the possibility of sorting mung bean in a non-uniform electric field.

Keywords: Mung bean, electric sorter device, sorting, working body, two different electrodes, voltage, electric field, non-uniform electric field, electric field strength, breaking angle, mass, geometric size, density, electrical resistance, dielectric absorption, seed fraction , technical faction.

INTRODUCTION

It is known from scientific sources that in order to obtain high-quality seeds of agricultural crops, biological properties close to each other, with high fertility and potential yield in laboratory and field conditions, it is necessary to electrotechnologically affect them, including sorting them according to all important physical and mechanical properties [1, 2]. This requirement is fully met by the sorting of agricultural crop seeds in the electric field. 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, agricultural 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 agricultural 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 physico-mechanical properties, mass, geometric dimensions, density, dielectric absorption, electrical resistance and other similar important properties. In addition to the electric field force, the seeds are affected by mechanical forces, and the sorting process depends on the mutual ratio of these forces. [4] .

Based on the above, we put forward the scientific idea that it is possible to improve quality indicators by sorting mung bean in an unevenly distributed electric field with electrodes of two different diameters wrapped around the working body.

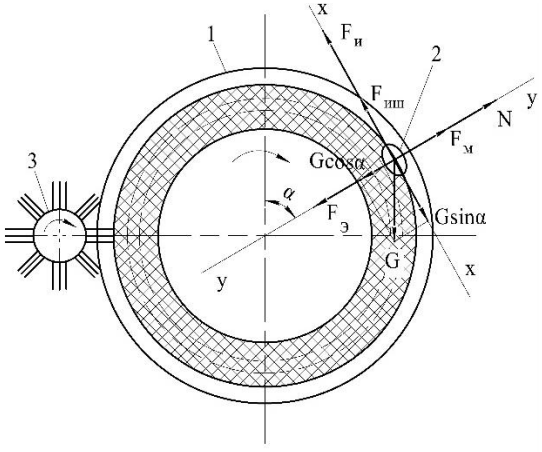


Figure 1. Scheme of forces acting on seeds

According to the scheme depicted in Fig. 1, the following condition must be met in order for mung bean to be separated from the surface of the working body of the electric sorting device.

$N = F_e + G\cos a - F_m = 0,$ (1)

In this a - the angle of separation of mush seeds from the surface of the working body, degrees.

F_e, G and F_m in the expression (1) and after some modifications, we get the following expression to find the angles of separation from the surface of the working body of the electric mung bean sorting device.

$$\alpha = \arccos\left[\frac{V_y^2}{gR} - \frac{2S_y U^2 \varepsilon_0 \varepsilon_u^2 (\varepsilon_y - 1)}{mg(2h_y\varepsilon_y + l_y\varepsilon_u)^2} \cdot \cos\frac{\theta}{2}\right]$$

(2)

In order to justify the angles of separation from the surface of the working body of the electric seed sorting device, we calculate the following values of the parameters of the expression (2): $V_u = V_b = 0.65$ m/s; g = 9.81 m/s^2; R = 0.155 m; $S_y = 67.12 \cdot 10^{-6}$ m^2; $\varepsilon_0 = 8.85 \cdot 10^{-12}$ f/m; $h_e = 1.15 \cdot 10^{-3}$ m; $l_y = 4.48 \cdot 10^{-3}$ m; $e_u = 4.0$; $e_u = 8$; cos(θ/2)=0.487; m=20;30;40;50;60; 70 and 80 mg; U = 3000; 4000 and 5000 V.

Figure 2 shows the graphs of changes in the angle of separation of mung bean from the surface of the working body at different values of voltage applied to electrodes of two different diameters depending on their mass.

With the change in the mass of the seeds, the angles of their separation from the surface of the working organ also change. For example, when a voltage of around 3000 V is applied to electrodes of two different diameters, a mung bean with a mass of 30 mg breaks off at an angle of 110º52′ from the surface of the working body, while a mung bean with a mass of 80 mg breaks off at an angle of 70º38′ (Fig. 2, curve 1). When a voltage of about 3600 V is applied, a 30 mg mung bean sticks to the surface of the working body and continues to move towards the brush, a 80 mg mung bean breaks off at an angle of 80º38′ (Fig. 2, curve 4).

A change in the value of the voltage applied to the electrodes of two different diameters causes a change in the angle of separation of the mung bean of the same mass from the surface of the working body of the device. For example, when a voltage of about 4000 V is applied to electrodes of two different diameters, mung bean with a mass of 50 mg are broken when the surface of the working organ is turned to an angle of 118°17' (Fig. 2, curve 6), when a voltage of about 4400 V is applied to the electrodes, they 144 It is cut off at an angle of 10' (Fig. 2, curve 8), when the voltage around 5000 V is applied to the electrodes, the mung beans are cut off with the help of a brush, moving together with the drum without breaking at all (Fig. 2, curve 11). This is the design of the electric sorting device

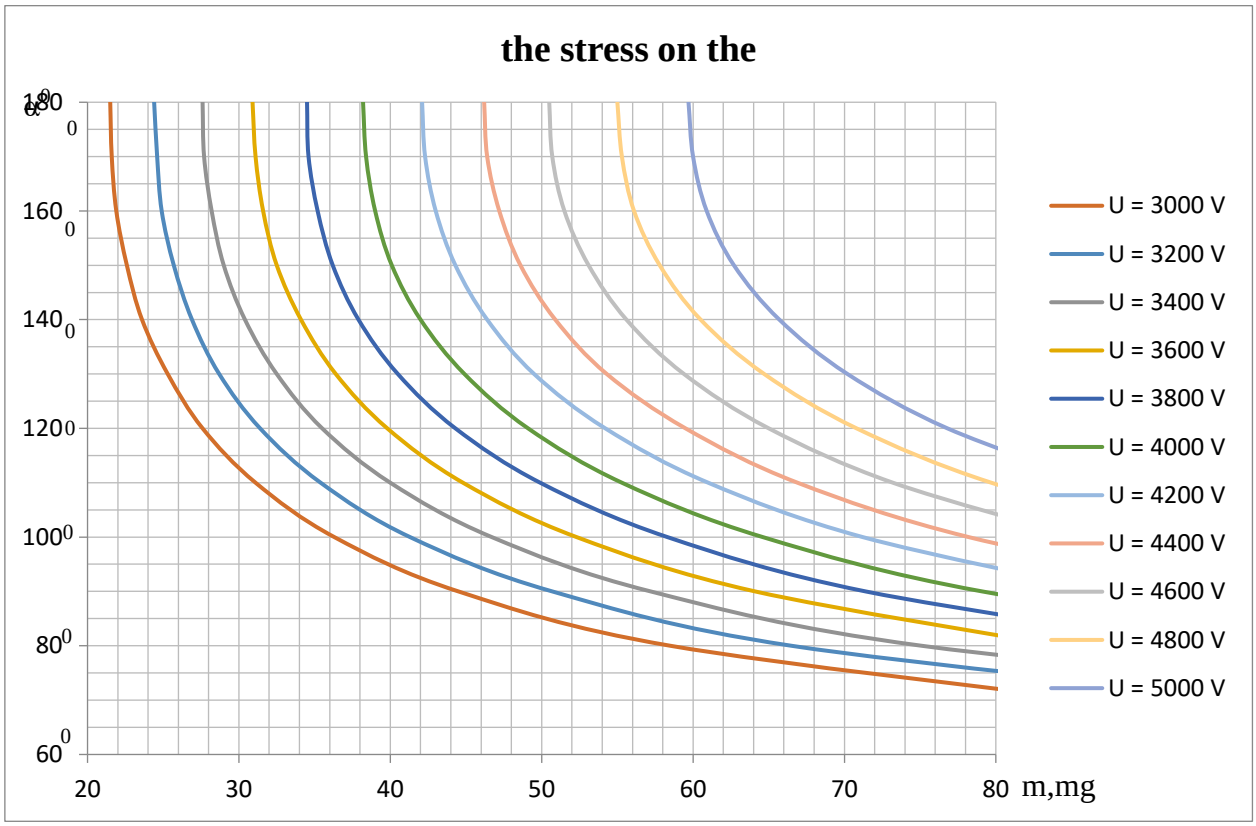


Figure 2. The voltage (U) supplied to the electrodes is different the breaking angles of mung bean(a) in value graphs of change depending on the mass (m).

while the dimensions and working modes remain unchanged, it is concluded that by changing the value of the voltage applied to the electrodes of two different diameters, it is possible to change the breaking angles of mung bean on a large scale and control the technological process of sorting depending on their physical and mechanical properties.

If we consider mung bean with a mass of less than 50 mg to be of poor quality and unsuitable for planting, in order to distinguish low-quality from high-quality mung beans, when m < 50 mg , a the following condition must be satisfied for all values of

$$N = F_e + G\cos a - F_m > 0, \quad (3)$$

(3) must be $F_e > F_m + G$.

the threshold electric field strength for the mung bean to be attracted to the surface of the working body $F_э^{чег}$.

$$F_э^{чег} = F_м + G = m\frac{V_y^2}{R} + mg, \quad (4)$$

where, m = 50 mg

$$F_э = \frac{2S_y U^2{}_{чег}\varepsilon_0\varepsilon_u^2(\varepsilon_y - 1)}{(2h_э\varepsilon_y + l_y\varepsilon_u)^2}\cos\frac{\theta}{2}, \quad (5)$$

where, U is the limiting voltage, V.

Using expression (4), we construct the following expression.

$$U_{чег} = \sqrt{\frac{F_э^{чег}(2h_э\varepsilon_y + l_y\varepsilon_u)^2}{2S_y U^2\varepsilon_0\varepsilon_u^2(\varepsilon_y - 1)\cos\frac{\theta}{2}}} \quad (6)$$

When the diameter of the working body of the electric sorting device is 310 mm and the number of revolutions is equal to 40 min^{-1}, V_u =

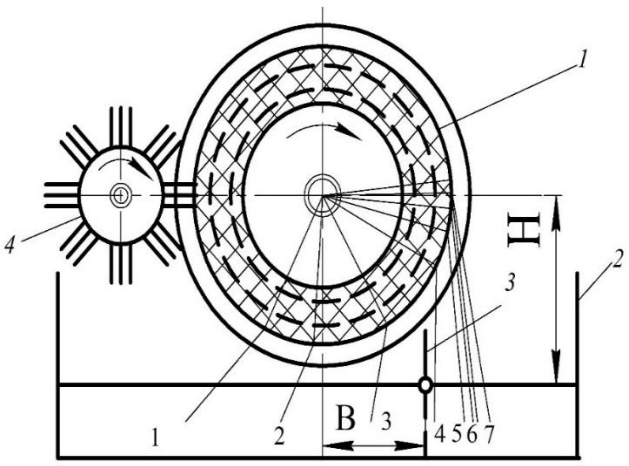
V_b =0.65 m/s; g = 9.81 m/s ^{2}; R = 0.155 m; m=50 mg; = $5.01 \cdot 10^{-4}$ N, = $U_{чег}$ 3058.8 $F_э^{чег}$ V.

Conducted theoretical studies showed that in our proposed device, $F_э$ >$5.01 \cdot 10^{-4}$ N, U >3058.8 V, voltage of around 4000 V to electrodes with two different diameters is enough to sort the initial mung bean at the required level. and allows to divide into technical fraction. Mung bean can be determined by changing the angles of separation from the surface of the working organ of the electric sorting device , the diameter of the electrodes connected to the ground and the potential wrapped in the grooves, as well as the coordinates of the axis of the dividing plane [5, 6].

It is known that when the structural dimensions and operating modes of the electric sorter device are unchanged, the angles of breaking off of the mung bean from the surface of the working body depend on their physical and mechanical properties, and it is broken off when it is turned to different angles. Therefore, it is important to base the coordinates of the axis of the dividing plane of the receiving hopper to separate the mung beancut at different angles from the surface of the working organ of the electric sorting device into different, that is, seed and technical fractions [7,8] .

To base the coordinates of the axis of the dividing plane of the receiving hopper installed under the working body, using expression (2) and the curves shown in Fig. 2, we find the intervals of change of the angles of break from the surface of the working body of the electric sorting device of different masses of mung bean.

In Figure 3, the diameter of the working body is 310 mm, the number of revolutions is 40 min^{-1}, the value of the electric field strength is $5 \cdot 10^{-4}$ V/m and the mass is 20, 30, 40, 50, 60, The intervals of change of break angles from the surface of the working body of the electric sorter device of mung bean equal to 70 and 80 mg are described.



1-work body; 2-receiving bunker; 3–plane of division; 4-brush
1; 2; 3; 4; 5 and 6 respectively 30; 40; 50; 60; It corresponds to 70 and 80 mg

Figure 3. Mung bean of different mass on the surface of the working body intervals of change of break angles.

As can be seen from the scheme depicted in Fig. 3, mung beans are cut off when they are turned at different angles depending on the mass of the working body surface of the electric sorter device. For example, if moose seeds with a mass of 20 mg are broken from the surface of the working body by passing through the axis of the dividing plane, then moose seeds with a mass of 50 and 60 mg are separated from the surface of the working body at 118°18′ and 104°24′, respectively. breaking when cornering. This, in turn, makes it possible to accurately separate mung bean cut from the surface of the working body at different angles into the seed and technical fraction by correctly setting the coordinates of the axis of the dividing plane of the receiving hopper.

As mentioned above, if we consider mung beanwith a mass of less than 50 mg to be of poor quality and unsuitable for planting, the coordinates of the axis of the dividing plane of the receiving hopper should be set at the following distances from the center of the shaft of the working body: V =175 mm in the horizontal plane and 255 mm in the vertical plane. At the same time, the

height of the dividing plane should not be greater than h =100 mm for the exact separation of sorted mung beaninto seed and technical fractions [9,10] .

The coordinates of the axis of the dividing plane of the receiving hopper can be sorted by the values of other leguminous crops as well. Only then, depending on the physico-mechanical properties of the mung bean, it is necessary to change the number of revolutions of the working body or the value of the voltage applied to the electrodes of two different diameters.

According to the results of theoretical and practical studies on the sorting of mung beans, the structural dimensions and operating modes of the electric sorting device, which ensure the separation of the seeds into the seed and technical fraction according to their physical and mechanical properties, were based.

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