EXCELLENCIA
INTERNATIONAL MULTI-DISCIPLINARY JOURNAL OF EDUCATION
Volume 02, Issue 04, 2024 ISSN (E): 2994-9521

Electrotechnological Sorting Devices

Makhmudov Nuriddin Makhamadali o‘g‘li [1], Rivojiddinov Jo‘rabek Ilhomjon o‘g‘li [2],

To‘khtabaev Jamshid To‘lqin o‘g‘l [3]

[1] Namangan Institute of Engineering and Construction, Associate Professor of the "Electric Power Engineering" Department, 160103, Namangan city, Islam Karimov street, 12-house

[2] Namangan Institute of Engineering and Construction, Master of the "Electric Power Engineering" department, 160103, Namangan city, Islam Karimov street, 12-house

[3] Namangan Institute of Engineering and Construction, Student of the "Electric Power Engineering" department, 160103, Namangan city, Islam Karimov street, 12-house

Abstract:

The article provides information on the result of the development of an electro technological sorting device for sorting mung beans belonging to the class of leguminous crops, its principle scheme and structure, and the principle of operation. The working body of the electro technological sorting device is made of a polyethylene pipe, and two-lane screw ditches with a slope angle "φ" and a width equal to "t" are directed to its surface. A potential electrode with a large diameter d1 and a grounded electrode with a small diameter d2 are wrapped around the grooves and connected to a high voltage source through current transmitters.

Good results have been achieved in preliminary experimental studies on the sorting of legume seeds with the proposed device.

Keywords: Legume seed, electro technological sorting device, sorting, working body, polyethylene pipe, two-point electrode, potential electrode, ground electrode, electric field, uneven electric field, electric field strength, seed fraction, technical fraction.

Enter. It is known that, in the following years, leguminous crops such as mung beans, beans, peas, and soybeans are being planted as repeated crops on the land areas freed from the main crop and grain. Because of this, scientists say that the amount of protein in the seeds of leguminous crops is twice as much as that of wheat, and three times as much as that of rice [1]. In addition, leguminous seeds contain enough complex carbohydrates, trace elements, vitamins and minerals of group B,

which are necessary for the human body. At the same time, leguminous crops are considered ointments for the earth, and they accumulate up to 105 kilograms of natural nitrogen per hectare in the soil [2, 3].

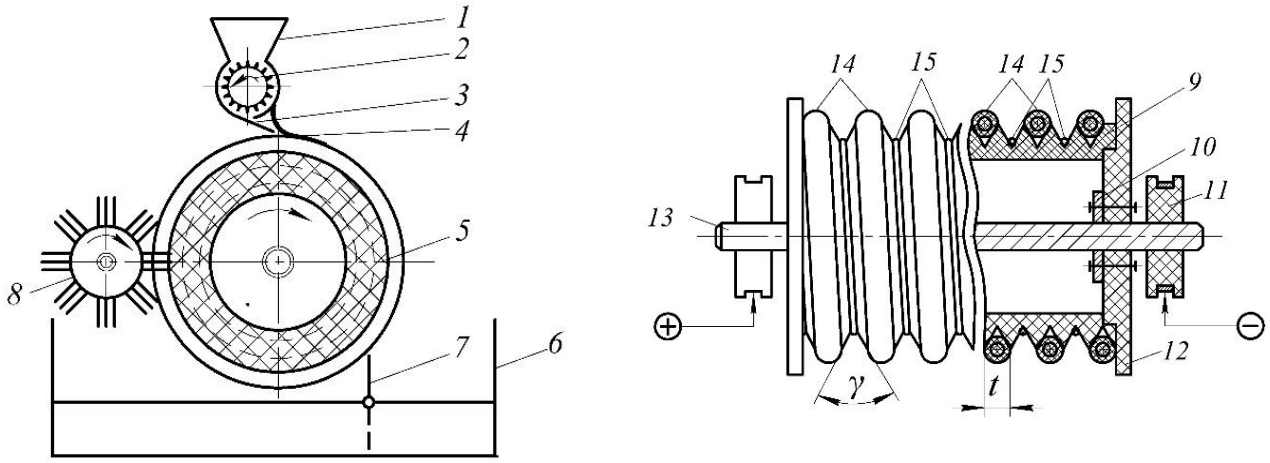
Taking into account the above, our government is paying special attention to the expansion of the land area for growing leguminous crops in the coming years. In increasing the productivity of leguminous crops, including mung bean crops, along with expanding the land areas where they are planted, improving the quality indicators of the seeds prepared for sowing plays an important role. Because the use of high-quality seeds for planting, biological properties close to each other, fertility in laboratory and field conditions, and high potential yield is one of the main factors in growing a plentiful harvest. However, until now there is no effective device for sorting mash seeds in seed preparation technological systems of agricultural production. The use of existing devices based on pneumatic and mechanical methods in sorting mash seeds does not allow obtaining seeds that meet the level of agrotechnical requirements. Because, in these devices, the seeds are sorted by only one important property, that is, in devices based on the pneumatic method - mass, and in devices based on the mechanical method - by geometric dimensions [4, 5].

It is known from scientific sources that it is necessary to sort the seeds of agricultural crops according to all important physico-mechanical properties in order to obtain high-quality seeds with similar biological properties, high fertility and potential yield in laboratory and field conditions [6]. This requirement is fully met by the sorting of seeds in the electric field. Based on this, we put forward the scientific idea that it is possible to improve the efficiency of mosh seed sorting by improving the design of electric sorting devices. In order to realize the scientific idea that we had previously put forward, the principle scheme and working body of the electric sorting device were developed and a model copy was prepared [7, 8].

The principle scheme and working body of the electric sorter device for sorting mash seeds was developed based on the patent research and analysis of the proposed technical means for sorting the seeds of agricultural crops in the electric field. A model copy of the device was prepared according to the developed principle scheme and working body [9, 10, 11, 12].

The figure shows the principle scheme and working body of the electric sorter device developed for sorting mash seeds.

The electric sorting device is composed of loading hopper 1, feeder 2, sliding board 3, guiding device 4, working body 5, receiving hopper 6, dividing plane 7 and separating brush 8.



a) b)

Picture. The principle scheme of the electric sorter device

(a) and work body (b):

1-loading hopper; 2–supplier; 3-sliding board; 4-directing device; 5-work body; 6-reception hopper; 7– dividing plane;

8–a separating brush; 9 – polyethylene pipe; 10 – flanges; 11-current transmitter; 12– side disks; 13-shaft; 14 and 15–electrodes with opposite signs;

The working body 5 is made of a polyethylene pipe 9, on the surface of which two-lane screw grooves with a depth angle " *g* " and a width equal to " *t " are directed.* The polyethylene pipe 9 is fixed to the shaft 13 by means of metal flanges 10 and side disks 12 made of dielectric material. Electrodes 14 and 15 of opposite direction, with a diameter equal to d_1 and d_2 , of large and small diameter , are wrapped in two-lane screw channels and connected to a high voltage source through current transmitters 11.

The principle of operation of the device is as follows. When it is connected to the network, with the help of an electric motor and a reducer, the feeder 2, the working body 5 and the separating brush 8 are rotated. At this time, the mosh seed to be sorted is supplied from the loading hopper 1 through the feeder 2 and the sliding board 3 to the surface of the working body 5 at the same rate. With the help of the device 4 that directs the mash seeds delivered to the surface of the working body 5, the small diameter electrode 15 is located in the coiled grooves, as a result of the friction of the brush 8, which separates it with the polyethylene pipe 9, and under the influence of the electric fields created between the opposite electrodes 14 and 15 is polarized. As a result, the seeds are affected by electric field strength, reflection electric field strength, and ponderomotor electric force, which is formed by uneven distribution of electric field between electrodes 14 and 15 with opposite directions, i.e. total electric field strength. In addition to the total electric field force, the seeds are also affected by centrifugal force, weight, inertia, reaction and frictional forces. Based on the mutual ratio of the acting forces, mush seeds, depending on their physical and mechanical properties, break off from the surface of the rotating working body 5 at different angles and fall into the appropriate fraction of the receiving hopper 6, that is, the seed or technical fraction. Seeds and other small impurities stuck to the surface of the working body 5 are separated from it with the help of a brush 8.

In the proposed device, by changing the value of the voltage applied to the electrodes with the opposite direction and the coordinates of the axis of the dividing plane of the receiving hopper, it is possible to control the amount of separation of mash seeds into fractions and the efficiency of the technological process of sorting depending on their physical and mechanical properties.

Based on the principle scheme of the proposed electric sorter device, a mock-up was prepared, and experimental studies on the sorting of mung seeds were conducted in it, and positive results were obtained.

The patent research conducted on the sorting of agricultural seeds in the electric field and the analysis of the technical means proposed in this direction showed that there are ways to improve the designs of the electric sorting devices. Based on this, the design of the electric sorter device was improved, and it was possible to create an unevenly distributed electric field on the surface of the working body. In this case, it is possible to determine the optimal ratio between the diameters of oppositely pointed electrodes wrapped in two-lane helical grooves on the surface of the working body and, accordingly, to determine the maximum value of the force of pulling mash seeds to the surface of the working body and to increase the technological efficiency of their sorting.

Summary. In order to obtain high-quality seeds with similar biological properties, high fertility and potential yield in laboratory and field conditions, it is necessary to select the seeds of agricultural crops according to all important physico-mechanical properties. Sorting of seeds in the electric field fully responds to this demand , and it can be achieved by improving the designs of electric sorting devices.

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