

STUDYING THE INDICATORS OF SORTING DIFFERENT AGRICULTURE PRODUCTS ACCORDING TO THE PARAMETRES OF THE TECHNOLOGICAL PROCESS

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Summary:

This article aims to present some experimental results obtained in order to sort the agriculture products on longitudinal oscillations screens. This study intends to outline the factors which influence this process. In laboratory conditions, using a special stall in order to make such experiments there have been tested the following seeds: bean, maize, corn, pea, soy, hemp. At the end of the experiment there have been proved that the process of sorting on screens is influenced by the shape of the holes of the screen, revolution, rotation device, the state of the surface of the seeds and their shape, and the specific loading. Thus the state of the surface of the particles influences in a negative way, together with the length of the rotation device, the separation efficiency. Generally the growth of the specific loading of the screen leads to the lowering the separation efficiency.

Key words: separation on screens, dimension of the particle.

1. INTRODUCTION

When cleaning and sorting the agricultural products using the screens with oscillations in length one may be: the machine characteristics and work equipments, the cleaning kinematics, the number of floor screens, the order of their disposal, the flow of basic product and of the unknown substances within the sifting process.

The technical and kinematics characteristics are part of the building particularities of the machine and can not be influenced but in little measure when it is used. It is very important for the efficiency of the cleaning process that the machine equipping is done with corresponding screens, in order that the result of the sifting process is optimal from an economico-technical point of view.

2. MATERIALS AND METHODS

For the execution of the experimental researches concerning the process of cleaning and sorting the agricultural product, a laboratory stall has been used, with this destination, being equipped with all the necessary appliances in order to reproduce under laboratory conditions, the real working process taking place within the exploitation of a cleaning and sorting machine.

Scheme of separation equipment to separate particles with plan sieve is presented in figure no. 1. The laboratory experiments have been realized using the following seeds: beans, maize, corn, pea, soy bean, hemp which have been considered representative from point of view of their differences in width (b) and thickness (c). In the laboratory there have been prepared tests on the filling drawer, and it has been obtained a mixture having some known components. For the particles mixture of the same species the tests have been of 1 kilo equal participation

of the components formed by variable particles in size and the same for the mixture of particles from different species.

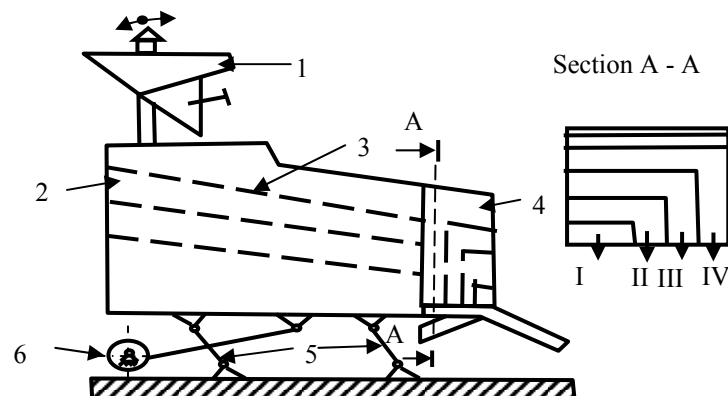


Fig. 1 Scheme of laboratory equipment to separate with plan sieve:
1 - box with feeder proportional; 2 - bloc of sieve; 3 - sieve dispose in decrease order of orifice; 4 - lead-in to evacuate the fractions (I-IV); 5 - Supports vertical elastic ; 6 - mechanism rod-crank.

In fig. no. 2 it is presented measuring scheme [4].

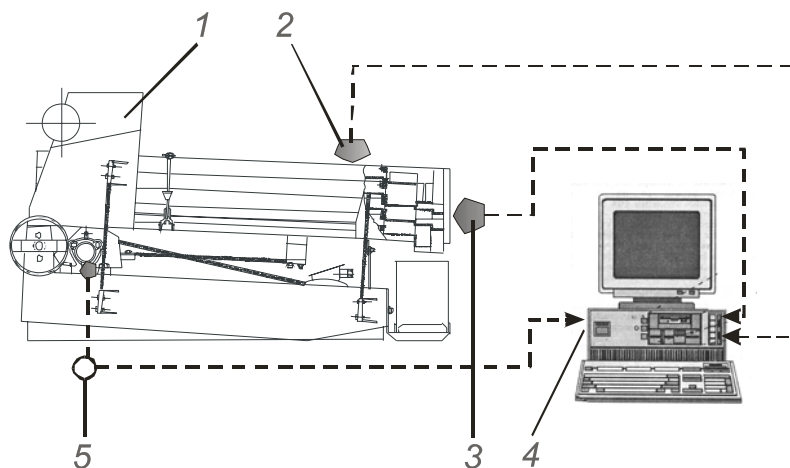


Fig. 2. Measuring scheme
1 - laboratory stall; 2 - inductive tractor for measuring the verticale movements; 3 - inductive tractor for measuring the horizontal movements; 4 - calculator with a data acquisition disc; 5 - tourmetre electronic

The efficiency of separation was determined with relation [8]:

$$\eta = \frac{M_c}{M \cdot \frac{a}{100}} \cdot 100 \quad (\%) \quad (1)$$

in which: M_c - represents the sifting mass (kg);

M - total mass of the test;

$\frac{a}{100}$ - the percentage of particles with the dimension for which the separation is made, smaller

that the dimension of the screen hole.

For particles mixture from the same category it is considered $a = 100$, and for particle mixtures from different species $a = 50$.

The experiment aimed to determine the efficiency of separating under the influence of the following factors: the dimension of the particle for beans, maize, corn, pea, soy bean, oat and hemp; the number of revolution of the rotation device ($n_1=700$ rot/min, $n_2=900$ rot/min, $n_3=1100$ rot/min, for beans), the length of the rotation device ($l_1=14$ mm, $l_2=16$ mm și $l_3=18$ mm, for maize) and the specific loading of the screen ($q_1=80\text{kg/m}^2\text{h}$, $q_2=100\text{kg/m}^2\text{h}$, $q_3=120\text{kg/m}^2\text{h}$, for corn).

3. EXPERIMENTAL RESULTS

The indicators of the separations of particles in function of their width on the screen having long-like oscillations and circular hobs are presented in figure 3 [5]. One may notice a variation within a big interval of values of the separation efficiency (22-96%).

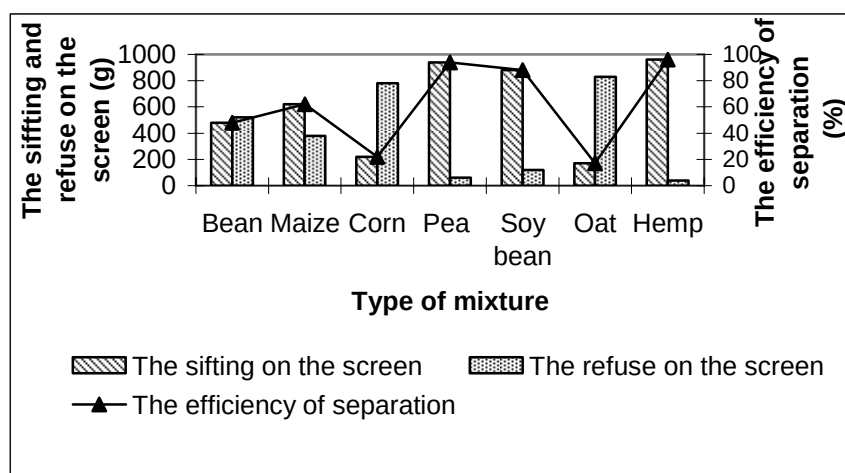


Fig. 3. The graphic representation of the variation of the indicators showing the separation of a mixture of particles in function of the width on screens with longitudinal holes

In figure 4 there are presented indicators of the separation process of the particle mixture on screens having longitudinal holes, respectively the separation of the mixture in function of the thickness of the particle. It may be noticed that the particle mixtures of a round shape have an efficiency of separation much more superior (more than 90%) different from the long particles or corners shaped ones [5].

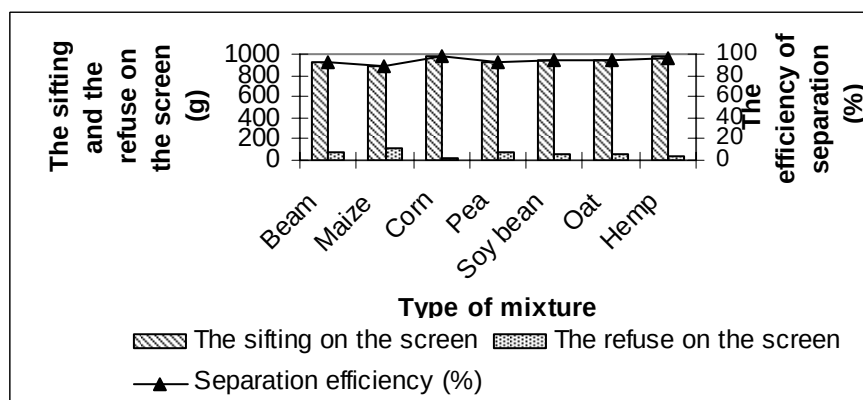


Fig. 4. The graphic representation of the separation indicators of a particle mixture in function of the thickness on the screens having long holes

The variation of the revolution of the rotation device of the mechanism tracking the screen block got to the obtaining of some different values of the efficiency of separation for the sifting, of the refusal and respectively of the separation efficiency for the studied mixtures is realized in figure 5 [5].

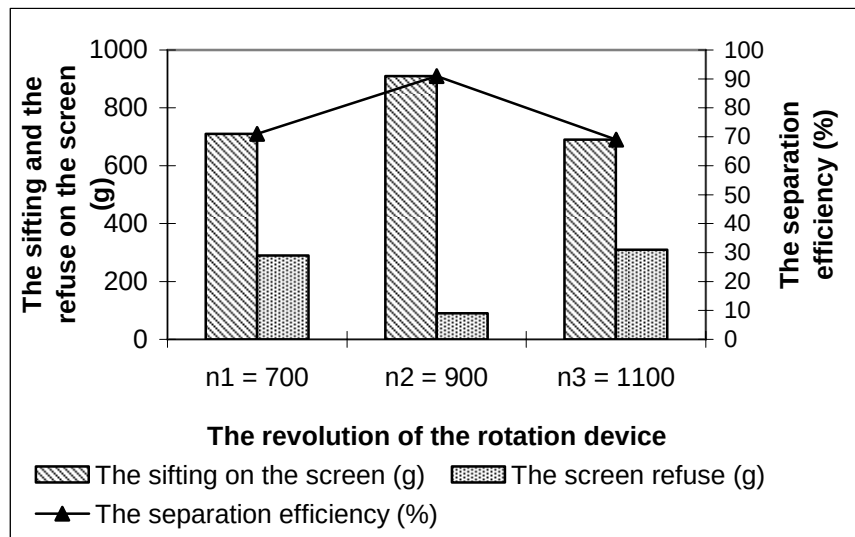


Fig. 5. The graphic representation of the separation indicators of a particle mixture after rotation device – bean –

The variation of the rotation device length of the mechanism tracking the screen block got to the obtaining of some different values of the separation efficiency for the studied mixtures, and the graphic representation of the sift, the refusal and respectively the separation efficiency for the studied mixtures is represented in fig. 6 [5].

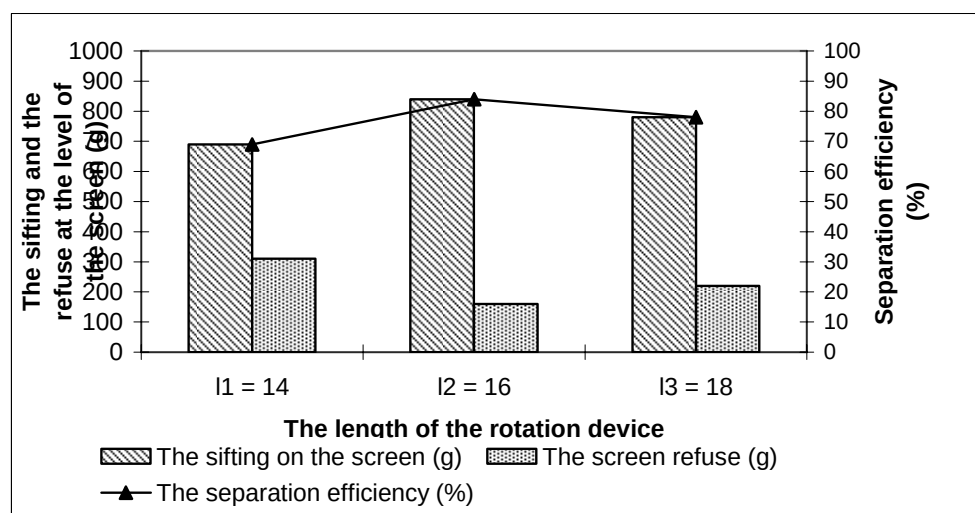


Fig. 6. The graphical representation of the separation indicators variation of a mixture of particles in function of the length of the rotation device – maize

The variation of the loading process specific to the screen got to the obtaining of some values different from the separation efficiency in the case of the studied mixtures, the graphic representation of the sifting process, the refusal and respectively the separation efficiency for the mixtures studied is realized fig. 7.

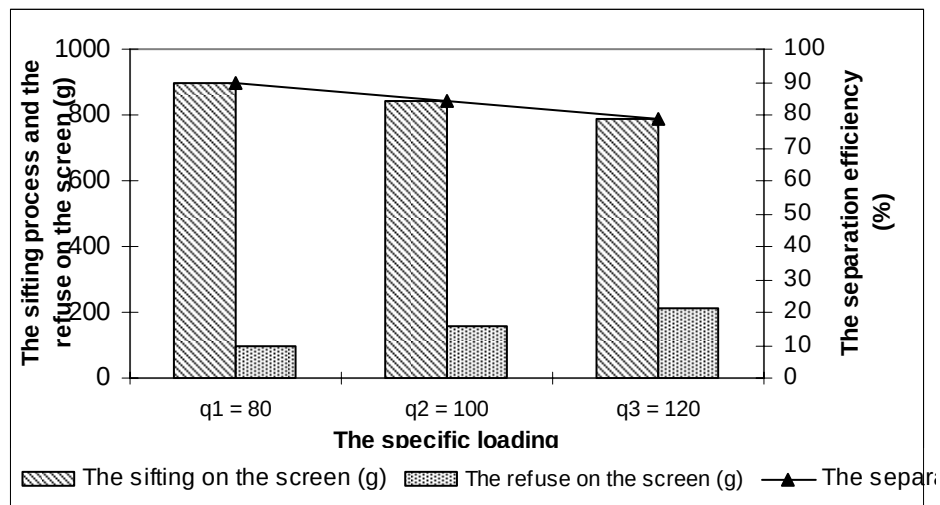
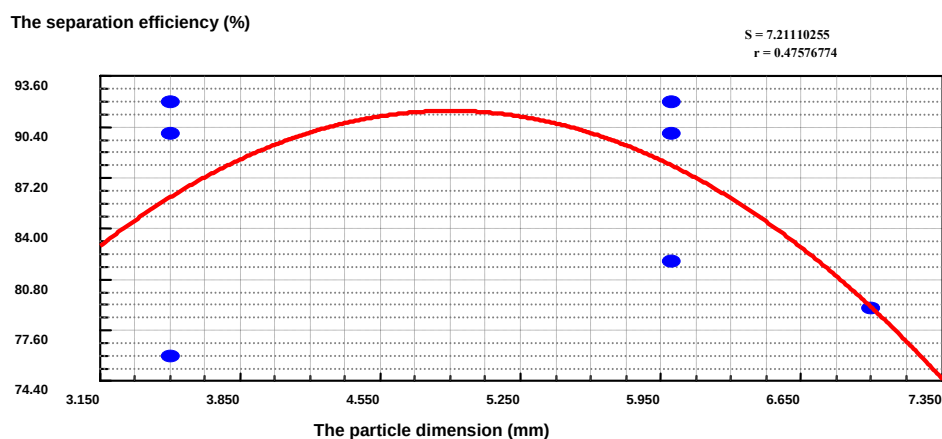


Fig. 7. The graphical representation of the separation indicators variation of mixture of specific charge of sieves – corn –

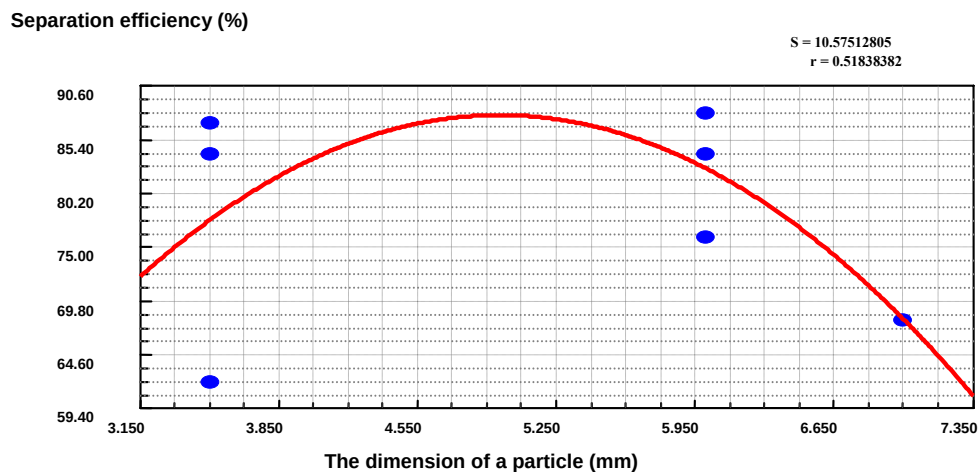
In order to better illustrate the influence of the specific loading on the separation efficiency + paying attention also to the type of mixture + we have tried a mathematical moulding of the relation between the variation of the specific loading of the sifter and the variation of the separation efficiency (fig. 8 - 10).



square equation: $y = a + bx + cx^2$

The coefficients have the values: $a = 24.4$; $b = 27.4$; $c = -2.8$.

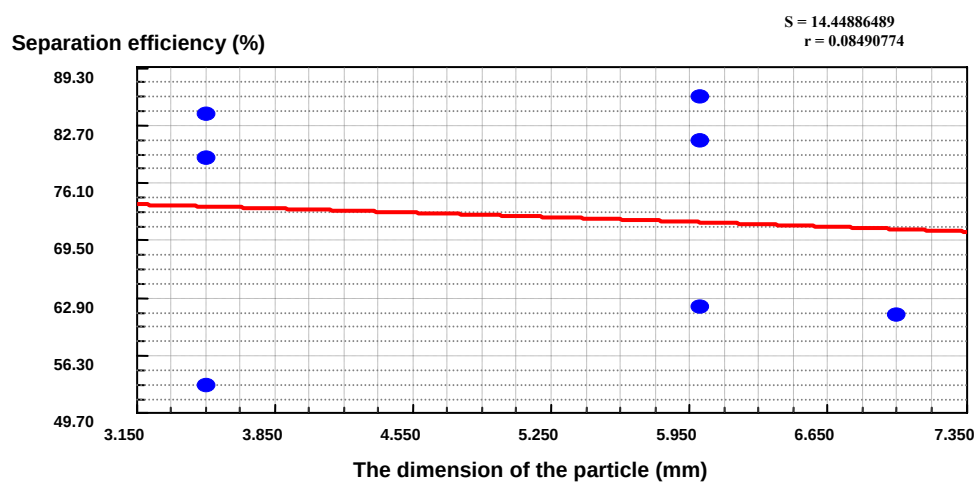
Fig. 8. The graphic representation of the separation efficiency variation in function of the type of particle $q = 80 \text{ kg/m}^2 \text{ h}$



square equation: $y = a + bx + cx^2$

The coefficients have the values: $a = -29.333333$; $b = 47.238095$; $c = -4.7619048$.

Fig. 9. The graphic representation of the separation efficiency variation in function of the type of the particle for $q = 100 \text{ kg/m}^2 \text{ h}$



$q = 120 \text{ kg/m}^2 \text{ h}$

Geometric equation: $y = ax^{(bx)}$

The coefficients have the values: $a = 74.689527$; $b = -0.0038908385$

Fig. 10. The graphic representation of the separation efficiency variation in function of the type of the particle for $q = 120 \text{ kg/m}^2 \text{ h}$

3. CONCLUSION

In the case of the working stall used and of the aimed results one can settle the following conclusions:

- The screens having circular holes make the separation in function of the width of the particle and as recommended for the particles having a spherical shape.
- The screens having long like holes make the separation in function of the thickness of the particle and as recommended for long-like particles.

- The big revolution of the rotation device makes the particles having an independent movement opposite to the screen movement and the particles do not have time to pass the screen holes.
- The smaller revolution of the rotation device makes the particles having an independent movement opposite to the screen, and they can not penetrate the lay of material in order to separate themselves through.
- The shape of the particles and the state of their surface improve the efficiency in separation process only for big revolutions or smaller ones than the average revolution of the work of the rotation device.
- The length of the rotation device has the same influence upon the efficiency of the separation process as the revolution but one may notice bigger differences of it depending upon the variation of the ray of the rotation device opposite to the revolution of the device.
- The state of the surface of the particles negatively influences, together with the length of the rotation device, the efficiency of separation.
- Generally the growth of the load specific to the screen brings to the lowering of the efficiency of separation. For the particles having a cornered shape and a rough surface this lowering is very visible, and for the smooth particles and having a round shape the lowering is much smaller.

BIBLIOGRAPHY

- [1] Adekoya, L. O. et all., *A precision punch planter for use in tiled and utilled soils*, Journal of Agricultural engineering Reserch, nr. 37, S.U.A., 2000;
- [2] Bontaș, O., *Aspecte privind optimizarea procesului de curățire și sortare a produselor agricole*, Universitatea „George Bacovia”, Buletin științific, anul IV, nr. 1/2001, Bacău;
- [3] Bontaș, O., *Stadiul actual al realizărilor și cercetărilor privind curățirea și sortarea produselor agricole*, Referat I;
- [4] Bontaș, O., *Proiectarea și realizarea bazei tehnice necesare pentru studiul procesului de curățat și sortat*, Referat II.
- [5] Bontaș, O., *Proiectarea și realizarea bazei tehnice necesare pentru studiul procesului de curățat și sortat*, Referat III
- [6] Neculăiasa, V., Țenu, I., *Bazele cercetării experimentale a mașinilor și instalațiilor din agricultură și industria alimentară*, Universitatea Tehnică “Gh. Asachi”, Iași, 1996;
- [7] Nedeff, V., *Procese de lucru, mașini și instalații pentru industria alimentară*, Universitatea Bacău, 1998;
- [8] Nedeff, V., Moșneguțu, E., Băisan, I., *Separarea mecanică a produselor granulometrice și pulverulente din industria alimentară*, Editura TEHNICA-INFO, Chișinău, 2001;