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A DESIGN OF SIFTING OF SOIL IN DRUM SEPARATOR

The design of sifting of soil is offered in the drum separator of potato-gathering machine.

Keywords: collection, separation, soil, potato, design.

Raising of problem in a general view and its copulas with important scientific or practical tasks. At collection of potato far of soil gets on transporting the organs of potato-gathering devices, worsening quality of commodity products. In this connection the actual is become by the problem of active separation of potato to the lots and creation of devices for realization of such separation. It follows no less important to count creation of theory of activated separation and its application for the analysis of work of concrete separating devices.

Analysis of the last researches. First in the most general view the theory of activated separation was offered in [1]. This theory is based on the analysis of evolution of function of division of soil factions on sizes at passing of them through the separating a device. Clearly, that the initial type of function of division depends on to the type and state of soil, and also from undermining workings organs. An eventual kind is determined mainly by separating devices. Introduction provides for to consideration of function of division, that lots show by itself the set of almost not united between itself soil aggregates [2]. Such model of soil allows to use for the analysis of dynamics differential equalizations [3] and to get a zero mathematical model of process of activated separation on by the concrete separating device.

That is why improvement of existing and invention of new methods of separation of soil and workings organs for these aims is an important task.

Formulation of aims of the article. Design of sifting of soil in the drum separator of potato liftsng machine [4, 5, 6].

Exposition of basic material of research.

Design of sifting of soil in a drum separator.

For description of process of sifting of soil possibly, that shallow particles which went down on the separated a surface sifted with probability of k_s, which, obviously, depends on a road clearance and size of openings of the separated surface, and also size of particles which are sifted.

For determination of coefficient of sifting of shallow particles will take advantage of the task of Byuffona known from the theory of chances [7, 8]. Pursuant to this task, probability of that a body will sift through a crack evened:

$$P = 1 - \frac{2S_0}{\pi S}, \tag{1}$$

where S_0 – halt-perimeter protuberant the contour of particle, *m*;

S – is a width of crack, *m.*

Counting the form of particles of soil near to spherical, halt-perimeter protuberant a contour will be evened:

$$S_0 = \frac{\pi\delta}{2}, \tag{2}$$

where δ – is a diameter of particle

As surfaces make educations of the separating surface only certain part of general surface, with an account (1) probability of sifting of particle by the diameter δ through the separating surface will be determined equalization:

$$P = \left(1 - \frac{\delta}{S}\right)\frac{S}{S+d} = \frac{S-\delta}{S+d}, \tag{3}$$

where d - is a diameter of small twig of separator, *m*.

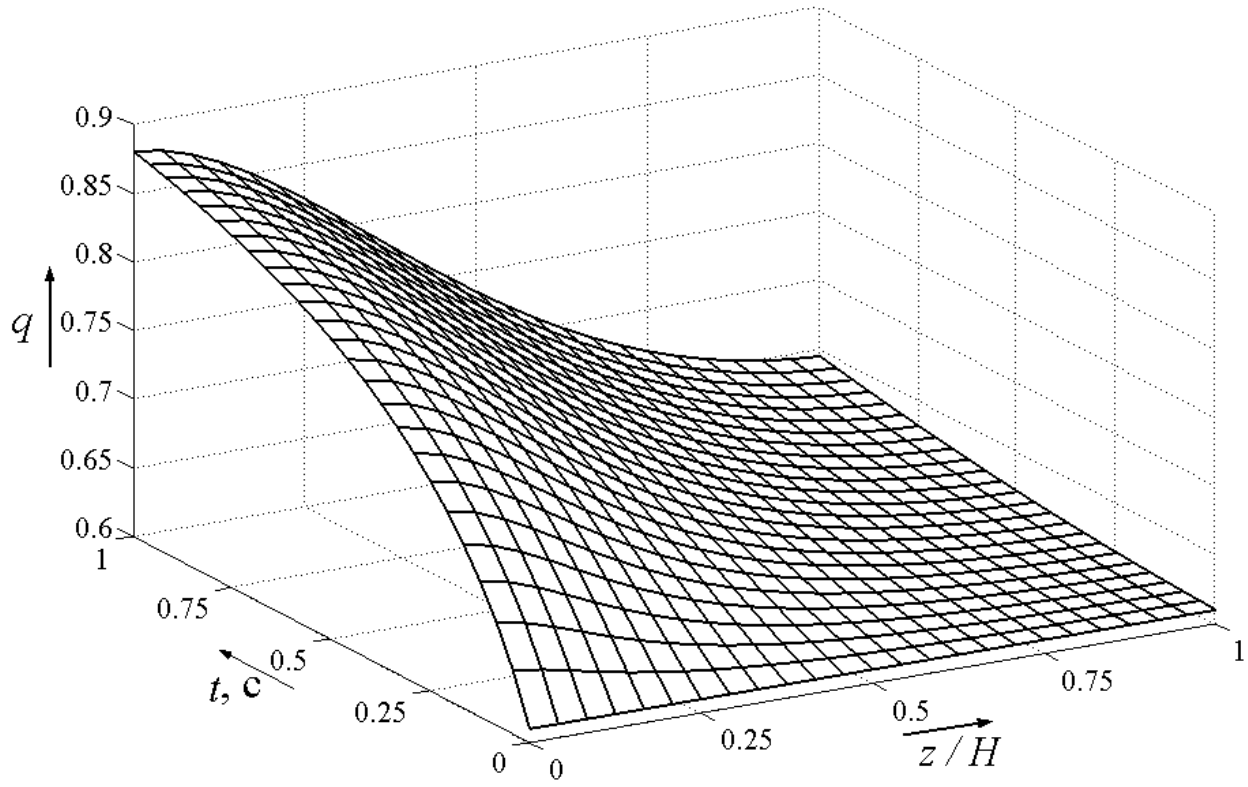
Because of that, that shallow particles have different sizes, the coefficient of sifting can be expressed the followings equalizations:

$$k_s = \int_0^S \xi(\delta)\frac{S-\delta}{S+d}d\delta, \tag{4}$$

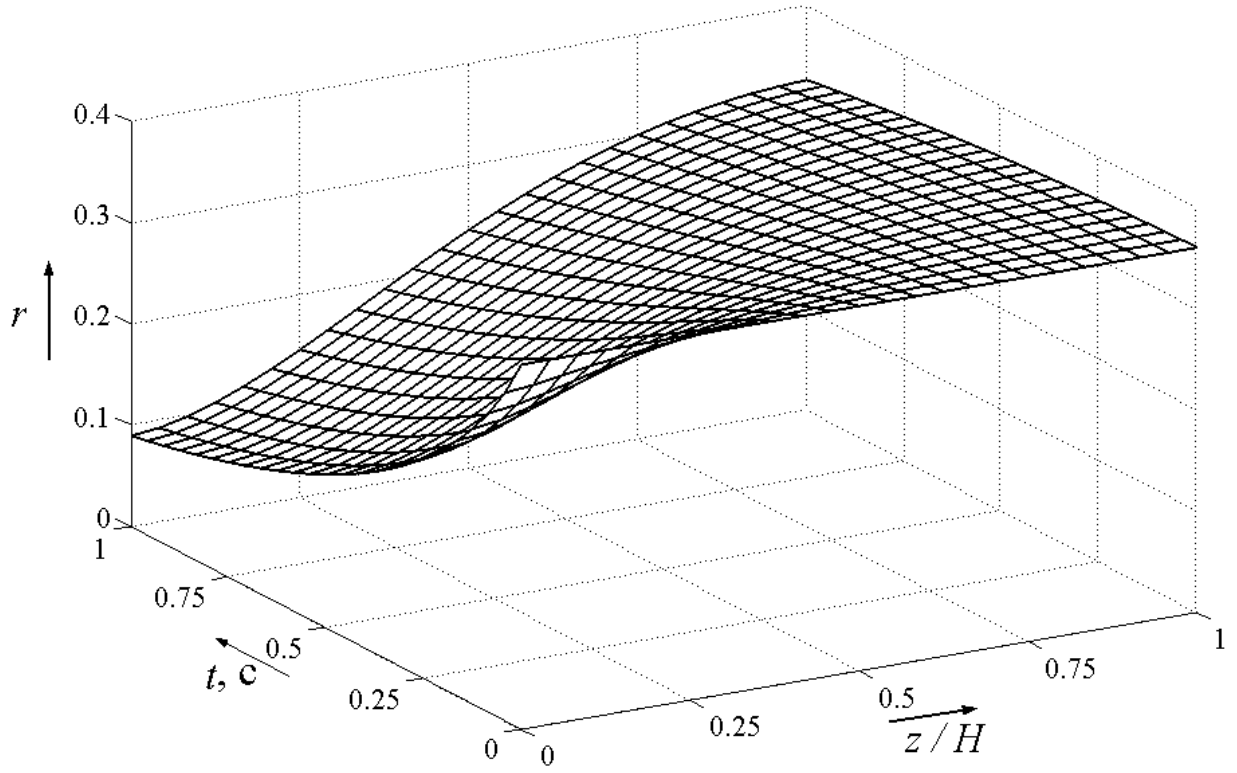
where $\xi(\delta)$ - is a function of division of size of particles which are on the surface of separator.

For determination of function of division of size of particles which are on the surface of separator it is enough to conduct the analysis of factious composition of

soil, what was sifted through the separatsng surface. The results of experiment on determination of coefficient of sifting are resulted in a table 1.



Rice. 1. Dependence of relative amount of shallow particles of soil *q* on the relative height of *z/H* above a separating surface from time of separation *t*



Rice. 2. Dependence of relative amount of large particles of sosl *r* on the relative height of *z/H* above a separating surface from time of separation *t*

Table 1

Determination of coefficient of sifting of soil

Size faction of clods of soil, mm	0...5	5...10	10...15	15...20	20...25
Middle size of clods of soil, mm	2,5	7,5	12,5	17,5	22,5
Mass of soil proper faction in a test, kg					
1	3,512	3,201	1,146	0,992	0,692
2	4,033	3,613	1,142	1,125	0,763
3	3,283	3,796	1,149	1,106	0,744
4	3,497	3,578	1,322	1,025	0,710
5	4,417	3,946	1,227	0,980	0,942
6	3,815	3,038	1,205	0,957	0,767
7	3,713	4,076	1,175	1,142	0,810
8	3,475	3,357	1,229	1,118	0,950
9	4,122	3,990	1,326	1,095	0,809
10	4,170	3,694	1,098	0,945	0,767
General mass of soil proper faction, kg	38,038	36,290	12,020	10,484	7,954
Factious composition of soil, %	36,30	34,63	11,47	10,01	7,59

Value of coefficient of sifting of soil determined after a formula:

$$k_s = \sum_{i=1}^{n} \xi_i \frac{S - \delta_i}{S + d}, \qquad (5)$$

where ξ_i - is a relative amount of i faction of soil in lots;

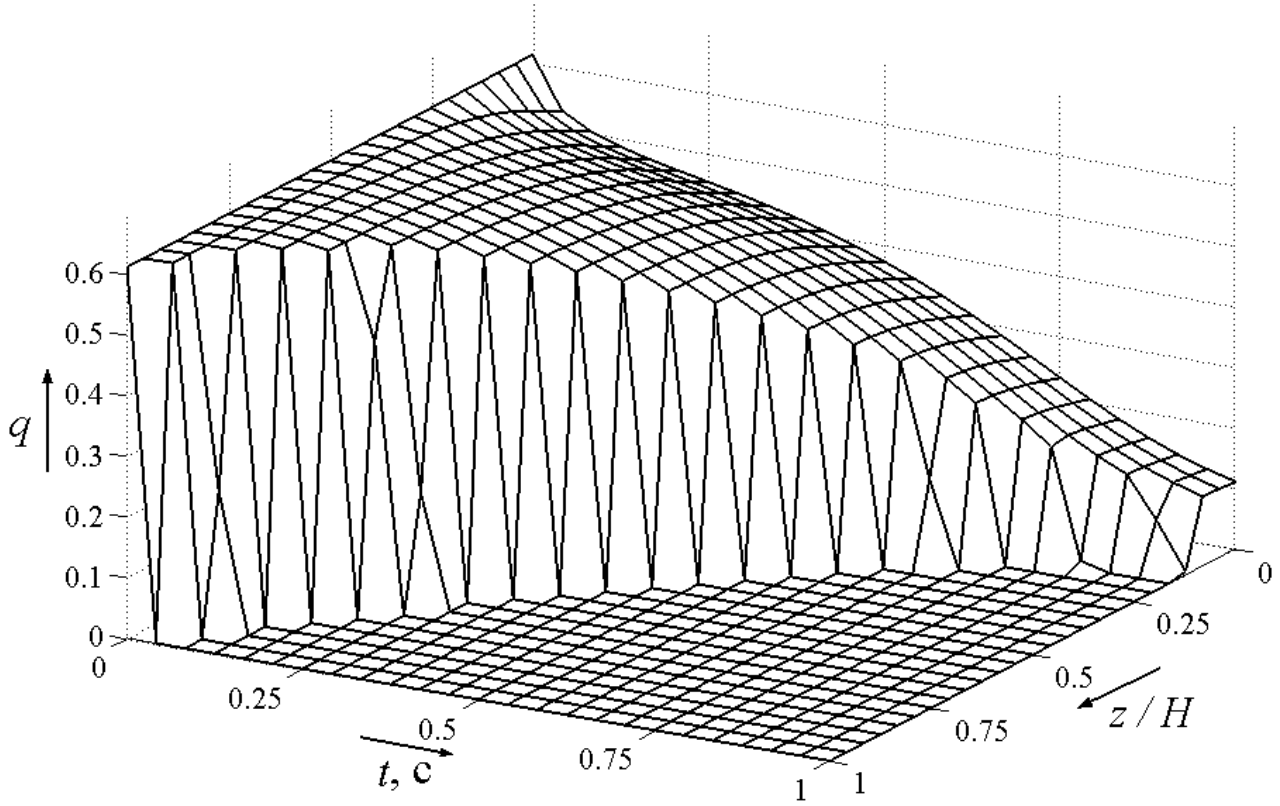
S - is a road clearance between the small twigs of separating surfaces, S = 0,025 m;

δ_i - is a middle size of clods of soil in i faction, mm;

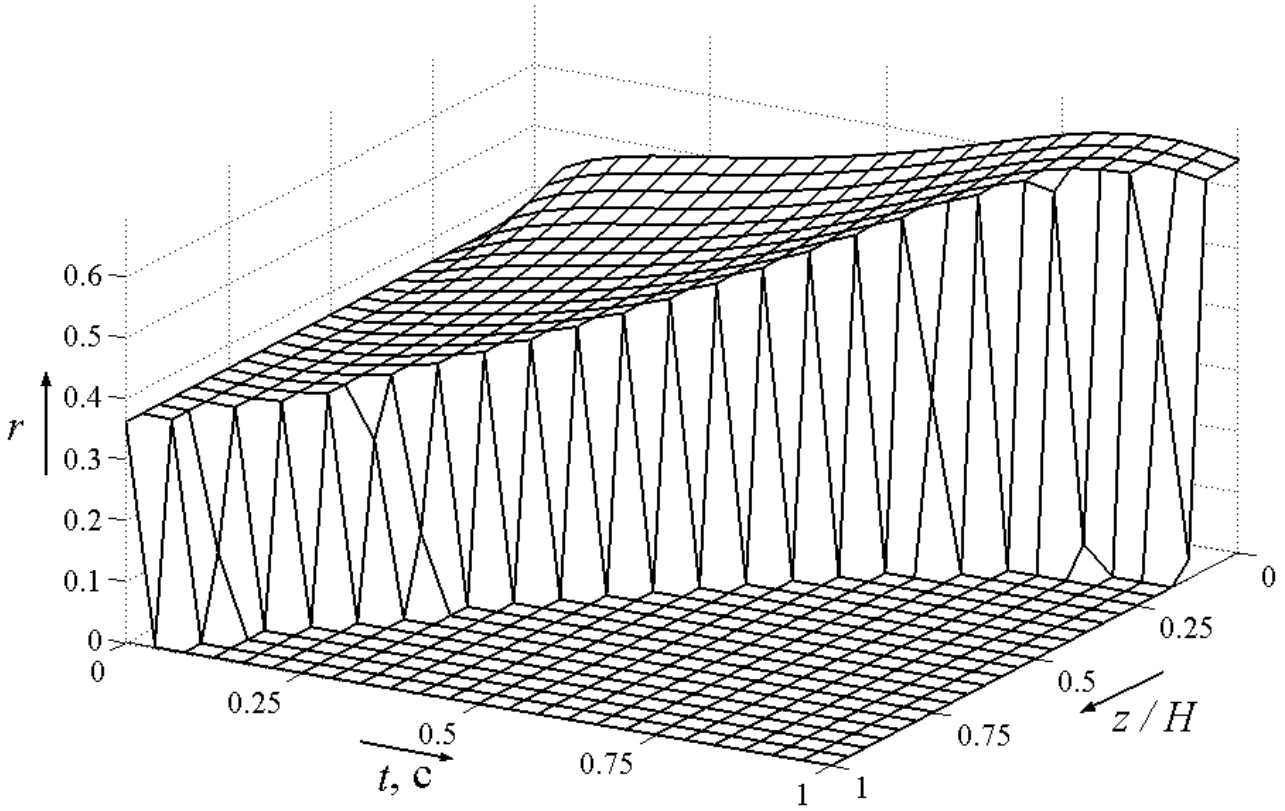
d - is a diameter of small twig of separator, d = 0,01 m.

A calculation is conducted by the tabular processor of Microsoft Excel 2000 enabled to calculate the value of coefficient of sifting *of* k_s = 0,227.

Dependence of amount of soil communicating faction in lots taking into account sifting of communicating faction of soil looks like (rice. 3, 4):



Rice. 3. Dynamics of change of relative amount of shallow particles of soil *q* on the relative height of *z/H* from separating surfaces



Rice. 4. Dynamics of change of relative amount of large particles of soil *r* on the relative height *of z/H* from separating surfaces

$$q(z,t_{i+1}) = \frac{1}{\sqrt{2\pi d\Delta t}} \int_0^h q(z,t_i) \left(e^{-\frac{(x-z)^2}{2d\Delta t}} + (1-k_s) e^{-\frac{(x+z)^2}{2d\Delta t}} + e^{-\frac{(x+z-2h)^2}{2d\Delta t}} \right) dx + \\ + r(z,t_i) \cdot (1 - k_1 \cdot e^{-k_2 \cdot z} \Delta t). \quad (6)$$

Equalization for other constituents it will be remained lots without changes.

Thickness of layer to the lots of *h* on a separator as a result of sifting of soil diminishes constantly:

$$h(t_{i+1}) = h(t_i) - \frac{H}{\sqrt{2\pi d\Delta t}} \int_0^{h(t_i)} k_s \cdot q(z,t_i) \cdot e^{-\frac{(x+z)^2}{2d\Delta t}} dx, \quad (7)$$

where N - is a thickness of layer to the lots in the initial moment of time of t_0.

Then degree of separation of soil it is possible to define after a formula:

$$\eta_c(t) = -\frac{H - h(t)}{H}. \quad (8)$$

As evidently from lines. 3, 4, in the process of separation as a result of interfusion lots and sifting of shallow clods of soil in an understratum the relative amount of large faction is multiplied lots of soil, what is in a position to be intensively ground down and sifted.

Conclusions are from this research and prospect of subsequent secret services: Theoretically substantiated the value of coefficient of sifting of clods of soil communicating faction, which depends on factious composition lots and sizes of road clearances of separation surfaces. For the explored potato bed this coefficient is even.

Most researches are the partial cases of decision of general tasks. As a process of separation of admixtures on the separators of potato lots has specific character lots, that is why the questions of consideration of motion of particles on a working surface and research of process of separation need subsequent theoretical researches.

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