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The basic design parameters constrictions of forages

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Abstract. Improving the efficiency of the process of mixing of feed for the small cattle can be achieved by applying the mixing of the working body able to qualitatively move groups of different sizes of particles from one position to another. Calculating the design parameters fodder mixing process is crucial when choosing the design parameters and it has a decisive significance is also important to take into account the fact that the quality ration can be obtained only from the ground components, the dimensions of which correspond to the zoo technical requirements. The results of the theoretical study of the mixer design parameters give reason to justify the basic design parameters of the working bodies of feed mixer. The proposed mixer, in the process, is a certain mass of shredded root vegetables. This consists of a mass of individual particles. The ternary mixture of root vegetable chips is the size of the cubes faces 10 mm, which is entirely consistent with the requirements of zoo technical. It was found that the feed particles oscillate in the variable radius with a simultaneous axial movement, which is achieved by a non-cylindrical shape of the hopper. The simplest non-cylindrical design of the hopper, from the standpoint of manufacturing in the production, is a truncated cone. Determine the total power expended on the work and power, the need to idle the rotor, thus reducing the value of the considered transport capacity.

Keywords*: adhesion, size, bunker consumption of materials, cone shape, feed mixture, the coefficient of friction, livestock requirements.*

Introduction. Practice shows that to achieve this goal of better understanding of science-based design parameters of the mixer and mixing the working body [1 - 5, 7], as well as ways to reduce energy and material. A cornerstone in this process is the lack of methods for calculating the design parameters of the mixer based on the calculation of the energy parameters of the process. It follows from the above that during operation must overcome the force of adhesion of the compound as a specific breaking load is not sufficient to separate particles that have relevance in the feed production process. That is why the development of a methodology for calculating the mixer parameters that can qualitatively move groups of different sizes of particles from one position to another, it must be recognized to date.

2. Analysis of the published data and the formulation of the problem. In [1, 6, 7-15] revealed the main provisions of the theory of blending, systematization and refinement of design parameters of mixers.

Analysis [3, 4] indicates the practical lesser usefulness of the proposed method of calculation and the need for clarification.

An indicator of the efficiency of the mixer is not only the quality of the mix (the degree of homogeneity of the mixture), and the specific energy consumption of the process of mixing and determining the parameters by means of laser systems [11, 16] by holography. These equations relate the basic structural and kinematic parameters of the rotating cone with physical and mechanical properties of the material moving Unfortunately, profiles section blades are investigated insufficiently and do not allow to unify the system of payments.

Analysis of published data shows [7, 8, 14], that the most appropriate mixing process to explore the theoretical - experimental way, but it is necessary to theoretically justify the design parameters of the working body of the mixer, which comprises mixing components will effectively move, alternately changing its position in the array [8, 11, 12, 15], but this is not done.

Rationale for design parameters is advantageously carried out using the following techniques.

3. The purpose and objectives of the study. The aim is a theoretical justification of the basic design parameters of the working bodies of the mixer feeds a continuous.

To achieve this goal it is necessary to solve the following tasks:

- To carry out theoretical study of structural parameters of the mixer on its effective operation;
- A scientific foundation for the design parameters of the mixer roughage.

4. The theoretical results feed mixer parameters. In practice, the mixing of the drag coefficient is determined empirically, but in the case of mixing chip succulent fodder and dry coarse and concentrated feed moisture redistribution will not allow to obtain adequate experimental data. Based on the foregoing, there is a need in the determination of the coefficient theoretically. To determine the coefficient of resistance is necessary to simulate one of the situations that arise in the process of mixing.

According to the conventional prescription feeding, root account for 45% of the weight of the mixture. The proposed mixer, in the process, is a certain mass of shredded root vegetables. This consists of a mass of individual particles. Suppose that in a ternary mixture of root vegetable chips is the size of the cubes faces 10 mm, which is entirely consistent with the requirements of zoo technical. The surface area of the cube 600 mm^2. The total area of the outer surface of the crushed root crops 600 • nK. The In this case - is the number of particles in the total mass of crushed roots. A particle of root and wet it with the force of adhered particles of coarse and concentrated feeds. If we consider the case where a single particle of root stuck one particle of another kind of food, you will see that this gluing force counteracts the force of the weight of the particles.

With the destruction of the adhesive compound is determined F_{pi} force necessary for pulling (or pushing) the fibres of the layer of adhesive and adhesive area S_{pi} connection. The adhesion strength was calculated by the formula [9 p.62]:

$$\tau_A = \frac{F_{Pi}}{S_{Pi}} \qquad (1)$$

where F_{Pi} - force necessary for pulling (or pushing) the fibres of the layer of adhesive and adhesive area N;

S_{Pi} - the area of the connection, m^2.

Weight strength creates specific τ_{RU} breaking load N/m^2 (m^2 weight of one component of the mixture in a single particle thickness).

Practice shows that this failure load is not enough to ensure a constant separation of the particles, so to ensure this effect, with the help of the working bodies of the mixer, you must create an additional breaking force. From the foregoing, it follows that for effective mixing succulent fodder with coarse and concentrated feed mixer, in the process, must overcome the force of adhesion compounds as specific breaking load not sufficient to separate particles.

As for the mixer drive uses a DC motor controlled using the controller, which includes a transformer and a diode bridge, so it is necessary in the expression (1) take into account the loss of power to the control devices.

$$N_{Cp} = \frac{K_i}{\eta} \times K_Y \times \left(A \times \omega_e + B \times \omega_e^{3} \pm \frac{Q_{com} \times H}{360} + \frac{c_0}{W_i} \times \frac{Q_{com} \times L_T}{360} + \frac{\tau_A}{\tau_{PY}} \times \frac{Q_{com} \times L_T}{360} \right), \quad (2)$$

where K_Y - coefficient taking into account the power loss in the control devices..

K_i- coefficient overcome inertia at the start, K_i = 1,2 – 2,5 [6];

ωe - the angular velocity of the rotor, s^{-1};

$A \cdot \omega e$ - power required to overcome the friction in the bearings, kW;

$B\ \omega e^3$ - the power needed to overcome air resistance, kW;

Q_{com} - performance mixer, t / h;

H - height of the raising or lowering of the mixed material, m;

c_o – coefficient of the material movement, which includes the wet ingredients, w = 8 - 18 [3 - 6];

L_T - transportation length, m.

Q_{com} - performance mixer t / h.

The analysis of existing scientific information and made theoretical studies provide the basis for the justification of the main design parameters of the working bodies of feed mixer. food particles oscillate in the variable radius with a simultaneous axial movement, which is achieved by a non-cylindrical shape of the hopper. The simplest non-cylindrical design of the hopper, from the standpoint of manufacturing in the production, is a truncated cone. A truncated cone is characterized by height and diameter of the base.

It is important to lower the base, because it can be completely filled with the material, the movement of which in the spacer connecting the cones will only spiral wound, and the transport capacity cones lead to overflow the mixer hopper.

Driving continuous feed mixer is shown in Figure 1.

Since half of the cone apex angle, φ must be 12 degrees, knowing the diameter of the smaller base of the cone and the silo conveying path length L_T can calculate the diameter of the greater base of which is 0,55-0,6 m. The height of the truncated cone is determined from the operating conditions . In our case it is 0,75 m. The height of the cone, and the helical pitch angle sc hopper tilt determine the overall length l_{OS} spiral and the length of the working part of the spiral l_{RS}. Since the transport must be carried out with constant stirring layers that achieved the highest possible oversleeping, winding step can be taken as the height of the cone.

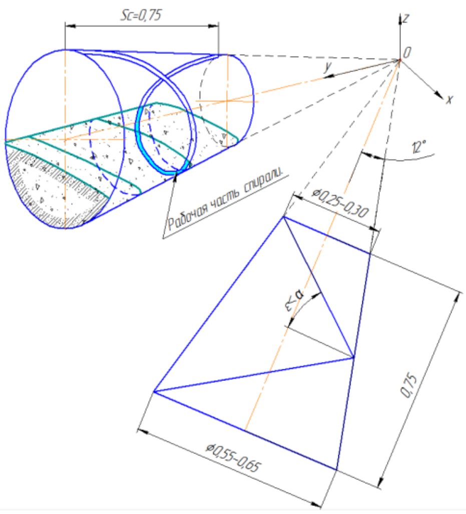


Fig. 1. On the justification of the design parameters of the mixer hopper

Step winding cone equal to the height of 0,75 mm provides the following condition. helix angle ε smaller than the angle of repose of the mixture of β. This spiral will effectively capture part of the mix, and raise it to the height at which the weight force will overcome the internal friction and the mixture begins to pour through the spiral. This condition determines the height of the helix. Raising the mixture to a certain height, wrapped with blades will cause gravity to do the work.

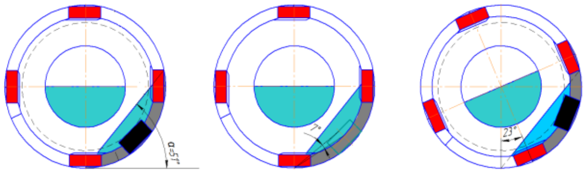
On this basis, the total amount to work [15, 18]:

$$\sum_{i=1}^{3} A = \int_0^1 G_1 dz + \int_1^2 G_2 dz + \int_2^3 G_3 dz = \\ = m_1 g\left(z_1 - z_0\right) + m_2 g\left(z_2 - z_1\right) + m_3 g\left(z_3 - z_2\right) \qquad (3)$$

Because dz is inherently scalar product of the unit vector ds on the vertical axis z, the [15, 18]:

$$\sum_{i=1}^{3} A = \int_0^1 G_1 ds + \int_1^2 G_2 ds + \int_2^3 G_3 ds, \quad (4)$$

Blades offset scheme during the rotation of the mixer is shown in Figure 2.



a b c

Fig. 2. Scheme of blades offset by the rotation of the mixer

Therefore, knowing the operating conditions of the mixer, as defined above, by changing the number of blades and extensions winding can control the amount of material in each section pour dz. The number of blades and extensions of winding, as well as their shape, combined with operating modes, must not allow a full rotation of the lifted material.

Knowing the calculated value Sp and the diameter of the larger base of the cone can be determined that section 0,5 of the layer will be placed over the wound at her height of 35-40 mm, which is consistent with previously accepted value of the winding height. By rotating the feed mixer will rise to a height of dz_1 (Fig. 6), which achieves an angle of repose, and the part of the feed, which is above the wound, it begins to pour.

Extension allows a part of the feed mixture to rise to the height of the dz_2, which is due to the large angle of rotation of the mixer, which is determined according to the scheme shown in Fig. 2b. For the received extension to the size of 100x50 mm, height dz_2 will be achieved when the angle between the horizon and ds_2 (Fig. 1) equal to 58 °. This will feed into a power strip oversleeping. The curved blade allows portability her stern sleep only when it is completely out of the movable layer. This condition (Fig. 2c), will be achieved when the angle between the horizon and ds_3 (see. Fig. 1) equal to 74 °.

Number of blades and extensions of winding is caused by the degree of homogeneity of the mixture and the mechanical and technological parameters of fodder components. Knowing the weight of the mixture, raise the wound, extension and scapula, and the length *ds* is possible to calculate the appropriate values of work.

Dividing the appropriate values of work at the time of oversleeping can get the values of power expended in the process that allows you to check the adequacy of expression.

Conclusions. Continuous feed mixer constructively should be a rotating hopper, consisting of two truncated cones joined by a smaller base. On the inner surface of the hopper is fixed spiral wrapped, complete with curved blades and rectangular extensions. Blades and extenders, in turn, to be installed at a distance that allows the feed mixture to raise to different heights and thus intensify the mixing process.

From the standpoint of mixing the bulk material layers must move wrapped with blades and the cone should contribute to movement, providing sliding and rolling of the particles, which is performed when the hopper rational speed 20 rev / min.

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