*installation belkovoy IZ Production pellet fraction zhmыha semyan maslychnыh cultures.*
***Maslychnыe culture, zhmыh, pellety, belkovaya, fraction, installation**.*

*The technique of experimental research installations for production of pellets from the protein fraction oilseed cake.*
***Oilseeds, cake, pellets, protein fraction, installation.***

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## RELATIONSHIP fill factor and angular velocities drum mixer

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*Determined mutual influence fill factor and angular speed cameras drum mixer for circulating motion mode mixing during mixing.*
***Mixing, drum mixer, circulating motion, fill factor, the angular velocity.***

**Formulation of the problem**. Production of feed quality in terms of economy requires resolve the issue of technical support mixing feed additives. Components of feed additives such as vitamin and mineral blends, enzymes, amino acids and others. contained in the composition of feed in very small quantities, and therefore their uniform mixing requires advanced technological and structural solutions. A given level of uniformity mixing in such cases provide a mixing drum. Of the total range of the best indicators of the quality sumishky are drum mixers with cylindrical chamber whose axis of symmetry



shifted relative to the horizontal axis of rotation at the specified angle camera [5].

**Analysis of recent research.** The process of mixing in the drum mixer consists of a number of basic processes occurring simultaneously [1, 2, 3, 4]. This displacement of adjacent particles from one place to another implementation and sliding layer material (Convective mixing) gradual redistribution of particles of different components through formed the line of partition (diffusive mixing) and the concentration of particles that have the same weight in the appropriate places mixer under the influence of gravity and inertial forces (segregation).

The first two processes contribute to improving the uniform dispersion of each component in the total mass sumishky. Third - segregation, by contrast, affects the uniformity redistribution components. Its impact is largely offset by the possibility of returning small particles and heavy components from the lower into the upper portions of food. It should be noted that depending on the filling chamber and on the speed of the plane cross section of the drum there may be three modes of material movement: the movement from collapse, traffic circulation and closed mode of movement [6].

In the first mode movement of the collapse is happening at the level of the chamber to fill 10% of its content, bulk material during rotation of the drum slides on its inner surface while remaining in the monolithic bound. As with the upper layers of relatively lower is not shifting interpenetration between individual adjacent particles does not occur, this mode can be used for mixing. When filling the chamber by the amount of more than 10% during the rotation of the drum comes circulation mode of movement when the material of the upper layers of the monolith lifted off from the lower layers and falls backwards in space camera that comes loose weight relative displacement [7]. Distribution of bulk material in the space is reduced to the mutual movement of particles in the cross section of the drum and along the axis of rotation. Moving in the plane of the cross section is in the radial and angular dimensions. [8] With increasing angular velocity of the drum volume of material that is in the area of lifting is reduced and the height of the location of its center of gravity increases.

With increasing rotational speed increases the value of the centrifugal force of the material while under its influence is held on the inner surface of the drum and not off into the interior chamber. The angular velocity increases to a value beyond which comes third - closed mode in which all the material prytyskuyetsya to the surface of the drum and rotates with it in a single stream. This mutual moving particle components can take place only through their differences in specific gravity and geometric dimensions.

Depending on the placement of the axis of symmetry of the drum in the horizontal and vertical planes can note four extreme position of the drum and consider them material behavior under the influence of the forces. On the far left and far right when both axles are in a horizontal plane, the movement of material in the chamber can liken the state of mixing in the drum mixer batch-type horizontal axis of rotation. In the upper and lower positions with the symmetry axis passing through the vertical plane of the material behavior is similar to the state of flow distribution in the mixing chamber continuous with the inclined axis of rotation. Given the appropriate review process of redistribution of material

particles in critical positions and apply at the same methodological approach to describe the state of motion in the mixer drum batch-type horizontal axis of rotation and continuous with the inclined axis of rotation [9, 10, 11].

The slope angle to the horizontal axis of the cylinder during rotation γ camera harmonious change. When the drum axis is horizontal γ = 0, and in the vertical plane γ = γmax = β.

To prevent bias circulating mass flow to the end walls of the cylinder must consider the angles of internal friction on the free surface of the material and external friction on the material surface. Taking into account that the angle φ friction material on the surface of the cylinder during the rotation is a constant value and dependent only on its physical and mechanical properties specified term stability of the process is written as β <φ. The angle of external friction, reflecting friction properties when moving material on the inner surface of the drum for the mixed is in the range of 21 to 26 degrees. The angle of internal friction, which is manifested in the mutual flow of moving components in the mixing chamber, and slightly higher for the mixed is in the range of 25 to 30 degrees.

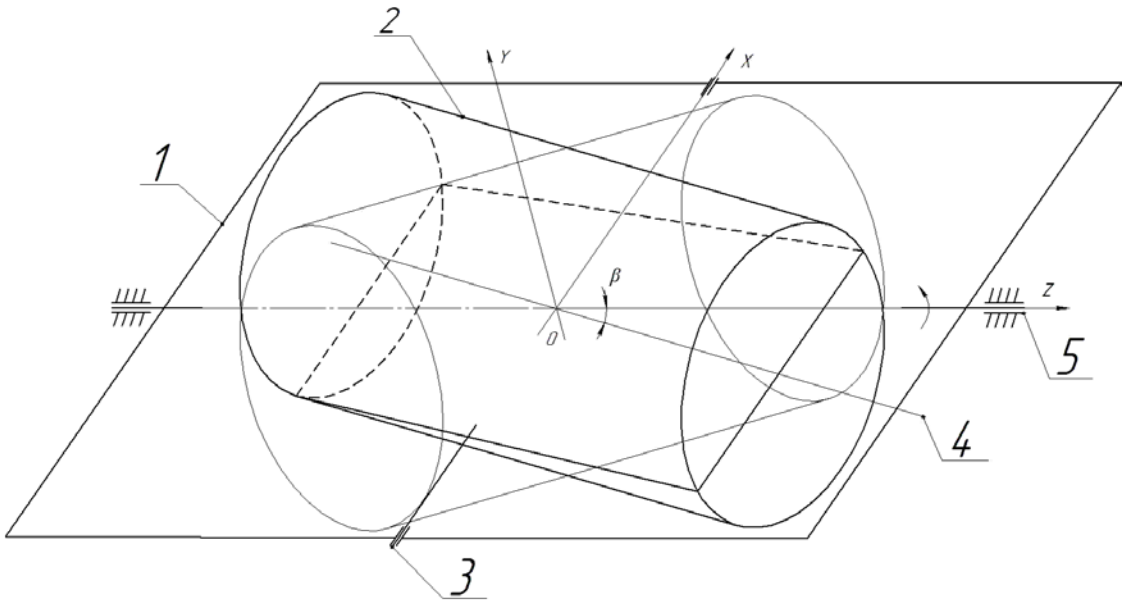


Fig. 1. Scheme drum mixer: 1 - rotating frame drum mixer; 2 - drum; 3 - Control the angle of inclination of the drum; 4 - axis of the drum; 5 - axis rotation frame drum mixer.

**The purpose of research.** Determine the mutual influence fill factor and angular speed cameras drum mixer for circulating motion mode mixing during mixing.

**research results**. After lifting the material along the arc BA and achieve particle material point A (or close) begins its movement in the

lower area in chord AB (Fig. 2), which can be described by differential equation of a particle material on an inclined surface [12]. This equation is commonly solution:

$$x = \frac{gt^2}{2}(\sin\alpha_W - f_B \cos\alpha_W), \quad (1)$$

where: x - passed part of the way of; $\alpha_W$ - The angle of the material to the horizon, councils; fB - coefficient of internal friction, ratio. ed .; t - the move with.

Taking into account the importance of the road, which passes through a piece of chord AB shifted to the angle of the axis of rotation of the drum:

$$x = 2R\frac{\sin\delta}{\cos\beta}, \quad (2)$$

where: - the half central angle, limiting filled material segment without tilting drum, councils; $\delta\beta$ - The angle of the axis of the drum, councils can determine the length of movement of the material particles to point B:

$$t = \sqrt{\frac{4R\sin\delta}{g\cos\beta(\sin\alpha_W - f_B\cos\alpha_W)}}. \quad (3)$$

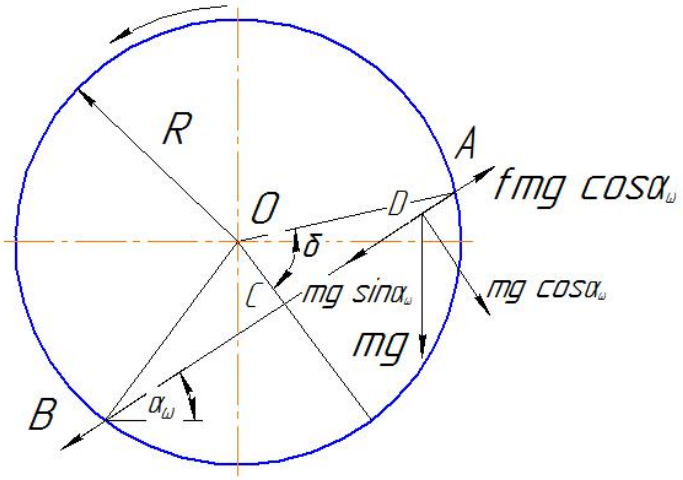


Fig. 2. Scheme of the forces on a piece of material sumishky while sliding down an inclined surface.

To ensure the circulation of movement is necessary that a sliding material on chord AB, which is displaced by an angle of inclination of the axis of rotation of the drum approaching the time of raising particles in an arc through the VA friction material on the surface of the drum. Time raising material on the arc BA considering the angular velocity of the drum and the angle δ is determined by the known expression:

$$t = \frac{2\delta}{w}. \quad (4)$$

Equating the expression (3), which determines the movement of particles in chord AB shifted to the angle of the axis of rotation of the drum and the expression (4), which determines the rise of material in an arc BA together with a drum, we get:

$$w = \delta\sqrt{\frac{g\cos\beta(\sin\alpha_W - f_B\cos\alpha_W)}{R\sin\delta}}. \quad (5)$$

Equation (5) defines the dependence of the angular velocity of the drum by changing the angle that reflects the degree of filling the mixing chamber. Drum filling ratio defined as the average value (the cross section of the drum cyclically inclined axis of rotation) ratio of the area segment of the material to the area of the drum section:$\delta$

$$k = \frac{2\delta - \sin 2\delta}{2\pi}. \quad (6)$$

Finding a common solution to the equations (5) and (6), we constructed plots of mixing chamber filling factor of the angular velocity of the drum (Fig. 3) when the angle of inclination of the axis of the camera β = 20 degrees.

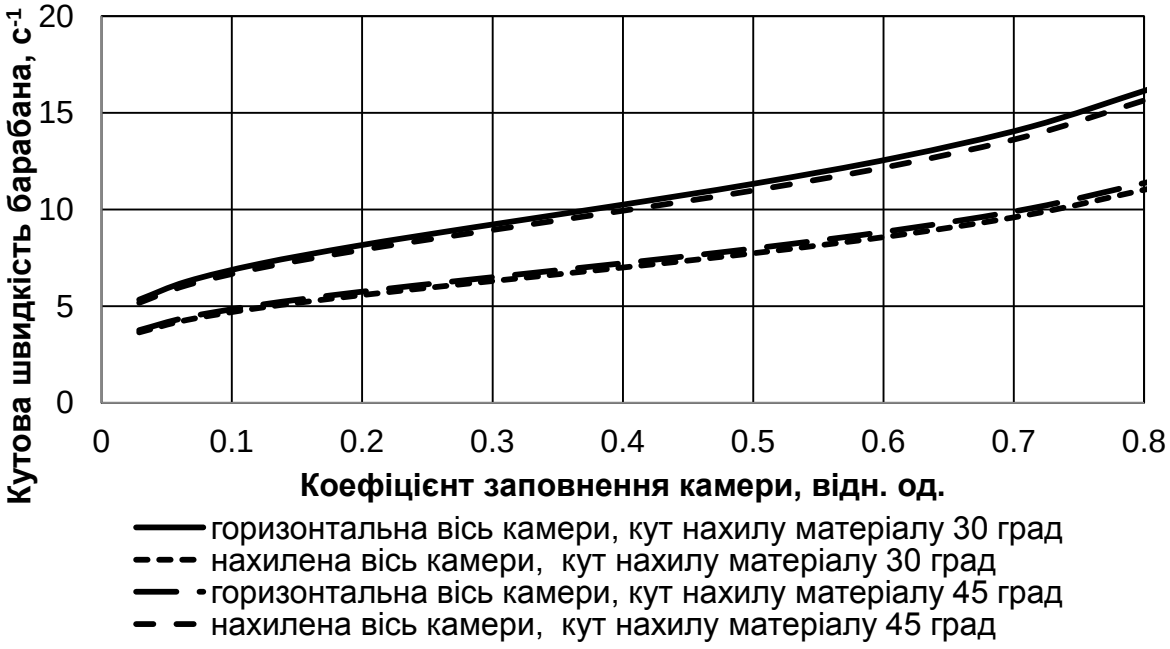


Fig. 3. Dependence of the filling of the angular velocity of the drum equipped with a circulating motion.

Analysis dependencies graphic shows that respect for traffic circulation is necessary to change the angular velocity by changing the degree of filling of the chamber. It was also established that the effect of

the angle of inclination of the axis angular camera to speed mixer feed additives negligible.

**Conclusion.** The dependence that determines the relationship between the angular velocity of the drum mixer with inclined axis of rotation and the coefficient of filling at which the traffic circulation material during mixing.

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*Opredeleno vzaymnoe Influence Factor zapolnenyya and uhlovoy Speed kameры drum mixer to implement the motion components circulating mode mixture vo Vremya smeshyvanyya.*

***Smeshyvanye, barabannыy mixer, tsyrkulyatsyonnoe motion, Factor zapolnenyya, Whatnot speed.***

*Interference fill factor and angular velocity of rotation of drum mixer chamber to ensure circulation mode motion components of mixture during mixing is defined.*

***Mixing, drum mixer, circulation motion, fill factor, angular velocity.***