8. *Babytskyy VI* Theory vybroudarnыh systems (pryblyzhënnыe methods) / *VI Babytskyy*. - M .: Nauka, 1978. - 352 p.

Pryvedenы dyfferentsyalnыe equation, kotorыe opysыvayut motion kontynualnыh discrete systems techenyy neustanovyvshyhsya (perekhodnykh) processes, kotorыe mogut bыt in dalnejshem yspolzovanы for Improvement and utochnenyya suschestvuyuschyh ynzhenernыh calculation methods podobnыh systems.

Mathematical modulyrovanye, kontynualnыe discrete systems, optimization regimes movement.

Differential equations which describe movement of discrete-continual systems during unsteady (transitional) processes are presented. One may use these equations for improvement and clarification of existing engineering techniques and for analysis of such systems, as well.

Mathematical simulation, discrete-continual systems, optimization of motion regimes.

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Observance STABILITY OF HUMIDITY kneading dough

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The article analyzes the methods of control for kneading, the basic factors that affect the process tistoutvorennya. A mathematical model of kneading, and new design solutions for kneading machines that will intensify the process of mixing and increase the quality test.

The process of kneading, the dough moisture, tistoutvorennya, quality control procedures dough, dough making machine working chamber, rate heterogeneity plasticizing test.

Problem. The widespread introduction in the baking industry intensive mixing process is accompanied by high demands on product quality. Quality is accurate adherence to prescription given dough composition - especially the humidity. Thus, precision components determined by the work of dosing equipment and construction machinery dough in the corresponding modes of operation.

Humidity test - one of the mandatory parameters of quality control. As you know, control and humidity control test is the actual problem, whose solution allows to further automate the process of mixing and accelerate the development of automated lines for the preparation of bakery products. Lack of control of variables of process parameters do not allow professionals to timely make adjustments to equipment performance, especially in the semi mixing. These parameters include: the number of dosing flour and components; variations in the temperature of water that enters the mixing; duration of mixing, etc. Rejecting these parameters as well as poor quality machining of components in the chamber dough making machine, leads to disruption of the entire process and quality of products. In this case especially important to choose methods and means of dispensing components and their control parameters during kneading.

Analysis of recent research. We know that choosing the optimal parameters kneading - duration of mixing, batching sequence flour, yeast and additives, water temperature and dough mixing process (initial and final) - the problem of production and engineering laboratory company.

To date, the most common method for determining moisture based drying the sample to constant weight and weighing it before and after drying.

These methods and laboratory complex and difficult to automate. So much attention is paid to work on automation control humidity test, aimed at improving the quality of the process tistoutvorennya in the chamber of the machine. There are different methods to control the humidity test.

Specifically known method, the essence of which is to create a system of automatic control of dosing, which should provide greater precision dosing ingredients will maintain the desired humidity test at a constant level. Humidity dough with water flow can be adjusted to mixing depending on the moisture content of flour at a stable cost of other components.

They also developed methods of measurement, based on the dependence of certain electrical characteristics test of humidity, such conductometric and dielkolotrychnyy.

Thus, VN Avralenko, VD Popov, AA Zaika prefer this method of determining moisture as infrared - photometric. The basis of this method is based on measuring the selective absorption of infrared radiation by water specified wavelength passing through the dough, or reflected its surface.

Of great interest is the study korrelyatsiynoho link between structural and mechanical parameters that are passed to the method of quality control and test which can be controlled automatically. So MM Blahoveschynskyy, IK Titrate, SA Machihin, SV Sorokin studied the relationship between moisture content and test its viscosity, which can be controlled automatically. In their view, high korrelyatsiyna relationship between viscosity and humidity test enables implementation of automatic control of one of the indicators of the dough, by determining their viscosity.

But none of these methods does not provide humidity control mixing quality.

Most kneading machines domestic and foreign production, semi-finished product in the chamber kneaded working bodies of different configurations. Therefore, in the production of desirable objective reliable methods for determining the consistency of dough to replace its organoleptic evaluation methods.

It was also established [1, 2] that the system variables and process characteristics can influence tistoutvorennya: quantity and quality of ingredients dough; specificity of action vibrodozatora flour; configuration mixing drum and plasticizer; three stages of mixing modes - temperature, duration, and, most importantly, pressure. By varying these factors can determine rational conditions of mixing for different types of dough.

Mastication test at certain rational modes leads to improved product quality and economy of material resources. It is therefore not surprising that this issue received considerable attention of scientists in creating new technologies and kneading machines.

Given the rapid development and great potential of modern computer technology, in solving problems of definition of rational parameters of mixing and further development of appropriate equipment necessary to use methods of mathematical modeling. In the field of mixing mathematical modeling is widely used, but kneading bezlopatevym working body surface plasticizer and regulatory - for the first time [3, 4].

Several authors [5, 6] created a classical mathematical model based on the equations of motion preservation binder that take into account the viscosity anomaly. However, they provided for converting the system of differential equations to dimensionless form-criteria using criteria *Re, Eu, Ec, Pe*, Which is very inconvenient.

Rheological equations used can not satisfactorily describe the behavior of dough with the characteristics of elastic-plastic and viscous material. So you need to find another expression for the equation of state in which the viscosity dependence on external conditions must characterize it appropriate dough recipe. So determining the consistency of dough - is the formation of its elasticity and density.

Still when considering workflows kneading pay attention mainly to the formation of homogenous dough with intensive processing components in the chamber of the machine. In [1, 2, 4] detail the sequence and duration of batching, mixing a significant impact body and compression process to change its properties with the assistance of design plasticizer.

Given stages kneading can be said that most typical indicator of dough kneading machine is uniform at the optimum duration and workload of the working chamber. This helps equalize the concentration of individual components. This index allows us to estimate the ratio of prescription components and compliance management process mixing stages. Using this method for determining the interaction mixing stages can justify their basic laws, establish rational parameters of mixing, and determine the size of the main structural elements of the machine.

Thus, with a brief analysis of the characteristics of control and humidity control dough during mixing follows that the problem of finding new directions in food engineering methods kneading, who decided to part or all of these problems are still highly relevant.

Results. Based on a thorough analysis of the processes established during mixing in the bulk of the working chamber machine dough particles of different components to mixing there alone or were in a heterogeneous condition, mutually mixed. As a result of mixing can be infinitely different placement of particles in the volume of the working chamber dough making machine. Under these conditions, the ratio of components in the mixture microvolumes - random value because most of the known methods of assessment uniformity (quality) mixture based on the methods of statistical analysis. To simplify the calculations all kneading the mixture components conventionally considered as being composed of two components: the basic and conditional, which includes other components. This method makes it possible to evaluate the homogeneity of the mixture components using distribution parameters of a random variable - the main component content in the samples of the mixture. Choose a main component that is easy to analyze or distribution in the mixture which is very important for the technical requirements. This criterion of evaluating the quality of the mixture is the coefficient of variation,%

$$V_C = \frac{100}{c}\sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(c_i - c)^2}, \quad (1)$$

where *with* - The arithmetic mean concentration of the main component in all *n* samples of the mixture,%

CI - Concentration of the main component in *i*th sample mixture%.

As for mixing dough, then this criterion is the heterogeneity factor because of its increasing heterogeneity of the mixture increases in the first minutes, and subsequently, smooths homogeneity.

Since the desired sample mass mixture components are taken depending on the method of analysis of samples for moisture content in the mixture, the analysis of experimental dependences *Vc = f (t)* (*t*-Mixing time) obtained in studies kneading machines periodic action of different designs showed that the kinetic curve mixing process has three characteristic areas. Each area represents a time period of mixing [7].

Thus, to describe the process that occurs in the chamber dough making machine, can be regarded as a system of input and output streams and show schematically as a connection between the respective signals:

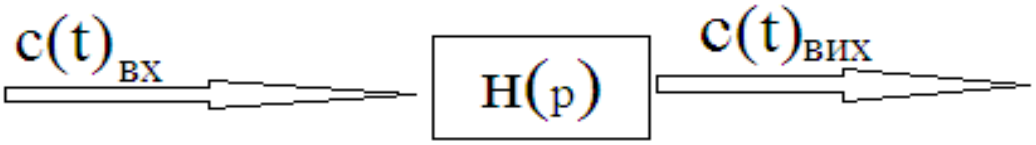
$$c(t)_{ВИХ} = A[c(t)_{ВХ}] \quad (2)$$

where *s (t) entrance* - Instantaneous concentration of the main component in the input stream;

s (t) ing. - The same, but in the finished mixture;

And - Conversion operator.

The set of mathematical expressions *And* - A statistical description of the system. It does not depend on time and determined process of kneading action scheme that looks like this:



where *H (p)* - Transfer function.

Record operator transformation *And* in equation (2) can be obtained using the dynamic characteristics of the environment: the weight h (t) and transmitting *H (p)* function. In this case, *h (t)* - A function of time, which describes the reaction system at a time *t* on a unit impulse function $\delta(T)$Fed to the input of the system at time *t - t3* (*t3* - Nezapiznennya signal that the passage of the pulse through the system).

The unit impulse function or delta function: $\delta = \{$ *0*If *t> 0*;$\delta = \infty$If *t = 0*:

$$\int_0^{\infty} \delta(t)dt = 1. \quad (3)$$

The transfer function *H (p)* is the Laplace transform functions:

$$h(t) : H(p) = \int_0^{\infty} h(t)e^{-pt}dt, \quad (4)$$

where *p* - Complex variable (*p = a + ib*Where *and*and *b* - Respectively the real and imaginary parts of a complex number; *i* = $\sqrt{-1}$*).*

By using the *H (p)*, Equation (2) for a linear system can be written as:

C (p) Ex = H (p) C (p) entrance (5)

where *C (p)* - Transformed by Laplace function *C (t).*

Given that the plasticizing test based on appropriately defined processes in the chamber dough machine, it allows you to install their patterns and calculate rational parameters of individual operations.

That is thoroughly assess the impact of structural parameters of the working chamber, the surface of the plasticizer, the surface of the body and their structural elements of the accuracy of passing the test process and after plasticizing properties, specific energy consumption, reliability and lifetime of the dough machine. The processes at the site plasticizing dough in the chamber machines have their own specifics.

They occur cyclically in a short period of time, lasting seconds. Therefore, the analysis must take into account Only those processes in a short time plasticizing effect on the state test and the process of mixing.

Justifying the reaction system during plasticization at a time, developed the device - softener. This design unit can simultaneously control the whole process in the chamber machines and generate vibration field during the formation of the dough from existing mechanical feedback plasticizer surface and rolling dough. This connection allows for a wide range of characteristics of restorative elastic force of the spring on the transmission process of mixing that meet certain gear *H (p)* features nonlinearity. Under section features the characteristics of nonlinearity refers area where there is a transition from a non-linear decrease in stiffness to its non-linear increase.

Conclusion. Implementation of these characteristics is developed for devices that can actively influence the intensity of mixing process in kneading machines with U - shaped or cylindrical cooking chamber, and establish consistency test, ie to assess its readiness.

References

1. *Stadnyk I.* Application methods pulsating vibration and kneading dough in developing new machines / *IJ Stadnyk, OT Lisovenko* // Bakery and confectionery industry Ukraine. - 2009 - №4. - P. 37-40.
2. *Stadnyk I.* Basic theory test plasticizing / *IJ Stadnyk, OT Lisovenko* // Bakery and confectionery industry Ukraine. - 2009. - №5. - P. 22-23.
3. *Coulaines RV* Mathematical Programming (p element information technology) / *RV Coulaines, EA Yunkova, AB Zhaltsov*. - K .: AIDP, 2000. - 124 p.
4. *Mykhailyshyn MS* Simulation of kneading bezlopatevym working body / *MS Mykhailyshyn, IJ Stadnik* // Bakery and confectionery industry Ukraine. - 2011. - №9. - P. 22-23.
5. *NB Urev* Physico-Mechanics and hymycheskaya yntensyfykatsyya education pyschevыh mass / *NB Urev, MA Taleysnyk*. - M .: Pyschevaya Industry, 1976. - 240 p.
6. *Fedotkyn IM* Mathematical Modeling. Theory of technological processes and s yntensyfykatsyy /*IM Fedotkyn, Y.S. Hulыy*. - K .: A-Arcturus, 1998. - 416 p.
7. *Lysovenko SA* Technological equipment hlebozavodov path and ego Improvement / *SA Lysovenko*. - M .: Lehkaya pyschevaya and Industry, 1982. - 208 p.

In Article conducted analysis methods zameshyvanyya process control tests, rassmotrenы Main factors, vlyyayuschye on testoobrazovanyya process. Proposals matematycheskaya model zameshyvanyya test process, and New konstruktyvnыe solutions for testomesylnыh machines kotorыe yntensyfytsyrovat permit process and zameshyvanyya povыsyt Quality test.

Process zameshyvanyya test, humidity test, testoobrazovanye, quality control methods test rabochaya camera testomesylnoy Machines, Factor inhomogeneities, plastyfykatsyya test.

The paper analyzes methods of process control kneading, the main factors that affect the formation of dough. A mathematical model of the process of kneading, and new design solutions for giving shaft mixer machines that will intensify the process of mixing and improve the quality dough.

Process of kneading, dry dough, dough formation, quality control procedures dough mixing machine working chamber, coefficient of heterogeneity, plasticizing dough.

UDC 631,356

TECHNICAL AND TECHNOLOGICAL BACKGROUND FODDER BEET HARVESTING