

## **PERSPECTIVE DIRECTION OF COMPLEX IMPROVEMENT OF RUSK WARES**

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**Abstract:** *The necessity of complex perfection of process of production of rusk wares comes up from the traditional method of production, wide usage of hand labour and bulky equipment. The process of mixing of dough, treatment of dough purveyances, baking and drying is investigational by us. It is set that the intensive mixing of dough allows to shorten duration of his fermentation, the using of dynamic method of loosen of dough purveyances and combined process of baking baking-drying. On the basis of the conducted researches the machine-instrumental chart of the complex stream-mechanized line of production of rusk wares is offered*

**Keywords:** mixing of dough, treatment of dough purveyances, baking, drying, intensive, complex stream-mechanized line

### **I. Introduction.**

Lately the expansion of demand and variety of rusk products, especially it touches the wares of small diameter. However for their production traditional technology and equipment are used. Continuous forming of dough cord is interrupted for a portion stowing of flags on sheets for del standing on the cradles of proofers. The duration standing for the rusk sleepers of small diameter in a few times exceeds duration of baking of this sort of rusks, that means that providing of the productivity of stove an area proofers must be in a few times more area of hearth del, and taking into account the small geometrical sizes of wares the volume proofers is used very ineffective.

The baked sleepers are maintained during 4 - 8 hours before cutting before cutting.

To the present times the question of cutting of rusk sleepers of small diameter in a stream is not solved. After cooling and standing rusks are cutting and that cause rising of hardness as a result of staling. In addition the repeated heating of rusk hunks to the temperature of evaporation after cooling of rusk flags before cutting cause the additional charges of heat.

The disadvantage of crackers in the traditional way is the need of large industrial areas and a large number of production personnel.

These problems need to be solved. It can be done by a comprehensive study of all processes

of production of rusk products, and apply research results to improve the instrumentation of the whole production cycle, from dough preparation till packaging of rusk products.

### **II. The research of complex improvement of rusk products**

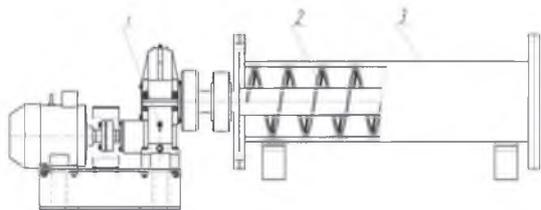
The practice of baking companies shows widespread adoption of intensive technologies of preparing dough in kneading machines with intense action. Without deterioration of the finished products without dough way to prepare the dough can be successfully used for rusks products.

Using our proposed method of production and distribution with loosening in dynamic conditions will ensure continuity of process handling dough purveyances.

The production of thin products baking and drying processes are mixed in a baking chamber and run consistently. Investigation of drying and baking dough purveyances of various shapes and sizes combined in a single baking chamber is needed to determine the size and conditions of heat treatment of products in which it is expedient to combine baking and drying processes for more efficient energy use and production areas

### 2.1. Research of the process of dough preparation and processing dough purveyances

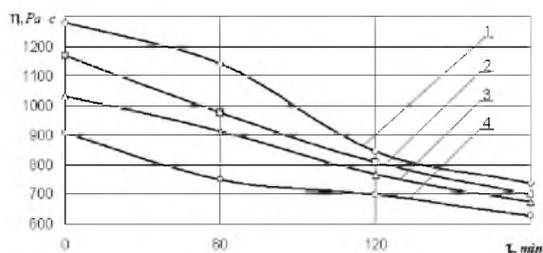
We investigated, the proposed experimental setup for intensive kneading, which ensured that all three stages of kneading dough. The working body consists of three parts: the tape, screw with variable step. Tape provides intensive mixing of components in the initial stage, actually mixing may occur at rest without significant expenditure of energy, so screw design covers the transportation of dough to the next stage. Plasticization are provided by intensive influence on dough screw with variable step



**Fig.1.** There is a chart of experimental fluidizer research of intensity of treatment of dough. 1 is an occasion; 2 is a working organ (screw); 3 is a corps;

The main indicator of the structural and mechanical properties the dough is the effective viscosity. We have conducted the research to determine changes in viscosity of the dough, depending on the specific work flow per knead.

Analysis of experimental data (Fig. 2.) showed that the viscosity of the dough is decreasing while the intensity of machining is increasing due to the weakening of connections between the particles of the dough and the forces of viscosity is overcoming by increasing of the kinetic energy of the molecules.



**Fig. 2.** Dependence of the effective viscosity of the dough from the time of fermentation when the specific work is: 1 - 7.5; 2 - 15; 3 - 22.5; 4 - 30 J / g.

As a consequence from the experimental data, reducing of viscosity occurs also during the

time of fermentation of the dough and especially intensively during the first hours of fermentation. The value of viscosity after 1 hour of fermentation with the consumption of 30 J / g specific work per batch is the same that is during 3 hours of fermentation with consumption of 7.5 J / g specific work per batch. Therefore, changes in the structural and mechanical properties of dough which occurs during the fermentation process due to repeated stretching during the formation of gas bubbles can be achieved by intensive mechanical treatment of the dough during kneading.

Application of the intensive mechanical treatment during the dough mixing process allows to reduces the process of fermentation of the dough and to distribute yeast cells more uniformly throughout the whole volume of the dough which , which promotes the formation of more centers of gassing and obtain a uniform fine-pored structure finished products.

The research process handling dough pieces in dynamic conditions was carried out using the experimental set forth in earlier studies [3], which allows a wide range of both kinetic and dynamic characteristics

Based on the research process and kneading dough processing blanks we proposed structure pf Mixing-Fermentation-forming unit, which sequentially processes of intensive kneading, fermentation and formation extruding loosened dough cords in the tunnel furnace.

### 2.2. Researching of combined baking and drying process.

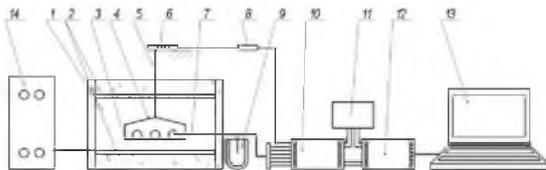
Baking and drying of rusk products took place in the baking chamber laboratory settings. Bakery camera has a top and bottom of the heating surface, wich corresponding the principle in most industrial tunnel ovens, for which both are offered this method of construction rusk products.

Experimental setup for baking and drying of rusk products (Fig. 3).

A stove has a hot automatic supply of heat to separate the upper and lower surfaces of the heating.

Temperature measurement in layers of dough cords are thermocouples, the potential of which goes to the analog module ICP CON I-7018 11 with conversion module ICP CON I-7520 12 signal is converted and transmitted to the computer.

To determine the intensity of external heat mass transfer on the results of experimental studies dough pieces of cylindrical shape, length 0.25 m and different average diameter, which varied from 0.017 to 0.06 m length was studied combined process of baking, drying, depending on the size determinant in different temperatures bakery camera.



**Fig.3.** There is a chart of experimental fluidizer baking and drying of rusk wares.

1 is a baking chamber, 2 - overhead and lower warming surfaces, 3 - bakestone, 4 is a pendant, 5 is a barbell, 6 is a gravimetric strain gauge sensor, 7 is a block of thermocouples, 8 is a strengthener of signal, 9 - Dewar flask, 10 is the analog module, 11 is the power module, 12 is the module of transformation, 13 is computer, 14 is a management corymb.

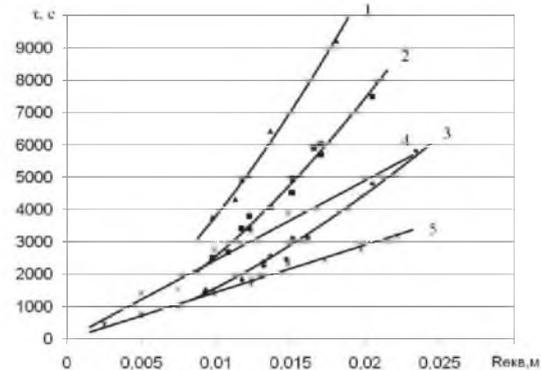
Analysis of experimental data shows that the baking time is 20-25% of the total duration of the process depending on the size of the determinant.

To determine the limits of geometrical dimensions in which it is expedient to combine the processes of baking and drying rusk plates in a baking chamber perform a comparative analysis of processes of baking and drying tusing the traditional method and proposed one. This identified the duration of drying rusk slabs and slices with equal limits defining dimensions. Rusk plates are shaped with the help of extrusion with determining size from 0.01 to 0.028 m length of drying rusk plates during the baking, drying, defined as the difference between the total duration of the process and duration of baking.

For slices of slab shaped extrusion with an average diameter 0,065-0,07 m and bake until cooked, cooled for 1 hour and cutting in slices of varying thickness. Then cut slices rusks dried and identified the duration of the process.

From the obtained comparative curves (fig. 4) duration of dry slices and bundles at different temperatures shows that for rusk panels this dependence is power-law character. With the increase of the equivalent amount the drying time increases for both samples, but the drying

cords increases more rapidly compared with slices that have a linear dependence on the length of the baking equivalent size.



**Fig.4.** Duration of drying of rusk flags and hunks depending on a qualificatory size: 1,2,3 - rusk flags at the temperature of baking chamber according to 120, 150, 190 °C; 4,5 - hunks at the temperature of baking chamber according to 150, 190 °C.

Dependences of the duration of drying of rusks slabs and slices of equivalent size and ambient temperature Baking chamber in the range studied the values described by equations (1) and (2) respectively:

$$\tau_{\text{cyu}}^{\text{nn}} = (-34264 \cdot t + 8.1 \cdot 10^6) \cdot R_{\text{ekv}}^{1.5} \quad (1)$$

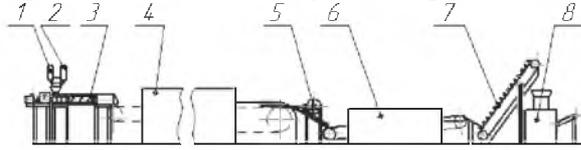
$$\tau_{\text{cyu}}^{\text{ck}} = (-2492 \cdot t + 0.619 \cdot 10^6) \cdot R_{\text{ekv}} \quad (2)$$

For the interval of values of equivalent size Rekv 0,01-0,013 = m characterized by a critical point at which the observed cross section curves of the length of the drying process. Before reaching the crucial importance of the size of the drying process suharnyh plates is faster compared to the drying slices. We believe this phenomenon is associated with a stage heating to a temperature of chilled slices of evaporation that takes place at the beginning of the drying process. With increasing size of determining the impact of this factor is reduced and consequently the drying suharnyh plates begins to exceed the drying slices

### 2.3. Create a stream-mechanized production line suharnyh products

On the basis of the studies we proposed machine-instrumental chart of production of rusk wares (fig.5), establishment of, Mixing-Fermentation-forming unit in that the intensive premix of dough, fermentation and forming of

loosening of dough plaits passes on under stoves, is foreseen in that. In a stove continuous rusk flags are baked and dried out, cut on separate slices, if necessary dry and packed.



**Fig.5** Threaded-mechanized production line suharnyh products: 1.2 - dispensers, 3 - Mixing, Fermentation molding unit 4 - oven, 5 - Cutting Machine, 6 - camera dosushuvannya 7 - transporter, 8 - packing machine

### III. Conclusions

Thus, the conducted researches allowed to carry out complex perfection of process of production of rusks :

- use of intensive premix of dough,
- loosen dough in dynamic terms,
- forming extruding of gasfilled dough;
- creation of mixing-fermentation-forming unit;
- combination of operations of baking and drying is in one stove unit.

Practical introduction of results of researches is creation of the stream-mechanized line for the production of rusks.

### References

- [1] Теличкун В. И. Поточно-механизиrowанная линия производства сухариков экструзией / В И Теличкун, Ю.А. Теличкун, А.А. Губеня, Н. Г. Десик // Хранителна наука, техника и технология 2009: Научна конференция с международно участие, Пловдив, 23-44 октомври 2009: Научни трудове, Том LVI, Свитък 2. сс. 295 – 300.
- [2] Теличкун Ю. Критериальные зависимости течения газонаполненно-го теста в цилиндрическом канале / Теличкун Юлия, Теличкун Владимир, Стефанов Стефан, Кравченко Александр// Научни трудове на УХТ, том 58, свитък 3. – Пловдив – 2011. - С. 319-324. ISSN 0477-0250 [България]
- [3] Yu. Telichkun, V. Telichkun, V. Taran, O. Gubenia, M. Desik. The research of the gas-filled dough rheological characteristics / EcoAgro-Tourism. - 2010. - N1. – pp.. 67-71.