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### SECTION 7. Mechanics and mechanical engineering.

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## OPTIMIZATION OF THE PRODUCTION TECHNOLOGY OF BAKERY PRODUCTS WITH A CARROTS IMPORTATION AS DIETARY SUPPLEMENT

**Abstract:** Now development of the functional food, in particular the bakery products with the increased nutrition value enriched with new types of raw materials is relevant.

Use in bread baking of fruit and vegetable additives which are sources of vitamins, fats, the active materials pectic, mineral and other biologically is perspective. So, in particular, at addition of carrots bakery products can be enriched with food fibers, vitamins of group A, B, PP, pantothenic and Acidum folicum, macro - and minerals, such as potassium, calcium, phosphorus, iron, Zincum, etc.

The rational technology of preparation of bread has to provide safety of the useful properties of a product at each stage of its production, and in particular, at a stage of its pastries.

At an electro contact (EK) way of baking of bread biologically the active materials of raw materials more remain, formation of undesirable substances, inassimilable is prevented by an organism of connections [1-5].

**Key words:** the functional food, bakery products with the increased nutrition value, enriched with new types of raw materials.

**Language:** English

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### Introduction

Due to the aforesaid the research of electro contact baking of the bread enriched with carrots is relevant.

For EK-baking of bread used expressly developed laboratory installation. Installation represents the special form made of not conductive heat-resistant material. On internal surfaces of two opposite walls of a form the plates from stainless steel which are the electrodes included for the period of pastries in the alternating current main of industrial frequency are established. Installation is supplied with devices for measurement of current and temperature of test preparation in the course of EK-pastries.

For a research of influence of reduction ratio of carrots on process of dough fermentation and quality

of finished products prepared exemplars with additive of carrots of different reduction ratio. Carrots were used three reduction ratios: with a size of a transverse section of particles 0.5; 2.45; 5. Carrots were crushed on the laboratory mechanical grinder. Reduction ratio of carrots was defined as follows: took a shot of 10 g of the fruit and vegetable raw materials crushed on a terochny surface and fractionated, differing in particle sizes. The sectional area of particles was defined by a caliper, taking conditionally the area form for a rectangle, a triangle or a segment of a circle depending on a proximity of a form of the areas to this or that element. The average area of a transverse section was determined as a weighted mean of sectional areas of all measured crushed particles [6].

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The amount of the added carrots was changed by from 0 to 15% of the mass of flour for each reduction ratio. Dough was cooked in the without steam way on the compounding providing 2% of dried yeast and 0.7% of food sodium chloride of the mass of flour. The humidity of the ready test was 53%. Before a batter the salt and yeast entering a compounding dissolved in water. Dough fermentation was carried out at a temperature of 30 of 2 °C. Duration of fermentation was made by 1.5 hours. The fermented-out exemplars weighing 450 g placed in installation for EK-pastries and sent to a preparation keeping at a temperature of 30 of 2 °C on 45 min. of preparation keeping exemplars baked in the EK-way. In the course of pastries controlled temperature and current.

The organoleptic assessment of crustless bread was carried out by a ranging method on four indexes: to taste, smell, consistence and appearance. For assessment of organoleptic properties of crustless bread the group of experts, being the experts in the field of bread baking who are well knowing a product and its technology was selected [7].

Calculation of uniform value of organoleptic assessment – a complex indicator of organoleptic properties crustless bread was carried out by totaling of the ranks on each index increased by significance coefficient which made for appearance – 3, consistences – 4, taste – 10 and a smell – 3.

The quality of bread was estimated on physical and chemical indexes: humidity, porosity, acidity.

Besides, defined a volume and weight exit of bread. For calculation of a complex indicator of physical and chemical properties (KPFH) of crustless bread the tenpoint scale of the transfer of values of separate indexes to points of a complex indicator of physical and chemical properties (table 1) was developed. At the same time KPFH was defined by totaling of estimates of the separate indicators of quality of bread increased by the corresponding coefficient of a significance which made: for a volume exit - 3, for a weight exit – 2, for porosity – 3, for acidity – 1, for humidity – 1, for pastries -2 duration. The size of coefficients of a significance was established by the group of experts.

Specific energy consumptions (UE) defined by division of energy consumptions into the mass of an exemplar of the crustless bread baked in the electrocontact way. Energy consumptions on electrocontact baking of exemplars of crustless bread determined by a path of integration of the surface area limited to the schedule of change of the power spent for process of pastries.

In figure 1 the schedule of change of a capacities for an exemplar of crustless bread with additive of 5% of carrots with reduction ratio of 2.45 mm<sup>2</sup> is presented.

When determining amount of the energy spent for process of electrocontact pastries calculated integrate the received equation.

$$\int_0^{0,070} (-6E - 05x^3 - 0,0124x^2 + 3,4027x + 922,84) = 64,6Vt \quad (1)$$

**Table 1. A ten-ball scale of the transfer of separate indexes to points of a complex indicator of physical and chemical properties of crustless bread with carrots additive.**

Complex indicator	Volume yield, %	Weight exit, %	Porosity, %	Acidity, hail	Duration of pastries, mines	Humidity, %
10	>=600	>=160	>=80	<1,6	<2,0	43,0- 46,0
9	560-599	156-159	77,5-79,9	1,6-2,3	2,1-2,5	42,9-42,0 46,1-47,9
8	520-559	152-155	75,0-77,4	2,4-3,1	2,6-3,0	41,9-41,0 48,0-48,9
7	480-519	148-151	72,5-74,9	3,2-3,9	3,1-4,0	40,9-40,0 49,0-49,9
6	440-479	144-147	70,0-72,4	4,0-4,7	4,1-5,0	39,9-39,0 50,0-50,9
5	400-439	140-143	67,5-69,9	4,8-5,5	5,1-10,0	38,9-38,0 51,0-51,9

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4	360-399	136-139	65,0-67,4	5,6-6,3	10,1-15,0	37,9-37,0 52,0-52,9
3	320-359	132-135	62,5-64,9	6,4-7,1	15,1-20,0	36,9-36,0 53,0-53,9
2	280-319	128-131	60,0-62,4	7,2-7,9	20,1-25,0	35,9-35,0 54,0-54,9
1	<280,0	<128,0	<60,0	>8,0	>25,0	34,9-34,0 55,0-55,9
Коэффициент значимости	3	2	3	1	2	1

After division of the spent energy into the mass of an exemplar specific energy consumptions energy for an exemplar of crustless bread with additive of 5% of carrots with reduction ratio of 2.45 mm<sup>2</sup> made 165 W/kg.

**Conclusion**

The analysis of results of the made experiments allowed to draw the following conclusions:

- the analysis of indexes of quality of finished products showed that increase in a dosage of carrots from 0 to 15% for the studied reduction ratios for a weight exit and humidity of bread has no significant effect. Increase in a dosage of carrots from 0 to 10% leads to increase in acidity of bread, further increase in a dosage - to decrease. A volume exit and porosity of bread for reduction ratio of carrots 0.5 and 5 of mm<sup>2</sup> at its importation increases to 5%, with further increase in a dosage of carrots - decreases. For reduction ratio of carrots of 2.45 mm<sup>2</sup> increase in its dosage from 0 to 15% leads to increase in porosity of finished products;

- the highest values of a complex indicator of physical and chemical properties were at exemplars with a carrots importation a refinement of 0.5 mm<sup>2</sup> at a dosage of 5%, a refinement of 2.45 mm<sup>2</sup> – at a dosage of 15%, a refinement of 5 mm<sup>2</sup> - at a dosage of 10%.

For definition of the optimum technological modes of production of crustless bread with carrots additive by well-known techniques [6] the plan of a two-factor experiment was made and implemented. As an influence factor by optimization of production of crustless bread with additive of carrots reduction ratio of carrots and its dosage were used. As exit pupils complex indicators of organoleptic and physical and chemical properties and also specific energy consumptions on process of electrocontact baking of crustless bread with carrots additive were chosen.

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