

# ***Innovative product as future vision for the development of the food industry at the turn of new industrialisation***

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**Abstract** — The article discusses the applied aspects of industrialization in one of vital areas related to industrialisation in the field of life support - food production. A set of measures for the development, implementation and production of innovative products using non-traditional types of raw materials is presented. It has been proved and realized experimentally the introduction of an aqueous extract of fireweed to the recipe of bakery products in this article. As it has been found in the process of research the replacement of 50% of dairy raw materials with an aqueous extract of fireweed in the recipe of bakery products improves the organoleptic and physico-chemical indicators of the quality of finished products. In addition the introduction of this supplement leads to an increase in the content of phosphorus and iron and leads to an increase in the biological value of products for the human body.

**Keywords** — *bakery products with nutritional supplements, extract of narrow-leaved fireweed*

## I. INTRODUCTION

New industrialisation is the creation of a high-tech industrial base for innovation.

Unlike the old, or primary industrialisation, the new industrialisation embodies a qualitatively higher stage of development.

The purpose of the new industrialisation is the development of industries basics. The category of such industries includes the food industry.

In the conditions of new industrialisation of food products, considerable attention of enterprises should be paid to the technical preparation of production, aimed at increasing its technical and organisational level through the planned introduction of modern high-performance equipment, advanced technology and organisation of production.

The technical preparation of production is implied as a set of measures for the development, implementation and mastering of cost-effective measures of scientific and technological progress, ensuring an increase in the technical level of production, the release of new products and the improvement of the quality of already manufactured products.

Today, the population shows an increased interest in the quality, chemical composition, nutritional value and the presence of functional ingredients in food products and is increasingly faced with the problem of unbalanced nutrition due to the consumption of purified and refined products [1].

It should also be noted that the market for bakery products is widely represented the products for preventive and therapeutic nutrition, such properties of the products give additional ingredients which are rich in nutrients (amino acids, vitamins, micro- and macronutrients), as well as the changes in the technology of products preparation [2].

At present the market of bakery products is rather saturated and represented by products of various shapes and tastes. In addition these products are very popular among the general population: you can have snacks on the go, drink tea in the company or take something with you. But, unfortunately, they do not bear any benefit except for a quick satisfying of hunger because they contain a small amount of valuable nutrient substances.

One of the outlooks to increase the biological value of baked products is the expansion of the range by using non-traditional types of raw materials [3], which is relevant in the context of new industrialisation in the food industry. In our case it is an extract of fireweed or willow-herb *Chamerion angustifolium* (L.) Holub.

## II. RESEARCH OBJECTS AND METHODS

The diverse biological activity of extracts of willow-herb in traditional medicine has long been known for its antioxidant, anti-inflammatory, antiandrogenic, antiproliferative, antifungal, antimicrobial and antinociceptive action.

In the fireweed there are different mineral salts: iron, copper, manganese, boron, molybdenum, titanium, they have a positive effect on blood formation. The plant contains sodium, potassium, calcium, lithium, magnesium, phosphorus, vitamin C, it helps to strengthen the immune system and improve the overall tone of the body [4].

To obtain an aqueous extract of fireweed, chopped grass is poured with water at a temperature of 90 ° C, infused for 20 minutes, and then filtered through the gauze. Warm extract is added at the stage of preparation of the sponge dough with the replacement of 50% liquid.

The sponge dough preparation method is used for the preparation of experimental samples [5]. Bakery products cooked on the sponge dough, as a rule, have good quality - the products have an elastic, soft crumb, developed porosity, with thin-walled pores, pleasant taste and intense flavor. The recipes from the collection of recipes for bread and bakery products are taken as a basis. The technology of preparing bakery products using herbal supplement is the same; only the components of the formula are different [6].

The choice of powder and extract dosage is based on the analysis of different sources. Buns formula is presented in Table 1.

TABLE 1 SAMPLE BUNS FORMULA

Ingredients	Sample without addition of extract of fireweed	Sample with 50% extract of fireweed
Wheat flour, premium grade, g	270	270
Baked yeast pressed, g	15	15
Pasteurized cow milk, ml	125	62,5
Sugar, g	60	60
Edible salt, g	5	5
Eggs, pieces	1	1
Butter, g	50	50
Pumpkin puree	-	-
Extract of fireweed	-	62,5

The quality of buns largely depends on the mode of each technological stage of its production.

When preparing the dough, several phases are distinguished: the kneading of sponge dough or starter, their fermentation, the kneading of dough and its fermentation. The method of dough preparation is chosen depending on the type and grade of the processed flour, its bakery properties, the method of loosening and the equipment used: 10 g of sugar, yeast and 45 g of flour are added to a warm liquid of 35–40 ° C. Then the sponge dough is placed in a laboratory proofing cabinet ShRL - 065 STU for 30 minutes, with a set temperature of 38 ° C.

After preparing the dough sponge in a separate bowl, mix all the baking: 1 egg, 50 g sugar, 50 g soft butter.

Then put together the dough sponge with baking, add salt and stir. The emergence of bubbles on the surface indicates the maturation of the dough sponge; the finished dough is shown in Figure 4.

Kneading the dough is carried out in the laboratory by hand; fermentation and proofing are carried out in a laboratory proofing cabinet at a temperature of 38 ° C. The fermentation process lasts for 60 minutes, and proofing the dough pieces- for 20 minutes. Before laying the dough into molds, it is pressed down for 2 minutes.

Baking test samples are carried out in a laboratory proofing cabinet ShRL - 065 STU at a temperature of 165 ° C for 20 minutes. After baking, finished products are cooled at a temperature of 17 ° C for 30-40 minutes and then taken out of the molds.

In order to study the effect of adding to the formula of bakery products narrow-leaved fireweed extract, an organoleptic evaluation of experimental samples has been made as well as such quality indicators as acidity, porosity, and humidity have been also determined.

Determination of the crumb moisture of bakery products has been carried out by drying the sample at a certain temperature according to GOST 21094-75. This indicator has been calculated by the formula

$$W = \frac{G_1 - G_2}{G_3} \times 100, \quad (1)$$

where G1 and G2 - the mass of the cup with bread before and after drying, g;

G3 - weight of the product, g [7].

The acidity of the finished bakery products is determined according to GOST 5670-96 by the accelerated method. In accordance with the method, two parallel titrations are performed, the difference between which should be no more than 0.3 degrees.

By the degree of acidity we mean the volume in cubic centimeters of a solution of the exact molar concentration of 1 mol / dm<sup>3</sup> of sodium hydroxide or potassium hydroxide necessary for neutralizing acids contained in 100 g of products. Physico-chemical indicator is calculated by the formula

$$X = \frac{V \times V_1 \times \alpha}{10 \times m \times V_2} \times K, \quad (2)$$

where V - is the volume of a solution of molar concentration of 0.1 mol/dm<sup>3</sup> of sodium hydroxide or potassium hydroxide, due to the titration of the test solution, in cm<sup>3</sup>;

V<sub>1</sub> - is the volume of distilled water taken to extract acids from the product under study, cm<sup>3</sup>;

$\alpha$  - is the conversion factor per 100 g of sample;

K is the correction factor for reducing the sodium hydroxide or potassium hydroxide solution used to a solution of an exact molar concentration of 0.1 mol / dm<sup>3</sup>;

1/10 - is the reduction coefficient of sodium hydroxide solution or potassium hydroxide with a molar concentration of 0.1 mol / dm<sup>3</sup>;

m - is the mass of the sample, g;

V<sub>2</sub> - is the volume of the test solution taken for titration, cm<sup>3</sup> [8].

Such an indicator as porosity characterizes an important property of the product - its digestibility.

The porosity of all samples of bakery products exceeds the minimum value specified in GOST. However, with the addition of narrow-leaved fireweed powder, this indicator begins to decline. That is due to the strengthening effect of the powder on gluten.

Phosphorus in the samples is determined according to GOST 30615-99, and iron according to GOST 26928-86 using a spectrophotometer GENESYS 10S UV - VIS. For these two analyzes, we prepare ash as follows. A weighed mass of 10 g is placed in tarred crucibles. First, charring is performed on a hot plate. After smoke emission the hinged crucible is placed in a laboratory muffle furnace heated to 600 °C. Ashing is carried out until the color of the ash turned white, and then the crucibles with ash are cooled in a desiccator.

The method for determining phosphorus consists of dry mineralizing the sample, dissolving the ash, conducting a color reaction with molybdenum-vanadium reagent and measuring the intensity of yellow staining of the solution  $I = (440 \pm 5) \text{ nm}$  using a spectrophotometer [9]

The mass fraction of phosphorus in mg per 100 g of product is calculated by the formula

$$X = \frac{m_1 \times V_0}{m \times V \times 10}, \quad (3)$$

where m<sub>1</sub> - is the mass of phosphorus, found on the calibration curve, µg;

V<sub>0</sub> - is the total volume of mineralization, cm<sup>3</sup>;

V - is the volume of mineralization taken for the test, cm<sup>3</sup>;

10 - conversion factor per 100 g of product;

m - is the sample weight, g.

The method for the determination of iron in products is based on measuring the intensity of the color of a solution of a complex compound of ferrous iron with red orthophenanthroline.

Similarly, as in the method for the determination of phosphorus, first we have found the mass of iron in µg (m<sub>1</sub>) from the measured concentration according to the calibration curve.

The mass fraction of iron in products in mg / kg is calculated by the formula

$$X_1 = \frac{m_1 \times V}{V_1 \times V_2}, \quad (4)$$

where m<sub>1</sub> - is the mass of iron found on the calibration curve, mcg;

V - is the total volume of the solution of mineralization, cm<sup>3</sup>;

V<sub>1</sub> - is the volume of the solution of mineralization taken for the determination, cm<sup>3</sup>;

m - is the mass of the sample product taken for mineralization, g;

V<sub>2</sub> - is the volume of product taken for mineralization, cm<sup>3</sup>.

### III. RESULTS AND DISCUSSION

The organoleptic properties of test samples of buns are presented in table 2 [10].

TABLE II ORGANOLEPTIC GRADING OF RICH PRODUCTS

Quality indicators	Norms according to GOST 24557-89	Bun without addition of a narrow-leaved fireweed extract	Bun with addition of a narrow-leaved fireweed extract
form	Without kissing crust. Round with a convex upper crust	Without kissing crust. Round with a convex upper crust	Without kissing crust. Round with a convex upper crust
exteriority	Glazed	Glazed, without cracks and explosions	Smooth, without cracks and expl Glazed osions
color	Light to dark brown	brown	Light brown
Crumb condition: baking	Baked, not moist to the touch, with a slight compression of the fingers between the upper and lower crusts of the crumb should take the original shape	Baked, not wet to the touch, elastic	Well-baked, not wet to the touch, elastic
crumb grain	Grain without voids and seals	Grain with cells of medium thickness	Grain with wall thinness cells
kneading	Without lumps and kneading	Without lumps and kneading	Without lumps and kneading
taste	Fancy, peculiar to this type of product, sweetish. When using flavoring supplements - the taste peculiar to the made additives	Fancy, sweetish	Sweet taste with tea aroma
flavor	Peculiar to this type of product, without foreign	Characteristic for this type of product, without foreign smell	Fancy with a slight herbal tint

	smell. When using aromatic additives - the smell peculiar to the added additives		
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In the study of physico-chemical parameters of bakery products we are guided by GOST 24557-89 "Bakery products. Technical conditions". According to the results of the research we have obtained data presented in table 3.

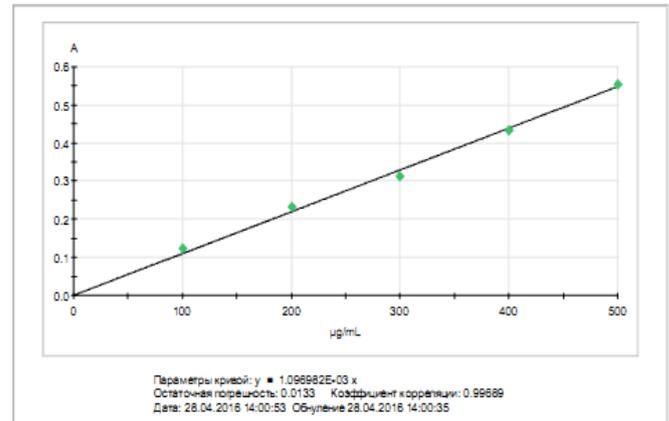
TABLE III PHYSICO-CHEMICAL QUALITY INDICATORS OF BAKERY PRODUCTS

Quality indicators of bakery products	Norms according to GOST	Bun without addition of a narrow-leaved fireweed extract	Bun with addition of a narrow-leaved fireweed extract
moisture, %, not more	35.0	29	35
Acidity, deg. no more than	2.5	2.3	2.5

From the data presented in table III, it can be seen that the change 50% of milk for the extract of narrow-leaved fireweed in the formula of bakery products leads to an increase in the moisture of the product and its acidity, but these values do not exceed the requirements of regulatory documentation.

The determination of such vital elements as phosphorus and iron by the method of ashing makes it possible to obtain the data presented in Fig. 1-2.

Метод: фосфор в пш. прод. 28.04.2016.mca (440 nm)  
 Последнее изменение: 28.04.2016 14:01:31 - 1-OLDI\1  
 Спектрофотометр: GENESYS 108 Bio  
 Серийный номер: 2N5Q173001  
 Fitматрица: 4.003  
 Обнуление: 04.05.2016 15:23:50  
 Измерено: 04.05.2016 15:24:08 - 1-OLDI\1  
 Имя файла результата: фосфор в сложных булках.rca



Проба	Разведение фактор	Ордината [A]	Концентрация [µg/mL]
10%	1	0.194	176.76
20%	1	0.198	180.04
30%	1	0.201	183.59
Контроль	1	0.180	164.45
Иван-чай	1	0.221	201.55

Fig. 1 - Optical density measurement results on a spectrophotometer

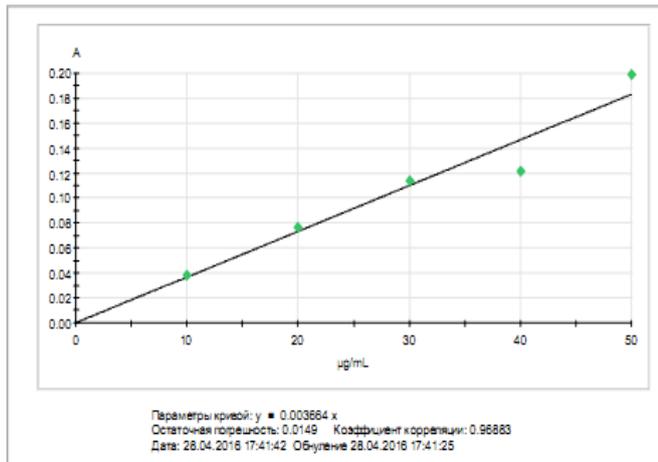
According to the obtained optical density value, the mass of phosphorus in µg is found from the calibration curve. By drawing up the proportions and recalculating the content of the component in the sample, it has been obtained that for the prototype without the addition of an extract of narrow-leaved fireweed, the phosphorus content is

$$X = \frac{657,8 \times 50}{10 \times 4 \times 10} = 82,2 \text{ mg} \quad (1)$$

In a prototype with the addition of an extract of narrow-leaved fireweed, the phosphorus content is

$$X = \frac{906,2 \times 50}{10 \times 4 \times 10} = 100,8 \text{ mg} \quad (2)$$

Метод: жалево в продуктах 28.04.2016.mca (510 nm)  
 Последнее изменение: 28.04.2016 17:42:42 - 1-OLDI\1  
 Спектрофотометр: GENESYS 10S Bio  
 Серийный номер: 2H5Q173001  
 Fitmate: 4.003  
 Обнуление: 04.05.2016 15:12:30  
 Измерено: 04.05.2016 15:12:47 - 1-OLDI\1  
 Имя файла результата: жалево в сладких булках измерение 2.гца



Проба	Разведение фактор	Ордината [A]	Концентрация [µg/mL]
10%	1	0.018	4.78
20%	1	0.029	7.78
30%	1	0.030	8.05
Контроль	1	0.012	3.28
Иван-чай	1	0.041	11.05

Fig. 2 - Calibration line and measurement results on a spectrophotometer

According to the data obtained for the sample without the addition of an extract of narrow-leaved fireweed, the mass with an appropriate recalculation of the iron content for the sample without the addition of an extract of narrow-leaved fireweed is

$$X = \frac{6,56 \times 50}{2 \times 10} = 16,4 \text{ mg/kg} \quad (3)$$

For the sample with the addition of the narrow-leaved fireweed extract, the iron content is

$$X = \frac{22,1 \times 50}{2 \times 10} = 55,3 \text{ mg/kg} \quad (4)$$

Thus, from the obtained data it can be seen that the addition of an aqueous extract of narrow-leaved fireweed to the recipe of buns leads to an increase in the content of phosphorus and iron, thereby increasing the biological value of products for the human body.

#### IV. CONCLUSION

In the course of the research work, a number of important tasks were solved:

- a technology has been developed and a technological process has been described for the production of an innovative product under the conditions of new industrialisation;
- the finished product is presented, which allows to expand the innovative range and fully meet the needs of the population with the least expenditure of resources in the process of manufacturing and consumption of products;
- new technological processes have been developed and introduced, in particular, those related to the processing of new types of raw materials, initial and intermediate products and an increase in the complexity of their use.

Studies conducted to determine the effect of aqueous extract of narrow-leaved fireweed on the quality of baked products have shown that with the addition of 50% of extract of narrow-leaved fireweed from the volume of milk, the product has good organoleptic and physico-chemical quality indicators. It also increases the content of phosphorus and iron compared with the sample baked according to the traditional recipe, by 18.5% and 70.3%, respectively. In this regard, we consider it expedient to add this component to the recipe, and recommend such a bakery product for people suffering from iron deficiency.

The development of technologies for the use of non-traditional raw materials in the food industry at the stage of new industrialisation makes it possible to provide access to specific products which are necessary for consumers here and now.

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