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DESSERTS WITH A HIGH NUTRITIONAL VALUE IN THE INDUSTRY EMPLOYEES NUTRITION

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Annotation. In the article there are considered questions of the sweet foods with a high nutritional value development. Evaluation of the organoleptic and physical-chemical properties of model jelly samples with jost and spirulina showed that the proposed formula and technology gives a product with high consumer properties. There is a theoretically substantiated expediency of a jost and spirulina jelly implementation in such restaurant enterprises as dining rooms in the industrial plants. Using the jost and spirulina nutritional supplements can expand the range of the preventive nutrition foods.

Key words: jelly, jost, spirulina, preventive nutrition foods, radio protector, structural and mechanical properties, diet.

СОЛОДКІ СТРАВИ З ПІДВИЩЕНОЮ ХАРЧОВОЮ ЦІННІСТЮ В ХАРЧУВАННІ ПРАЦІВНИКІВ НА ПРОМИСЛОВИХ ПІДПРИЄМСТВАХ

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Анотація. У статті розглянуто питання розробки солодких страв із підвищеною харчовою цінністю. Оцінка органолептичних і фізико-хімічних властивостей модельних зразків желе з йогуртом та спіруліною показала, що запропоновані рецептура й технологія забезпечують одержання продукту з високими споживчими властивостями. Теоретично обґрунтовано доцільність впровадження желе з йогуртом та спіруліною у виробництво таких підприємств ресторанної галузі, як їдальні на промислових підприємствах. Завдяки використанню добавок йогурту та спіруліни можна розширити асортимент страв лікувально-профілактичного харчування.

Ключові слова: желе, йогурт, спіруліна, лікувально-профілактичне харчування, радіопротектор, структурно-механічні властивості, раціон харчування.

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Introduction

A rationally organized preventive nutrition of workers in industrial plants is an important part of modern material production organization. The preventive nutrition is a way to improve the body's resistance to harmful human factors, reduce morbidity and prevent premature human fatigue, promotes health, energy replenishment of workers, establishment of normal socio-psychological climate in the team.

For the improvement of the organization the preventive nutrition for workers in restaurant industry, we need to solve problems with developing food rations with balanced chemical composition and new preventive nutrition.

The problem and literature review

Workers which are connected with hard and bad work conditions (chemical production of inorganic products, organic products, drugs and paints, chemicals, and mining working and chemical-pharmaceutical production, production of non-

ferrous metals, electrical engineering and radio production, etc.) are free-provided by preventive nutrition. Also, preventive nutrition ensure workers engaged in construction, commissioning, working full-time on existing industries with particularly hazardous conditions [1]. In turn, the worker's lunches are related to the system of material stimulation, which have a social character. In that way, the preventive nutrition offering is a social aspect, which the employer gives employees, and which is independent from specific work results or the volume of performed work [2].

Nevertheless, today we can admit a need of solving a question about the worker's nutrition improvement. All studied industrial enterprises of Ukraine are facing this problem [3]. The level of worker's preventive nutrition provision ranges from 20.3 to 49.5 %, and in the mines this index does not exceed 10 %. The questionnaire revealed the need for preventive nutrition in the mining industry – 24.1 %, metallurgy – 17.8, machine building – 18.2 %. The research [3] confirmed that the catering for employees is a paramount to solving social problems in the

industry. It is necessary to carry out a differential approach to the catering considering the work specific in the industry.

A rationally organized preventive nutrition includes a developing of complex food ration, considering the energy costs of different groups of work intensity and essential nutrients. Solving this question there has to be a coordination of an industry and catering administration. The most viable option is to organize a preventive nutrition at the expense of industry and trade unions, which will provide its regular provision in work canteens in according to the procedure of therapeutic feeding system, approved by the Ministry of Health of Ukraine from May 29, 2013 № 931 and requirements of a balanced diet.

The preventive nutrition is differentiated on the basis of pathogenetic mechanisms of the working environment harmful factors. According to the current regulatory factory documentation with are hazardous working conditions, there are provided free milk, milk and pectin products. And in enterprises with extra hazardous working conditions there's provided a free preventive nutrition like lunches with hot dishes [4].

The food ration composition is determined by the specific conditions. For example, if the employees in their working process are affected by ionizing radiation, the mass fraction of antioxidants and pectin in food ration has to be increased. However, the employees who work in shifts (e. g. 30-km zone of Chernobyl), doesn't have a satisfying current food ration [5].

There is a need to find ways of improving the employee's preventive nutrition who are in the area of the negative impact of production factors for a long time, such as radiation.

The main part

Considering the problem state, the food technology experts should focus on developing the preventive food rations for employees, who work with hard and hazardous working conditions.

One of the main tasks is the new high nutritional value dishes developing with radio protective properties. The perspective way in solving this problem can be the desserts developing, such as berry jelly with a new raw material which has a radio protective property. That new raw material is jost and processed products of *Spirulina Platensis* micro-alga. Due to the high bioactive substances and radio blockers there is a radio protective effect of jost and spirulina.

Jost is hybrid product from gooseberries and currants. Jost's main advantage is the high content of bioactive substances - it concentrates both currants and gooseberries nutrients [6]. Nutritional value of jost is primarily determined by the large amounts of vitamin C (90 – 160 mg/100 g). The bioflavonoids of

jost amount is equal to 320 – 380 mg/100 g jostaberry low calorie (45 calories) can be attributed to this product category to diet. Jostaberry berries have not only excellent taste and fresh aroma, but also some healing properties. They may be applied in diseases of the gastrointestinal tract to improve blood circulation, and rapid excretion of heavy metals and toxic substances. Fruits Smorodino-ahrusovyh hybridrydiv, including jostaberry is a valuable source of pectin [7].

As it known, in dietetics nowadays is paid a great attention to pectin, as it is a natural radio protector. Environmental degradation in Ukraine will require increased use of pectin as a natural substance with detox properties. Pectin is a necessary food component that has beneficial effects on the person's metabolism. Pectin promotes not only toxins and radionuclides removal of body, but also increases its overall non-specific resistance.

We believe that in preparing jelly it is appropriate to use raw materials containing pectin such as jost. The use of jost additives in jelly, a product with pectin, not only gives prophylactic properties of this dessert, but will withdraw its component formulations such as gelatin. There is no special benefits in gelatin – a product from collagen denaturation. Therefore, nutritionists do not recommend using gelatin in food frequently because of the risk of kidney stones and increased blood clotting. Jost using which contains 1.5 % of pectin and spirulina, which according to some authors contains alginic acid [8] will help to reduce the mass fraction of gelatin, or refuse it altogether, without substantial change of structural and mechanical properties of jelly.

Spirulina Platensis – is a multicellular spiral mikroalgae, which is one of the first representatives of life on our planet. The nutritional value of spirulina conditioned by the high content of proteins (60 % protein on dry substance) and balanced amino-acid composition. The content of vitamins and minerals of *Spirulina* is superior to many foods both vegetable and animal origin. The content of beta-carotene in spirulina is 10 times more than in carrots, iron – 20 times more than in other plants. One gram of spirulina's digestible form of vitamin B₁₂ contains more than in 100 grams of beef of the highest category. The problem of vitamin B₁₂ deficiency in body is removing completely by using spirulina. This allows you to use the product in small quantities to obtain the required dose of nutrients [8,9].

Spirulina has vitamins E (tocopherol), C, minerals: potassium, calcium, magnesium, zinc, manganese, phosphorus, iron, iodine, selenium, which are essential for the human body. Only in *Spirulina* and some other blue-green and red algae there are such valuable compounds for human health as fikotsyanin, stimulating the immune system. The chemical composition of spirulina (Table 1) defines its basic properties. The most important of them – radio protective,

metabolism normalization, vitamins and minerals balance replenishment, immune system strengthening.

In its composition spirulina contains a protein with complete amino acid composition. Since the content of essential amino acids in spirulina reaches 47 % of the total number of amino acids. As we know, the unbalanced essential amino acids food ration leads to serious violations of protein synthesis, which inevitably causing negative effects: structure changes of the organelles cell membranes, degradation of the enzyme system of metabolism regulation,

infringement biosynthesis of important nitrogen-containing compounds etc. The difference of Spirulina proteins is a relatively low molecular weight and easily absorbed by the human body. In digestibility they even slightly surpass the main milk protein – casein, which is used in nutrition as a standard for assessing the nutritional value of proteins. Spirulina's protein may be a useful for person with increased fatigue, reduced performance, with an increased physical and mental stress, during and after serious illnesses. Generally, spirulina biomass digestibility is about 80 %.

Table 1 – Chemical composition of dried spirulina biomass [6]

Component name	Content	Component name	Content
Protein, %	60,0	Fatty acids, mg/100 g	
Carbohydrates, %	20,0	lauric	20
Fats, %	5,0	myristic	60
Ash, %	8,0	Palmitic	1650-2114
Water, %	7,0	Palmitolenic	149-203
Amino acids % of the total		Palmitolinolen	35
Isoleucine	5,7	Heptadekan	9-14
Leucine	8,7	Stearin	0-35
lysine	5,1	Oleic	197-300
Methionine	2,6	Linolenic	1092-1378
Phenylalanine	5,0	Gamma-linolenic	875-1197
Threonine	5,4	Beta-linolenic	16-42
Tryptophan	1,5	Vitamins, mg / 100 g	
Valine	7,5	Beta-carotene	170,0
Alanine	7,9	B1 (thiamine)	5,5
Aspartic acid	9,1	B2 (riboflavin)	2,4
Cysteine	0,9	B3 (niacin)	11,8
Glutamic acid	12,7	B5 (pantothenic acid)	1,1
Glycine	4,8	B6 (pyridoxine)	0,3
Histidine	1,5	B8 (inositol)	35,0
Proline	4,1	B12 (cobalamin)	0,2
Serin	5,3	BC (folic acid)	0,05
Tyrosine	4,6	PP (nicotinic acid)	11,8
Pigments mg/100 g		E (tocopherol)	19,0
Carotenoids	5,2	C (ascorbic acid)	18,0
Chlorophyll A	50,0	Macroelements mg/100 g	
Fikotsyanin	500,0	Calcium	120
Microelements mg/100 g		Magnesium	370
Selenium	6,0	Boron	300
Copper	52,0	Phosphorus	830
Silicon	3100,0	Potassium	1400
Chrome	11,0	Sodium	30
Cobalt	8,0	Iron	53
Molybdenum	5,0	Zinc	17
Iodine	4,5-9,0	Manganese	20
Germanium	3,9	Chlorine	420

In spirulina composition there are also three dye pigments: carotenoids, chlorophyll A and fikotsya-

nin (Table 1), that helps the body to synthesize enzymes necessary for the regulation of metabolism and have a

strong antioxidant properties. One important human pigment is fikotsyanin (blue pigment), which is capable to stop the formation of cancer cells. Japanese physicians research showed that fikotsyanin strengthens the immune system and increases the activity of the lymphatic system. Meanwhile the main function of the lymphatic system is to support the normal functioning of all organs of the human body, protecting it from various diseases – cancer, ulcers, fibroids, seasonal allergies, herpes, hives, HIV and others. Chlorophyll A is the main source of organic iron, and combined with the complex substances found in spirulina, it promotes the biosynthesis of hemoglobin. That allows to normalize the function of blood-forming organs in short time. Spirulina's chlorophyll helps to restore liver cells and has anticancer effect. Spirulina is the richest in the content of beta-carotene, that gives it intensive anti-cancer properties.

Spirulina's minerals are strong bioregulators of normal body development. They play a vital biological role: interacting with amino acids, pigments, vitamins they affect the processes of hematopoiesis, respiratory tissue, normalize the cardiovascular, nervous and other body systems [8].

At the end of the twentieth century, Japanese physiologists found that the use of spirulina in food leads to correction of human organs and systems at cellular, genetic and tissue level. Belarus has developed a whole program of using spirulina to treat victims of the Chernobyl AU. As a result of research it was concluded that the use of drugs from Spirulina reduces the influence of cesium – 137 and strontium – 90, derived from contaminated food.

The robots, which found the spirulina's extract radio protective effects on the bone marrow with gamma irradiation have been published in China. The Institute of Experimental Radiology Medical Sciences of Ukraine studied the effect of spirulina on people who have suffered serious radiation. Found that daily consumption of 4 – 5 grams of dry spirulina biomass for months promotes full recovery of bone marrow function and cleanses the body from remaining radionuclides [9].

The researches results, conducted behind overseas and in Ukraine, and the wide experience of spirulina introduction in the world, confirm its unique curative properties as radio protector and adaptation gene. Currently, spirulina produces and consumes in more than 60 countries [10-15].

Based on the monitoring of the chemical composition, properties, physico-chemical and organoleptic characteristics of jost and spirulina, we made a decision to develop jelly technologies based on this material.

Manufacturers offer Spirulina microalgae supplements with various types of processing: dry biomass of spirulina, spirulina powder, spirulina paste and so on. The microalgae biomass drying is performed at a temperature of 22 – 24 °C. A dry Spirulina biomass is a particulate additive mixed with slices in size. Spirulina powder

der - dried and crushed into powder microalgae biomass. The analysis of technological, structural and mechanical properties of various refined products of Spirulina allowed to choose a Spirulina powder (producer – company "Spirulina LTD", Ukraine) as an additive for a jelly technology development. There have been developed the jost jelly samples with different content of spirulina powder supplements – namely, 5, 10 and 15 % by weight of the product.

When the new dishes are developing, some ingredients are replaced by other. That's why it definitely affect on the technological and consumer properties of the newly created product, on its nutritional value. Therefore, the first step in the development of the new jost and spirulina jelly technology are theoretical justification and planning the compositions of ingredients, methods of processing raw materials, modes of cooking, taking into account the processes that form the desired structure with a given composition of the final product, physical, chemical and technological properties.

For the whole quality control of the new product, a complex of its properties was studied: organoleptic, chemical, physical, and others. Structural and mechanical properties of the jelly mass are qualitatively outer expression of the inner essence of objects that define the state of aggregation, dispersion, structure and species interactions in the middle of the product. There were also studied some changes of its structural and mechanical properties provided to replace gelatin to spirulina.

It shown (Fig. 1) that the density of the samples with the spirulina addition slightly decreases compared to the control sample. Since density is associated with structural jelly strength, the spirulina additives adding will affect the rheological properties of jost and spirulina jelly.

The particular importance for the development of gelatinous foods technology is studying the effect of additives on the sliding properties of the finished dishes.

The dependence of limiting voltage of the jost jelly offset on the spirulina mass fraction is shown in Fig. 2. Since the structure-gelatin is completely excluded by the chemical composition of spirulina and jost, the value of the limiting voltage of samples offset was slightly decreased. The most important indicator near the limiting voltage offset to the control sample indicator is a sample of jost jelly with 15 % content of spirulina and which is close to the reference value. Thus, the growth rate of the dessert limiting voltage offset with increasing mass fraction of spirulina (15 %), characterizes strengthening structure of jelly as appropriate. The structure strength increase is a favorable factor in the stages of solidification, forming, storage and implementation of the gelatinous foods.

The data about density and structural strength of product are correlating with the jelly turnover before freezing (Fig. 3). It is proved that the presence of used feedstock hydrocolloids provides a structure-satisfactory performance.

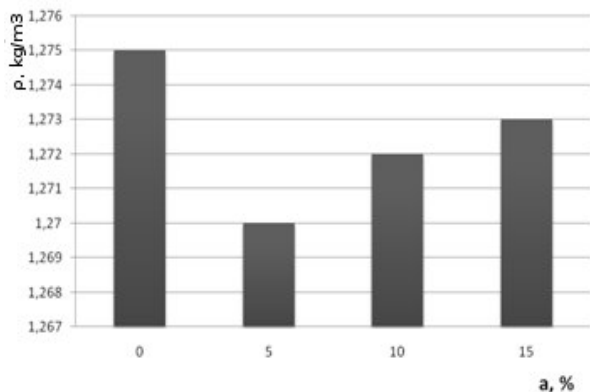


Fig. 1. Dependence of the jost jelly density ρ , kg/m³ on the spirulina contents and supplement %

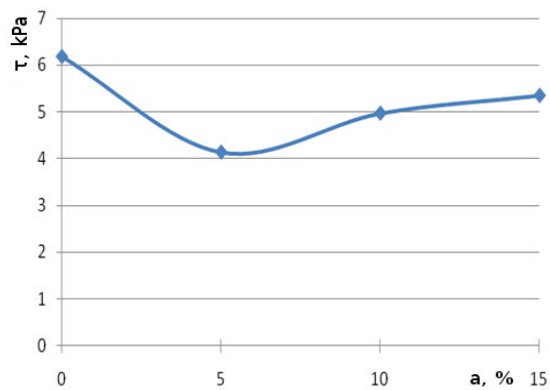
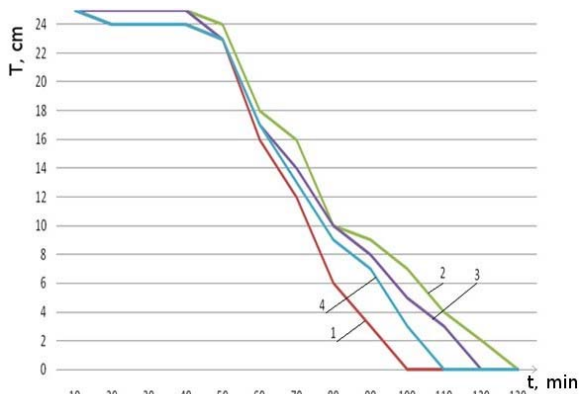


Fig. 2. The dependence of limiting voltage of the jost jelly offset τ , kPa on the spirulina mass fraction a, %



1 – control; 2 – 5 % of adding; 3 – 10 % of adding; 4 – 15 % of adding.

Fig. 3. The dependence of the jost jelly turnover T, sm on the content of spirulina adding

The use of spirulina in recommended quantities for the jost jelly production does not worsen its organoleptic characteristics. Evaluation of structural and mechanical properties of jost jelly with the addition of spirulina in the context of positioning the possibility of obtaining stable gelatinous system showed that the proposed formula and technology gives a product with high technological properties.

Under the regime of the process and manufacturing the developed jost and spirulina jelly technology gets high nutritional value. Also, it is the best structural and mechanical, physical and chemical properties with attractive consumer properties.

Under the regime of the process and manufacturing the developed jost and spirulina jelly technology gets high nutritional value. Also, it is the best structural and mechanical, physical and chemical properties with attractive consumer properties.

Conclusions

Thus, we developed the jost and spirulina jelly technology with high nutritional value. It is proved that the product is a source of biologically active substances. These substances are radio blockers and deodorants, that can be used for preventive nutrition of the workers employed in jobs with difficult and hazardous conditions. The developed jost and spirulina jelly technology can be recommended for implementation in the production of such restaurant industry institutions as canteens at the industrial enterprises.

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СЛАДКИЕ БЛЮДА С ПОВЫШЕННОЙ ПИЩЕВОЙ ЦЕННОСТЬЮ В ПИТАНИИ РАБОЧИХ НА ПРОМЫШЛЕННЫХ ПРЕДПРИЯТИЯХ

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Аннотация В статье рассмотрены вопросы разработки сладких блюд с повышенной пищевой ценностью. Оценка органолептических и физико-химических свойств модельных образцов желе с йогуртом и спирулиной показали, что предложенная рецептура и технология обеспечивает получение продукта с высокими потребительскими свойствами. Теоретически обоснована целесообразность внедрения желе с йогуртом и спирулиной в производство таких предприятий ресторанной отрасли, как столовые при промышленных предприятиях. Благодаря использованию добавки спирулины можно расширить ассортимент блюд лечебно-профилактического питания.

Ключевые слова: желе, йогурт, спирулина, лечебно-профилактическое питание, радиопротектор, структурно-механические свойства, рацион питания.

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