



The scientific heritage

Nº 55
Vol 1



2020



VOL 1, No 55 (55) (2020)

The scientific heritage

(Budapest, Hungary)

The journal is registered and published in Hungary.

The journal publishes scientific studies, reports and reports about achievements in different scientific fields.

Journal is published in English, Hungarian, Polish, Russian, Ukrainian, German and French.

Articles are accepted each month.

Frequency: 24 issues per year.

Format - A4

ISSN 9215 — 0365

All articles are reviewed

Free access to the electronic version of journal

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FUNCTIONAL PASTY CHEESE PRODUCTS WITH FILLERS

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Abstract

The results of research allow us to conclude about the possibility and feasibility of using sea kale (*laminaria*) to create a new curd mass with harmonious taste and flavor using mathematical programming, as well as conducting their own experimental research allow us to draw the following conclusions and make specific suggestions both for producers and consumers of this product

The optimal concentration of the main components was established. The cottage cheese with a fat mass fraction of 5%, sea kale, table salt and gelatin stabilizer. The recipe of the curd mass has the following composition, i.e. 5%–93% of cottage cheese, 5% of sea kale, 1.5% of table salt, and 0.5% of gelatin.

The organoleptic characteristics of cheese products with sea kale have not significantly changed. The taste of the test samples was slightly salty with a pleasant taste of sea kale. The consistency of the test samples was homogeneous and gentle.

Keywords: cottage cheese, curd mass, fillers, starter, quality, sea kale.

The main task of the state is to ensure the highest standard of living. To fulfill this task, it is important to provide the population with high quality food. It is possible to satisfy the population's need for milk and dairy products by transferring the dairy industry to new management methods. The dairy industry is one of the main sectors of the economy providing the population with milk and dairy products. They are one of the main foods and their role in human nutrition is growing.

The health of the population and so-called diseases of civilization is largely determined by the state of the normal microflora of the human body. That is why a new direction of medicine and food biotechnology became widespread in the developed countries in the 1990s. We mean industrial production and mass use of food products aimed at correcting the normal microflora of the digestive tract. So, we are talking about fermented milk products and their role in maintaining good health.

The problem of preserving and improving the health of the country's population is a priority of the state. Research of creating effective measures to increase the creative longevity of the population, preserve its health and prevent disease is relevant and has social, economic and political significance. The balanced diet is the most important factor for a large part of the elderly population. The importance of functional foods containing ingredients that increase the body's resistance to disease, allowing it to maintain an active lifestyle for a long time, is growing.

Functional foods are products intended for systematic consumption in the diets of all age groups of

the healthy population in order to reduce the risk of developing various diseases, maintaining and improving health [13].

These products effect is caused by physiologically functional ingredients in their composition; they can have a beneficial effect on metabolic and biochemical processes, psychosocial behavior, and the basic physiological functions of the body. The main components of functional products can be only physiologically active and safe substances, which properties have been scientifically proven; the norms of their daily use as a part of food rations are necessarily defined [17].

The problem of healthy eating has troubled mankind for many years. Fermented milk products are natural dairy and protein products, they are one of the most valuable dairy products and food in general.

They contain the same amino acids as milk. Fermented milk products have a much higher content of minerals and less lactose.

The high content of calcium allows to recommend fermented milk products for the treatment and prevention of various inflammatory processes.

These products have long been recognized as dietary due to high digestibility and stimulation of the secretory function of the stomach and pancreas.

Lots of enterprises are successfully introducing new technologies that can speed up the production of the finished product in addition to the production of fermented milk products. Progressive recipes and technological solutions enable the dairy industry to withstand a difficult period when energy prices are rising.

Fermented milk products are more valuable than milk. Dietary and medicinal properties of these products are due to the beneficial effects on the human body,

microorganisms and substances formed as a result of biochemical processes occurring during fermentation of milk [1].

Regular consumption of these products strengthens the nervous system because they accumulate the necessary human vitamins synthesized by lactic acid bacteria [2].

The healing properties of fermented milk products are based on the bactericidal properties of lactic acid bacteria and yeast against pathogens of some gastrointestinal diseases, tuberculosis and other diseases [3].

Fermented milk products are widely used in the treatment of various disorders of the digestive system and lung diseases, metabolic disorders, and atherosclerosis [12].

Nowadays the newest technologies directed on improvement and updating of a compounding of sour-milk products, increase of their dietary and medical properties, development of products with new functional properties are introduced in Ukraine.

Unfortunately, the current state of the Ukrainian economy and the decline of agriculture do not allow to use the potential of the dairy industry fully. Lots of companies are on the verge of bankruptcy, they need serious financial investment to revive the dairy industry. However, the catastrophic situation in agriculture has caused been the root cause of everything. The revival of the dairy cattle herd is a priority that should be addressed by the state leadership [19].

Dairy and plant systems comply with the formula of a balanced diet and increase the body's protective function.

Curd mass is a milk product made from cottage cheese with or without the addition of butter or cream, evaporated milk with sugar, salt and non-dairy components, which are not introduced to replace the components of milk. It is not allowed to add consistency stabilizers [7].

It contains the same amino acids as milk. However, its content is in 6-7 times higher than in milk [10, 17].

The development of technology has allowed manufacturers to control the manufacturing process better. It also contributed to the standardization of curd masses prepared by modern production methods

Curd mass is a product of universal application, because it is highly digestible. Its main feature is its high protein content. According to the modern classification, the curd mass is divided into types depending on the mass fraction of fat, i.e. fat, semi-fat and low-fat.

Essential amino acids are part of curd proteins. Methionine and choline are of particular importance, they are recommended for treatment of the cardiovascular system, liver and lungs diseases. The fat is absorbed by the body by 90... 95%. Milk fat is the best for human nutrition because it contains a number of essential fatty acids needed by the human body. In addition, there are substances in the shells of fat globules that have properties increasing the nutritional value of curd mass [6].

The minerals are necessary for the formation of bone tissue and metabolism. Calcium and phosphorus

play a special role. Calcium promotes the normal functioning of the heart muscle and central nervous system, and the excretion of fluid from the body. Phosphorus plays an important role in the functions of the central and peripheral nervous system, metabolism of fats, proteins and carbohydrates. The cheese also contains other mineral elements, including magnesium and iron. Magnesium is involved in mineral metabolism and growth processes. Iron, being a component of hemoglobin, plays a role in circulatory functions [4].

Curd masses have a high caloric content and physiological value. Curd masses are convenient for a number of diets of medical nutrition due to their delicate consistency taking into account the mass fraction of fat, sugar and salt [5].

Cheese masses are applied for human nutrition, sale and use in the restaurant industry and in the food industry. They are consumed without restrictions in accordance with the relevant recommendations (for fortified species) on the daily rate of the product application, it is calculated on the dose of additional enrichment of components and components providing added value if the product is made using them [8].

Recommendations for the fortified kinds application in the daily diet are agreed with the health authorities in the label on the finished product of a particular manufacturer. In world practice, it is used directly in food without additional cooking, and as part of many recipes [18].

Curd masses must meet the requirements. They are produced according to recipes and technological instructions in accordance with the state sanitary rules for dairy enterprises [11, 9].

The assortment policy of the food industry in general and the dairy industry in particular has changed with the country's entry into a new level of market relations.

Stricter consumer requirements for the taste of dairy products with a limited raw material base and reduced quality of raw materials encourage scientists to create a new direction in the dairy industry, i.e. the development of combined foods based on dairy products.

The addition of various vegetable domestic fillers enriching the product with biologically active substances, has recently become widely used in order to solve this goal.

Modern recommendations for the food products creation for herodietic purposes are analyzed. It is proposed to use sesame seeds to enrich the curd mass with protein, calcium and polyunsaturated fatty acids. It is established that the biological value of the protein of the enriched product increases due to the combination of raw materials of animal and vegetable origin, it has a balanced amino acid composition. Physicochemical and organoleptic parameters of curd mass with sesame were determined. The optimal shelf life of the new product is set [16].

Thus, the curd mass manufactured using vegetable raw materials combines traditional consumer properties with the technological capabilities of functional and technological ingredients of plant origin. Such technological steps are aimed at expanding the raw material base of the milk processing complex and solving the

problem of reducing the deficiency of essential nutrients in the diets of the population. It is impossible to solve this problem without a comprehensive scientific approach [15].

The fermented milk products are useful and in great demand among the population. That's why the chosen topic is relevant.

The aim of the work was to develop the technology of curd mass from low-fat cottage cheese using sea kale in order to expand the range of curd products and increase the nutritional value.

The object of research is the technology of curd mass with biologically active substances of sea kale [14].

To obtain the curd mass we used such products as

cottage cheese 5% SSU 4554:2006; starter FD-DVS CHN-11 (for direct introduction into the tank) of the company Chr. Hansen (Miltex) is a starter culture consisting of lactococci and leukostocks, some of which emit gas and flavor, mainly used in the production of fermented milk products; dry sea kale (laminaria) TM Vprok; gelatin as a stabilizer GOST 11293-89; table salt DSTU 3583:2015.

Analysis of raw materials, semi-finished products and finished products was performed using organoleptic, physical, chemical and microbiological research methods.

The block diagram of the general research concept and its basic stages is given in Figure 1.

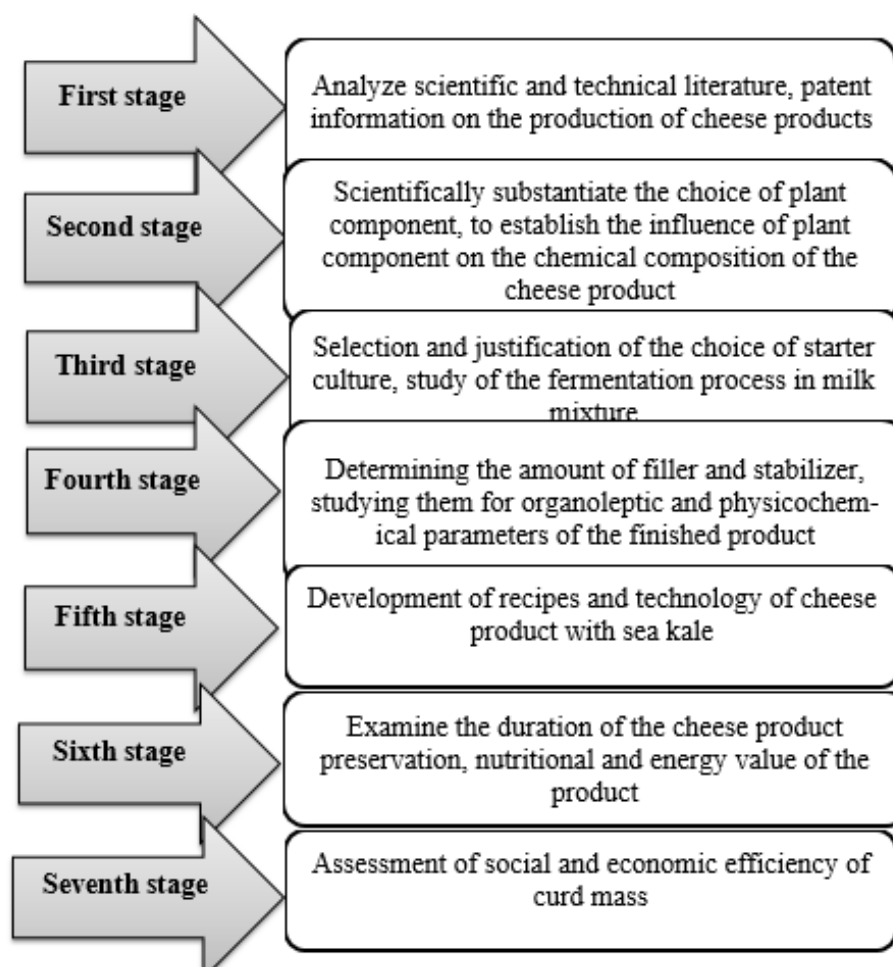


Fig. 1. Structural scheme of research

Curd masses have a high caloric content and physiological value. Multicomponent products from raw materials of animal and vegetable origin meet the requirements of adequate nutrition to the greatest extent. The use of plant raw materials allows to enrich them

with functional ingredients, increase their digestibility, and to obtain products meeting physiological standards. Organoleptic characteristics of cheese products in accordance with State Standard of Ukraine are given in table 1.

Table 1

Organoleptic characteristics of cheese products in accordance with 4503:2005 State Standard of Ukraine

Indicator	Characteristic
Consistence	The curd mass is homogeneous, tender, and moderately dense. The presence of particles of fillers, soft cheese crumbs, and light flour is allowed.
Taste and flavor	Taste of sour flavor, salt. The appropriate filler tastes.
Color	White, white with a cream tint or the color of the injected filler
Form	Packed cheese products of various shapes

Cheese products must meet the standards for physicochemical parameters specified in table 2.

Table 2

Physicochemical and microbiological parameters of curd mass

Indicator	Norm	Control methods
Mass fraction of fat, %, not more than	26	according to GOST 5867
Mass fraction of moisture, %, not more than	78	according to GOST 3626
Mass fraction of sucrose, %, not less than	5	according to GOST 3628
Mass fraction of table salt, %, not more than	1.5	according to GOST 3627
Titrated acidity, °T, within	from 150 to 230	according to GOST 3624
Phosphatase	absent	according to GOST 3623
Temperature of output, °C, not more than	6	according to GOST 3622

Cottage cheese was chosen as the main raw material. Cheese is one of the oldest sour milk products, it is very useful for our body. It contains all essential amino acids; it is better digested than meat (unless you are intolerant to dairy products).

Cottage cheese is a source of calcium, potassium and phosphorus. It contains magnesium, sodium, iron, vitamins C, PP, β -carotene, B₁, B₂, B₆, B₁₂, twenty different amino acids, and protein.

Cheese is so-called building material needed for the growth and strengthening of bone tissue, and necessary for the growth of the body. Cottage cheese is an indispensable product of a complete diet for everyone.

Cottage cheese has a high content of methionine, it is recommended for the prevention of liver disease

and atherosclerosis (methionine normalizes fat metabolism and cholesterol metabolism, their disorders are the cause of atherosclerosis and liver disease).

Cottage cheese products and their various products should be included in the daily diet of a person, in particular children of preschool and school age, who have a particularly high need for calcium due to their growth.

Sea kale was chosen as a filler. Sea kale is called green-brown seaweed (*laminaria*) used in food. Sea kale is an excellent preventative containing a significant number of vitamins, trace elements and amino acids, it is also an excellent tool for cleansing the body of toxins. The chemical composition of sea kale is given in table. 3.

Table 3

Chemical composition of sea kale

Indicator	Value
Organic substances, %	50–79
Proteins, %	20
Ether-soluble substances, %	3.8
Cellulose, %	14
Other nitrogen-free non-lipid substances, %	32.6
Trace elements, mg /100 g:	
Ca	1,200
Mg	79
K	620
Na	2,400
Trace elements, mg /100 g:	
Fe	50
I	200
Al	197
Co	2.5

Laminaria helps to improve digestion and metabolism, strengthen the immune system, normalize thyroid function (includes a large amount of easily digestible iodine, which helps to normalize thyroid function), central nervous system and cardiovascular system, removes toxins and radionuclides. The antisclerotic effect of algae is explained by the high content of iodine, and the presence of beta-sitosterol helping to dissolve cholesterol deposits on the walls of blood vessels. Sea kale has anticoagulant properties, i.e. prevents increased blood clotting. Hormone-like substances with antisclerotic action have also been found in algae.

The cheese product will increase the amount of protein, minerals, and vitamins due to the enrichment of cottage cheese with sea kale. The cheese mass is enriched with vegetable fats (polyunsaturated fatty acids,

i.e. oleic, linoleic and linolenic acids), it removes cholesterol from the body.

As a result, we get a cheese product (cheese mass) with richer chemical composition, and the finished product can be used to prevent iodine deficiency.

The recipes were compiled on the basis of traditional recipes for cheese production with the addition of vegetable raw materials for further research.

Cottage cheese with 5% fat mass fraction was made by rennet method, it was based on starter containing a mixture of multiple strains of *Lactococcus lactis subsp. cremoris*, *Lactococcus lactis subsp. lactis*, *Leuconostoc mesenteroides subsp. cremoris* i *Lactococcus lactis subsp. Diacetylactis*. Culture produces flavor and CO₂.

The biochemical growth zone of mesophilic microorganisms as a part of the starter is in the temperature range of 20–45 °C. Starter manufacturers FD-DVS CHN-11 specified a temperature of 30 °C for the optimal fermentation regime.

The vegetable component (sea kale in dry form) is prepared for further research. The dried sea kale is thoroughly washed with water. Then it is filled with water at a temperature of 90–100°C, sea kale is kept at this temperature for 30–40 minutes, while the sea kale swells, it becomes softer. Then it is cooled to a temperature of 30–35°C and crushed to a particle size of 2–3 mm.

Preparation of the stabilizer: dissolve 12.5 g of gelatin in 0.5 liters of boiled and cooled water and leave for 40–60 minutes to swell.

Different ratios of the milk base to the plant component were investigated during the selection of the composition of the cheese product with sea kale.

Sample 1: the ratio of cottage cheese, seaweed, salt and stabilizer is 83.9:15:1.0:0.1.

Sample 2: the ratio of cottage cheese, seaweed, salt and stabilizer is 88.2:10:1.5:0.3.

Sample 3: the ratio of cottage cheese, seaweed, salt and stabilizer is 93:5:1.5:0.5.

The developed recipes of cheese products are given per 1,000 kg of finished product (excluding production costs).

The table 4 shows three variants of the proposed recipes for salty curd mass using sea kale.

Table 4

Рецептури солоних сиркових мас із додаванням морської капусти				
No.	Ingredients	Recipes		
		1	2	3
1	Cottage cheese, 5%	839.0	882.0	930.0
2	Sea kale	150.0	100.0	50.0
3	Table salt	10.0	15.0	15.0
4	Stabilizer (gelatin)	1.0	3.0	5.0
	Total	1,000	1,000	1,000

The concentrations of prescription components for curd mass with the addition of sea kale, salt and stabilizer were established

The concentrations of prescription components for curd mass with the addition of seaweed, salt and stabilizer were established as a result of the presented calculations on the mathematical model of optimization of

the product.

A profile method was used to assess the organoleptic quality indicators of new plant and curd masses.

Profilograms of form, consistency, smell and taste were developed (Fig. 2.).



Fig. 2. Profilogram of cheese mass by the filler content of the experimental samples

Another important group of indicators for the characterization of curd masses are their physicochemical parameters.

The physicochemical parameters were selected to study the quality of vegetable and curd masses. They are titrated acidity, moisture content and mass fraction of table salt.

The mass fraction of moisture in curd masses with vegetable filler should not exceed 78.0%, according to the requirements of SSU 4503:2005.

The results of determining the moisture mass fraction in the experimental samples are presented in Fig. 3.

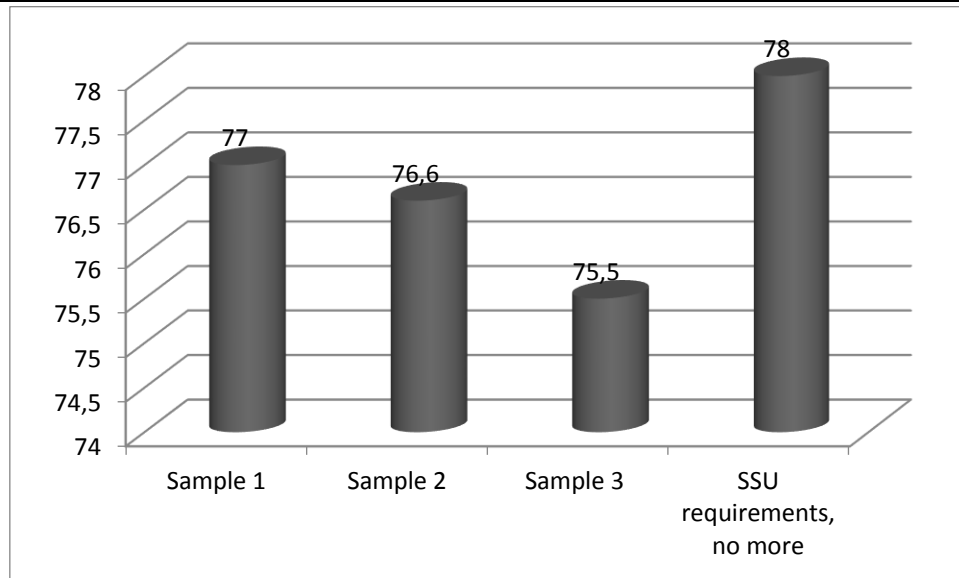


Fig. 3. Moisture mass fraction, % in curd masses with vegetable filler

The mass fraction of salt should not exceed 1.5 % shown in Figure 4. in accordance with current regulations, the results are

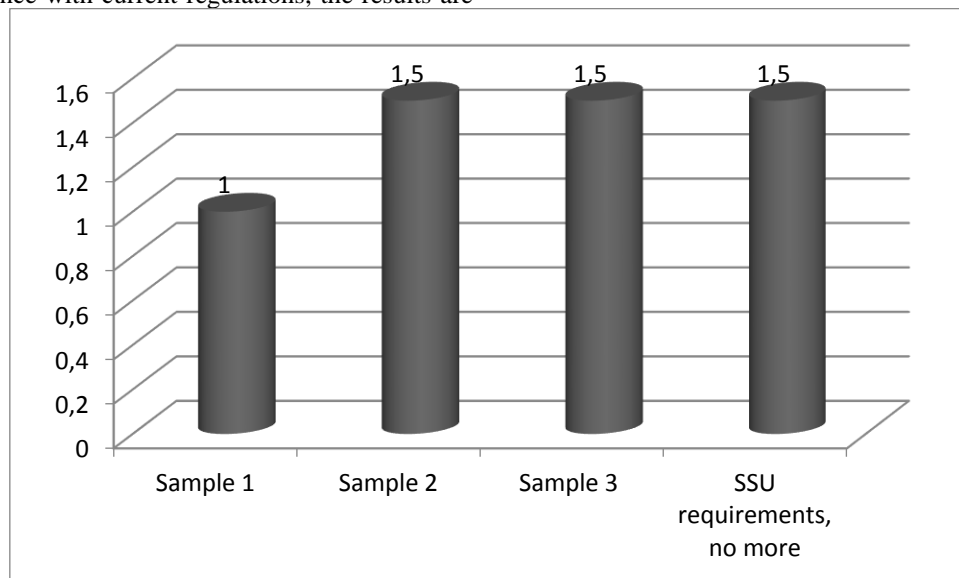


Fig. 4. Salt mass fraction of, % in curd masses with vegetable filler

The titratable acidity ranges from 140°T to 220°T. Acidity is one of the main indicators fermented milk products of quality. Developed prototypes are within acceptable limits (Fig. 5).

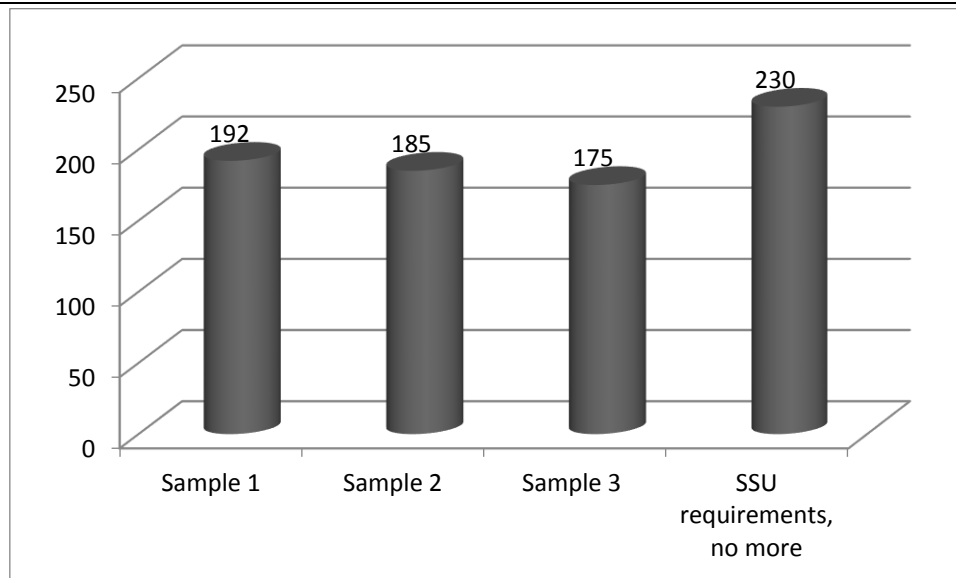


Fig. 5. Titrated acidity, °T curd masses with vegetable filler

Thus, the titrated acidity of the experimental samples of salted curd masses was 175-1,912⁰T, the moisture mass fraction is 75-77%. It should be noted that the addition of sea kale does not significantly affect the physicochemical characteristics of the experimental samples without taking them beyond the normative values.

The best indicators according to organoleptic and physicochemical evaluation were curd mass with sea kale (*laminaria*) content of 5%.

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ПЕРСПЕКТИВЫ ИСПОЛЬЗОВАНИЯ ПОРОШКОВ ФРУКТОВ И ОВОЩЕЙ В ОБЩЕСТВЕННОМ ПИТАНИИ

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PROSPECTS FOR USING FRUIT AND VEGETABLE POWDERS IN PUBLIC FOOD

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Аннотация

Основным способом продления сроков использования фруктового и овощного сырья считается низкотемпературная сушка, отличающаяся высоким качеством продукции, низким энергопотреблением производства и доступной стоимостью готовой продукции. Более полно таким требованиям отвечает двухступенчатая сушка, первой ступенью которой является конвективная сушка и второй ступенью - конвективная вакуумная сушка. В статье обоснованы перспективы использования порошков фруктов и ягод в общественном питании, с использованием электрофизического воздействия, существенно снижающих потери ценных компонентов исходного сырья. Авторы предложили комбинацию обычных конвективных процессов обезвоживания с вакуумной СВЧ-обработкой, с целью достижения высоких качественных показателей сушеной продукции.

Abstract

The main way to extend the use of fruit and vegetable raw materials is considered low-temperature drying, characterized by high quality products, low energy consumption of production and affordable cost of finished products. More fully, these requirements are met by two-stage drying, the first stage of which is convective drying and the second stage-convective vacuum drying. The article substantiates the prospects for the use of fruit and berry powders in public nutrition, using electrophysical effects that significantly reduce the loss of valuable raw material components. The authors proposed a combination of conventional convective dewatering processes with vacuum microwave processing, in order to achieve high quality indicators of dried products.

Ключевые слова: фруктовое и овощное сырье, низкотемпературная сушка, общественное питание.

Keywords: fruit and vegetable raw materials, low-temperature drying, public catering.

Введение

Проблема повышения качества пищевых продуктов для населения нашей страны имеет актуальное значение, что неоднократно отмечали на различных симпозиумах и конференциях по проблемам производства высококачественных пищевых продуктов. Переход страны на потребление импортных генномодифицированных продуктов и использование синтетических средств в обогащении пищевых продуктов сказался на общем здоровье граждан России. По данным Минздрава, гражданин России должен потреблять примерно 140 кг овощей и бахчевых, а также 100 кг фруктов, а потребляет

почти в два раза меньше. Нехватка витаминов и минеральных веществ ставит серьезную угрозу иммунитету будущих поколений. Ухудшение среды обитания человека в связи с загрязнением нижних слоев атмосферы сбросными газами и загрязнением гидросферы, утилизируемыми в водоемы отбросами различного производства, обуславливает необходимость потребления физиологически активных веществ фруктов и овощей, обладающих антиоксидантными и иммуномодулирующими свойствами.

Эффективным решением данной проблемы является применение высококачественных порошков,

VOL 1, No 55 (55) (2020)

The scientific heritage

(Budapest, Hungary)

The journal is registered and published in Hungary.

The journal publishes scientific studies, reports and reports about achievements in different scientific fields.

Journal is published in English, Hungarian, Polish, Russian, Ukrainian, German and French.

Articles are accepted each month.

Frequency: 24 issues per year.

Format - A4

ISSN 9215 — 0365

All articles are reviewed

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