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Қ. И. Сәтпаев атындағы Қазақ ұлттық техникалық зерттеу университеті

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ГЕОЛОГИЯ ЖӘНЕ ТЕХНИКАЛЫҚ ҒЫЛЫМДАР СЕРИЯСЫ



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NAS RK is pleased to announce that News of NAS RK. Series of geology and technical sciences scientific journal has been accepted for indexing in the Emerging Sources Citation Index, a new edition of Web of Science. Content in this index is under consideration by Clarivate Analytics to be accepted in the Science Citation Index Expanded, the Social Sciences Citation Index, and the Arts & Humanities Citation Index. The quality and depth of content Web of Science offers to researchers, authors, publishers, and institutions sets it apart from other research databases. The inclusion of News of NAS RK. Series of geology and technical sciences in the Emerging Sources Citation Index demonstrates our dedication to providing the most relevant and influential content of geology and engineering sciences to our community.

Қазақстан Республикасы Ұлттық ғылым академиясы "ҚР ҰҒА Хабарлары. Геология және техникалық ғылымдар сериясы" ғылыми журналының Web of Science-тің жаңаланған нұсқасы Emerging Sources Citation Index-те индекстелуге қабылданғанын хабарлайды. Бұл индекстелу барысында Clarivate Analytics компаниясы журналды одан әрі the Science Citation Index Expanded, the Social Sciences Citation Index және the Arts & Humanities Citation Index-ке қабылдау мәселесін қарастыруда. Web of Science зерттеушілер, авторлар, баспашылар мен мекемелерге контент тереңдігі мен сапасын ұсынады. ҚР ҰҒА Хабарлары. Геология және техникалық ғылымдар сериясы Emerging Sources Citation Index-ке енуі біздің қоғамдастық үшін ең өзекті және беделді геология және техникалық ғылымдар бойынша контентке адалдығымызды білдіреді.

НАН РК сообщает, что научный журнал «Известия НАН РК. Серия геологии и технических наук» был принят для индексирования в Emerging Sources Citation Index, обновленной версии Web of Science. Содержание в этом индексировании находится в стадии рассмотрения компанией Clarivate Analytics для дальнейшего принятия журнала в the Science Citation Index Expanded, the Social Sciences Citation Index и the Arts & Humanities Citation Index. Web of Science предлагает качество и глубину контента для исследователей, авторов, издателей и учреждений. Включение Известия НАН РК. Серия геологии и технических наук в Emerging Sources Citation Index демонстрирует нашу приверженность к наиболее актуальному и влиятельному контенту по геологии и техническим наукам для нашего сообщества.

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**S. N. Turovskaya¹, A. G. Galstyan², I. A. Radaeva¹, A. N. Petrov³,
E. E. Illarionova¹, A. E. Ryabova², E. K. Assembayeva⁴, D. E. Nurmukhanbetova⁴**

¹All-Russian Research Institute of Dairy Industry, Moscow, Russia,

²All-Russian Scientific Research Institute of Brewing, Non-Alcoholic and Wine Industry –
branch of the Gorbатов's Federal Scientific Center of Food Systems of RAS, Moscow, Russia,

³All-Russian Scientific Research Institute of Preservation Technology – branch of the Gorbатов's
Federal Scientific Center of Food Systems of RAS, Vidnoye, Russia,

⁴Almaty Technological University, Almaty, Kazakhstan.

E-mail: conservlab@mail.ru, 9795029@mail.ru, conservlab@mail.ru, vniitek@vniitek.ru,
conservlab@mail.ru, anryz@hotmail.com, elmiraasembaeva@mail.ru, dinar2080@mail.ru

SCIENTIFIC AND PRACTICAL POTENTIAL OF DAIRY PRODUCTS FOR SPECIAL PURPOSES

Abstract. For many years, the All-Russian Research Institute of Dairy Industry (VNIMI) has been developing technologies for special purpose dairy products, including for on-board rations of crews of spacecraft and orbital stations. The work was carried out in complex with the Institute of Biomedical Problems, the Scientific Research Institute of the Food Concentrate Industry and Special Food Technology and a number of other industry and medical institutions. At VNIMI was created the special products shop, the scientific and production base of which allowed not only to provide research with experimental workings, but also to produce products in the required assortment and quantities. Development of technologies for astronauts products is continuing and at the present time, medical and biological requirements are being adjusted, modern technological representations are being expanded to find an applied solution, aimed at improving the quality while reducing processing intensity, introducing new packaging materials and so on.

Special requirements are imposed on the products: they must be tasty, highly nutritious, well balanced in macro- and micro-nutrient composition, have certain preventive properties, be simple in preparation and use, have increased storage stability, etc. This group of products is rightfully considered the most knowledge-intensive in terms of technological innovations and solutions.

Special purpose products on a dairy basis can in principle be divided into two main groups: sterilized (abiosis) and freeze-dried (xeranoabiosis). To date, dozens of technologies have been created in both groups – milk, dairy drinks, soups, cereals, dairy products, cottage cheese and others. The products were tested for the duration of storage and included in the diets of astronauts. Part of the products was approved in the works of orbital stations and spacecraft, including international ones. Qualitative indicators of dairy products are highly appreciated not only by Russian, but also by foreign cosmonauts.

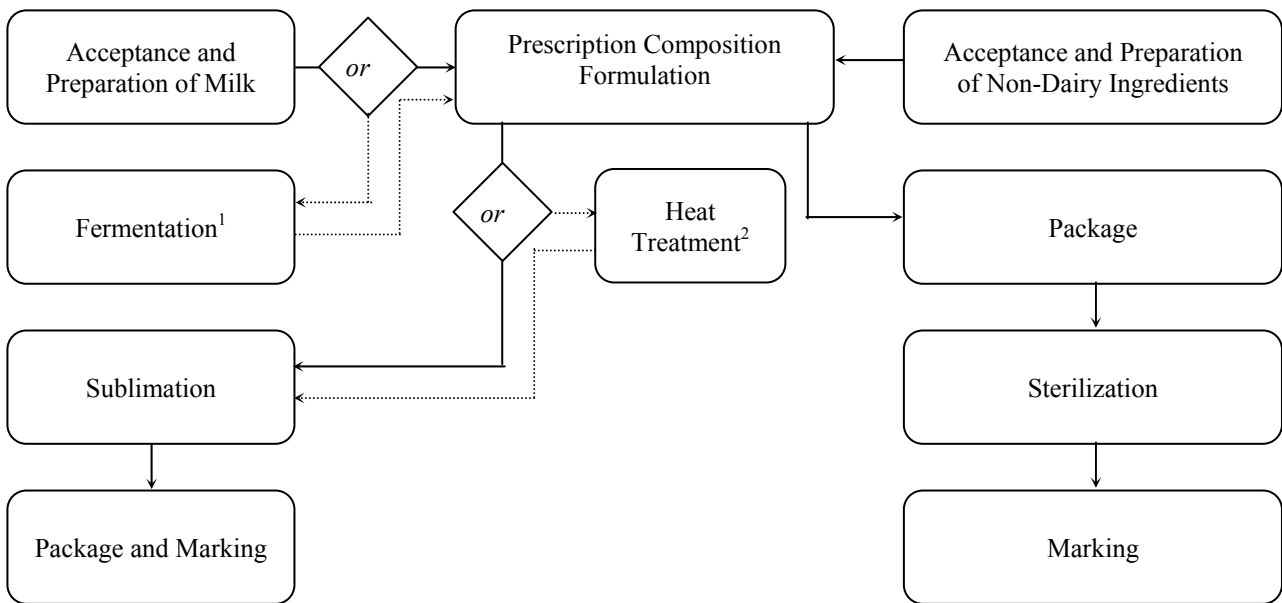
Keywords: space, nutrition, dairy products, technology, sublimation, sterilization.

With the beginning of the era of space exploration and organization of human flights into space, there was a need to provide cosmonauts with food. The everyday process of eating food in the conditions of space acquires many nuances of "everyday", medical-biological, technological and other formats [1, 2].

The peculiarities of labor and life of cosmonauts in flight, associated with the stressful effects on the body of conditions of non-trivial situation, such as speed of movement, weightlessness, emotional and mental stress, limited space of the ship's cabin and others, make special demands on the qualitative and quantitative composition of the diet, mass-volume characteristics of its constituent products and packaging [3-7].

The pioneers in the preparation and organization of food for astronauts were enthusiasts and coryphaeis in the field of food technology Frumkin M.L., Efimov V.P., Kudrova R.V. and others. They brought to the solution of this problem branch scientific research institutes, including the All-Union (now All-Russian) Research Institute of the Dairy Industry (VNIMI). In the late 60-ies in VNIMI under the guidance of Doctor of Technical Sciences, Professor Radaeva I.A. began to develop technology for special purpose products. Further research in this direction was done by Rossikhina G.A., Usacheva V.A., Dobriyan E.I., Volkova L.G., Guskova L.D., Filchakova S.A., Blinova T.E., Sokolova T.V. etc. The works were carried out in complex with the Institute of Medical and Biological Problems, the Scientific Research Institute of the Food-Concentrate Industry and Special Food Technology, and a number of other branches and medical institutes. At VNIMI the special products shop was created, the scientific and production base of which allowed not only to provide research with experimental workings, but also to produce products in the required assortment and quantities. Development of technology for astronauts products is continuing and at the present time, medical and biological requirements are being adjusted, the modern technological ideas aimed at improving the quality while reducing the processing intensity are being expanded and applied, and new packaging materials are being introduced [5-15].

Dairy products for special purposes can in principle be divided into two main groups: sterilized (abiosis) and freeze-dried (xeroboanobiosis) [16, 17]. The features and advantages of these preservation methods have long been known and widely used. They allow you to create products that retain their native properties for a long time and, at the same time, are easy to prepare and use. Principal schemes of technological processes are presented in figure.



Principal Schemes of Production of Freeze-Dried and Sterilized Special Purpose Products for Cosmonauts Nutrition (where: ¹ – for sour-milk and curd products; ² – for dairy drinks, porridges and soups; dotted line-possible technological solutions)

The group of sterilized dairy products includes: high-fat products (cream with coffee, cream with cocoa, kaimak) and high-protein products (cottage cheese with raisins, cottage cheese “Yablochko”, cottage cheese with lemon, cottage cheese with cumin, cottage cheese with dill). Sterilized dairy products have pasty, homogeneous consistency with taste and odor, characteristic of the introduced filler. Their physicochemical parameters are presented in table 1.

Sterilized dairy products are high-calorific easily digestible products, which have a high biological and energy value. These properties of products are due to their enrichment with high-grade milk proteins and the presence of fatty and fat-like substances. Due to the high content of milk fat, which is a mixture of lipids, creams can be referred to products, the need for which increases with nervous tension [18, 19].

Purposeful work on the creation of technologies for sterilized curd products and detailed studies of amino acid and fatty acid and mineral composition allow to classify them to a group of products with

Table 1 – Physico-Chemical Parameters of High-Fat and High-Protein Sterilized Dairy Products of Special Purpose

Product	Product Indicator					
	Moisture Mass Fraction, %	Fat Mass Fraction, %	Protein Mass Fraction, %	Carbohydrates Mass Fraction, %	Mineral Substances (Ash) Mass Fraction, %	Energy Value, kcal/100g
- Sterilized High-Fat Dairy Products						
Cream with Coffee	32.0	45.0	5.0	15.0	3.0	489
Cream with Cocoa	30.0				5.0	485
Kaimak	37.0	50.0		5.0	3.0	490
- Sterilized High-Protein Dairy Products						
Cottage Cheese with Raisins	56.0	15.0	12.0	15.0	2.0	243
Cottage Cheese "Yablochko"						
Cottage Cheese with Lemon	52.0	25.0	8.0	14.3	0.7	312
Cottage Cheese with Cumin	58.0		10.0	6.3		272
Cottage Cheese with Dill						

preventive orientation. It is known that cottage cheese contains easily digestible protein, and in combination with fillers and additives, which in turn are additional sources of protein, vitamins, minerals, is a product with preventive properties. Even early studies conducted in Institute of Biomedical Problems (IBMP), found that when a person stays for a long time in conditions of weightlessness, one of the problems is the washing out of the body of potassium, which is one of the necessary macroelements that take part in metabolic processes in muscle and nerve tissues. For partial solution of this problem, curd products enriched with this macroelement were created and intended for use in the period of stress and emotional stress.

The shelf-life of sterilized dairy products is at least 12 months with unregulated room conditions and at least 20 months at a temperature of 1 to 5 °C. They consume them without prior preparation.

Sublimated dairy products developed by the Institute (www.vnimi.org) can be divided into the following subgroups: freeze-dried milk; dairy freeze-dried drinks (milk with sea buckthorn oil, milk with tea, skimmed milk with tea, milk with coffee, milk with cocoa); fermented milk products of freeze drying (acidophilic paste, acidophilus paste of increased fat content, yoghurt, sweet yogurt, fruit yoghurt, clabber Mechnikovskaya, bifidin milky-apple); cottage cheese and curd pastes freeze-dried (cottage cheese "Special", fruit cottage cheese, curd pasta with dried apricots, cottage cheese pasta with cranberry, cottage cheese pasta with black currant, cottage cheese pasta with nuts); porridge dairy freeze drying (manna porridge, rice porridge); soup with vermicelli.

Sublimated dairy products are a powder consisting of particles of different shapes, scattered by light mechanical action. The taste and smell of products is determined by their appearance and introduced fillers.

Milk, milk porridge and milk soup with vermicelli freeze-dried were developed in order to expand the range of products of increased nutritional value and long shelf life, as well as meet the desire of cosmonauts to have hot dairy products in the diet. Dried freeze-dried drinks can compensate for the deficit of potassium and other macro-elements, as well as vitamin C, which occurs in cosmonauts. The physico-chemical parameters of these products are presented in table 2.

Sour-milk products of freeze-drying due to their ability to normalize the microflora in the human gastrointestinal tract are especially useful for prolonged feeding of cosmonauts with canned food. Physicochemical parameters of freeze-dried fermented milk products are presented in table 3.

Table 2 – Physicochemical Parameters of Freeze-Dried Milk, Dairy Drinks, Porreges and Special Purpose Soups

Product	Product Indicator					
	Moisture Mass Fraction, %	Fat Mass Fraction, %	Protein Mass Fraction, %	Carbohydrates Mass Fraction, %	Mineral Substances (Ash) Mass Fraction, %	Energy Value, kcal/100g
- Milk, Milk Porridges and Soup with Vermicelli of Freeze-Drying						
Milk	4.0	25.8	26.0	38.2	6.0	489
Manna Porridge		28.0	13.0	50.0	5.0	504
Rice Porridge		23.0	10.0	59.0	4.0	483
Soup with Vermicelli		20.0	17.0	53.0	6.0	460
- Milk Drinks						
Milk with Sea-Buckthorn Oil	4.0	25.0	22.0	43.0	6.0	485
Milk with Tea		18.0		55.8	4.2	457
Low-Fat Milk with Tea		---	25.0	66.0	5.0	364
Milk with Coffee		18.0	20.0	53.3	4.7	455
Milk with Cocoa		20.0	19.0	51.5	5.5	462

Table 3 – Physicochemical Parameters of Dairy Lactic Freeze-Dried Products

Product	Product Indicator					
	Moisture Mass Fraction, %	Fat Mass Fraction, %	Protein Mass Fraction, %	Carbohydrates Mass Fraction, %	Mineral Substances (Ash) Mass Fraction, %	Energy Value, kcal/100g
Acido-Filo Paste	4.0	12.5	15.0	66.5	2.0	438
Acido-Filo Paste of Increased Fat Content		19.0		60.2	1.8	472
Yogurt		36.0	16.0	39.0	5.0	544
Sweet Yoghurt		27.5		48.0	4.5	503
Fruit Yoghurt		26.0		49.6	4.4	496
Clabber Mechnikovs-kaya		40.0	18.0	33.0	5.0	564
Bifidin Milky-Apple		17.5	17.0	57.0	4.3	454

Cottage cheese and cottage pastes of freeze drying have a high biological value [20]. Milk components such as protein and calcium are present in it in much larger quantities than in milk, and therefore they can be considered as milk concentrates. One portion of reconstituted cottage cheese (100-150 g) allows you to meet half the daily requirement of the body in calcium, as well as in essential amino acids. The introduction of cottage products of herbal supplements into the formulation promoted an increase in nutritional value. The physicochemical parameters of the freeze-dried cottage products are given in table 4.

Table 4 – Physicochemical Parameters of Cottage Cheese and Cottage Pastes of Freeze-Drying

Product	Product Indicator					
	Moisture Mass Fraction, %	Fat Mass Fraction, %	Protein Mass Fraction, %	Carbohydrates Mass Fraction, %	Mineral Substances (Ash) Mass Fraction, %	Energy Value, kcal/100g
Cottage Cheese "Special"	4.0	30.0	50.0	12.5	3.5	520
Cottage Cheese Fruit		17.0	32.0	45.0	2.0	461
Cottage Cheese Paste with Dried Apricots		15.0	28.0	50.7	2.3	450
Cottage Cheese Paste with Cranberries						
Cottage Cheese Paste with Black Currant		25.0	39.0	2.0	501	
Cottage Cheese Paste with Nuts						

Shelf life of freeze-dried dairy products is at least 15 months at a temperature of $(25 \pm 1) ^\circ\text{C}$ and not less than 24 months at a temperature of 1 to 5 $^\circ\text{C}$. The sublimated dairy products are packaged in multi-layer polymeric materials under vacuum. In food they are used after dissolution in water.

The intellectual component of technologies and ways of obtaining products for astronauts are registered. The products were tested for the duration of storage and included in the diets of astronauts. Qualitative indicators of dairy products are highly appreciated not only by Russian, but also by foreign cosmonauts.

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**С. Н. Туровская¹, А. Г. Галстян², А. Н. Петров³, И. А. Радаева¹,
Е. Е. Илларионова¹, А. Е. Рябова², Э. К. Асембаева⁴, Д. Е. Нурмуханбетова⁴**

¹ФМБФМ «Бүкілресейлік сүт өнеркәсібі ғылыми-зерттеу институты», Мәскеу, Ресей,

²Бүкілресейлік сыра қайнату, алкогольсіз және шарап өнеркәсібі ғылыми-зерттеу институты – ФМБФМ филиалы В. М. Горбатов атындағы «Азық-түлік өнімдерінің федералдық ғылыми орталығы» РҒА, Мәскеу, Ресей,

³«Бүкілресейлік консервілеу технологиясы ғылыми-зерттеу институты» ФМБФМ В. М. Горбатов атындағы филиал ««Азық-түлік өнімдерінің федералдық ғылыми орталығы» РҒА, Видное, Ресей,

⁴ Алматы технологиялық университеті, Алматы, Қазақстан

АРНАЙЫ МАҚСАТТАРҒА АРНАЛҒАН СҮТ ӨНІМДЕРІНІҢ ҒЫЛЫМИ-ТӘЖІРИБЕЛІК ПОТЕНЦИАЛЫ

Аннотация. Көптеген жылдар бойы Бүкілресейлік сүт өндірісінің ғылыми-зерттеу институты (БСҰҒЗИ) арнайы мақсаттағы сүт өнімдерін өндірумен, соның ішінде орбиталық станциялардың және ғарыш кемесінің экипаждары үшін борттық ас-мәзірінің технологияларын әзірлеп келеді. Жұмыстар медициналық-биологиялық мәселелер институтымен, азық-түлік өндірісі концентратының және арнайы азық-түлік технологиясы ғылыми-зерттеу институтымен, сондай-ақ бірқатар басқа салалық және медициналық институттармен бірлесіп жүргізілді. БСҰҒЗИ-да арнайы өнімдер цехы құрылды, оның ғылыми-өндірістік базасы тек эксперименталдық зерттеулермен қамтамасыз етуге ғана емес, талап етілетін ассортиментте және мөлшерде өнімді шығаруға мүмкіндік берді. Ғарышкерлерге арналған өнімдердің технологияларын дамыту жалғасуда және қазіргі уақытта медициналық және биологиялық талаптар реттелуде, өңдеу сапасын жақсартуға, жаңа орам материалдарын енгізуге және тағы басқа сапаны жақсартуға бағытталған қолданбалы шешім табу үшін заманауи технологиялық-сыныстар кеңейтілуде.

Түйінді сөздер: ғарыш, тағам, сүт өнімдері, технологиялар, сублимация, стерилдеу.

С. Н. Туровская¹, А. Г. Галстян², А. Н. Петров³, И. А. Радаева¹,
Е. Е. Илларионова¹, А. Е. Рябова², Э. К. Асембаева⁴, Д. Е. Нурмуханбетова⁴

¹ФГБНУ «Всероссийский научно-исследовательский институт молочной промышленности», Москва, Россия,

²Всероссийский научно-исследовательский институт пивоваренной, безалкогольной и винодельческой промышленности – филиал ФГБНУ «ФНЦ пищевых систем им. В. М. Горбатова» РАН, Москва, Россия,

³Всероссийский научно-исследовательский институт технологии консервирования – филиал ФГБНУ «ФНЦ пищевых систем им. В. М. Горбатова» РАН, Видное, Россия,

⁴Алматинский технологический университет, Алматы, Казахстан

НАУЧНО-ПРАКТИЧЕСКИЙ ПОТЕНЦИАЛ МОЛОЧНЫХ ПРОДУКТОВ СПЕЦИАЛЬНОГО НАЗНАЧЕНИЯ

Аннотация. На протяжении многих лет ВНИИ молочной промышленности (ВНИМИ) занимается разработкой технологий молочных продуктов спецназначения, в том числе и для бортовых рационов экипажей космических кораблей и орбитальных станций. Работы проводились комплексно с Институтом медико-биологических проблем, Научно-исследовательским институтом пищевого концентрата промышленности и специальной пищевой технологии и целым рядом других отраслевых и медицинских институтов. При ВНИМИ был создан цех спецпродуктов, научно-производственная база которого позволяла не только обеспечивать исследования экспериментальными выработками, но и осуществлять выпуск продукции в необходимом ассортименте и количествах. Разработки технологий продуктов для космонавтов продолжаются и в настоящее время, корректируются медико-биологические требования, расширяются и находят прикладное решение современные представления технологического характера, направленные на повышение качества при одновременном снижении интенсивности обработки, внедряются новые упаковочные материалы и прочее.

К продуктам предъявляются особые требования: они должны быть вкусными, высокопитательными, хорошо сбалансированными по макро- и микронутрентному составу, обладать определенными профилактическими свойствами, быть несложными в приготовлении и употреблении, иметь повышенную хранимостойчивость и др. Эта группа продуктов по праву считается наиболее наукоемкой в части технологических новшеств и решений.

Продукты спецназначения на молочной основе принципиально можно разделить на две основные группы: стерилизованные (абиоз) и сублимированные (ксероанабиоз). На сегодняшний день созданы десятки технологий в обеих группах – это и молоко, молочные напитки, супы, каши, кисломолочные продукты, творог и прочее. Продукты прошли испытания на длительность хранения и включены в рационы питания космонавтов. Часть продуктов прошла апробацию в рамках работ орбитальных станций и космических кораблей, в том числе международных. Качественные показатели молочных продуктов высоко оценены не только российскими, но и зарубежными космонавтами.

Ключевые слова: космос, питание, молочные продукты, технологии, сублимация, стерилизация.

Information about authors:

Turovskaya Svetlana Nikolaevna – All-Russian Research Institute of Dairy Industry, Senior Researcher of the Laboratory of Dairy Preserved Foods; conservlab@mail.ru; <http://orcid.org/0000-0002-5875-9875>

Galstyan Aram Genrikhovich – All-Russian Scientific Research Institute of Brewing, Non-Alcoholic and Wine Industry – branch of the Gorbатов's Federal Scientific Center of Food Systems of RAS, Head of the Interbranch Scientific and Technical Center for Food Quality Monitoring, Doctor of Technical Science, Professor of RAS, Corresponding Member of RAS; 9795029@mail.ru; <http://orcid.org/0000-0002-0786-2055>

Petrov Andrey Nikolaevich – All-Russian Scientific Research Institute of Preservation Technology – branch of the Gorbатов's Federal Scientific Center of Food Systems of RAS, Director, Doctor of Technical Science, Academician of RAS; vniitek@vniitek.ru; <http://orcid.org/0000-0001-9879-482X>

Radaeva Iskra Alexandrovna – All-Russian Research Institute of Dairy Industry, Chief Researcher of the Laboratory of Dairy Preserved Foods, Doctor of Technical Science, Professor; conservlab@mail.ru; <http://orcid.org/0000-0002-1920-0577>

Illarionova Elena Evgenievna – All-Russian Research Institute of Dairy Industry, Preserved Milk Laboratory Researcher conservlab@mail.ru; <http://orcid.org/0000-0002-9399-0984>

Ryabova Anastasiya Evgenievna - All-Russian Scientific Research Institute of Brewing, Non-Alcoholic and Wine Industry – branch of the Gorbатов's Federal Scientific Center of Food Systems of RAS, Interbranch Scientific and Technical Center for Food Quality Monitoring Researcher; anryz@hotmail.com; <http://orcid.org/0000-0002-5712-2020>

Asembayeva Elmira Kuandykovna – PhD student at the Almaty Technological University; elmiraasembaeva@mail.ru

Nurmukhanbetova Dinara Erikovna – candidate of engineering sciences, acting associate professor, Almaty Technological University, Department of Food safety and quality; dinar2080@mail.ru; <https://orcid.org/0000-0002-8939-6325>

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