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НАЦИОНАЛЬНОЙ АКАДЕМИИ НАУК
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THE BULLETIN

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OF THE REPUBLIC OF KAZAKHSTAN

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NAS RK is pleased to announce that Bulletin of NAS RK 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 Bulletin of NAS RK in the Emerging Sources Citation Index demonstrates our dedication to providing the most relevant and influential multidiscipline content to our community.

Қазақстан Республикасы Ұлттық ғылым академиясы "ҚР ҰҒА Хабаршысы" 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 Хабаршысының Emerging Sources Citation Index-ке енуі біздің қоғамдастық үшін ең өзекті және беделді мультидисциплинарлы контентке адалдығымызды білдіреді.

НАН РК сообщает, что научный журнал «Вестник НАН РК» 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 Вестника НАН РК в Emerging Sources Citation Index демонстрирует нашу приверженность к наиболее актуальному и влиятельному мультидисциплинарному контенту для нашего сообщества.

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EVALUATION OF THE PERFORMANCE OF THE HACCP APPROVAL SYSTEM OF HACCP QUALITY ASSESSMENT

Abstract. In a market economy, the quality problem is an important factor in raising living standards, economic, social and environmental security, in particular, issues related to the analysis of the effectiveness of production processes and finished products are important. In this paper, approaches are described in the analysis of processes and products in a single production of fermented milk products based on camel milk after the introduction of the quality assurance system of HACCP. As a result, the indicators of the effectiveness of the production process of sour-milk products were determined, the collection and analysis of the data obtained as a result of the testing of the finished product was carried out. The advantages of using the process approach are shown. A relationship between the ongoing production process and the workforce was found. The developed evaluation methodology and performance criteria for the introduction and operation of a quality management system can be applied to improve the quality of finished products.

Key words: HACCP, performance evaluation, quality assessment systems, software.

Introduction. At present, much attention is paid to the quality and safety of the products. In the conditions of market relations only stable quality of the goods can attract the buyer and provide the enterprise with profit. An indisputable fact is that the consumer has the right to expect that the food they use is safe (harmless), suitable for eating and, importantly, they are the source of all the substances necessary for proper development [1, 2]. Diseases and disorders caused by food are at best unpleasant, at worst - deadly. Therefore, ensuring the safety and harmlessness of food is part of the policy, including in the field of protecting the population in the conditions of food crises [2-4, etc.].

Materials and methods of research. The indicators of the effectiveness of the process of production of sour-milk products were determined by assessing the compliance of the measured data, as a result of the process, to the process data that was planned to be received, including by selected indicators:

1. Implementation of the production plan for the development of finished products, the percentage of the fulfilled from the planned;

2. The quantity of finished products produced, the discrepancies in which were revealed before shipment to the consumer, the percentage of the output produced

3. The amount of non-conforming products received as a result of production, the inconsistencies in which were identified by the consumer, the percentage of the output produced

4. Return of the main raw materials to the supplier based on the results of the incoming inspection, the percentage of the analyzed main raw materials

5. The number of semi-finished products with inconsistencies in key technological processes, the percentage of completed volume

Since the activities of enterprises are carried out on a commercial basis, the productivity directly depends on the applications of retail and wholesale trade networks, as well as on the possibilities of selling through branded stores. To minimize the influence of the quantity of products produced on the degree of the evaluation of the performance of the production process, the relative values in percentage terms were used as performance indicators [5].

Results study and discussion. For the indirect assessment of the effectiveness of the quality system functioning at the enterprise and the efficiency of the production process, the data obtained as a result of testing the finished products of the selected assortment list were collected and analyzed. Tests were carried out during the first stage of work on the development and implementation of the system in the period from March to August 2012. Tests on physico-chemical and microbiological indicators were carried out by an accredited production laboratory. Tests on safety indicators were carried out by an accredited testing center.

In carrying out all studies, the rules of average samples were strictly observed, each sample was examined for the same index twice, with the calculation of the mean value.

In the process of diagnostic audit and research of finished products, it was established that the quality and safety control system has a number of weaknesses. First of all, this is the lack of regulated ways of collecting and transmitting information, which significantly reduces the effectiveness and effectiveness of the quality system as a whole. At the same time, there are a large number of separate elements of the system, covering the activities of individual structural units or individual chains of subprocesses. Most of these elements are effective enough in the first place with regard to identifying nonconforming products, and not preventing its production. Therefore, for the indirect assessment of the effectiveness of the finished product quality system functioning at the enterprise, the data characterizing the productivity of the production of the dairy products of the selected assortment list were collected and analyzed. Data were collected weekly for five months.

During the collection of information, the following observations were made: in most cases, inappropriate products identified before the completion of the process by order of the site master or replacement technologist were sent for processing within the production site or the direction of processing of such raw materials within the production process was changed; therefore, such rearrangements were not fixed in production reports as non-conforming products. For the purposes of the study, it was possible to calculate this index of inappropriate products obtained at various stages of the production process. As it was not possible to cut off the index at all production sites, we selected key technological operations in which the main raw materials undergo significant qualitative changes, in particular homogenization of the milk mixture, pasteurization, fermentation and fermentation of the cream mixture. Accordingly, the quality and safety of the finished product depend more on these changes. From another point of view, these stages of the production process have a large number of controlled (including critical) parameters, which presumably involves a large number of negative deviations in the case of imperfection of the control system or other weaknesses in the production process. The collected information is summarized and presented in table.

The results showed that, on the whole, the results are sanitary in general, as none of the results of the studies gave a negative or borderline result, which allows to doubt the safety of the finished food products from a microbiological point of view [6]. However, production can improve the production process from a sanitary point of view, in consequence:

– significant differences in the value of the resulting outcomes (standard deviation comprise 14% of the mean signals)

– comparative increase in QMAFAnM by 25.4% in finished products compared to previous studies;

At the same time, the results of product research have a wide spread [7]. For example, standard deviations in the mass fraction of fat are from 3.15 to 3.25, while the value of the indicator itself does not exceed 1.4%.

In some samples of the finished product, an excess of the fat content was detected, since the production technology allowed the deviation of the mass fat percentage + 0.1% due to the fact that the fat content in camel milk varies in a fairly wide range, which depends on the species, season, forage, individual and other factors.

The finished prodet by the index of the mass fraction of the protein was similar to other indices, but the spread of the values is also wide (standard deviations from 0.98% to 1.01%). In addition, all the products examined had an Acidity lower than the regulated normative document by an amount equal to 5% of the regulated one.

The results of the studies testify to the instability of qualitative characteristics in the implementation of the production process. Existing measures and a control system allow to effectively identify inconsis-

Average values of indicators by months from January to June 2012 and the overall average for a given period of time

Indicator name	Average values of indicators by months from January to June 2012 and the overall average for a given period of time					
	January	February	March	April	May	Average
Indicator 1, Execution of the production plan, %	90,3	90,32	90,3	90,3	90,29	90,3
	±1,14	±1,11	±1,14	±1,16	±1,14	±1,14
Indicator 2, The number of products, inconsistencies in which were identified before SEND to the consumer, %	0,51	0,53	0,53	0,49	0,48	0,5
	±0,05	±0,03	±0,05	±0,03	±0,06	±0,04
Indicator 3, The number of products, the discrepancies in which were identified by the CONSUMER, %	0,33	0,34	0,32	0,31	0,36	0,33
	±0,05	±0,03	±0,05	±0,03	±0,08	±0,05
Indicator 4.1, Number of incidents detected in the process Milk collection and sorting	10,03	10	10,04	10,03	10,02	10,02
	±3,16	±3,14	±3,17	±3,15	±3,19	±3,16
Indicator 4.2, Number of cases of non-compliance in the process	0,02	0,03	0,03	0,01	0,02	0,02
	±0,15	±0,02	±0,01	±0,01	±0,01	±0,04
Indicator 4.3, Number of incidents detected in the process Normalization	0,01	0,01	0,02	0,04	0,02	0,02
	±0,01	±0,01	±0,01	±0,02	±0,01	±0,01
Indicator 4.4, Number of incidents detected in the process Homogenization of the milk formula	0,03	0,01	0,04	0,05	0,03	0,03
	±0,02	±0,01	±0,02	±0,03	±0,01	±0,02
Indicator 4.5, Number of incidents detecting inconsistencies in the process Pasteurization	0,02	0,01	0,05	0,05	0,03	0,03
	±0,01	±0,01	±0,02	±0,02	±0,02	±0,02
Indicator 4.6, Number of cases of non-compliance in the process Fermentation and fermentation of the cream mixture	0,02	0,05	0,02	0,02	0,03	0,03
	±0,01	±0,01	±0,01	±0,01	±0,02	±0,01
Indicator 4.7, Number of incidents detected in the process Cooling and mixing.	0,02	0,01	0,02	0,04	0,01	0,02
	±0,01	±0,01	±0,01	±0,02	±0,01	±0,01
Indicator 4.8, Number of cases of identification of discrepancies in the process	0,04	0,06	0,07	0,07	0,04	0,06
	±0,02	±0,03	±0,02	±0,04	±0,02	±0,02
Indicator 4.9, Number of incidents detected in the process Pre-cooling and maturation	0,05	0,04	0,04	0,02	0,03	0,04
	±0,02	±0,03	±0,02	±0,01	±0,01	±0,02
Indicator 4.10, Number of incidents detected in the process Quality control of the finished product	0,09	0,07	0,07	0,11	0,12	0,09
	±0,02	±0,01	±0,04	±0,04	±0,03	±0,03
Indicator 4.11, Number of cases of non-compliance in the process Storage	0,07	0,04	0,04	0,09	0,1	0,07
	±0,04	±0,06	±0,02	±0,07	±0,03	±0,04

tencies (including consumer characteristics of products), after they occurred in production. The inconsistencies in the finished product, revealed before the implementation, reach 0.53%, the average value is 0.50% [8].

There are refunds and complaints from trading enterprises. Despite the fact that significant (critical) inconsistencies among such cases have not been identified, but the percentage of returns is 0.33% (data do not include returns due to the expiration of the expiration dates). The maximum amount of refunds was 0.5%.

All deviations in the production process recorded at the time of collection of information entailed costs of various origins for the enterprise, including:

– The intrinsic value of nonconforming products or semi-finished products by the technological process;

– Loss of profit due to lack of sales of this product;

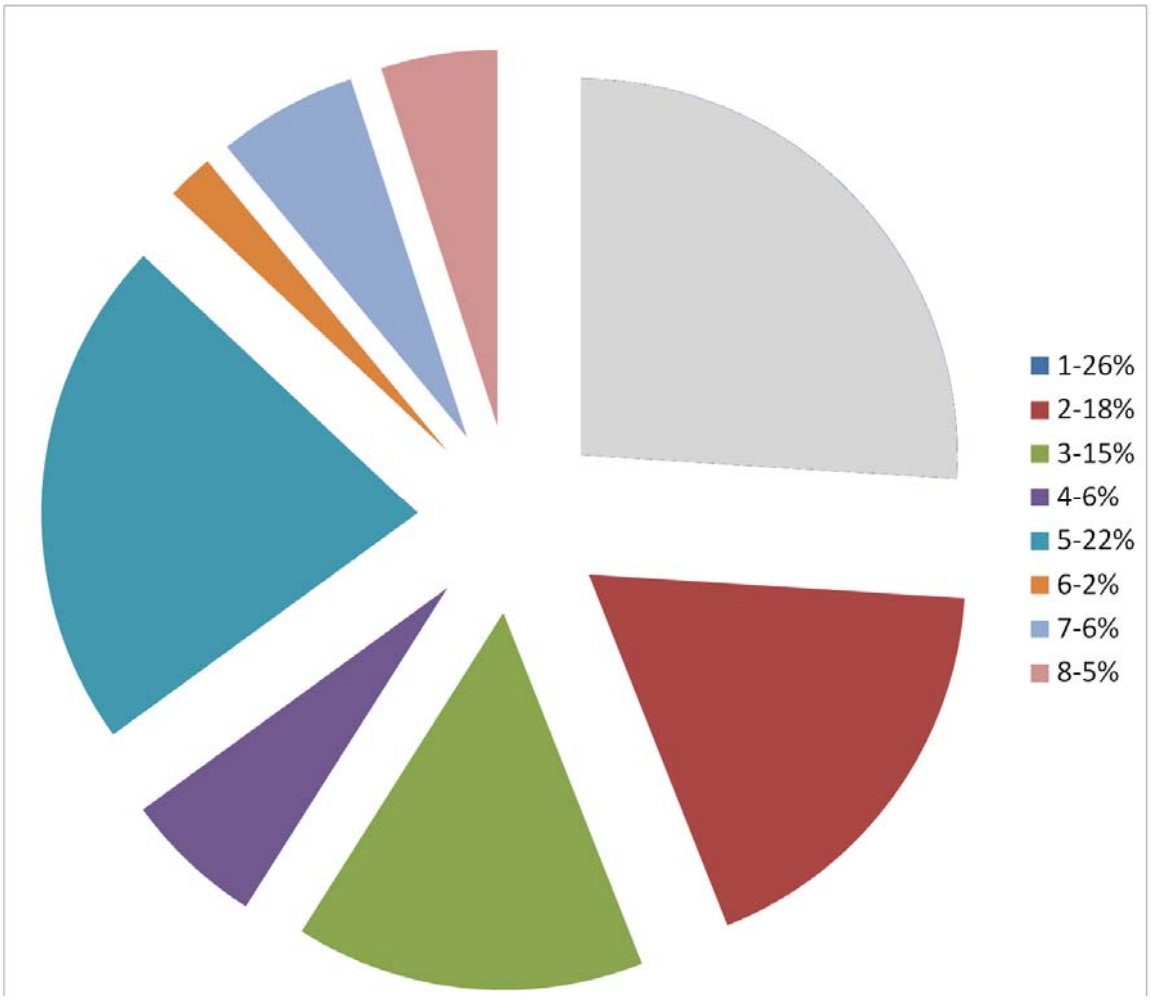
– the cost of excessive production time;

– in the case of product disposal – the cost of disposal;

– reimbursement of damages for claims, consideration of complaints, transportation of returned products, etc.

These costs were not allocated as additional, which led to an unjustified rise in the cost of the entire production process, which adversely affected the formation of the cost of production, and, ultimately, its competitiveness. An analysis of the nature of the inconsistencies and the reasons for their occurrence in most cases amounted to incriminating and punishing the perpetrators, this circumstance did not in any way stimulate the prevention of similar inconsistencies in the future by identifying them at the early stages of the process [9].

We have attempted to identify the patterns of distribution of the value of non-conforming products, depending on the causes of the inconsistencies. For inconsistencies in terms of indicators: "the volume of products, the discrepancies in which were revealed before the mandrel to the consumer" and "the volume of inconsistencies in the stages of the production process", the causes of their occurrence were found and analyzed [11]. The analysis data are shown in figure.



The emergence of inconsistencies, depending on the reasons:
(1) Negligence or lack of knowledge of working personnel
(2) Staff turnover (inadequate production experience)
(3) Non-observance of parameters and modes of production
(4) Insufficient technical equipment
(5) Raw materials, ingredients, auxiliary materials that are not appropriate to quality or not subjected to extended control,
(6) Absence or delay in transmission of necessary information, including changes in the technological process
(7) Inconsistency of actions
(8) Unexplained reasons

Outreach. Thus, the following conclusions can be drawn from the analyzed data:

1) There is no coherent and comprehensive quality management system for finished products.

2) The data indicate that there are no violations for the safety of the finished product.

3) There is a need to improve the production [12] process from a sanitary point of view (by regulating the Good Manufacturing Practices (GMP) programs).

4) The instability of the quality indicators of the finished product may be due to the lack of data analysis and the instability of individual operations and stages of the ongoing process, insufficient input data for effective correction of the technological process.

The lack of a system for identifying raw materials, materials, and finished products during the advancement of the production process and the imperfection of the monitoring and traceability system, including the collection of information on emerging inconsistencies, are established [13, 14]. Thus, the technological process was carried out by the working personnel according to the planned chain of actions with a number of different inconsistencies that were not fully analyzed and were limitedly prevented subsequently.

The application of the process approach in the formation of the flowchart allowed to maximally specify the production process, as well as to establish a more flexible regulatory system that establishes not stringent conditions for the implementation of certain actions, but the level of responsibility in making decisions and ways of informing in case of deviations from planned results [15, 16]. Thus, the response in the event of any inconsistencies will be more rapid (since in some cases the decision will be made by the masters directly on the sites) and more substantive, as the areas of competence of the individual structural divisions of the enterprise are divided [17, 18].

Dependence of the ongoing production process on the personnel (44% of the non-compliance was realized through the fault of the staff), assumes that the main directions of the transformations in the development and implementation of the system will be the regulation of areas of responsibility, documentation and monitoring of key (critical) operations and multi- including on the control of dangerous factors [19, 20].

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НАССР САПА БАҒАЛАУДЫҢ ҚОЛДАНЫЛУ ЖҮЙЕСІНІҢ ОРЫНДАУЫН БАҒАЛАУ

Аннотация. Экономикалық, әлеуметтік және экологиялық қауіпсіздіктің, өндірістің және өндірістегі өндеу үрдістерінің нәтижелерін талдау және негізгі мәселелерді көтеру нарықтағы маңызды фактор болып табылады. Зерттеулер мен технологиялық үрдістерді анализдеу барысында сүтті өңдеу арқылы сүтқышқылды өнімдердің ассортиментін шығаратын өндірісіне негізделген. Өндірістің қауіпсіздігін қамтамасыз ете отырып, сапалы өнімдер шығарылады. Нәтижесінде, сүт қышқылды өнімдерін өндіру үрдісінің талапқа сай дұрыс жүрмеуі анықталады. Өндіріс үрдісінің әрбір процесстерінің жұмыс істеу режимжері технологияға сай дұрыс қолданылуын қадағалау. Өндіріс үрдісімені мен жұмыс істейтін персоналдың арасындағы өзара іс-қимылдың бірліктігі. Құрыл-жабдықтар, әдістемелік нұсқауды бағалау мен сапасын басқару жүйесінің функционалды басқару мүмкіндіктерінің үйлестігі қарастыралады.

Түйін сөздер: НАССР, өнімділікті бағалау, сапаны бағалау жүйесі, бағдарламалық қамтамасыз ету.

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ОЦЕНКА РЕЗУЛЬТАТИВНОСТИ ДЕЙСТВУЮЩЕЙ СИСТЕМЫ ОЦЕНКИ КАЧЕСТВА ХАССП

Аннотация. В рыночной экономике проблема качества является важнейшим фактором повышения уровня жизни, экономической, социальной и экологической безопасности, в частности важны вопросы связанные с анализом результативности производственных процессов и готовой продукции. В работе описаны подходы в анализе процессов и продукции на отдельно взятом производстве кисломолочных изделий на основе верблюжьего молока после внедрения системы обеспечения качества НАССР. В результате были определены показатели результативности процесса производства кисломолочных изделий, произведен сбор и проделан анализ данных, полученных в результате испытаний готовой продукции. Показаны преимущества применения процессного подхода. Найдена зависимость между осуществляемым производственным процессом и рабочим персоналом. Разработанная методика оценки и критерии результативности внедрения и функционирования системы управления качеством могут быть применены для улучшения качества готовой продукции.

Ключевые слова: НАССР, оценка результативности, системы оценки качества, программное обеспечение.

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