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ENSURING THE SAFETY IN THE PRODUCTION OF FERMENTED MILK PRODUCTS WITH ENTEROSORBING DIETARY FIBERS

M.K. ALIMARDANOVA , *V.M. BAKIYEVA* *

(Almaty Technological University, Kazakhstan, 050012, Almaty, Tole bi str., 100)
Corresponding author e-mail: venerabakieva@mail.ru*

The current trend of health-conscious consumers and healthy eating habits is encouraging researchers to explore the development of food products with synbiotic benefits. Dietary fiber in vegetables, fruits and cereals is one of the prom-

ising prebiotics and its use in supplementing dairy product formulations. However, the important point is to produce safe products according to the current standards of the country of production and sale. This article identifies critical control points and conducts a metrological study of quality control at each stage in the production of a new fermented milk product with the addition of enterosorbing dietary fibers. The study identified potential and five critical control points and presented an optimized scheme with factors that ensure the safety and quality of the final product.

Keywords: enterosorbing dietary fiber, critical control point, fermented milk, safety.

ОБЕСПЕЧЕНИЕ БЕЗОПАСНОСТИ ПРИ ПРОИЗВОДСТВЕ КИСЛОМОЛОЧНЫХ ПРОДУКТОВ С ЭНТЕРОСОРБИРУЮЩИМИ ПИЩЕВЫМИ ВОЛОКНАМИ

*М.К. АЛИМАРДАНОВА, В.М. БАКИЕВА**

(Алматинский технологический университет, Казахстан, 050012, Алматы, ул. Толе би, 100)
Электронная почта автора корреспондента: venerabakieva@mail.ru*

Нынешняя тенденция потребителей, заботящихся о своем здоровье и привычках к здоровому питанию, побуждает исследователей изучать разработку пищевых продуктов с синбиотическими преимуществами. Пищевые волокна в овощах, фруктах и злаках являются одним из перспективных пребиотиков и использование их в дополнении рецептур молочных продуктов актуально. Но важным моментом является производство безопасных продуктов, согласно действующим стандартам страны производства и реализации. В статье приведены критические контрольные точки и проведено метрологическое исследование контроля качества на каждом этапе при производстве нового кисломолочного продукта с внесением энтеросорбирующих пищевых волокон. В результате исследования выявлены и пять критических контрольных точек, а также представлена оптимизированная схема с факторами, обеспечивающими безопасность и качество конечного продукта.

Ключевые слова: энтеросорбирующие пищевые волокна, критические контрольные точки, кисломолочный продукт, безопасность.

ЭНТЕРОСОРБЕНТТІ ТАҒАМДЫҚ ТАЛШЫҚТАРЫ БАР АШЫТЫЛҒАН СҮТ ӨНІМДЕРІН ӨНДІРУ КЕЗІНДЕ ҚАУІПСІЗДІКТІ ҚАМТАМАСЫЗ ЕТУ

*М.К. АЛИМАРДАНОВА, В.М. БАКИЕВА**

(Алматы технологиялық университеті, Қазақстан, 050012, Алматы, Толе би көш., 100)
Автор-корреспонденттің электрондық поштасы: venerabakieva@mail.ru*

Тұтынушылардың денсаулығы мен дұрыс тамақтану әдеттеріне деген қазіргі тенденциясы зерттеушілерді синбиотикалық пайдасы бар тағамның дамуын зерттеуге итермелейді. Көкөністердегі, жемістердегі және дәнді дақылдардағы диеталық талшықтар перспективалы пробиотиктердің бірі болып табылады және оларды сүт рецептерін толықтыруда қолдану. Бірақ өндіріс пен сату елінің қолданыстағы стандарттарына сәйкес қауіпсіз өнімдерді шығару маңызды мәселе болып табылады. Мақалада сыни бақылау нүктелері анықталды және энтеросорбентті диеталық талшықтарды енгізе отырып, жаңа ашытылған сүт өнімін өндірудің әр кезеңінде сапаны бақылау бойынша метрологиялық зерттеу жүргізілді. Зерттеу нәтижесінде ықтимал және бес сыни бақылау нүктелері анықталды және соңғы өнімнің қауіпсіздігі мен сапасын қамтамасыз ететін факторлары бар оңтайландырылған схема ұсынылды.

Негізгі сөздер: энтеросорбциялық тағамдық талшықтар, сыни бақылау нүктелері, ашытылған сүт өнімі, қауіпсіздік.

Introduction

Proper nutrition and the avoidance of harmful products can enhance the body's resilience to negative effects [1]. In the context of increasing competition and heightened consumer expectations for novel dairy products, ensuring product quality and safety is a crucial aspect of production [2].

The Food Safety Management System (FSMS) is an effective quality control system for food products based on the principles of HACCP [3]. To maintain product quality and improve production, it is essential to implement or update the already established Quality Management System. According to CU TR 033/2013, food product manufacturers are required to develop,

implement, and maintain procedures based on HACCP principles [4].

HACCP gives special attention to Critical Control Points (CCPs) where physical, chemical, and biological risks associated with food production are identified. This quality control system covers the entire technological process, from raw material intake to the release of the final product and its provision to the consumer. The implemented measures identify critical control points (CCPs) and minimize hazardous factors that may affect the safety of the product.

Research that involves supplementing dairy product formulations with dietary fibers, plant polysaccharides, starter cultures, vitamins, antioxidants, and other additives is a fundamental approach to creating functional products [5-8]. This process makes production technology more complex, requiring strict adherence to technological production discipline, sanitary and hygiene rules, and standards [9].

The World Health Organization (FAO/WHO) recommends including foods that are rich in dietary fiber in the diet [10]. For adults, the recommended daily intake is 25 grams, with at least half of this amount consisting of coarse dietary fibers such as cellulose, hemicellulose, and lignin, and the other half coming from soft dietary fibers such as pectins and gums.

Rice bran is a fibrous substance that contains coarse dietary fibers such as lignin, cellulose, and pentosans, along with a small amount of protein, vitamins, and minerals. The minerals make up 10-20% of the fiber, and 92-97% of the fiber is silica [13]. The fiber content in rice bran is 78% [13]. Rice bran differs in chemical composition from all other cereal crops due to its high content of amorphous silicon dioxide in the straw and bran [13].

Silicon is recognized as a conditionally essential trace element, playing several vital roles in the human body. The onset of a silicon deficiency can have undesirable consequences. Its most extensively researched function is its participation in collagen synthesis. Silicon deficiency can impede the formation of connective tissue, including the organic framework of bones [14].

Researchers have examined the HACCP methodology to identify critical control points and conducted metrological research on quality control at each stage of the production of fermented milk products with enterosorbing dietary fibers (ESDF) (i.e., oral intestinal adsorbents with dietary fibers).

Therefore, the introduction of an HACCP plan is necessary when developing new fermented milk products. To establish critical control points (CCPs), each relevant hazard factor should be analyzed separately, taking into account all types of potentially hazardous factors [15-19].

The study aims to use HACCP methodology to identify critical control points and metrological analysis of quality control at each point in the production of a fermented milk product with enterosorbent dietary fiber (ESDF).

According to the objective, the following objectives were set:

- identification of CCP of the technological process of production of fermented milk products with ESDF;
- development of preventative actions;
- development of recommendations on the organization and distribution of responsibility for corrective actions.

Materials and research methods

The article explores the production process of fermented milk products with enterosorbing dietary fibers (ESDF).

The risk associated with each potentially hazardous factor for the product manufactured has been assessed using an expert method, taking into account all available information and practical experience.

The study was based on the requirements of current standards:

The study relied on the requirements of ST RK ISO 22000-2019 "Food safety management system. Requirements for organizations involved in the food chain";

ST RK 1179-2003 "Quality Management System. Quality Management of Food Products based on HACCP Principles. General Requirements". The purpose of use and implementation in production;

Technical Regulations of the Customs Union 021/2011 «On Safety of Food Products» (CU TR 021/2011);

Technical Regulations of the Customs Union 033/2013 «On Safety of Milk and Dairy Products» (CU TR 033/2013).

Results and discussion

In the territory of the Customs Union, there is a technical regulation CU TR 033/2013 "On the Safety of Milk and Dairy Products", which establishes mandatory requirements for milk and dairy products produced and sold in the customs territory (Table 1).

Table 1 – Requirements for milk and fermented dairy products [20]

Definition according to the regulatory document	Regulatory document	Quality requirements
Fermented dairy product is a dairy product or dairy composite product produced in a way that leads to a decrease in the pH value, an increase in acidity, coagulation of milk protein, milk fermentation, and/or dairy products or their mixtures with non-dairy components, which are introduced not to substitute milk components (before or after fermentation), or without adding the specified components using fermentative microorganisms, and contains live fermentative microorganisms in the quantity established in the annex to this regulation.	CU TR 033/2013 "On the Safety of Milk and Dairy Products"	Fat content – 0,1-9,9 %. Protein content – 2,8%. Total solids content: not less than – 7,8%. Permissible levels of lactic acid bacteria, microorganisms, and yeasts: 1*10 CFU/cm (g).

Within the study, a technological flowchart of the production process of fermented milk products with ESDF is presented (Fig. 1). The determination of critical control points was conducted using the decision tree method.

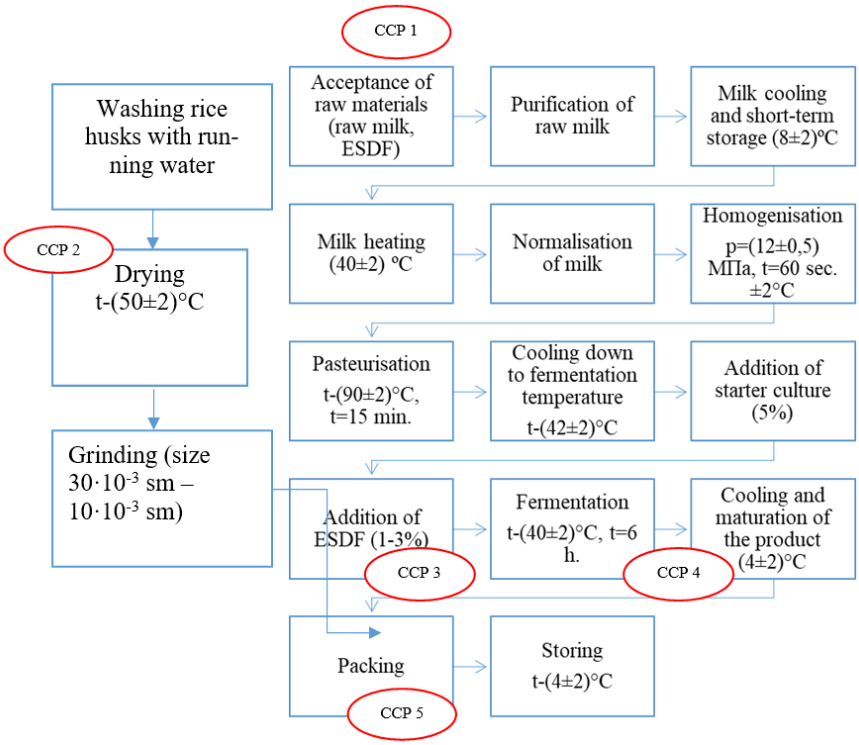

Figure 1 – Technological flowchart of the production process of fermented milk products with ESDF.

An optimized scheme of the technological process has been developed to improve the monitoring system, incorporating preventive and corrective actions for critical control points of the production process of the developed product (Table 2).

The hazard analysis of the production process of fermented milk products with ESDF resulted in the identification of the main CCP for effective management and control: the acceptance and preparation of ESDF. This is because the product is susceptible to contamination from external sources and requires careful preparation of ESDF before introduction. The primary critical point remains the moisture content of the ESDF to prevent mold growth during product storage. When producing fermented milk products, it is important to pay special attention to key processes such as milk pasteurization and product fermentation.

The above-mentioned monitoring system of control, preventive and corrective actions of each stage, based on the HACCP ISO 22000:2019 standard, will identify the technological stages of risk occurrence and ways to eliminate them in the production of fermented milk product with ESDF.

Table 2 – Determining of Critical Control Points (CCPs) in the production of fermented milk products with enterosorbing dietary fibers (ESDF).

CCP	Stage	Considered parameters	Preventive actions	Corrective actions
CCP 1	Reception of raw materials - milk and rice husk	Organoleptic, physical-chemical, microbiological	Control of accompanying documentation, selective control of titratable acidity, level of coliform bacteria content, quantity of mesophilic aerobic microorganisms and facultative anaerobic microorganisms, toxic metals, milk antibiotics upon reception, control of rice husk upon reception. Absence of foreign impurities	Return to supplier in case of non-compliance of raw materials with regulatory documentation
CCP 2	ESDF preparation	Organoleptic, physical-chemical, microbiological	Temperature and time control during chemical processing and drying of raw materials	Control of complete drying, uniform shredding of ESDF
Potential CCP	Pasteurization	Organoleptic, physical-chemical, microbiological	Control of temperature and pasteurization time	Verification of equipment operation
Potential CCP	Thermization	Physical-chemical	Temperature regulation and time control during cooling	Verification of equipment operation
CCP 3	Incorporation of starter culture and ESDF	Organoleptic, physical-chemical, microbiological	Absence of foreign impurities, control over the quantity of input	Observance of aseptic conditions
CCP 4	Fermentation	Organoleptic, physical-chemical, microbiological	Temperature and time control	Observance of suitable conditions
Potential CCP	Packaging	Physical-chemical, microbiological	Equipment control	Observance of aseptic conditions
CCP 5	Storage	Physical-chemical, microbiological	Microbiological control, indicators of titratable acidity, curd density	Creating favorable storage conditions

Conclusion

Fermented milk products are socially significant food items and must comply with sanitary standards and regulations throughout the production process. It is crucial to execute a program of preliminary measures meticulously during the manufacturing process. Minor deviations during the heat treatment of basic and/or vegetable raw materials can have adverse effects on both the consumer properties of the fermented milk product and the human body.

Quality control metrological analysis during production has enabled us to develop recommendations for the technological process of producing a new fermented milk product with ESP. The study has identified potential Critical Control Points (CCPs) that can help avoid unfavorable outcomes in production.

It is important to optimize the HACCP plan for new product types, conduct timely risk analysis, and implement preliminary action programs at all production stages to ensure that enterprises produce safe and high-quality fermented milk products with ESDF.

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BIO-FERMENTED MILK PRODUCT BASED ON *L.ACIDOPHILUS* FORTIFIED BY *SANGUISORBA OFFICINALIS* EXTRACT

*A.A. UTEBAEVA** , *E.A. GABRILYANTS* , *ZH.A. ABISH* , *A.ZH. AITBAEVA* , *G.E. ISLAMOVA*

(M.Auezov South-Kazakhstan University, Kazakhstan, 160000, Shymkent, Tauke Khan Av. 5)
Corresponding author e-mail: aidana.utebaeva@gmail.com*

The development of new functional food products containing probiotics and prebiotics of plant origin has actual scientific and practical values. The presented study purpose is the creation of fermented milk products based on