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ИССЛЕДОВАНИЕ КАПИЛЯРНЫХ ДЕЛИТЕЛЕЙ ДАВЛЕНИЯ ДЛЯ СЛОЖНЫХ ДРОСЕЛЬНЫХ СИСТЕМ

Приведены основные варианты делителей давления, их функциональные зависимости и показана возможность их использования на примере систем динамического приготовления газовых смесей. Исследованы свойства делителей давления, в частности определен диапазон коэффициентов деления давления при дроселировании различных газов. Показаны преимущества линейных делителей давления для построения газодинамических систем синтеза смесей с микроконцентрациями компонентов.

Ключевые слова: капилляр, делитель давления, коэффициент деления давления, линейность изменения давления, газодинамический синтезатор.

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ВИВЧЕННЯ ФІЗИКО-ХІМІЧНИХ ВЛАСТИВОСТЕЙ М'ЯКОГО СИРУ, ВИГОТОВЛЕНОГО ІЗ ЗАСТОСУВАННЯМ НЕТРАДИЦІЙНИХ ІНГРЕДІЄНТІВ

Вдосконалена технологія м'якого сирного продукту основана на використанні сухого знежиреного молока, з частковою його заміною на подрібнений концентрат арахісового ядра та борошно кукурудзяне, з використанням рафінованої, дезодорованої соняшникової олії. Проведено дослідження фізико-хімічних властивостей удосконаленого продукту. Удосконалений продукт дозволить розширити асортимент дешевої сирної продукції.

Ключові слова: м'який сирний продукт, сухе знежирене молоко, подрібнений концентрат ядра арахісу, кукурудзяне борошно.

1. Introduction

At present the world market of dairy products is the high-competition sector, which dynamically develops. The leading specialists testify that cheese production is the most profitable among dairy products production and it causes considerable interest among producers. Producers of dairy products face with the problem of dairy products assortment expansion which rises in the conditions of the increased competition at the market of rennet cheeses and customer's demand in the high quality products [1].

The risk of milk production reducing, mainly, through the factor of seasonality, results the certain difficulties

in the cheese-making industry especially during winter-spring period.

That is why the dairy products production especially the production of cheeses on the basis of restored and recombined milk is actual task. The stable quality as one of the most important criteria of food stuff competition takes the lead now.

Production of soft cheese products is developing taking into account insignificant labor intensiveness of technology of soft cheeses. They have wide assortment and considerable advantages comparatively with natural rennet cheeses and their high characteristics allow to satisfy requires of wide circle of customers [1, 2].

At present the ration of ordinary citizen is poor on proteins, but at the same time the part of animal protein for the population is too large [3]. That is why the elaboration of combined cheese product with the use of vegetable proteins and fats is perspective task.

Vegetable ingredients of different nature and their combining in the technology of cheese product provide the presence in such product of great amount of food substances and their new ratio in comparison with traditional cheeses.

The main advantage of the combined products is in potential possibility of the mutual enriching by the food substances according to one or few factors with the aim of product accordance to the formula of the balanced diet [1–3].

Actuality of use of vegetable ingredients consists in the economy of animal origin raw material and reducing of part of animal constituents of product, expansion of the assortment of the combined cheese products; it allows to overcome the seasonality and to produce cheese products in different climatic regions for the wide circle of customers. By there is the search of innovative decisions in the field of cheese making with use of vegetable oil and vegetable additions of protein and polysaccharide nature for the receipt of cheese product soft, that has stable chemical composition and does not yield to traditional soft cheeses in quality is priority direction of new technology of soft cheese product.

The features of vegetable additions chemical composition allow realizing technological properties during all stages of soft cheese product producing and storage, and it gives the possibility to reduce the risk of production losses [2, 3].

The technology of soft cheese product on the basis of the dried skimmed milk with partial its substitution on the peanut kernel concentrate and corn flour with use of refined and deodorized sunflower oil was elaborate. The new product is independent and can be used for producing of the varied dishes and appetizers [2].

2. The purpose and tasks of the study

The purpose of the work is to determine the effect of concentrate peanut kernels and corn flour to change the number of physical and chemical properties of soft cheese product and their relationship with sensory, structural and mechanical properties of a new product.

3. Recent investigations

3.1. Materials and methods. Technological process of the soft cheese product includes the steps: reception of milk and its preparation for coagulation, coagulation of milk, the processing of the bunch and the introduction of prepared components and salt, forming and pressing, maturation.

The results of investigation of some physical, chemical and organoleptic properties of the soft cheese product. Most methods of with expansion of assortment of cheese products of cheap segment of market. The results of investigations may be used for working of the high quality product.

All results were obtained in our laboratory.

Acidity, in degrees Turner ($^{\circ}T$), found by multiplying the amount of sodium hydroxide solution it took to neutralize the acid contained in the volume of the product [2, 4].

Organoleptic characteristics of soft cheese product determine the most common method – point scoring [5].

3.2. Analysis of research and publications. The peanut vegetable protein as one of main component which stipulates the high biological value of product plays considerable role in the technology of new soft cheese product. Corn flour is the perspective raw material for combined dairy products because it has high nutrition and biological value; textures indices of new product depend on features of corn flour chemical composition. The chemical composition of vegetable components is given in a Table 1.

Table 1

The chemical composition of vegetable raw material of soft cheese product

Indices	Kernel of a peanut	Corn flour
Water, %	10,0 ± 0,2	14,0 ± 0,2
Proteins, %	26,3 ± 0,1	10,0 ± 0,1
Fats, %	45,2 ± 0,1	1,5 ± 0,1
Carbohydrates, %	9,7 ± 0,5	75,8 ± 0,5
Fiber, %	—	0,7 ± 0,5
Ash	2,6 ± 0,5	0,8 ± 0,5
Minerals, mg (error to 2 %)		
Na	23	—
K	658	—
Ca	76	—
Mg	182	—
P	350	—
Fe	5	—
Vitamins, mg (error to 5 %)		
A	0	0,20
B1	0,74	0,40
B2	0,11	0,13
PP	13,2	1,80
C	5,34	0
Energy value, Kcal	548	327

As we can see from the data of Table 1, the peanut kernel contains great amount of protein, vitamins and vegetables fats (80 % of fat are unsaturated fatty acids). In addition, the peanut proteins have optimum ratio of amino acids, and that is why they have good digestion in the man's organism [6].

From the chemical composition of peanut and works of leading specialists it is possible to establish, that the peanut kernel and products of its processing are the sources of complete protein, polyunsaturated fatty acids, minerals and vitamins [1–3]. The peanut kernel concentrate is white or grey powder which contains about 50..70 % of protein; 8..11 % of fat, and also fiber and complete spectrum of minerals and vitamins. Its energy value is about 290 kcal. The peanut kernel concentrate was got for the first time [2]. The special press wrings out peanut kernels in accordance with the technology. The method of the cold pressing for the temperatures of 50 °C allows wringing out the concentrate oil from pure kernel. Corn flour has high nutritional and biological value. Corn flour contains great amount of carbohydrates (57..70 % – starch, 2,1 % are food fibers), proteins, vitamins. Corn flour is one of the richest natural sources of vitamin K. It exceeds all vegetable origin products in 16..32 times by content of provitamin A [2, 6, 7]. Vegetable oil is used

as fatty component for reducing the content of cholesterol in new product. Vegetable fats in the composition of cheese products should have neutral taste. The refined deodorized sunflower oil which is used in the composition of new product has neutral organoleptic indices and also saturates the product with the polyunsaturated acids of linolic and olein group [2, 6]. Thus, the new combined soft cheese product has new organoleptic properties compared with traditional cheeses, it also has stable physical and chemical characteristics, balanced composition, and it causes their high nutritional and biological value and reduced production cost [2].

The aim of the research paper is the examination of indices changes of soft cheese product on the basis of untraditional raw material.

4. Results of research f improved technology of soft cheese

Suggested substitution of milk raw material for vegetable component mustn't exceed 5 % because of texture characteristics drawbacks. That is why for grounding the physical, chemical and organoleptic properties of the new product it is expedient to present change of structural and mechanical indices depending on compounding composition. The dependence of relative deformation of squeezing of soft cheese product with different content of vegetable components with general substitution of 5 % dried skimmed milk from the time of tension is presented for evident reflection of correlation of the peanut kernel concentrate and corn flour and their influence on some rheological indices.

The changes of structural and mechanical indices of product prove that the insertion of vegetable components stipulates high resilient properties of product. Especially the sample with the concentrate has the highest resiliency (about 48 %) and the lowest plasticity (approximately 18 %). Compounding composition does not promote the appropriate change of elasticity. Thus, the influence of proteins of peanut kernel concentrate is not the instrument for strong spatial structure formation, probably, through the presence of great amount of hydrophobic groups. Proteins and polysaccharides of corn flour have plenty of reactivity groups, which cause the redistribution of moisture in the product, the origination of physical and chemical bond and spatial structure formation [8–10]. The bond of moisture in cheese product stipulates difficult physical and chemical, colloid and biochemical processes, because of changes of structural and mechanical properties of it. The moisture content of cheese plays important role in physical and chemical and organoleptic indices formation [10].

The samples of cheese product with the peanut kernel concentrate have higher content of free moisture as compared to the samples with corn flour [2]. The increase of content of free moisture, high content of proteins and products of their disintegration in the samples of cheese product with the peanut kernel concentrate causes intensive growth of titrated acidity (the potential or titrated acidity is the concentration of components which has acid character). All these factors are synergists. Substances from peanut kernel concentrate and corn flour in the cheese mass have protein and polysaccharide nature, they can absorb and keep the moisture. During the collision these substances actively absorb water. Proteins of peanut kernel concentrate and corn flour and also corn flour starch

make the unique synergistical system. This system has a direct influence on the whole technological process of the new cheese product production. Corn flour plays important role as the factor of moisture keeping in the cheese product. The mechanism of moisture binding which was suggested by P. M. Shu and Ts. V. Mor is presented on the Fig. 1 [11].

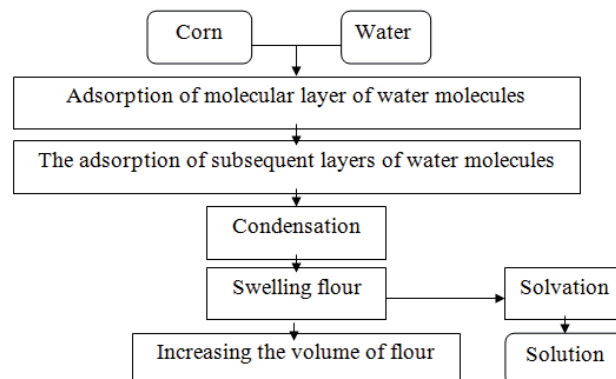


Fig. 1. Mechanism of grain binding moisture

The determination of acidity titrated changes during necessary time is one of ways of establishment of ripening term and the ground of cheese product shelf-life because of new components in the cheese product which are untraditional in ratio to the classical receipts. The changes of titrated acidity of cheese product with different compounding composition from the receipt of the freshly made samples and during storage are presented on Fig. 2.

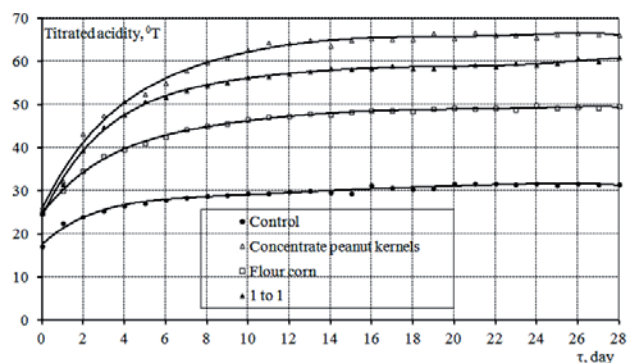


Fig. 2. Titrated acidity change of cheese product with a rational prescription composition

From the data of Fig. 2 we can see that the main changes of titrated acidity in the samples take place during the first week of storage. Then the titrated acidity rises slower and at the end of ripening goes down as a result of accumulation of alkaline products of proteins disintegration. The titrated acidity of the control sample rises during storage from 17 to 31,5 °T, of the sample with concentrate is in an interval 26,4...66,3 °T, of the sample with flour – 24,7...49,7 °T.

Physical, chemical and biological properties of cheese product components are changing during the ripening of cheese product. The proteins of the product are subject to the considerable changes and as the result the great amount of soluble compounds (protein dissimilation products) forms in the product. Increase of the acidity of product with the

peanut kernel concentrate connects with the great amount of protein in such product. The amount of soluble products of protein dissimilation rises during the storage [3, 10].

As we can see from the data of Fig. 3, the value of titrated acidity change of sample with correlation of concentrate and corn flour 1 to 1 is close to the values of sample with concentrate. It is possible to establish, that the use of the vegetable components in the technology of cheese product causes the increasing of titrated acidity, thus the influence of peanut kernel concentrate on the increasing of the acidity index is more substantial.

Organoleptic indices of the product with rational substitution of the dried skimmed milk for the peanut kernel concentrate and corn flour are presented in the Table 2. Analysis of data of the Table 2 testifies that samples of the product, which have in the composition vegetable additions in different correlation, have high organoleptic properties comparatively with control sample. Organoleptic indices on the 14th day of storage are higher comparatively with the indices on the first and on the last days of research.

Table 2

Scoring organoleptic rating product

Index, points	Sample											
	Control			Peanut kernel concentrate			1 to 1			Corn flour		
	Storage, days											
	0	14	28	0	14	28	0	14	28	0	14	28
Appearance (10)	10	8	6	10	10	8	10	10	8	10	9	9
Consistence (25)	18	20	16	21	23	23	21	24	23	22	24	24
Taste and smell (45)	43	41	40	43	43	41	45	45	41	45	44	43
Color (5)	5	5	5	5	5	5	5	5	5	5	5	5
Pattern (10)	9	10	10	8	10	10	8	10	10	8	10	10
Packaging (5)	5	5	5	5	5	5	5	5	5	5	5	5
Total points	90	89	82	92	96	92	94	99	92	95	97	96

The cheese product contains new components which are untraditional in relation to the classic compounding of cheeses. The ripening and storage of fresh made cheeses are important factors which stipulate their quality and consumers properties. The soft cheese product must be allowed for realization in age not less than 14 days.

5. Conclusions

The conclusions are formulated on the basis of foregoing. — The technology of new soft cheese product on the basis of the dried skimmed milk with its 5 % substitution for the peanut kernel concentrate and corn flour are elaborated. The new product has vegetable components of high biological value in its composition, and it stipulates the increase of general quality of soft cheese product.

— The role of vegetable proteins is stipulated as the factor of moisture keeping in the product.

— The use of vegetable components in the new product causes the growth of titrated acidity.

— The soft cheese product with vegetable components has high organoleptic properties.

— The rational term of ripening of soft cheese product is 12...14 days; subsequent storage is about two weeks.

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ИЗУЧЕНИЕ ФИЗИКО-ХИМИЧЕСКИХ СВОЙСТВ МЯГКОГО СЫРА, ИЗГОТОВЛЕННОГО С ПРИМЕНЕНИЕМ НЕТРАДИЦИОННЫХ ИНГРЕДИЕНТОВ

Усовершенствованная технология мягкого творога предполагает использование сухого обезжиренного молока, с частичной его заменой на измельченный концентрат арахисового ядра и муку кукурузную, с использованием рафинированного, дезодорированного масла подсолнечного. Проведено исследование показателей качества творога мягкого, изготовленного по усовершенствованной технологии. Сырный продукт позволит расширить ассортимент дешевой молочной продукции.

Ключевые слова: мягкий сырный продукт, сухое обезжиренное молоко, измельченный концентрат ядра арахиса, кукурузная мука.

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