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INNOVATIVE ASPECTS OF SUNFLOWER ISOLATE USE IN TECHNOLOGY OF CRAFT PRODUCTS

Natalia Bolgova,
*Ph.D. in Agricultural Sciences,
associate professor,
Sumy National Agrarian University,
Sumy, Ukraine,
bolgova_1981@i.ua
<http://orcid.org/0000-0002-0201-0769>
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Viktoriiia Tsyhura,
*Senior Lecturer,
Sumy National Agrarian University,
Sumy, Ukraine,
viktoriya.cigura@gmail.com
<https://orcid.org/0000-0002-2049-7013>
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Tamara Khmeliuk,
*Master Student,
Sumy National Agrarian University,
Sumy, Ukraine,
tamara111115@ukr.net
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The topicality. Despite the existing numerous herbal supplements, sunflower isolate is quite promising. Protein isolate has high nutritional value, balanced amino acid composition, except for low levels of lysine. **Purpose and methods.** There is a substantiation of optimal amount of sunflower isolate introduction into the recipe of cheese product, analysis of organoleptic and physicochemical parameters of the developed product, technology improvement of cheese products with changed recipe composition. **Research methods** are organoleptic, physicochemical, structural-mechanical, mathematical processing of experimental data using computer technology. **Results.** According to the results of organoleptic evaluation, the cheese product with sunflower isolate in the amount of 0.5% exceeded the analogue by 0.8 points, and the second sample is by 1.5 points. The titrated acidity of the analogue is 8.2 and 4.6 degrees higher than 1 and 2 samples, respectively. The value of the mass fraction of moisture decreased with increasing percentage of sunflower isolate by 0.7 and 1.7%. The rheological parameters of samples 1 and 2 relative to the analogue were higher: penetration forces at 7.78 and 7.88 kN / m², and elasticities at 4.75 and 4.79 kN / m². Microbiological parameters did not exceed the normative values. **Conclusions and discussions.** The developed craft cheese product with the introduction of 0.5% sunflower isolate meets the requirements of regulatory documentation and consumers, which allows expanding the range. The scientific novelty of the obtained results is that sunflower isolate was first proposed as a protein recipe component of fermented milk product and its effect on physicochemical and rheological parameters was studied. The practical significance of the obtained results is manifested in the ability to use the proposed technology and recipe of the cheese product both in factories and in low-capacity enterprises.

Keywords: sour milk cheese; cheese product; sunflower isolate; organoleptic; physicochemical parameters; rheology; microbiological indicators.

The topicality of the problem

Formulation of the problem. Food shortages, the constant growth of the world's population provoke the search for new resources, especially protein from unconventional raw materials. Statistics claim that almost 25% of the population does not eat enough protein, which is a source of amino acids and nitrogen. Today, most manufacturers combine animal and plant proteins to address this issue. Despite the existing numerous herbal supplements, sunflower isolate is quite promising.

Sunflower is an agricultural crop widely represented in Ukraine as the main raw material for oil production. As a result of technological processing about 30% of meal is formed. It solves not only the issue of utilization and storage of waste from the main production, but also the production of sunflower isolate. Protein isolate has high nutritional value, balanced amino acid composition, except for low levels of lysine. A valuable property of this product is also the absence of toxic substances.

Lactic acid products made according to classic recipes have certain functional properties, but need to be improved to expand their range and focus to obtain high quality products for human consumption.

State study of the problem. The question of the use of sunflower isolate in the food industry was studied in the works of H. Nan and others (2019), Dabbour M., He R., Ma H., Musa A. (2018), Brückner J., Mieth G., Dabrowski K., Gwiazda S., Rutkowski A. (1982), Dube M., Schäfer C., Neidhart S., Carle R. (2007), Shchekoldina T., Aide, M. (2014), Mehryar L., Esmaili M., Zeynali (2017), Salgado P. R., Molina Ortiz S. E., Petrucci S. (2012), Evlash V., Tovma L., Tsykhanovska I., Gaprindashvili N. (2019).

Unresolved issues. Along with the innovative products development with sunflower isolate in the literature there is almost no information about fermented milk products with this additive. Sunflower isolate as a form of vegetable protein without a specific taste and smell is a cost-effective raw material that allows its widespread use in various proportions. Given the in-depth study of physicochemical, rheological and biological characteristics of sunflower isolate by scientists in different countries (Taha et al., 2013; Ivanova et al., 2013; 2017; Pickardt et al., 2011), the question of development relevance and production of innovative sour-milk products with sunflower isolate becomes expedient and substantiated.

Development of curd sour milk product will allow expanding the existing range; will promote use of regional raw materials.

Purpose and research methods

The purpose of the article is to substantiate the introduction of the optimal amount of sunflower isolate into the recipe of the cheese product, analysis of organoleptic and physicochemical parameters of the developed product, the technology improvement of cheese products with a changed recipe.

The methodological basis of the study is to study the level of consumption of this type of dairy products, analysis of shortcomings and finding ways to solve them.

Research methods are organoleptic, physicochemical, structural-mechanical, mathematical processing of experimental data using computer technology.

The research object is the production technology of cheese product using sunflower isolate.

The subject of research is sour milk cheese (DSTU 4554: 2006), samples of cheese product with sunflower isolate (DSTU 4503: 2005), model samples of cheese product with the addition of sunflower isolate in the amount of 0.5, 1.0% of the total weight.

The scientific novelty of the obtained results is that sunflower isolate was first proposed as a protein recipe component of fermented milk product. The influence of sunflower isolate on physicochemical and rheological parameters of the finished product was studied for the first time.

The information base of the research is based on scientific articles, materials of international scientific-practical conferences of scientists of Ukraine and abroad, normative and technical documentation.

Research results

Healthy food production is an important issue for scientists and manufacturers. Current trends in nutrition of the Ukrainian population encourage improving existing or even developing new foods. Sunflower isolate of TM “Fruty Yummy” was used to develop the recipe of the cheese product (Table 1).

Tabl. 1. Recipe for curd product with sunflower isolate, %

Components	Sample	
	1	2
Cottage cheese	99,5	99,0
Sunflower isolate	0,5	1,0
Total	100,0	100,0

Analyzing the literature data of sunflower isolate, we concluded that the supplement is characterized by a high content of protein (about 83.8%) and fiber (about 12%). It also contains all the essential amino acids. The first limiting amino acid of these is lysine.

The basis of the advanced technology of production of a curd product with sunflower isolate is the traditional scheme of production of sour-milk cheese. The basic technological scheme is presented in fig. 1.

The production of an innovative product differs from traditional technology only by an additional technological stage and the introduction of sunflower isolate.

Given that cheese products are common foods and are recommended for all age groups, organoleptic characteristics should be at a high level. The sensory evaluation of the developed products and sour milk cheese was performed by a group of tasters of five people.

Each of the indicators were assessed a maximum of five points. The results of organoleptic evaluation are presented in table 2.

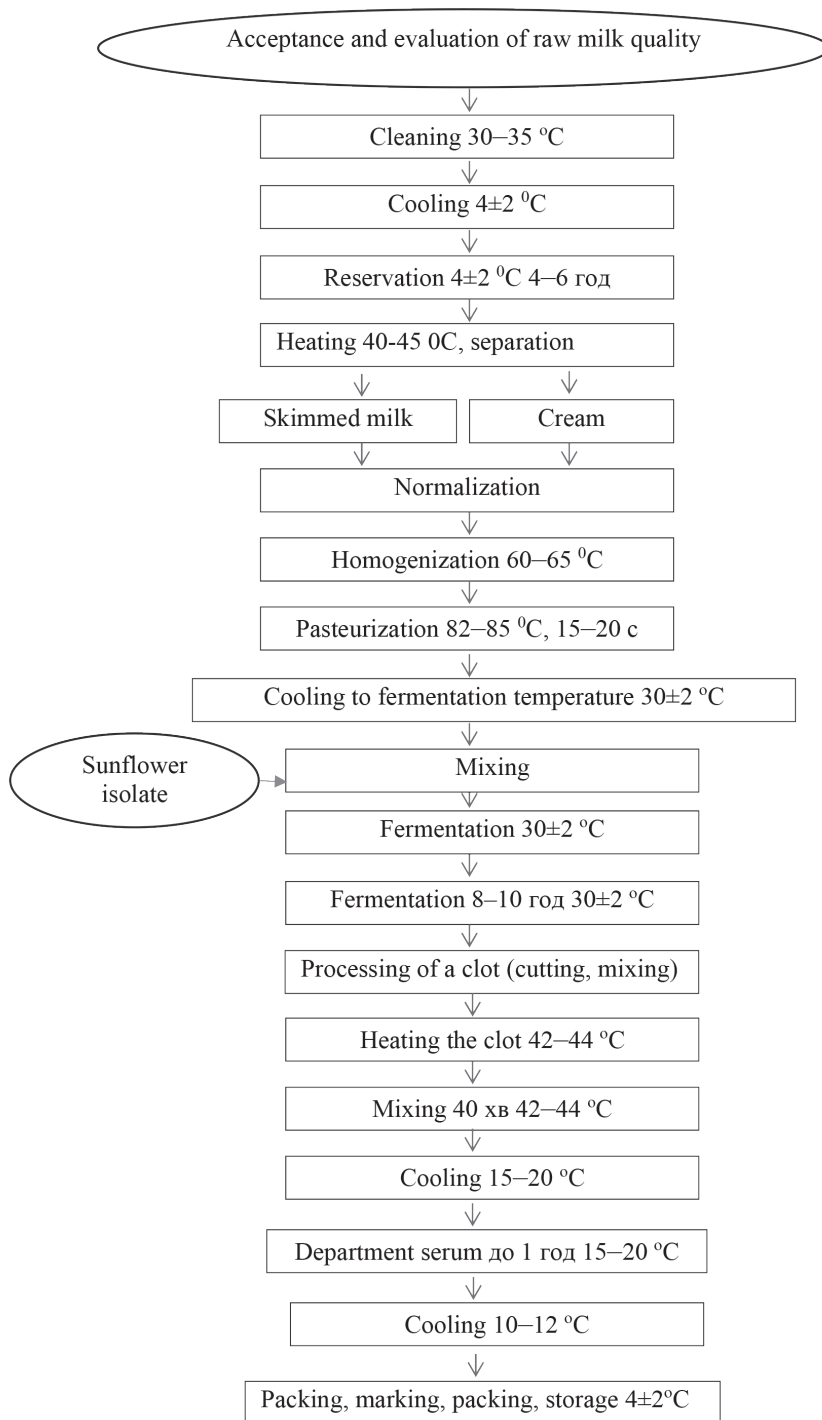


Fig. 1. Schematic technological scheme of cheese product production

Tabl. 2. Organoleptic evaluation of test samples, M \pm m

Indicator	Sample		
	analogue	1	2
Taste and smell	4,4 \pm 0,16	4,8 \pm 0,12	2,8 \pm 0,17
Consistency and appearance	4,4 \pm 0,10	4,8 \pm 0,13	3,6 \pm 0,10
Color	4,8 \pm 0,08	4,8 \pm 0,13	3,4 \pm 0,11

Sour milk cheese produced by traditional technology must have the following characteristics of the studied indicators: consistency and appearance are smear or crumbly, allowed slight granularity and slight separation of serum; taste and smell are characteristically sour-milk, without extraneous tastes; color is white or with a cream shade on all weight. In view of this and the results presented in table 2, it should be noted that the analogue in all indicators is rated higher than the second sample. In total, it was estimated at 4.5 points. Sample № 1 with the addition of 0.5% sunflower isolate according to the results of the tasting evaluation exceeded the analogue by 0.8 points. Its taste and smell were characteristic of sour milk with a pleasant taste of the plant component. The consistency of the first sample was characterized by the presence of filler particles and was moderately dense.

Given that the conditions of the research (technological parameters and the main components of the recipes) were identical, it should be noted that one percent of the introduced protein food isolate leads to a deterioration in the consumer characteristics of the product. The introduced plant component in the amount of 0.5% does not spoil the organoleptic characteristics of the cheese product and meets the requirements of DSTU 4503: 2005.

During the development of innovative products, not only the organoleptic characteristics of the product but also the technological ones are important, which is the purpose of further research in this direction. All physicochemical studies of the samples were performed three times. The results of studies of physicochemical parameters are presented in table 3.

The highest value of the titrated acidity of the studied samples after packaging is characterized by the analogue. Its titrated acidity is 8.2 and 4.6 degrees higher than the first and second samples, respectively.

Mass fraction of moisture is an important indicator of quality for most foods. It determines the organoleptic and rheological parameters of the product, affects the shelf life and is used in economic calculations. The value of the mass fraction of moisture decreased with increasing percentage of sunflower isolate. The difference in relation to the analogue is 0.7 and 1.7%, respectively. This indicator did not significantly affect the quality of the product and was within the regulatory framework.

Penetration and elasticity efforts characterize the rheological parameters of the product. Thus, the penetration rate expresses the depth of penetration of a body of standard shape (calibrated needle) into semi-liquid and semi-solid materials under a certain mode, which determines the ability of the body to penetrate the material, and the material is to resist this penetration. For its part, elasticity characterizes the ability of bodies to regain their shape and volume after the cessation of external forces. The increase in the penetration of the curd product is observed with increasing percentage of the introduced plant component. The increase in the value of the elasticity index is

also associated with the introduction into the recipe of the curd product of sunflower isolate. However, it should be noted that a significant difference between the rheological parameters of the first and second samples is not observed. Compared to the analogue, the difference between the values of the penetration force is 7.78 and 7.88 kN / m², and the elasticity is 4.75 and 4.79 kN / m².

Tabl. 3. The results of physicochemical and rheological parameters after packaging, M±m

Indicator	Sample		
	analogue	1	2
Titrated acidity, OT	133,8±0,02	125,6±0,01	129,2±0,05
Mass fraction of moisture, %	75,4±0,42	74,7±0,57	73,7±0,57
Mass fraction of dry matter,%, including:			
fat	15±0,12	15,2±0,18	15,2±0,20
protein	17,3±0,19	17,4±0,61	17,4±0,24
Penetration effort kN / m ²	10,30±4,27	18,08±2,60	18,18±2,60
Elasticity kN / m ²	6,90±1,29	11,65±1,22	11,69±1,22

Therefore, the introduction into the formulation of the cheese product of sunflower isolate contributes to the improvement of the rheological parameters of the finished product and affects the ability to preserve the form during transportation and sale.

The characteristics of the product will not be considered complete if the microbiological parameters have not been studied. Microbiological indicators of sour milk cheese and cheese products with a vegetable component should not exceed the criteria established by regulatory legal acts. The studies were performed after packaging and at the end of shelf life. Expiration date of sour milk cheese at a storage temperature of 2 0C to 6 0C in the case of packaging in parchment up to 3 days, and non-thermoses cheese product at a storage temperature of 0 0C to 2 0C has expiration date of not more than 4 days. Microbiological parameters of the studied samples during storage are given in the table 4.

Tabl. 4. Microbiological parameters of the studied samples

Indicator	Meanings					
	after packing			for the expiration date		
	ana- logue	1	2	ana- logue	1	2
The number of lactic acid bacteria, CFU in 1 g of product, not less	1,1×10 ⁹	1,2×10 ⁹	1,1×10 ⁹	5,1×10 ⁹	4,7×10 ⁹	4,8×10 ⁹
Bacteria of the Escherichia coli group (coliforms) in 0.001 g of product	Not found	Not found	Not found	Not found	Not found	Not found
The number of molds, CFU in 1 g of product, not more	<10	<10	<10	<10	<10	<10
The amount of yeast, CFU in 1 g of product, not more	<100	<100	<100	<100	<100	<100

Continuation of the Table 4

Pathogenic microorganisms, in particular Salmonella, in 25 g of product	Not found	Not found	Not found	Not found	Not found	Not found
Staphylococcus aureus, in 0.01 g of product	Not found	Not found	Not found	Not found	Not found	Not found

The results of microbiological studies presented in table 4 showed that at the end of the shelf life of cottage cheese and cheese products were not observed BGKP, pathogens and *Staphylococcus aureus*, and the number of yeasts and molds was within normal limits. The number of lactic acid bacteria of the analogue at the expiration date was higher due to the increase in the mass fraction of moisture and the high value of water activity.

From the obtained results it can be concluded that the introduction into the formulation of fermented milk product sunflower isolate did not significantly affect the microbiological parameters of the finished product, and hence the final expiration date.

Conclusions and results discussion

Thus, the following conclusions are:

1. According to the results of organoleptic evaluation of the studied samples, it should be noted that the introduction of 0.5 percent of sunflower isolate in the recipe of the curd product helps to improve the consumer characteristics of the product.

2. As a result of the analysis of physicochemical and rheological parameters of samples after packing there is a slight decrease in the value of titratable acidity of cheese products relative to the analogue and, at the same time, improvement of structural and mechanical characteristics.

3. The microbiological parameters of the finished products for the final shelf life were within the normative documents, and therefore, the introduction into the recipe of sunflower isolate did not have a negative impact.

4. The developed craft cheese product with the introduction of 0.5% sunflower isolate meets the requirements of consumers, which will expand the existing range.

The practical significance of the obtained results is manifested in the ability to use the proposed technology and recipe of the cheese product both in factories and in low-capacity enterprises.

Prospects for further research are a deeper analysis of the interaction of plant and animal proteins with the possibility of expanding the range of functional dairy products.

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Наталія Болгова,

кандидат сільськогосподарських наук, доцент,
Сумський національний аграрний університет,
Суми, Україна,
bolgova_1981@i.ua
<http://orcid.org/0000-0002-0201-0769>

Вікторія Цигура,

старший викладач,
Сумський національний аграрний університет,
Суми, Україна,
viktoriya.cigura@gmail.com
<https://orcid.org/0000-0002-2049-7013>

Тамара Хмелюк,

магістр,
Сумський національний аграрний університет,
Суми, Україна,
tamara111115@ukr.net

ІННОВАЦІЙНІ АСПЕКТИ ВИКОРИСТАННЯ СОНЯШНИКОВОГО ІЗОЛЯТУ В ТЕХНОЛОГІЇ КРАФТОВИХ СИРКОВИХ ВИРОБІВ

Актуальність. Незважаючи на існуючі численні рослинні добавки, доволі перспективним є і зюлят соняшнику. Протеїн ізоляту має високу поживну цінність, збалансований амінокислотний склад, за винятком низького рівня лізину. **Мета і методи.** Обґрунтування введення в рецептуру сиркового виробу оптимальної кількості соняшникового ізоляту, аналіз органолептичних та фізико-хімічних показників розробленого продукту, удосконалення технології виробів сиркових зі зміненим рецептурним складом. Методи дослідження: органолептичні, фізико-хімічні, структурно-механічні, математична обробка експериментальних даних за допомогою комп'ютерних технологій. **Результати.** За результатами органолептичної оцінки сирковий продукт із соняшниковим ізолятом у кількості 0,5 % перевищив аналог на 0,8 бали, а другий зразок – на 1,5 бали. Титрована кислотність аналога на 8,2 та 4,6 градуси вища відповідно 1 та 2 зразків. Значення показника масової частки вологи знижувалося зі збільшенням відсотка соняшникового ізоляту на 0,7 та 1,7 %. Реологічні показники 1 та 2 зразків відносно аналога були вищими: зусилля penetрації на 7,78 та 7,88 kN/m², а пружності – 4,75 та 4,79 kN/m². Мікробіологічні показники не перевищували нормативні значення. **Висновки та обговорення.** Розроблений крафтовий сирковий продукт із внесенням 0,5 % соняшникового ізоляту відповідає вимогам нормативної документації та споживачів, що дозволяє розширити асортимент. Наукова новизна одержаних результатів полягає у тому, що соняшниковий ізолят було вперше запропоновано як білковий рецептурний компонент кисломолочного продукту і досліджено його вплив на фізико-хімічні та реологічні показники. Практичне значення одержаних результатів проявляється у можливості використовувати запропоновану технологію та рецептуру сиркового продукту як в умовах заводів, так і на підприємствах малої потужності.

Ключові слова: сир кисломолочний, сирковий продукт, соняшниковий ізолят, органолептика, фізико-хімічні показники, реологія, мікробіологічні показники.

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Наталія Болгова,

кандидат сільськогосподарських наук, доцент,
Сумської національний аграрний університет,
Суми, Україна,
bolgova_1981@i.ua
<http://orcid.org/0000-0002-0201-0769>

Викторія Цыгура,

старший преподаватель,
Сумської національний аграрний університет,
Суми, Україна,
viktoriya.cigura@gmail.com
<https://orcid.org/0000-0002-2049-7013>

Тамара Хмелюк,

магістр,
Сумської національний аграрний університет,
Суми, Україна,
tamara111115@ukr.net

ИННОВАЦИОННЫЕ АСПЕКТЫ ИСПОЛЬЗОВАНИЯ ИЗОЛЯТА ПОДСОЛНЕЧНИКА В ТЕХНОЛОГИИ КРАФТОВЫХ ТВОРОЖНЫХ ИЗДЕЛИЙ

Актуальность. Несмотря на существующие многочисленные растительные добавки, перспективным является и изолят подсолнечника. Протеин изолята имеет высокую питательную ценность, сбалансированный аминокислотный состав, за исключением низкого уровня лизина. **Цель и методы.** Обоснование введения в рецептуру творожного изделия оптимального количества изолята подсолнечника, анализ органолептических и физико-химических показателей продукта. **Методы исследования:** органолептические, физико-химические, структурно-механические. **Результаты.** По результатам органолептической оценки творожный продукт с подсолнечным изолятом в количестве 0,5 % превысил аналог на 0,8 балла, а второй образец – на 1,5 балла. Титруемая кислотность аналога на 8,2 и 4,6 градуса выше соответственно 1 и 2 образцов. Значение показателя массовой доли влаги снижалось с увеличением процента подсолнечного изолята на 0,7 и 1,7 %. Реологические показатели 1 и 2 образцов относительно аналога были выше: усилия пенетрации на 7,78 и 7,88 kN/m², а упругости – 4,75 и 4,79 kN/m². Микробиологические показатели не превышали нормативные значения. **Выводы и обсуждение.** Разработанный крафтовый творожный продукт с внесением 0,5 % подсолнечного изолята соответствует требованиям нормативной документации и потребителей, позволяет расширить ассортимент. Научная новизна исследования заключается в том, что подсолнечный изолят был впервые предложен как белковый рецептурный компонент кисломолочного продукта, и изучено его влияние на физико-химические и реологические показатели. Практическое значение полученных результатов проявляется в возможности использовать предложенную технологию и рецептуру творожного продукта как в условиях заводов, так и на предприятиях малой мощности.

Ключевые слова: творог, творожный продукт, подсолнечный изолят, органолептические характеристики, физико-химические показатели, реология, микробиологические показатели.