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The production of the innovative craft cheese "Anchan"

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ABSTRACT

The analysis of regional raw materials for producing craft cheese "Anchan" and studies of raw milk for its physical and chemical properties and technological indicators. Milk samples were pasteurized in the laboratory at a temperature of 80 °C for 10 seconds. Anchan was added to the milk for colour. Next, the milk before coagulation was heated in a pasteurization boiler by heating with saturated steam 36 – 38 °C. The enzyme 4 mL per 100 kg of milk and 4 mL of black cornflower extract was added to the prepared milk to improve milk coagulation and the formation of a dense cheese clot. Strains of probiotic cultures were selected for Anchan. The composition of the main complex yeast of mesophilic lactococci acid and aroma-forming cultures, namely *Lactococcus lactis subsp. lactis*, *Lactococcus lactis subsp. Lactococcus lactis subsp. diacetilactis*, *Leuconostoc lactis*. As an additional leaven used thermophilic lactic acid sticks of the species *Lactobacillus acidophilus* (incoherent race to obtain a new taste of craft cheese. Using these ingredients reduced fermentation time by 8 – 10 minutes. Closing the skin of the cheese by watering the cheese heats with hot water (50 – 55 °C). Marking, packaging, transportation and storage were carried out per the craft product's specifications for the craft producer. The following criteria were used for optimizing the technological process of Anchan cheese production: temperature treatment of milk, amount of added water for whey deoxidation and amount of salt in cheese. as a result of previous research.

Keywords: craft cheese, milk production, probiotic culture, cornflower, temperature treatment, Anchan

INTRODUCTION

Ukraine is traditionally famous for its range of hard cheeses, a small amount of soft cheeses, processed cheeses and cheeses with fillings, while European countries, in particular France and Italy, are traditionally proud of the sophistication of the range of soft cheeses. Hard cheeses have high nutritional and energy value due to their composition, the presence of essential and non-essential amino acids, vitamins of different groups, and mineral salts of calcium, phosphorus and others **[1]**. The concentration of proteins and fats determines the nutritional value of the food. Different product varieties contain 15 – 27% protein and 20 – 32% fat per 100 grams. The energy value of 100 g of cheese is up to 450 kcal. Hard rennet cheeses with different cooking technology are highly nutritious products. The manufacturing technology differs in the enzymatic fermentation of the milk mixture, including different processing temperatures. The difference is also the temperature and maturation of the cheese in the chambers **[2]**. There are more than 2,500 varieties of cheese in the world by name, region of production and composition of raw materials. Statistically, the quantitative composition has no limits because cheese is a work of nature, human hands and time **[3]**. The works of Ukrainian scientists raise the issue of the functioning of the cheese market and highlight the solution to this problem through the use of both secondary raw materials and innovative processing technologies **[4]**, **[5]**.

The State Statistics Service of Ukraine 2021 provides the production of chees in the amount of 15,326 tons, including fresh unfermented cheese (unripe and unripened, including whey cheese and cottage cheese) amounted to 5,589 tons; sour milk cheese and baby food products 488 tons; grated cheese, powdered, blue and other unmelted cheese (excluding fresh cheese, whey cheese and sour milk cheese) 6,688 t; processed cheese (except grated or powdered) 2601 tons. In August 2018, Ukraine produced 17,125 tons of cheese, including fresh unfermented cheese (unripe and unripe, including whey cheese and cottage cheese) is 5,766 tons; of grated cheese, powdered, blue and other unmelted cheese (except fresh cheese, whey cheese and cottage cheese) 8293 t; processed cheese (except grated or powdered) 2442 t.

Long-standing traditions of cheese-making in Ukraine can be traced in the works of modern cheese producers, such as Ukrainets Agro (Cheese Garden brand), Bilozgar (Ukrainian cheese), and Bimol LLC. Possibilities and problems of adaptation of European craft cheese-making to Ukrainian, particularly Vinnytsia, conditions in Podillya from local, regional raw materials are analyzed.

The introduction of craft production in Ukraine has an imperfect control system, unavailability of loans, licensing, limited financial resources, certification, high costs of economic activity, outdated production technologies, and differences in regional prices. Therefore, analyzing problems and prospects of craft cheese production in Vinnytsia is important in the context of Podillya as a region with a developed cheese industry and quality, safe product.

Ukraine has many tasks - not to be afraid of innovations, new standards, and implementation of regulations. Cheese and craft cheese factories are experiencing an innovative boom: they do not live in a separate reality but are part of the global life of global industry because in 2021, in Ukraine will be organized a global craft cheese competition – World Cheese Awards **[2]**. Great prospects for the transformation of quantity into quality and safety of finished cheeses is the task of the technologist to experiment, the opportunity to assess themselves against the product, without worrying about their individuality.

We have proposed the production of natural craft cheese called "Anchan". It is based on the basic features of the technology (pasteurization temperature), low temperature of the second heating and the method of coagulation of milk with the introduction of extract – anchan and black cornflower, which was used to form a cheese clot craft hard cheeses and the use of milk of 2nd and 3rd grades.

The purpose of writing this work is the craft development of Anchan cheese technology based on the laboratory of food production VTEI KNTEU. The laboratory is certified in the quality management system (certificate No UA.80050.063 QMS-21 recertified from 21.06.2021). The article covers the assessment of the composition and quality of milk obtained in Podolia - regional raw materials.

Scientific Hypothesis

In the development of craft technology of Anchan cheese, unique plants were used: Black Cornflower and Anchan. The application was carried out with pasteurized extracts – to form a cheese clot. Strains of probiotic cultures (including acidophilic bacillus) were selected for the aromatic component.

In the technology, we have used the degree of transition of dry matter (SR) into cheese, which depends on seasonal fluctuations in the chemical composition of milk, which are related to the region and seasonality.

MATERIAL AND METHODOLOGY

Samples

We used milk as a raw material that meets the quality standard of DSTU 3662:2018 "Cow's raw milk. Specifications". The black cornflower extract was obtained at the Ladyzhyn factory of bio- and enzyme preparations "Enzym" (Vinnytsia region, Ladyzhyn). The plant raw material of the grass "Anchan" (Clitoria ternatea) is taken from the assortment of the "Svitchayu" company.

Chemicals

When working on the material of the article, we used high-quality chemicals purchased from IKF-Service Plus (Ukraine), distributor.

Animals and Biological Material

In this study, raw materials from the Podillia region were used for the production of craft cheese.

Instruments

The research used a Bond milk analyzer (120 seconds with a printer, Bulgaria), Somatos "Scan" (Bulgaria), an electric stove ESPERANZA EKH008 (Germany), a dry-air thermostat "MICROmed" TS-80 (Bulgaria), an AD130 pH meter ADWA (Bulgaria).

ADS60 hygrometer scales (AXIS, England), Orbita laboratory centrifuge (Ukraine), Lambda 25 spectrophotometer (PerkinElmer Ltd., USA).

The additional and basic leaven of the State Research Enterprise of Bacterial Ferments TIMM, rennet. We proposed to use the flowers of the clitoris of the trifoliate plant with the original name Anchan. In our work, we proposed using a milk-clotting enzyme as an enzyme, namely a plant coagulant - black cornflower *Centurea* spp. Cornflower is a black plant that contains excess cell sap, which helps form clots. The enzyme preparation "Maxiren" from DSM Food Specialties (Netherlands), which is chymosin obtained from special strains of milk yeast *Kluyveromyces lactis*, is also used as a milk coagulant.

Laboratory Methods

Indicators of raw materials and "Anchan" cheese were determined using microbiological, biochemical and physico-chemical generally accepted standard methods of analysis, outlined in the relevant standards and instructions for microbiological and technical-chemical control.

Description of the Experiment

Number of samples analyzed: 20 samples.

Number of repeated analyses: all biochemical procedures were conducted in triplicate.

Number of experiment replication: 2 times.

Design of the experiment:

For the production of "Anchan" craft cheese, we used raw milk that came from the farm to the Lytinsky dairy plant (Vinnytsia region). In fact, milk is not always stable and standard (Table 3). Therefore, the quality of milk pasteurization was checked. Experimental milk samples were processed at (81 ±1) OS with exposure at 20 – 25 C (option II) and ultraraumizocomperia (UVT) (Figure 7). To reduce contamination, the process was carried out in a FJ 15 raw boiler, the pasteurization efficiency reached 99.99%. (Table 4). During the experiment, we did not violate the technological scheme. Our research is about improving the structure and color of cheese. The recipe includes raw materials for the production of calcium chloride, a synthetic drug containing 27% of calcium. The active substance is calcium chloride. The black cornflower Centurea spp and the flowers of the clitoris plant with the original name Anchan for color were used as an enzyme for fermentation. Introduction of ingredients-extract from plants. To determine the parameters, the extract was centrifuged for 10 min (obtaining the extract). During the experiment, the following were controlled: acidity of cheese, moisture content in cheese (W), salt concentration (N), amount of added water in %, antioxidant activity, polyphenols and flavonoids. The obtained data were expressed in mg of standard compound per gram of dry weight (DW).

The cheese production raw material is calcium chloride, a synthetic preparation containing 27% calcium. The active substance is calcium chloride (Figure 1).

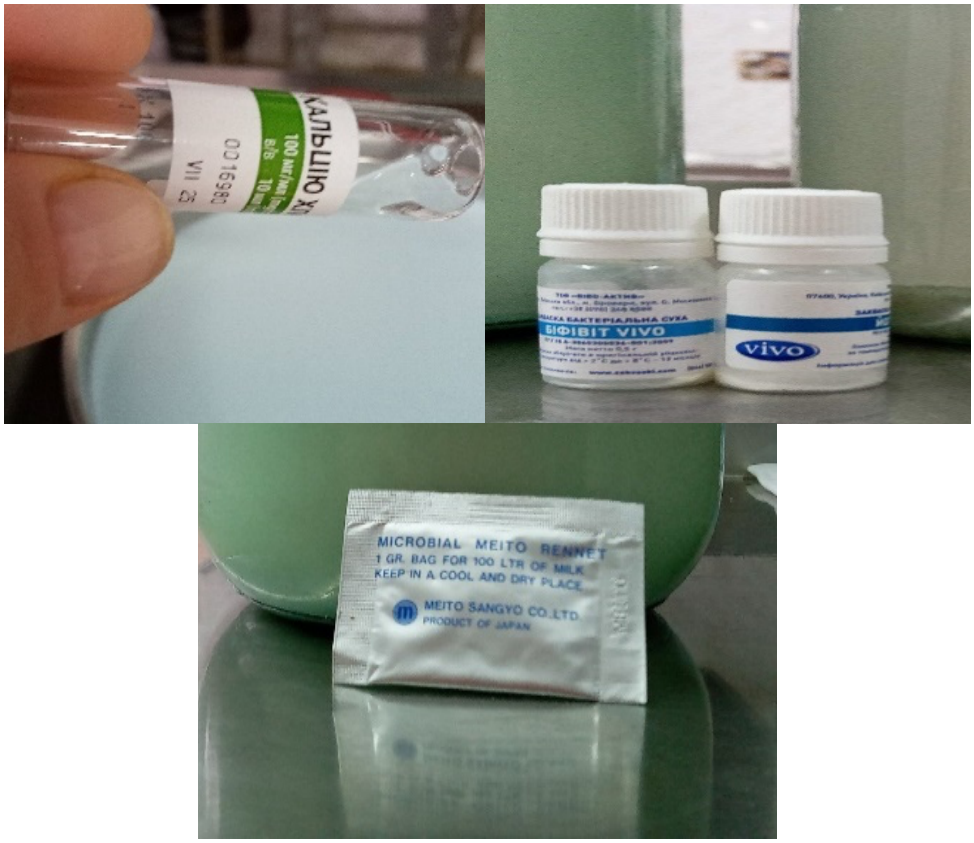

Figure 1 Ingredients of craft cheese.

Figure 2 "Black Cornflower" and "Anchan".

Table 1 Research methods.

Indicator	The principle of the research method
Sampling of raw milk and preparing them for analysis	For GOST 26809-86
Mass fraction of fat, %	Gerber acid method according to GOST 5867-90
Mass fraction of protein, %	According to GOST 2579-90 and GOST 23327-78
Active acidity (pH), (units)	Potentiometric method according to GOST 26781-85
Titrated acidity, °T	Titrometric method according to GOST 3624-92
Density, g/cm^3	Areometric method according to GOST 3625-84
Degree of purity of milk, group	Filtering
Sampling for microbiological analysis	For GOST 26668-85
The amount of acidophilic bacilli, %	The method of limiting dilutions in sterile skim milk at a temperature of 43 °C
QMAFANM, kuo/cm^3	According to GOST 9225-84 and GOST 10444.12-88
The composition of free amino acids, %	Using the amino analyzer "Bio-tronik LC 2000" after treatment with a solution of sulfosalicylic acid
Fractional protein composition of beverages, %	Polyacrylamide gel electrophoresis method (Lemley method in modification with introduction of urea gel)

Statistical analysis

Primary processing of experimental data was carried out with the help of a package of application programs for statistical analysis using criteria. Statistical criteria were used: Cochran's criterion – to assess the homogeneity of variance, Studen's criterion – to assess the significance of the calculated coefficients, Fisher's criterion - to assess the adequacy of the obtained equations. A package of application programs for experiment planning and optimization was used to optimise the parameters of technological processes. Significant differences (p <0.05) between means were assessed using ANOVA and the Tukey–Kramer test. Correlation coefficients were calculated using Statistica software version 13.0 (StatSoft, Tulsa, OK, USA). The research program is included in the DFE-24-1 experiment planning matrix. Experiments were performed in triplicate.

RESULTS AND DISCUSSION

The article presents the craft development of Anchan cheese **[6]**. The expediency and relevance of using regional milk raw materials for production are described. Milk was selected and researched by seasons and regional suppliers for selection by quality indicators (Table 2). Changes in the chemical composition of milk and microbial contamination depending on the type of ownership of the supplier and changes in milk quality depending on the season were statistically processed and studied **[7]**, **[8]**. The use of strains of microorganisms is proposed. Temperature regimes for safe product have been determined. Modes of milk pasteurization in the production of craft cheese. **[9]**. The expediency and relevance of using extracts of black cornflower herbal coagulant – black cornflower *Centurea* spp. and Anchan extract to obtain a specific new taste of cheese. Organoleptic evaluation of Anchan cheese is shown in Table 4.

Craft cheese was presented **[10]** – with extracts of black cornflower *Centurea* spp. and Anchan extract (42nd) **[7]**. The chemical composition of the cheese is enriched with yeasts of mesophilic lactococci. The composition includes acid- and aroma-forming cultures of *Lactococcus lactis subsp. lactis, Lactococcus lactis subsp. Lactococcus lactis subsp. diacetilactis, Leuconostoc lactis*, thermophilic lactic acid bacilli of the species *Lactobacillus acidophilus* (non-viscous race). The main and additional bacteria of starting cultures **[11]** lactobacilli from several different sources **[12]** have broad antimicrobial activity.

Table 2 Organoleptic evaluation of cheeses after maturation at different temperature regimes, (points).

Organoleptic indicators	Options for temperature modes of maturation		
	1	2	3
Taste and smell	38.0	39.0	36.5
Consistence	24.0	24.0	23.5
Drawing	10.0	10.0	10.0
Overall rating	92.0	93.0	90.0

Figure 3 Appearance of craft cheese "Anchan".

All over the world, the task is to expand the range and improve the quality, biological value, safety, taste and range of certain foods **[44]**. Therefore, developing craft technology for cheese production using regional raw materials and extracts of black cornflower "I Anchan" will be a very promising task for craft production **[6]**. We present the organoleptic studies results of the prototype craft cheese "Anchan". The samples were predicted to mature at different temperatures.

The taste and smell of variants 1 and 2, compared to variants 3, were purer and more pronounced, and the texture was not very soft, more typical of hard cheese. Organoleptic evaluation of both individual indicators and the overall organoleptic evaluation of cheeses of the first two variants of maturation was higher. The lowest in the main indicator of organoleptic evaluation of cheese "taste and smell", which primarily depends on the

cheese grade, were cheeses of option 3, which had a variety of unpleasant tastes.

The high saturated fat content of butter has been criticized for many years from a health perspective, and this, combined with recommendations to reduce the total amount of fat in the human diet, has led to a growing interest in low-fat products. Mixed fat spreads containing a mixture of milk fat and vegetable oil (more often rapeseed) are presented on the market. Many of these foods seem to lack the texture, mouthfeel, and flavor of full-fat foods. However, consumer interest in low-fat products is steadily growing, and in the future, quality will undoubtedly be achieved due to the results of numerous studies in this direction **[13]**, **[14]**, **[15]**, **[16]**. The addition of oil shows little effect on the physicochemical characteristics, and consumer evaluation highlighted that all fresh cheeses were considered acceptable, although cheeses with linseed oil and raspberry oil were most appreciated. High-protein milkshakes, powders, milk drinks, smoothies, and fortified dairy products are some examples of commercial milk-based beverages with additional health benefits in the world **[17]**, **[18]**.

Prediction of the content of minerals, fatty acids (FA) and cholesterol in cheese samples was carried out based on the results of near-infrared transmission spectroscopy studies **[19]**. When determining the influence of iodine content on dairy raw materials, we relied on a large number of studies conducted in this area **[20]**, **[21]**, **[22], [23]**.

Functional foods containing dietary fiber (DF), prebiotics, probiotics, and synbiotics are known to be associated with various health benefits. DFs containing edible carbohydrates and closely related compounds resistant to digestion in the human small intestine with complete or partial fermentation in the large intestine can be classified as water-soluble and water-insoluble **[24]**. Prebiotic properties depend on molecular weight, composition of monosaccharides and type of glycosidic binding. Prebiotic substances stimulate the growth of bifidobacteria and lactobacillus species – bacteria that are considered beneficial for health **[25]**, **[26]**, **[27]**, **[28]**. In particular, the use of S. carnosus strain No. 5304 is effective for denitrification of milk with high nitrate content in the technology of production of fermented milk products **[29]**.

Lactobacillus rhamnosus and L. delbrueckii are known to have broad antimicrobial activity and L. rhamnosus isolate was found to be presented with a survival percentage of 6.9% at pH 4.5 and 5.1% at pH 2.0) and L. rhamnosus (5.7% at pH 4.5 and 4.9% at pH 2.0) is tolerated by an acidic environment, Lactobacillus spp. has an antimicrobial effect **[30-37]**.

The use of spirulina in the production of dairy products leads to a 29.56% increase in the amount of Lactobacillus acidophilus, a 20% reduction in fermentation time and the total amount of probiotics. Spirulina probiotic yogurt was found to be acceptable to consumers as assessed by an affective consumer test **[38-41]**.

For the production of craft cheese, we studied the chemical composition of milk in the farm; the correspondence of fat and protein content in milk was checked; changes in the value of the ratio between fat and protein content as a basis for the normalization of milk for craft cheese. The milk quality indicators obtained during the quarter statistically processed and studied the change in the chemical composition of milk and microbial contamination depending on the type of ownership of the supplier and changes in milk quality depending on the season.

Samples of milk clots were obtained at different temperatures of pasteurized milk. Samples were examined for the moisture-retaining ability of the clot (HEI).

The data show a certain dependence of the obtained rennet clots on the temperature of pasteurization of raw milk and the duration of exposure at the temperatures used. With an increase in the pasteurization temperature of milk from 65 to 75 °C, the university of the obtained clots increases by almost 10%, with a further increase in temperature – for every next 10 °C, the university of rennet clots increases by 5%. The effect can be explained by profound changes in the properties of milk proteins, especially whey, which occur during heat treatment.

The data obtained correlate with the results of studies of other scientists who have analyzed the impact of high -temperature treatment on dairy raw materials and qualitative indicators of finished cheese **[43]**.

The results of the study of protein, fat and DMSR in milk from different suppliers during the year are shown in Figure 4, Figure 5 and Figure 6.

At the same time, it should be noted that the protein content of milk obtained from farms throughout the year is higher than 3.0%, and in the third quarter even exceeds this Figure, which almost meets the requirements for milk intended for hard cheese. The fat content of milk obtained from farms in the first, third and fourth quarters was above 3.6%.

The lowest amount of fat – 3.3% and protein 2.97% contained milk received from private farms in the second quarter. Reducing the amount of these components in milk, especially protein, is accompanied by a decrease in cheese yield. The content of lactose and minerals in milk during the lactation period of animals is practically unchanged.

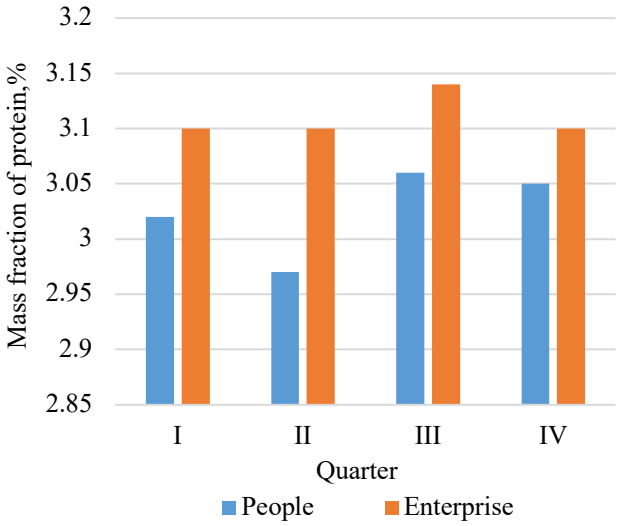

Figure 4 Changes in protein content in milk depending on the type of farm and period of the year.

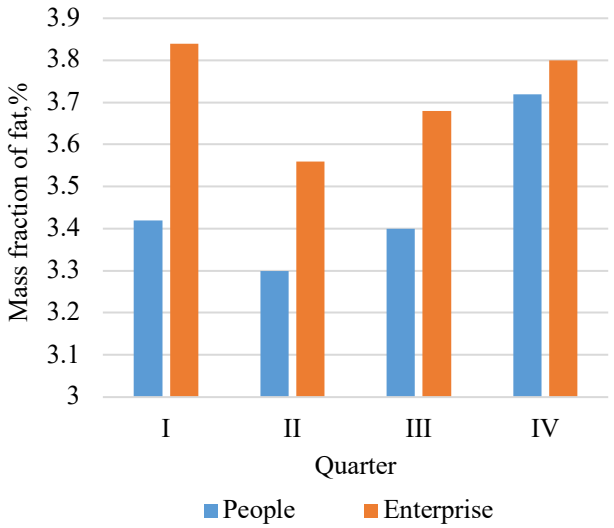

Figure 5 Changes in fat content in milk depending on the type of farm and period of the year.

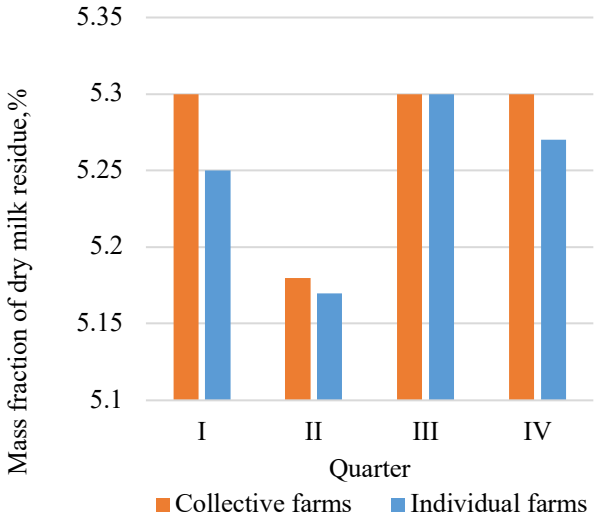

Figure 6 Change in the content of DMSR in milk depending on the type of management and period of the year.

Table 3 Characteristics of milk depending on the type of supplier and season (n = 3, $p \geq 0.95$).

Indexes	Farms (quarter)				Private farms (quarter)			
	I	II	III	IV	I	II	III	IV
Density, kg/m^3	1032	1030	1032	1032	1030	1028	1032	1029
Titrated acidity, °T	18	17	18	18	18	17	18	17
Active acidity (pH)	6.68	6.58	6.80	6.70	6.66	6.52	6.76	6.68
Degree of purity, group	I	I	I	I	I	I	I	I
QMAFAnM	II	II	II	II	II	II	II	II
Rennet-fermentation test, class	II	II	II	II	II	II	II	II
Coagulation of milk (according to Dylanian), type	II	II	II	II	II	II	II	II
Number of somatic cells, thousand/cm^3	320	450	300	410	460	495	380	478
Bacterial contamination, CFU thousand/cm^3	280	380	310	350	360	390	360	380
Inhibitors of growth of fermenting microflora	Not found				Not found			

Table 4 Bacterial contamination of raw milk before and after high-temperature treatment (n = 3, $p \geq 0.95$).

Milk suppliers	QMAFAnM (t = 6 °C) for 24 h CFU/cm^3	Raw milk Pasteurization mode	QMAFAnM, CFU/cm^3	Efficiency of pasteurization,%
Farms (n = 10)	920 ±41	(73 ±1 °C) with exposure 25 c (control)	20 ±1.3	99.35
Private farms (n = 18)	95900 ±9100	(73 ±1 °C) with exposure 25 c (control)	188 ±13.76	99.81
Farms (n = 10)	920 ±41	(81 ±1 °C) with exposure 25 c	16 ±1.4	99.88
Private farms (n = 18)	95900 ±9100	(81 ±1 °C) with exposure 25 c	97 ±7.76	99.94
Farms (n = 10)	920 ±41	(120 ±5) °C with exposure 3 – 5 c	0	100.0
Private farms (n = 18)	95900 ±9100	(120 ±5) °C with exposure 3 – 5 c	12 ±0.63	99.99

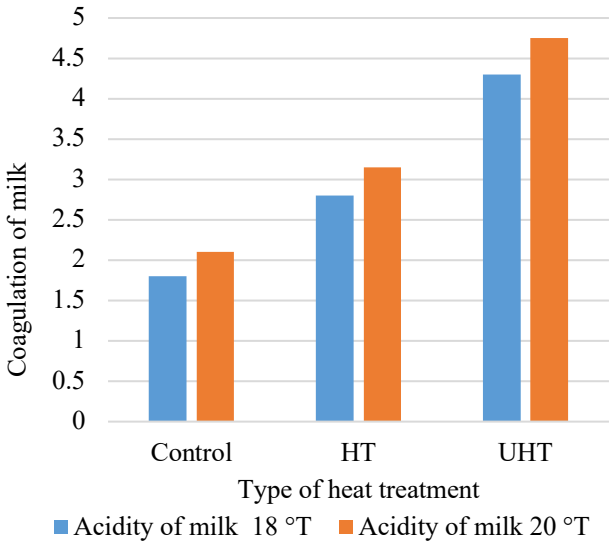

Figure 7 Dependence of milk coagulation on the type of heat treatment and the amount of rennet enzyme and extract of "Black Cornflower" in the presence of 20 g of calcium chloride.

Table 5 Characteristics and storage of ingredients.

Name the ingredient for fermentation	Manufacturer	Composition	View
Cornflower black-ball plant extract	Ladyzhyn Plant of Bio- and Enzyme Preparations “Enzyme” (Vinnytsia Region, Ladyzhyn). Podillya	Enzyme preparation with different mechanism of action based on bacteria and microscopic fungi	Enzyme preparation
Calcium chloride	PJSC "Biopharma" (Kyiv). Biopharma Company	Synthetic preparation	White powder, may be granules
Enzymatic preparation "Maxiren"	DSM Food Specialties (Netherlands),	Chymosin obtained from special strains of milk yeast *Kluyveromyces lactis* enzyme	Brown powder, with odor, natural strain of *Penicillium canescens*
Basic/Additional	TIMM State Research Enterprise of Bacterial Yeasts Ukraine, Kyiv. www.ddpbz.com.ua	*Lactobacillus acidophilus* (incoherent race)	BZ "ANV" cocci present sticks of different lengths

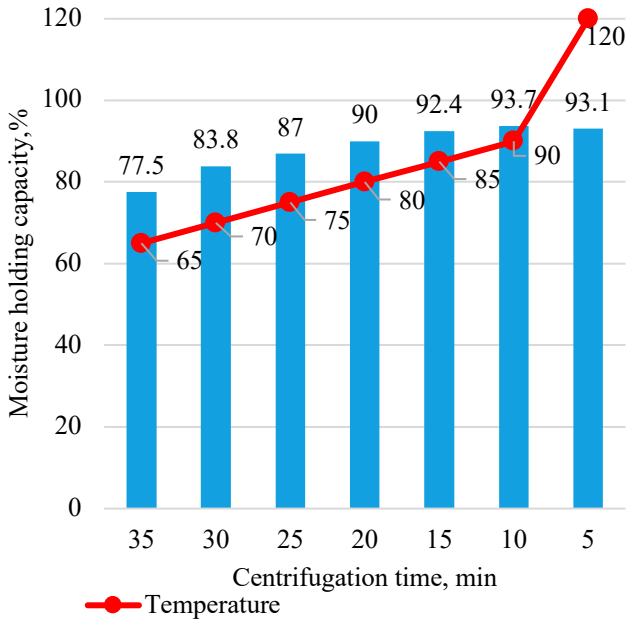

Figure 8 Dependence of moisture-retaining capacity of rennet clot on the mode of pasteurization of raw milk.

The main independent parameters that change and significantly affect the initial optimal indicators of the technological process in the production of hard rennet cheeses were determined: the temperature of the second heating – x1 (T), the amount of added deoxidation water – x2 (V), salt concentration in cheese – x3 (N). The mass fraction of moisture determined the initial optimization parameters – y (W) and soluble nitrogen – y (P) content.

In the production of cheese, the temperature of the second heating was chosen in the range from 40 to 42 °C, the amount of added water – from 5 to 15%, the mass fraction of salt in the cheese – from 1.3 to 2.5%.

As a parameter with a fixed value, we chose the duration of salting cheese in brine – 2 days.

The research was performed according to the matrix of experimental planning following the plan of small factorial experiment DFE-24-1.

The scheme of the experiment consists of three stages of the multifactorial experiment of the production of "Anchan" cheese. At first, doses of the main components (black cornflower, anchan, water, salt) and their effect

on the process of fermentation and ripening of cheese were experimentally studied. At the second stage, the total content of polyphenols in plant extracts of black cornflower and anchan grass was determined.

At the third stage, the parameters of the ready-made "Anchan" cheese were determined: the mass fraction of moisture in the cheese was determined by the express method in the drying cabinet and the arbitration method according to GOST 3626-73; the mass fraction of sodium chloride without ashing of the product according to GOST 3627-81 and the mass fraction of protein – by the Kjeldahl method according to GOST 25170-90. Active acidity was determined electrometrically on a pH meter with a measurement error of 0.05 units. pH according to GOST 26781-85. The mass fraction of fat is following GOST 5867-69.

The implementation of a multifactorial experiment made it possible to evaluate the influence of the second heating temperature of 40 °C, the amount of added water in the amount of 10% and the level of salting of cheese within the limit of the concentration of salt in the finished product of 2.3% on the quality of ripened cheese and to link the above-mentioned factors into a mathematical model. Experiments on the introduction of components were carried out in triplicate.

The milk was processed at a temperature of 71 ±1 °C with a holding time of 20 – 22 seconds. The raw material was cooled to 32 – 34 °C and the components were added: a 40% calcium chloride solution at the rate of 25 g of anhydrous salt per 100 kg of milk, bacterial starter from pure cultures of specially selected DVS microorganisms, as well as plant corn enzyme - 0.5 kg/t and extract of anchan grass – 0.5 kg/t.

The duration of milk coagulation was 25 minutes. For "Anchan" cheese, milk curdled at a temperature of 40 °C. For the action of the plant lactic enzyme, the optimal pH value is 5.9 – 6.0.

Converting dimensionless variables xi into independent values, we obtained the following equation

$$W = 348.4 – 13.96 \cdot T – 2.16 \cdot V – 14.68 \cdot N + 16 \cdot T2 + 0.053 \cdot T \cdot V + 0.33T \cdot N + 0.97 \cdot V \cdot N – 0.024 \cdot T \cdot V \cdot N$$

The obtained equation adequately describes the process of cheese production in the given intervals of changes in the most influential factors, which we established as a result of previous studies. The obtained results of the dependence of the moisture content in the product on technological factors are shown in Figure 9.

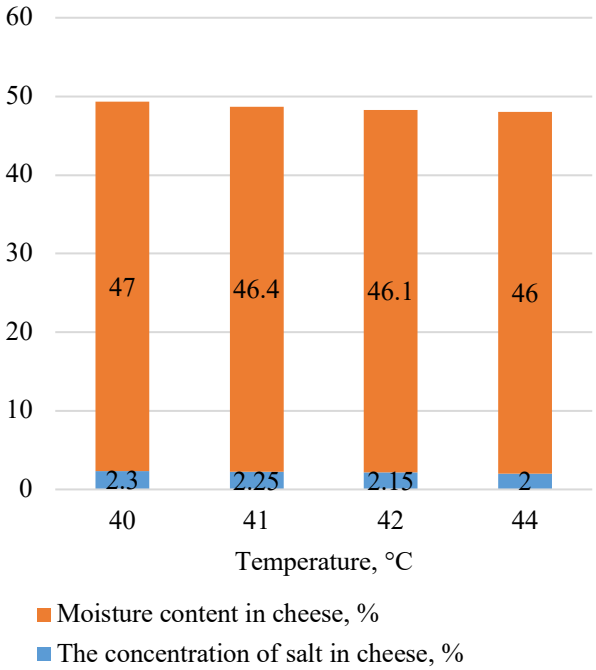

Figure 9 Dependence of moisture content in cheese (W) on the salt concentration (N) at the temperature of the second heating (T) at the amount of added water 15%.

The graphs show that in the variant where the temperature of the second heating was 40 °C, the mass fraction of moisture in the cheese is in the range from 46.5% to 46.8%. The addition 5 to 15% water for the deoxidation of whey affects the moisture content of cheeses insignificantly. The main criterion that actively influences the conditions of development of the microflora in cheese is the mass fraction of salt in the water contained in the cheese.

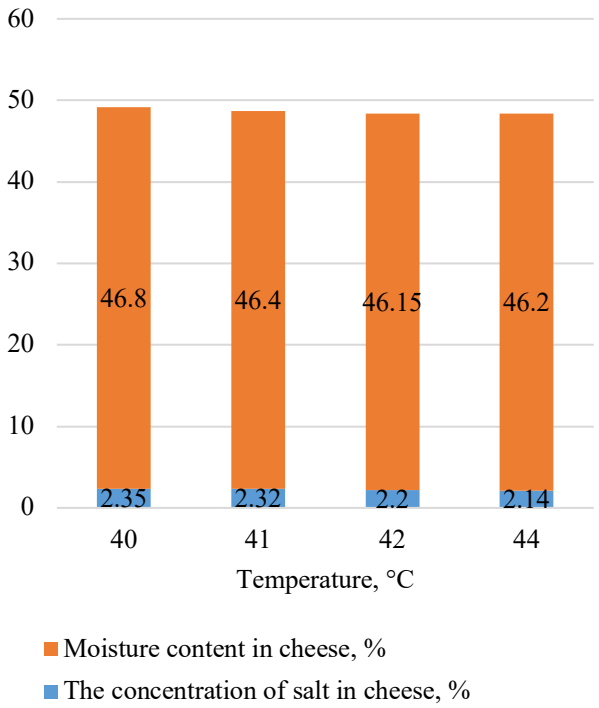

Figure 10 Dependence of moisture content in cheese (W) on salt concentration (N) at the second heating temperature (T) and the amount of added water 10%.

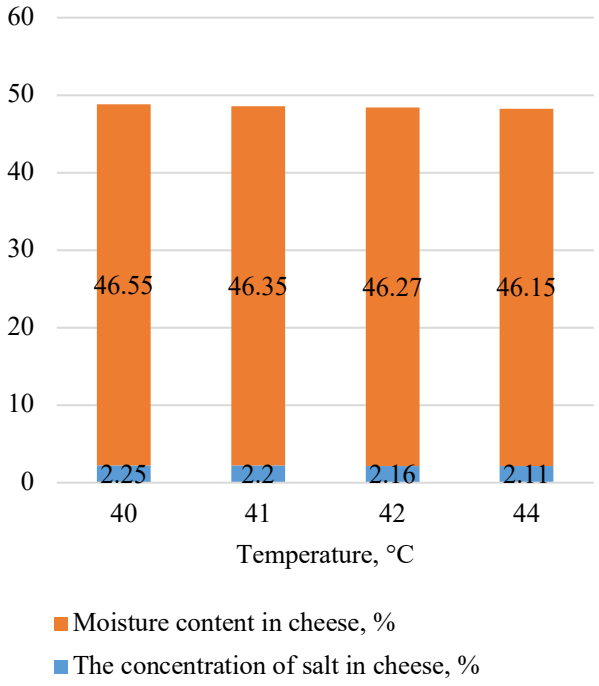

Figure 11 Dependence of moisture content in cheese (W) on salt concentration (N) at the second heating temperature (T) and the amount of added water 5%.

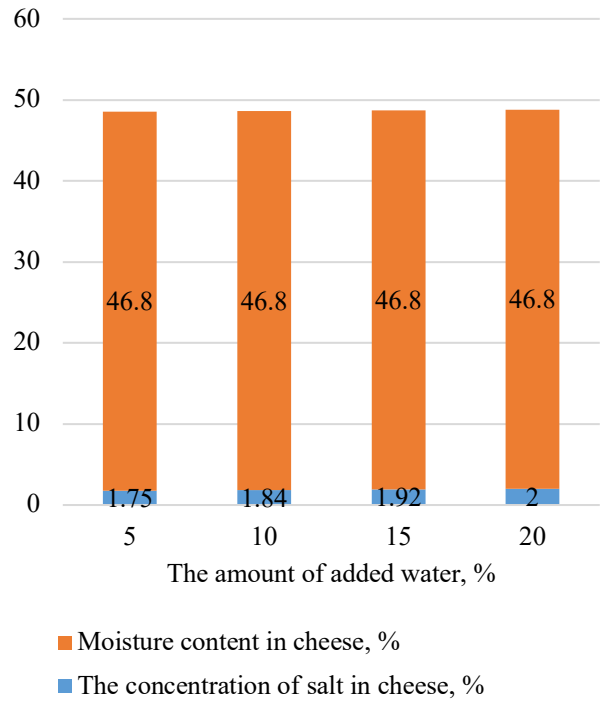

Figure 12 Dependence of moisture content in cheese (W) on the amount of added water (V), and salt concentration (N) at the temperature of the second heating 41 °C.

CONCLUSION

As a result of this work, we can conclude that the increase in ripening temperatures of cheeses is accompanied by an increase in lactic acid microflora, especially lactic acid bacteria, and, as a consequence – an increase in protein proteolysis and fat lipolysis. However, increasing the content of hydrolysis products of proteins and fats does not always give cheeses high organoleptic properties. It was found that the most acceptable temperature regime of maturation to obtain a product with high organoleptic characteristics is a step temperature regime, namely, 10 – 12 °C during the first 10 days of maturation and 14 – 16 °C until the end of maturation.

Our proposed method of production of hard rennet cheeses with low temperature of the second heating, in comparison with the existing method of production of cheese "Litinsky", which we used as a control, improves the quality of the finished product by reducing bacterial contamination of raw milk and prevent defects in the product maturation process.

Studies of microbiological, biochemical and physicochemical parameters of raw butter and semi-finished products in the production of fermented milk drinks were carried out by generally accepted methods of analysis, which are set out in relevant standards and guidelines for microbiological and techno-chemical control of fermented milk products. literature. Table 1 shows the research methods.

We used regional raw materials to produce craft cheese "Anchan" and researched raw milk for its physical and chemical properties and technological parameters. Test milk samples were pasteurized in the laboratory at a temperature of 80 °C for 10 seconds. Anchan was added to the milk for color. Next, the milk before coagulation was heated in a pasteurization boiler by heating with saturated steam 36 – 38 °C. The enzyme 4 mL per 100 kg of milk and 4 mL of black cornflower extract was added to the prepared milk to improve milk coagulation and the formation of a dense cheese clot. Strains of probiotic cultures were selected for Anchan. The composition of the main complex yeast of mesophilic lactococci acid and aroma-forming cultures, *Lactococcus lactis subsp. lactis, Lactococcus lactis subsp. Lactococcus lactis subsp. diacetilactis, Leuconostoc lactis*. As an additional leaven used thermophilic lactic acid sticks of the species *Lactobacillus acidophilus* (a non-viscous race to obtain a new taste of craft cheese. When using these ingredients, the fermentation time is reduced by 8 – 10 minutes. Processing of cheese grain, and removal of whey was carried out according to the general technology. We have proposed technology for closing the cheese skin by pouring hot cheese heads (t = 50 – 55 °C). Marking, packaging, transportation and storage were carried out according to the craft product's technical conditions for the craft product.

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