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STUDYING THE POSSIBILITY OF USING DAIRY PRODUCTS FOR PICKLING OF RABBIT RAW MATERIALS

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ABSTRACT

Modern technology of manufacture of fur raw materials based on the use of main and auxiliary materials, contributing to the increasing of diffusion rate of the components of the working solutions into the dermis leather fabric and the reducing of process duration. Many chemicals when released into wastewater are an environmental threat because they can cause the death of aquatic organisms or change the ecological community that may eventually lead to eutrophication and the disappearance of the water body. The solution may be in the technologies excluding the use of aggressive acids. The authors propose new structures and closed ways to pickling fur raw material, the effectiveness of their application in rabbit raw materials. Pickling composition 1 containing the combined whey used in the pickling of rabbit raw material by the dip method. Pickling composition 2 on the basis of fermented milk composition (FMC) was applied to the leather tissue of rabbit skins by pasted way. Pickling composition 2 in contrast to the known compositions did not contain sodium chloride, which reduces the costs of manufacturing and disposal of salts in the waste solutions. Were set out requirements for the composition and parameters of technological regimes.

Keywords: pickling technology, combined whey, fermented milk composition, rabbit pelts, leather fabric, strength, elastic-plastic properties.

INTRODUCTION

Fur industry among the urgent problems includes exploration of new, highly effective ways of carrying out technological processes. The greatest attention is given to the technology based on the combination of liquid processes, to the rational use of raw materials and chemical materials, to the use of nonaqueous media, to the reduction of environmental pollution.

In the process of pickling by the action of acids of different nature is observed a destruction of the bonds between fibers in the bundle, the destruction of some intermolecular bonds in collagen, the removal of the mucopolysaccharides, which are bonding to the structure of the dermis - all this leads to the achievement of optimum parameters of elasto-plastic properties of the leather fabric and its permeability.

The permeability of the dermis strongly affects the subsequent penetration of tanning substances, relatively large in size. Therefore, the permeability of the dermis as a result of pickling must be sustainable to some extent [1].

Traditionally for pickling is used a composition including sulfuric, formic or acetic acid and sodium chloride. Chemical interaction of acids with collagen leads to the destruction of hydrogen and electrovalent bonds in its structure [2]. Considering the process of pickling, one must consider the damage to the environment and to the health of employees of enterprises by the use of technology of toxic substances harmful to the skin and respiratory tract. Among the acids used for the process of fur pelts, the most harmless are acetic and lactic. Moreover, when using formic acid it is possible the formation of formaldehyde and methyl alcohol.

In this regard, one of the rational ways of manufacture of fur raw material is the use in the process of pickling of secondary products of the dairy industry, including the combined whey and milk compositions, containing a complex of organic acids and enzymes. The aim of this work was to study the possibility of using a combination of whey and milk compositions in the process of pickling of rabbit pelts.

To achieve this goal, the authors solved the following problems:

- to investigate the chemical composition and indicators of organoleptic and physico-chemical properties of the combined whey and milk compositions;
- to investigate the technological parameters of the process of pickling of rabbit pelts using a combination of whey and milk compositions;
- to study the quality of rabbit pelts, dressed by experienced and well-known technologies.

The objects of study

The objects of study were the secondary products of the dairy industry, which were used instead of acids for pickling of rabbit pelts.

Choice of pickling composition as the combination of whey and fermented milk compositions is associated with proven presence in it of the complex of organic acids and enzymes [3, 4], suitable for separation of the structure of the dermis. Are well known positive results of the use of dairy products in the processing of collagen-containing raw materials [5, 6].

Combined whey was prepared by fermentation of milk whey (cheese, casein, whey) and was a greenish-yellow liquid color, with a multi-component composition, with the concentration of lactic acid of 5-30 g/dm^3. At the enterprises of dairy industry, whey is produced in large volumes and to process it in full is often impossible due to rapid deterioration of the product [7].

We should take into the consideration that from the primary production the whey is delivered with a temperature of about 30°C, which corresponds to an optimum mode of life of most microorganisms. The grow of microflora in the milk whey during a storage leads to an increase of acidity up to 300°T and higher. With such a titratable acidity the whey is not suitable as the raw material for the production of milk sugar, as the increase in the acidity of 100°T leads to the loss of more than 20% of lactose [8, 9]. The increase of lactic acid in the whey is the result of the involvement of the lactose contained in the feedstock, in the metabolism of lactic acid bacteria and the excretion of lactic acid. Therefore, whey with acidity from 300ºT and above is a source of lactic acid (equivalent to 27 g/dm^3) and a set of other organic acids suitable for carrying out the process of dip pickling of fur raw materials.

For comparison, were selected milk compositions [10, 11]? Their obtaining method included the activation of microorganisms (fungi kefir, *Lactobacillus acidophilus*, *Lactobacillus delbrueckii sp.*) and cultivation on different nutrient media compositions having a high acid-forming ability:

FMC 1 - a composition obtained by culturing of kurunga starter culture in pasteurized skim milk with the amount of titratable acidity;
FMC 2 - composition obtained by culturing of kurunga starter culture in the pasteurized cheese whey;
FMC 3 - composition obtained by culturing of kefir grains in pasteurized skim milk;
FMC 4 - composition obtained by culturing of kefir grains in pasteurized cheese whey.

An important characteristic of FMC is the value of titratable acidity, which consisted of 305ºT or 27 g/dm^3 of lactic acid.

Milk compositions differed from combined whey with relatively high viscosity, which leads to their use for the pasted pickling of rabbit pelts.

The studied raw material is represented by rabbit pelts processed by a fresh-dry method of preserving, which undergone the preparatory processes and operations of tanning technologies, valid at LLC "Small innovative enterprise "Ecom". The pickling was performed by experimental (a combined whey pickling, pickling by fermented milk composition) and by control options (technology [Lowenstein] [12] a technology by Fur Industry Scientific Research Institute (FISRI) [13]). Tanning- fatliquoring was carried out by the pasted way according to technologies "Baikal".

RESEARCH METHODS

To investigate the possibility of using the secondary products of the dairy industry in the process of pickling were used standard and original methods. The validity of the obtained results was ensured by the selection of the required number of parallel measurements of indicators of the investigated objects.

To describe the consistency, color and smell of the combined whey were applied organoleptic methods in accordance with regulatory documents (State standard - GOST 28283-2015. Cow milk. The method of organoleptic evaluation of taste and smell).

Indicators of physico-chemical properties of the combined whey and FMC were studied according to the known methods. The density was measured using pycnometer according to GOST R 54758-2011. Milk and products of milk processing. Methods for determining the density, titratable acidity in Turner degrees (°T) - titrimetric method by GOST 3624-92. Milk and dairy products. Titrimetric methods for the determination of acidity, pH - according to GOST R 53359-2009. Milk and products of milk processing. Method of pH determining, mass fraction of fat and of dry matter - by gravimetric method according to GOST 5867-90. Milk and dairy products. Methods of determination of fat, GOST 3626-73. Milk and dairy products. Methods for determination of moisture and dry matter.

The study of the surface properties of the whey was performed on stalagmometer of Traube. Surface tension (σ, j/m^2) of liquids was determined by the formula 1:

$$\sigma = \sigma_{h2o} \times \frac{d_i \times n_{h2o}}{d_{h2o} \times n_i}, \quad (1)$$

where
[σ_{H2O}] - a water surface tension, j/m^2;
[d_i] - a density of the investigated solution, g/cm^3;
[d_{H2O}] - a density of water, g/cm^3;
[n] - number of drops of investigated solution;
[n_{H2O}] -is the number of water droplets [14].

Conditioning of samples of leather fabric and fur of rabbit were performed according to GOST 938.14-70 Leather.

Method for conditioning of sample. To exclude the influence of topography of pelts the samples were selected by the asymmetric fringe method [15].

The study of indicators of quality of tanned pelts of rabbit was performed according to GOST 32077-2013. Fur skins and tanned sheepskin. Rules of acceptance, methods of sampling and preparing them for the monitoring, GOST 938.13-70 Leather. Method for determination of mass and linear sizes of samples GOST 32165-2013. Fur skins and tanned sheepskin. Method for the determination of pH in water extract, GOST 32090-2013. Fur skins and tanned sheepskin. Methods of determining the mass fraction of chromium oxide (III) GOST 17631-72. Fur skins and sheepskin fur tanned. The method of determining the mass fraction of ash in the leather fabric, GOST 938.1-67 Skin. Method for determination of moisture content, GOST R 53018-2008. Fur skins and sheepskin fur tanned. Calculation of unbound fatty substances, GOST 33267-2015. Fur skins and sheepskin tanned. Methods of mechanical tests, GOST 26288-84. Skin. Methods of test for shrinkage.

To assess of the pickling condition of fur raw material was determined the temperature of the welding according to GOST 32078-2013. Fur skins and tanned sheepskin. Method for determination of welding temperature, when samples of leather fabric are heated in water and expressed in Celsius degrees, as the arithmetic average of results of at least five definitions.

The stiffness of the leather tissue of the rabbit skins was determined according to the amount of deflection of the sample on a special device. Prior to testing, hair were previously removed from the specimens and were conditioned at normal conditions. The stiffness of the leather fabric was calculated by the formula (2):

$$Д = \frac{K \times P}{M - K}, \quad (2)$$

where
K - sample thickness, mm;
P - load on the sample which is equal to 3 H (without a load);
M - specimen deflection, mm [16].

The residual elongation of the leather fabric (E %) was determined according to the results of physico-mechanical tests on a tensile testing machine and calculated by the formula (3):

$$E = \frac{\Delta l_1}{l_0} \times 100, \quad (3)$$

where
E - the relative residual elongation, %;
Δl_1 - an increase in the length of working section, mm;
l_0 - the initial length of working section, mm.

The process of pickling is considered effective if the rate of residual elongation of leather tissue after pickling is not less than 26±2 % [17].

RESULTS AND DISCUSSIONS

To substantiate the possibility of using the secondary products of the dairy industry for the processing of rabbit pelts in the first phase of the work were investigated the chemical composition, physico-chemical and colloidal properties of the combined whey and milk compositions.

Acid composition (AC) and FMC were represented by a homogeneous liquid of yellow-greenish and milky white colors with a specific smell of the whey and milk products.

FMC differed from AC by the greater density and viscosity, which were related to the method of producing the FMC and used a starter for fermentation.

The experimental data (Figure-1) showed that the mass fraction of solids in the combined whey and compositions prepared in the cheese whey (FMC No. 2 and No. 3), less (6, 8-7, 4 %) than in the compositions based on skim milk (8, 1-8, 5).

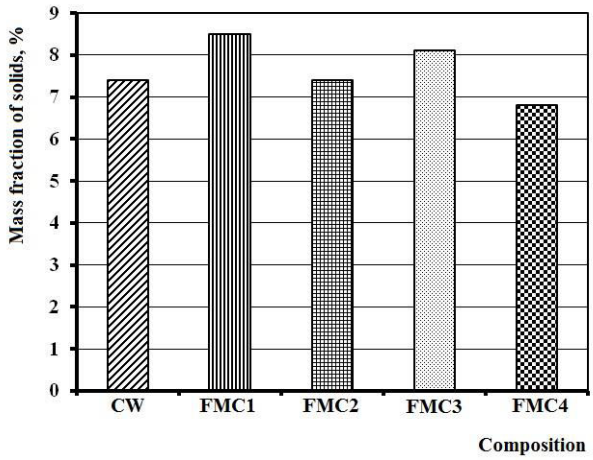

Figure-1. Mass fraction of solids in the investigated compounds.

Dry matter of AC and FMC, probably, are the components of initial raw material - milk (4.2 to 7.5 percent), cheese (4.2 to 7.4 %) of the whey and skim milk (8.8 per cent) [18]. These are mainly proteins (casein and whey) remaining after the technological processes of milk processing, which number depends on the efficiency of the processes of filtration and settling, milk fat, mineral salts, organic acids.

It is established that the mass fraction of fat in the AC and FMC are comparable with the literature data [19] for the dairy (not exceeding 0.5 %), for cheese (up 0.4 percent) for whey and for skim milk (not more than 0.05 %). Mass fraction of mineral substances in the investigated compounds was 0.59-0.75% and had higher values for fermented milk compositions obtained in skim milk.

The low content of fat and mineral substances (Figure-2) in the tested compounds will not affect the efficiency of the process of pickling of rabbit pelts with AC and FMC.

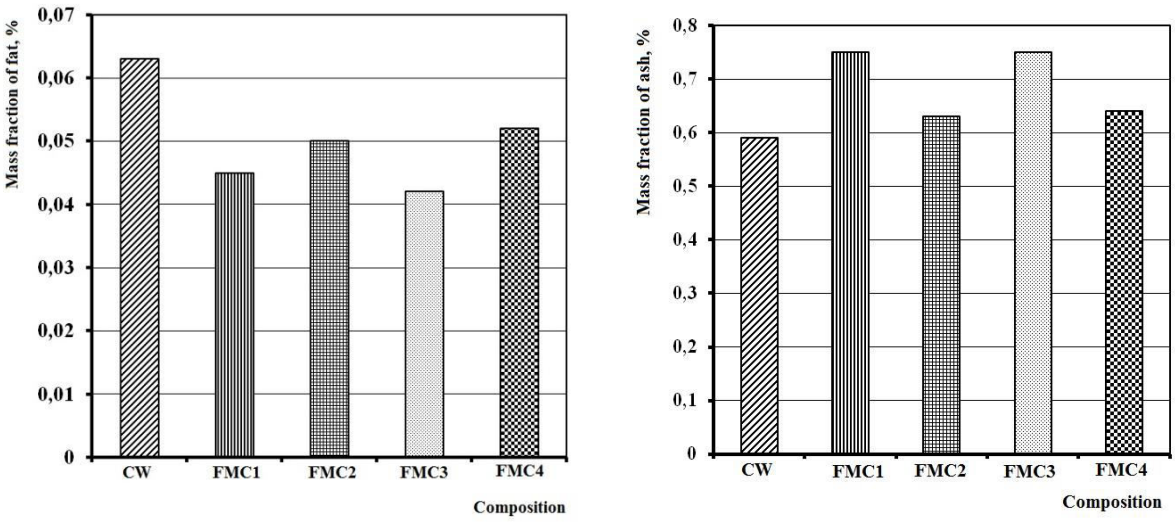

Figure-2. Mass fraction of fat and minerals in the investigated compounds.

As it was shown by the results of the study (Figure-3), the pH value of the pH of AC and FMC was 3.1 and 3.19. The acidity of the whey is due to the presence of organic acids, mainly lactic, which have an increased affinity to the collagen of the skin [1] and will allow a gentle processing of the raw material. This is the optimal condition not only for the separation of the structure of the dermis when conducting pickling, but also to preserve the shine and the structure of hair of rabbit`s pelts.

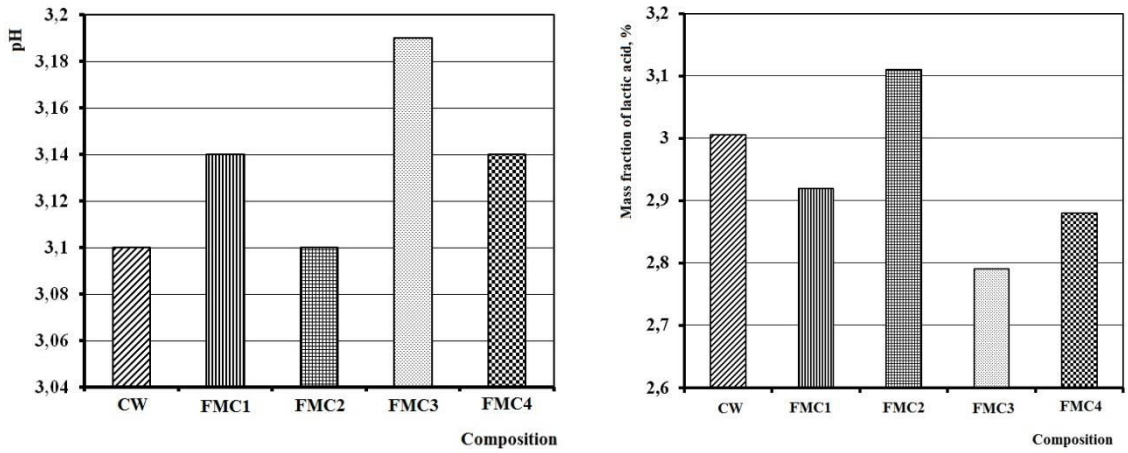

Figure-3. Acidity of the studied compounds.

Thus, the study of the chemical composition of AC and FMC proposed for pickling of rabbit pelts showed that the investigated compounds without a further dilution may be used instead of solutions of organic acids. Since the process of pickling is associated with the wetting of the leather fabric by pickling solution in the presence of simultaneous contact with the air, so, a further interest was in the study of colloid-chemical properties of AC and FMC.

The surface tension is determined by the surface energy, located on $1m^2$ of surface, i.e., corresponds to the work that must be performed in order to increase the interfacial surface area by 1 unit. The surface tension of the AC and FMC was determined by the stalagmometric method. The results of the experiment showed (Figure-4) that the studied system have a lower surface tension compared to aqueous solutions of lactic acid.

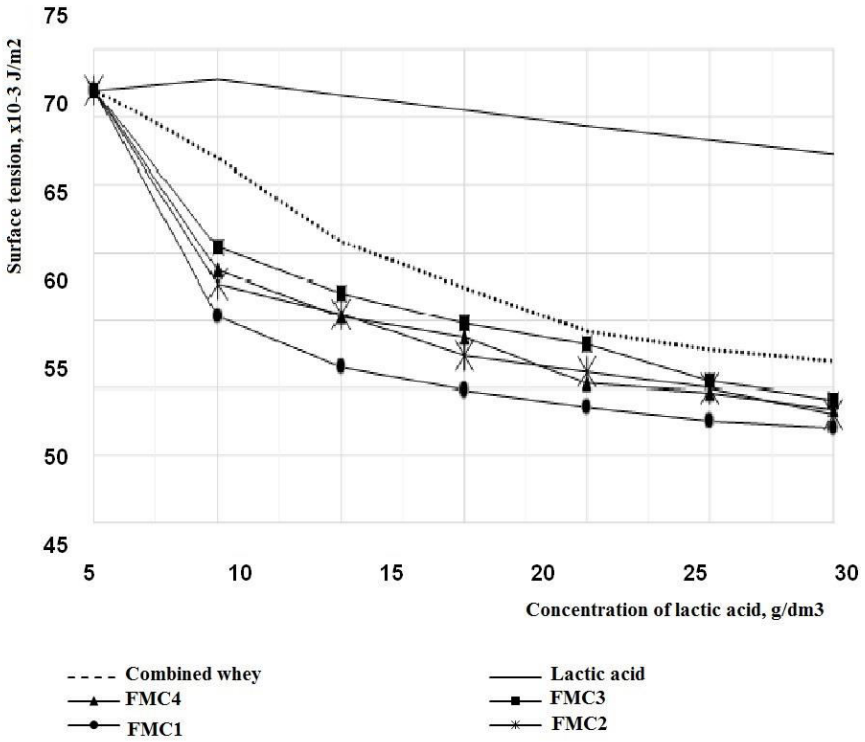

Figure-4. Change in the surface tension of the studied systems depending on the concentration of lactic acid.

Surface activity of AC and FMC due to the presence of surface-active substances (saturated and unsaturated aliphatic acids, alcohols, ketones, protein) having a defilee structure, i.e. polar (functional groups) and nonpolar part (a hydrocarbon radical). As it was shown in Figure-9, the increase of acidity of the studied compounds increased their surface activity.

It was found that the maximum surface activity ($47{,}08\times10^{-3}$ j/m^2) had a composition with the concentration of lactic acid of 27.9 g/dm^3, obtained by the fermentation of the kurunga starter culture in skim milk. A combined whey with a concentration of lactic acid of 30 g/dm^3 had a value of surface tension of $51{,}99\times10^{-3}$ j/m^2. In relation to the water AC and FMC had a smaller surface tension and they could be attributed to biological anion-active surface-active substances, because they dissociate in water with the formation of the anion of lactic acid. In order of decreasing of surface tension the studied systems were located in the following sequence: lactic acid-AC-FMC No. 3- FMC No. 4- FMC No. 2- FMC No. 1.

The wetting properties of AC and FMC were determined by the change in contact angle of wetting on substrates with hydrophilic (skim glass) and hydrophobic surface (paraffin). According to the results of the study it was found that the best wetting ability relatively to hydrophilic (9 gr.) and hydrophobic (34 gr.) surface had a fermented milk composition. It was obtained by culturing the kurunga starter culture in skim milk. Combined whey wetted a surface at an angle of 15 gr. - on the skim glass, and 37 gr. - on the paraffin. It is shown that the increase in the concentration of lactic acid in the investigated systems led to lower contact angle of surfaces.

AC and FMC possessed the best wetting ability with the concentration of lactic acid of 30 g/dm^3. The obtained dependence is correlated with the dependence of the surface tension of the studied systems.

The study of colloid-chemical properties of AC and FMC allowed us to include the data of the studied system to the surface-active substances, which is very important for the diffusion of active ingredients into the dermis of the skins when conducting pickling.

On the second stage were conducted screening researches on the basis of which were established technological parameters of the process of pickling of rabbit pelts using a combination of whey and milk compositions.

An experimental pickling of rabbit pelts using a combination of whey (Experiment 1) after soaking, degreasing and fleshing were carried out by dip method in barrels at the following process parameters: liquid ratio 15, process temperature 35°C, the duration of the first pickling - 16-18 h, of the second pickling - 16-18 h, the composition of pickling bath - a combined whey concentration of lactic acid of 15 g/dm^3 (first pickling) and of 20 g/dm^3 (the second pickling) with the addition of sodium chloride 50 g/dm^3. The proposed method of pickling in the combined whey, having a pH of 3, 11-3, 28 makes it possible to increase the duration of treatment without the risk of plumping of the leather fabric and also to exclude additional water consumption and the use of expensive organic acids.

An experimental pickling of rabbit pelts, using fermented milk composition (Experiment 2) was performed after soaking, degreasing and fleshing pasted method if the technological parameters were adherence with: pickling composition consisted of kefir fungi, cultivated on cheese whey with the value of titratable acidity 305°T; applying of picking composition on the leather tissue was performed every 30 minutes for three times, leaving the pelts stacked in a pile, then they were left lying for 24 hours, after which was additionally applied the composition and kept the pelts left lying for another 24 h.

As the control options of pickling was considered a modern technology [Lowenstein], [12] and FISRI [13]. According to technology [Lowenstein] were conducted the first and the second pickling for 16-24 h, and pickling composition consisted of formic acid (conc.) 5.0 cm^3/dm^3, Elbro-SR 2.0 cm^3/dm^3, Wetter US 0,5 cm^3/dm^3, sodium chloride 50 g/dm^3. According to technology of FISRI was performed a single pickling with duration of 16-18 h, consisted of formic acid (conc.) 8,0 g/dm^3, Gamma 2 1.0 g/dm^3, Mehsana 2.0 g/dm^3.

Control of pickling was carried out according to the acidity of pickling solution, to the temperature of the welding, the pH of the slice and the presence of "sushinka" when you bend the leather tissue (Table-1).

Table-1. Controllable parameters of the experimental pickling.

Figure	Experiment 1		Experiment 2	
	Before the process	After the process	Before the process	After the process
The concentration of lactic acid, g/dm^3	15,9	11,43	-	-
Temperature of welding of leather tissue, ºC	62	41	61	45
pH of the cutoff with methyl red	Red, yellow, pink			
Sushinka	When you bend the leather fabric is formed white stripe			

Hydrogen value of PH of pickling solutions after the first pickling was increased and consisted of 3, 40 for experimental pickling 1, 2, 25 - for the technology [Lowenstein], 2, 27 - for the technology of FISRI. After the second pickling the pH of the solution was changed slightly, which was probably due to lower sorption of acids from solution due to the full saturation of the collagen of the skin with acid.

Pickled pelts of rabbit had a temperature of leather fabric welding of 40-42º, the organoleptic evaluation of the leather tissue showed the presence of "sushinka" when you bend the leather fabric, and staining with methyl red - showed red yellow-pink colors, indicating the sufficient pickling condition of the leather tissue of rabbit.

The pelts of rabbit, past pickling, were subjected to neutralization, to tanning-fatliquoring by technology of "Baikal" [19] and finishing operations [20].

Finished fur pelts were evaluated for compliance with the requirements of GOST 2974-75 "Rabbit tanned fur pelts. Technical conditions".

Tanned pelts of rabbit according to organoleptic indicators had a soft, pure leather fabric with broach in all directions, the fur of pelts is clean and crisp. Pelts were absent with defects that were most frequently found with improper pickling: in insufficient pickling - a coarse fabric with leather-padded areas, in strong pickling - the rag, loose and fragile leather fabric.

The indicators of the chemical composition of the leather fabric tanned pelts of rabbit are shown in Table-2.

Table-2. Indicators of quality of tanned pelts of rabbit.

Name of the indicator	The experiment version 1	The Experiment version 2	Control		Norms of GOST State standart 2974-75
			[Lowenstein]	FISRI	
Mass fraction of moisture, %	10,31	10,86	11,62	11,38	Not more then 14
Chromium oxide, %	1,34	0,97	1,35	1,32	0,5-1,5
Unbound fatty substances: for leather fabric for hairline	13,5 1,03	15,9 1,88	14,6 1,15	14,12 1,24	12-20 Not more then 2,0

From Table-2 it is seen that the performance of the chemical composition - mass fraction of moisture, oxide of chromium and unbound fatty substances in the leather tissue of the experimental pelts of rabbit match the control skins ([Lowenstein], FISRI) and the requirements of GOST 2974-75 " Rabbit tanned fur pelts. General technical conditions".

Temperature of welding of leather fabric tanned pelts of rabbit was 78ºC - for experimental, 75ºC and 79ºC for [Lowenstein] and for FISRI, which corresponds to requirements of GOST 2974-75 (not below 65ºC)

The value of pH of aqueous extract leather fabric for 1 experimental option was 3.92, for the second - 4, 58, for the control - 3, 79 and 3, 71. In accordance with GOST 2974-75 this figure should be in the range from 3.5 to 7.0.

Consumer properties of the tanned skins of rabbit depend on the mechanical properties of the fibrous weave of individual fibers and are determined by the efficiency of pickling and subsequent tanning.

To establish the relationship were carried out physico-mechanical test on the whole pelts of rabbits and was determined the tensile strength of tensile; load at break; the full, residual, elastic and elongation at break of the leather fabric, and also were recorded the load and elongation at cracking of the surface layer (Table-3).

Table-3. Results of physical-mechanical tests of tanned rabbit pelts.

echnology of pickling	The load at fracture, N (kgf/mm^2	Tensile strength tensile, MPa (kgf/mm^2)	Elongation at rupture		Elongation stress MPa (kgf/mm^2)						Load, N(kgf) corresponding to specified voltage MPa	Cracking of the surface layer		
					whole		residual		elastic			Load , N (kgf)	When extending	
			mm	%	mm	%	mm	%	mm	%			mm	%
Experiment 1	425	35,4	47	94	19	38	4	8	15	30	120	425	47	94
Experiment 2	343	30,6	41	82	17	34	4	8	13	26	85	343	41	82
FISRI	391	43,4	46	92	18	36	5	10	15,5	31	90	391	46	92
[Lowenstein]	423	42,5	45	90	18,5	37	5,5	11	13	26	100	423	45	90

The strength properties of the leather fabric were determined according to the load at break, related to the entire subject sample. The breaking load depends on the strength of individual fibers, number of fibers in the cross section of the sample and the angle of interlacing of the individual fibers and indirectly connected with the efficiency of carrying out pickling and tanning. The load at break was 425 H for prototype 1, 343 N - for prototype 2, 413 and 391 H for the control specimens. Foreign researchers say that the thicker the skin, the more it feels stress at break. Probably the high strength of the prototype 1 was due to the thick leather fabric of rabbits with thick subcutaneous fat layer, due to a more complete separation of the structure of the dermis and a uniform distribution of the molecules of the tanning agent in the thickness of the leather fabric.

In the result of physico-mechanical testing was determined the complete, residual, elastic and elongation at break of leather fabric (Figure-5). Figures are not regulated by GOST 2974-75; therefore, the obtained

results were compared with values obtained for the control options of pickling.

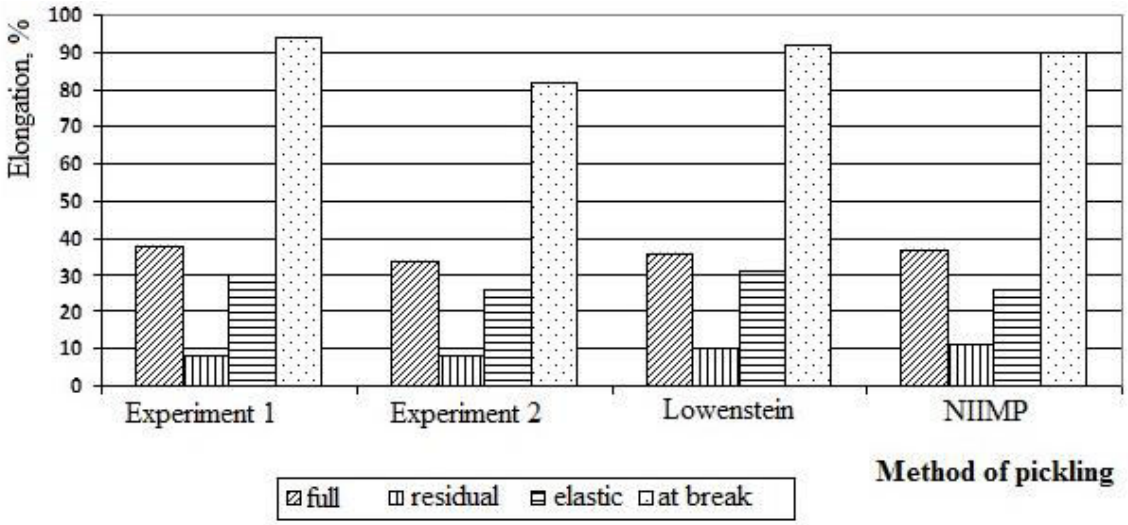

Figure-5. Elongation of the leather tissue of rabbit pelts due to the different way of pickling.

From Figure-5 it is seen that the pelts of rabbit, processed in the process of pickling with combined whey, had an elongation at break of 94%, processed with FMC 4 - 82 %, according to the technology [Lowenstein] - 90 % and to FISRI - 92 %. Distinctive indicators had the samples processed with SMC4 (prototypes 2).

A residual elongation determines the plasticity of the leather fabric, which is important for the creation of the desired shape for the finished product. The prototypes did not differ significantly on this index of the samples, made by technologies [Lowenstein] and FISRI.

Elastic elongation of leather fabrics determines the dimensional stability of parts of the finished product during the operation, transport or storage. From Figure-1 it is evident that the elastic elongation of the leather fabric of experimental (1) and control samples was comparable.

Therefore, we can assume that as a result of experimental pickling the leather tissue of the rabbit achieve elastic-plastic properties, comparable with modern technologies of FISRI and [Lowenstein].

This confirms the effectiveness of pickling with combined whey and milk compositions, as well as the economic feasibility of the proposed technology by eliminating the consumption of expensive acids, and auxiliary substances, such as enzymes, surfactants, preservatives, fat liquoring materials.

An equally important quality indicator of the leather fabric is the stiffness of the leather fabric or the inverse of softness.

The stiffness of the leather fabric was 0,47 H for experimental (1) samples, 0.50 H for the experimental (2) samples, 0.46 and 0.48 H - are respectively for the samples, tanned by technologies of [Lowenstein] and FISRI (Table-4).

Shrinkage of whole pelts of rabbits was determined by area, the results are presented in the table below. It is shown that depending on the method of pickling shrinkage of experimental and control samples were 3.1-3.15%.

Table-4. Indices of elastic-plastic properties.

Figures	Experimental variant 1	Experimental variant 2	[Lowenstein]	FISRI
Stiffness, H	0,47	0,50	0,46	0,48
Shrinkage, %	3,13	3,15	3,10	3,13

Industrial tests of the pickling technology had confirmed the effectiveness of pickling of pelts of rabbit by combined whey and milk compositions. Tanned pelts of rabbits differed with the high elastic-plastic and strength properties of the leather fabric, which increase the consumer value of ready-made prefabricated.

CONCLUSIONS

The study confirmed the possibility of using the secondary products of the dairy industry in pickling of rabbit pelts. The developed technology by authors ensures rational use of resources related industries (dairy industry), and also eliminates the additional use of water, introduction to the pickling composition of acids and auxiliary substances, which is very important in reducing of the cost of finished products from rabbit pelts.

Based on the results of researches were determined technological parameters of the process of pickling of pelts of rabbit, using a pickling composition, including a combined whey with concentration of lactic acid 15 g/dm^3 for the 1-St pickling, 20 g/dm^3 for the 2nd pickling, sodium chloride 50 g/dm^3: the liquid ratio 15; process temperature 35°C; the mechanical mixing at a speed of rotation of the blade of a launch is about 15-20 rpm for 15 min - every 30 min during the first four hours; the duration of the 1st pickling is 16-18 h, period of the 2nd pickling is 16-18 hours.

For pickling of rabbit pelts with milk composition (kefir fungi, cultivated on cheese whey) with the value of titratable acidity 305ºT, it is necessary to comply with the following technological parameters of the process of pickling: application with a brush with natural bristles of pickling composition on the leather tissue three times every 30 minutes, the hides are left lying for 24 h, the hides are left lying additional 24 h with three-time repeated application of the composition.

On the basis of physical and mechanical tests of tanned pelts of rabbit it is determined that pickling compositions based on secondary products of the dairy industry increase the degree of separation of the structure of the leather tissue in the process of pickling. This result is achieved due to the total effect of the complex organic acids (lactic, acetic), and enzymes. The efficiency of the combined whey and milk compositions is also due to the weak chemical affinity of collagen with organic acids, which provides a gradual diffusion and uniform distribution of pickling composition in all layers of the dermis, thereby providing a more complete separation and extraction of substances from the fibrous structure of the leather fabric.

An advantage of the developed technology is also a gentle effect of the secondary products of the dairy industry on the hair-covering of the rabbit, in contrast to the effects of acids, which reduce the shine and strength of hair, which is important in the assessment of consumer properties of the finished product.

GRATITUDE

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