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INFLUENCE OF MILK WHEY ON CHANGES IN STRUCTURAL ELEMENTS OF KARAKUL SKIN TISSUE

Sadirova Saodat Nasreddinovna
senior lecturer Bukhara Engineering Technological Institute
E - mail : yasmina 27.03@mail.ru

Abstract. Bread fermentation and softening are the classic methods of making fur skins and have been used for a long time in the processing of the entire range of raw fur, as they provided the highest quality leather fabric. For fermentation of purebred karakul dry-salted canning, the test of milk whey obtained from dairy waste containing lactic acid may be of practical interest.
Keywords: Bread fermentation, karakul, milk whey, lactic acid, dairy waste

Introduction . Karakul skins are the main product of Karakul sheep. The beauty, unique shape and originality of the curls, their variety, the noble shine and silkiness of the hair, and the elegance of the designs have brought fame to astrakhan skins. Karakul skins are in great demand among the population. Therefore, much attention is paid to the quality of smoke products. When preserving astrakhan skins, fermentation is used. Fermentation is the processing of fur raw materials with bread kvass. This is one of the oldest methods of fur dressing. Fermentation provides high softness and ductility of leather fabric, mechanical strength, while maintaining dimensions, reducing the thickness and weight of the skins, as well as their cracking and delamination. Fermentation gives the hair a special shine and emphasizes the beauty of its natural color. During fermentation, characteristic changes in the microstructure of leather tissue occur: the intertwined collagen bundles are divided into smaller structural elements than during pickling . The loosening of raw materials with a simple structure of leather tissue is especially noticeable , when the bundles consist directly of fibrils.

The duration of processing, the use of food products, which is irrational due to incomplete saccharification of starch, the difficulty of regulating the process, fermentation defects and the lack of objective control methods force us to look for more rational, but similar in their effect on leather tissue, processing methods.

For pickling purebred karakul dry-salted canning, the testing of whey obtained from dairy waste, which contains lactic acid, may be of practical interest .

Materials and methods. We investigated the process of pickling purebred karakul using whey obtained from dairy waste products instead of oat flour. In addition to lactic acid, whey also contains citric, nucleic and volatile fatty acids - acetic, propionic, butyric and formic.

During fermentation, 50%, 75% and 100% concentrations of whey were used. Karakul skin samples were processed in the corresponding fermentation solutions. At the same time, the karakul skins were fermented in the traditional way, i.e. with barley flour. Before loading the skins, the acidity of the solutions was controlled and table salt was added at the rate of 40 g / l. The acidity of the solutions in terms of acetic acid was 1.5 g / l; 2.3 g / l and 4.4 g / l, respectively. Fermentation was carried out at a temperature of 35 ^{0} C. During the fermentation process, the degree of weakening of the hair was controlled and, if detected, table salt was added up to 60 g / l. The acidity gradually increased during the fermentation process and on the sixth day it reached 12 g/l in terms of acetic acid in the fermentation solution where 100% concentration whey was used, as well as 5.7 g/l and 7.3 g/l, respectively, in fermentation solutions of 50% and 75%

concentration of whey.

To conduct the research, the following were used at different stages of the work: standard methods (potentiometric titration method, histological analysis of stained sections of skin tissue).

The reliability of the obtained results was ensured by selecting the required number of parallel measurements of the parameters of the objects under study. Factors influencing the fermentation process were also studied. The pH of the fermentation bath affects the proteolytic activity of enzymes. The optimal value is about 7 (neutral or slightly acidic environment). As acid accumulates and pH decreases, the activity of the enzymes decreases. Temperature is of decisive importance, since both the activity of enzymes and the intensity of microflora development depend on it. The optimal temperature for the development of lactic acid microflora is 37-40 °C. An increase or decrease in temperature can create unfavorable conditions for the accumulation of lactic acid in the fermentation solution.

The reaction of the environment has a great influence on the fermentation process. Insufficient acidity of the fermentation solution causes under- fermentation of the skins. To avoid this, we monitored the initial acidity and loaded the skins after the acidity reached 3-5 g/l. Insufficient acidity enhances the softening and loosening action of enzymes, which are most active in a slightly acidic environment. This can lead to severe hair flow and spoilage of the semi-finished product.

As the processing time increases, the changes in the microstructure of the leather tissue increase, while the strength of the bond between the hair and the dermis decreases. Sodium chloride - prevents the occurrence of fat in the presence of organic acids. It has virtually no effect on enzymatic and microbiological processes. Therefore, during pickling, the accumulation of acid in the solution, pH, sodium chloride content, solution temperature, and the pickling of the skins were monitored. The end of pickling in a 100% concentration whey solution was determined by achieving loosening of the leather tissue and the appearance of slight weakening of the hair on the groin areas of the skins. The color of the flesh side of the finished skins is light, when folding and pressing, a " dry spot " appears on the leather tissue .

Experience of recent years in assessing the souring of karakul has shown that different degrees of separation of collagen bundles can be observed under a microscope only in skins with well-developed collagen ligament, when the collagen fiber ligament is more mature and perfect. In such skins, fine or coarse separation of collagen bundles can be determined by longitudinal striation . In skins of lambs with less developed collagen ligament, the degree of separation of collagen bundles is difficult to determine, since they have an elementary structure.

The changes that occur as a result of fermentation of karakul are manifested in a slight peeling of the epidermis, as well as partial damage to non-keratinized hair follicles and bursae, which can lead to weakening of the hair covering on the skins if the impact is too harsh.

We have checked the fermentation of the skins' leather tissue with fermented whey. The main criterion for assessing the fermentation was the separation of collagen bundles by the presence of longitudinal striation in collagen bundles in the presence or absence of delamination of the dermis.

Sections of leather tissue obtained on a freezing microtome were stained with basic and acid dyes, dehydrated and placed in a drop of cedar balsam under a cover glass. During microscopic observation of sections of leather tissue. The effect of the fermentation process on the protein-carbohydrate complex is manifested in a sharp weakening or complete disappearance of the nuclear coloration of all epithelial structures of the leather tissue, as well as in the manifestation of free cavities between collagen bundles and hair follicles. Hair follicles swell, sometimes get damaged, which can be judged by the pigment grains that have spilled out of the follicle.

The effect of kvass on collagen was judged by the appearance of longitudinal striation of the longitudinal bundle, which was more contrasting when sections of leather tissue were stained with acid dyes. As observations under a microscope showed, under the influence of kvass, the collagen bundle opens up, which makes it possible to see smaller fibers that are clearly contoured , and the outlines of a large bundle are always preserved.

Based on the conducted research, batches of fermented karakul of various assortments, the degree of fermentation of the leather tissue of unselected karakul is determined by the degree of loosening of the leather tissue and the state of the collagen bundles, the degree of preservation of the hair roots, and the degree of preservation of the epidermis.

According to the state of the structure of the leather tissue, karakul skins are divided into normally fermented, under-fermented, and over-fermented.

Normally fermented skins are characterized by: the presence of cavities between the reticular and papillary layers, as well as at the base of the hair follicles and between them, as a result of which the papillary layer as a whole appears loosened; the presence of collagen bundles with signs of longitudinal striation ; swelling of the hair follicle, but without damage; the absence of pigment rash from the follicle and damage to the hair sheaths; the presence of signs of loss of connections between the epidermis and the underlying dermis, preserved on the cut in the form of individual patches.

Under-fermented skins are characterized by the presence of: collagen bundles without signs of "opening"; hair follicles without swelling, located tightly in the thickness of the cut of the skin tissue; epidermis preserved along the entire length of the cut. According to the microscopic picture, under-fermented skins are close to raw materials.

are characteristic of over-fermented skins: severe loosening of the skin tissue, as well as a violation of the overall integrity of the skin tissue cut; the presence of cavities devoid of hair and repeating the outlines of the configuration of the fallen hair; a sharp swelling of the sheaths of the remaining hair with a violation of their integrity in different areas, primarily in the bulbous part of the hair, while pigment rash is possible; complete absence of the epidermis or retention on the cut in the form of deformed flaps; the state of the collagen fibers and the degree of their opening into thinner elements is veiled due to signs of collagen dissolution.

The study of the condition of the leather tissue of karakul skins after pickling by the sign of bacterial contamination and structural preservation showed that the pickling of the leather tissue of karakul skins largely depends on the quality of the skins entering the pickling. It is noted that in highly bacterial skins the effect on the state of the structures is difficult to determine, since the leather tissue in such skins is poorly hydrated and loosened due to strong structural damage as a result of bacterial action.

Conclusion. After the conducted comprehensive analysis of whey dairy waste, it was found that whey is a source of lactic acid and is characterized by a protein composition, exhibits biosurfactant properties , and also the separation of collagen fiber bundles, similar to the fermentation solution prepared from barley flour, selected for comparison. It was found that the shelf life of whey at elevated temperatures is longer than that of the fermentation solution prepared from barley flour. After fermentation with whey, as with other pickling compounds, there is a decrease in strength and an increase in the elongation of leather tissue, which indicates the separation of the collagen structure into elementary fibers. Further aging promotes additional loosening of the leather tissue. It is recommended to reduce the aging period after fermentation to 24 hours for karakul skins.

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