INVESTIGATION OF THE PROCESS OF SOAKING WHEN PROCESSING OSTRICH SKINS

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In this work, the results of a study of the process of soaking in the processing of exotic leather raw materials of ostrich skins were carried out. In order to reduce the negative impact of wastewater from the tanning industry on the environment and to accelerate the soaking process, an enzyme preparation of microbial origin Letan SE2 and a surfactant CH-22C, which meets the requirements of the European regulations REACH and ECHA, were used. When these chemicals are used in the soaking process, mucopolysaccharides and non-collagen proteins are intensively removed from the interfiber space, the moisture content in the skin tissue of the ostrich skin increases, and uniform soaking in thickness and area is ensured. Intensive and correct soaking process improves the quality of subsequent processing of the ostrich skin. The paper shows the possibility of carrying out the soaking process using environmentally friendly chemicals, the use of which allows reducing the level of technogenic impact of chemicals on the environment, which is very important for the preservation of natural objects.

Keywords: ostrich, skins, the process of soaking

INTRODUCTION

Recently, exotic leather obtained from ostrich skins as a material for the leather and footwear industry has become in demand by designers for the manufacture of shoes, accessories, clothing, and furniture decoration. The uniqueness of the ostrich skin gives a characteristic pattern due to large follicles from feathers, good wear resistance and plasticity (Sukhinina, 2014). The originality of the texture of the ostrich skin made it possible to create exclusive leather products, which ensured a high demand for a semi-finished ostrich product in the global fashion industry and a high price compared to other types of leather (Cooper, 2001; Belleau *et al*., 2002).

Ostrich farming as a poultry industry in Uzbekistan was founded in 2016. Currently, ostrich breeding is widely spread in many regions of the republic, especially in the Fergana region in the city of Rishtan. The first and largest specialized farm in Uzbekistan with a full cycle of breeding black African ostriches was the Anglo-Uzbek farm “Straus farm” (Straus Farm, 2017).

Many studies aimed at improving the technology of processing ostrich skins provide information about the peculiar structure of the ostrich skin and the technology for processing ostrich skin (Ulugmuratov *et al*., 2019; Ulugmuratov *et al*., 2020).

The present research was aimed at studying one of the important and initial processing of ostrich skins, as the soaking process. In order to reduce the level of technogenic impact of the applied chemicals on the environment, an enzyme preparation of microbial origin and an environmentally friendly surfactant were used, which is very important for the preservation of natural objects and, in general, for improving the ecological situation in Uzbekistan.

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MATERIALS AND METHODS

In experimental study, 20 sets of wet-salted raw skins obtained from 12-14 months old ostriches at slaughter stage were processed. The average weight of a set of skins was 4-6 kg, and the area was 140-160 dm^2.

Currently, they also pay great attention to the use of environmentally friendly non-ionic and ionic surfactants (surfactants), industrial wastewater containing non-biodegradable surfactants complicates purification and has a detrimental effect on the environment. To minimize this negative impact on the environment, it is necessary to reduce the consumption of harmful substances or replace them with environmentally friendly enzyme preparations and surfactants that meet the requirements of the European Chemical Agency (ECHA) and the European REACH regulation (European chemicals agency (REACH); REACH-Registration. html). In studies to solve the above problems, an enzyme preparation of microbial origin Letan SE2 (ODAK kimyevi maddeler) and a surfactant - CH-22C (Shebekinskaya Industrial Chemistry LLC., 2018), were used. The soaking agent CH-22C meets the requirements of the European regulations REACH and ECHA. Table 1 shows the physicochemical characteristics of the chemical materials used in research.

Table 1. Physicochemical properties of surfactants CH-22C, Letan Biosit B-40 and Letan SE2

Parameters	Surfactant CH-22C	LETAN BIOSIT B-40	LETAN SE 2
Chemical characterization	Composition based on biodegradable nonionic and anionic surfactants, REACH compliant	Organic sulfur compounds	Mixture of aliphatic substances
Active substance content, %	37	-	-
Hydrogen exponent, 1% solution	6.0-8.5	Approx 10	Approx 8-9
Appearance	Clear colorless liquid	Light colored liquid	Clear colorless liquid
Ionogenic character	Anionic	Non-ionic	Non-ionic
Steadiness	Resistant to electrolytes. acids and alkalis in common concentrations. Resistant to chromium and aluminum salts		
Consumption in the process of soaking from the mass of wet-salted skins	Up to 2.0	0.05-0.10	0.10-0.25

The mass of a part of the skins was determined on an analytical balance with an accuracy of 5 mg, the thickness of the skins was measured using a special thickness gauge with an accuracy of 0.01 mm. The following methods according to International Union of Leather Technologists and Chemists Societies (IULTCS) official methods of analysis for leather (The IULTCS Official Methods of Analysis., 2020), were used to determine the physical and chemical properties of the processed leathers: IUC 2 (2017) for sampling, IUC 3 (2017) for preparation of chemical test samples, IUC 4 (2018) for

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determination of matter soluble in dichloromethane, IUC 5 (2005) for determination of volatile matter, IUC 7 (1977) determination of sulphated total ash and sulphated water insoluble ash, IUC 10 (1984) determination of nitrogen and hide substance, IUP 1 and 3 (2012) for sample preparation and conditioning, IUP 2 (2017) for sampling location, IUP 4 (2016) for measurement of thickness, IUP 16 for measurement of shrinkage temperature up to 100°C.

To determine the content of mucopolysaccharides in the soaking solution, the solutions were initially subjected to preliminary washing to remove protein and evaporated (Kachetkova, 1967). Several methods were tested in the work: spectrophotometric, the method for determining the protein with a biuret reagent and Flores (State pharmacology, Issue 2, 1990). The first two methods did not lead to results. When using the spectrophotometric method, it became impossible due to the presence of NaCl in the test solutions. When using the biuret method, the protein concentration in the samples used was found to be too low. The method for determining protein according to Flores turned out to be sensitive also in solutions containing inorganic salts (Suzuki, 2006).

RESULTS AND DISCUSSION

Correct performance of the soaking process should ensure sufficient and uniform watering of the raw material throughout the entire thickness and area with minimal loss of gel substance, the maximum possible extraction of salt from the raw material, residues of blood, dirt and soluble proteins (albumin and globulins) and other preservatives, as well as complete protection raw materials from bacterial influences. Insufficient and uneven watering of the skins during the soaking process can cause a screed of the facial surface of the skin in subsequent processes or the appearance of stiffness. Excessive losses of protein substances during soaking lead to looseness of the finished skin up to fragrance (lagging of the facial layer of the skin from the underlying layer).

Table 2. Parameters of the soaking process when processing ostrich skins

Processes	Name of chemical materials	Temperature, °C	Consumption of chemical materials, %	Duration of the process, hr
Soaking - 1	Water Bactericide, Letan Biosit B-40 surfactant, CH-22C	20	400 0.2 0.3	18 hr
Soaking - 2	Water Surfactant, CH-22C Enzyme preparation Letan SE2	20	400 0.3 X=0.1; 0.20; 0.30; 0.40; 0.50	18 hr

The processing of ostrich skins was similar to the following technology developed by Turkish researchers (Chiftchi *et al*., 2012; Bitlisli *et al*., 2004; Afsar *et al*., 2002). In contrast to this technology, during the soaking process, an enzyme preparation Letan SE2 and an environmentally friendly surfactant CH-22C were used to intensify the soaking process. The parameters of the soaking process when processing ostrich skins are shown in Table 2.

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The structure of the ostrich skin tissue, consisting of thick, densely spaced parallel collagen bundles and a large amount of mucopolysaccharides and fatty inclusions, prevents the penetration of an aqueous solution into its thickness during soaking. Experimental studies have shown that the watering of ostrich skins in soaking solutions using only surfactants is not enough than for skins treated in solutions with the addition of the Letan SE2 enzyme preparation. At the same time, the moisture content in the control samples is comparatively lower (by 5-7%) with the same duration of the soaking process. The mass fraction of moisture in experimental samples, with the use of an enzyme preparation in the process of soaking, reaches a value of 68-70%. To determine the optimal consumption of the enzyme preparation, experimental studies were carried out on pieces of ostrich skin. The skin was cut into pieces measuring 5×5 cm, mainly from the tail section closer to the crown of the hide and pieces in experimental studies of the soaking process. In the process of soaking on ostrich skin samples, analyzes were carried out to determine the content of leached mucopolysaccharides in the soaking liquid. Initially, the solutions were pre-washed to remove protein and evaporated (The IULTCS Official Methods of Analysis, 2020). Then the resulting residue was weighed, first taking into account the content of surfactants, NaCl, and then after their deduction. At a concentration of 0.5%, the highest value of leached mucopolysaccharides was obtained. Moreover, the results minus the surfactant and salt differ from the control by 2.0-2.5 times.

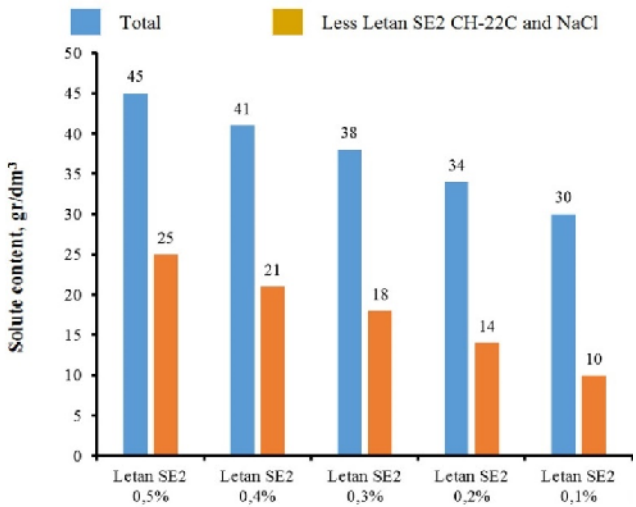

Figure 1. Dependence of the leachable mucopolysaccharides content in soaking solutions obtained after the second soaking

Figure 1 shows the results of determining the content in the soaking solution obtained after the second soaking of skin samples with the participation of CH-22C and Letan SE2. The concentration of the latter is in the range of 0.10–0.5%. In the control experiment, the enzyme preparation was absent.

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The role of the enzyme preparation is not limited to the leaching of mucopolysaccharides, but the breakdown of non-collagen proteins contained in the skin tissue of the hide occurs.

The experimental results were processed using the method of mathematical statistics.

In experimental samples using enzyme preparation Letan SE2, the content of water washable non-collagen proteins is 2.5 times higher than in the control sample.

The results of experimental studies have been tested and confirmed on whole parts of the ostrich skin (skins of the body, legs, neck and wings). According to the studies carried out, the optimal concentration of CH-22C and Letan SE2 are 0.3% and 0.25-0.35%, respectively. With an increased consumption of the Letan SE2 enzyme preparation of 0.4-0.5%, excessive loosening of the structure of the skin tissue is observed, which is undesirable. At that time, the Turkish company ODAK recommends the use of Letan SE2 from 0.1 to 0.35%, depending on the type of leather raw materials. With the removal of mucopolysaccharides and non-collagen proteins from the interfiber space, the moisture content in the skin tissue of the skins increases and a uniform soaking of the skin tissue of the skins is provided in thickness and area.

CONCLUSIONS

The possibility of carrying out the soaking process with the use of environmentally friendly chemicals allows reducing the level of technogenic impact of chemicals on the environment, which is very important for the preservation of natural objects of the Republic. The obtained research results on the soaking process are the basis for the development and improvement of a competitive, environmentally friendly technology for processing ostrich skins.

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