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Study of the effect of the degreasing process on the dyeing and fatty technology processes when processing ostrich skins

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ABSTRACT. In this work, the results of a study on the effect of the degreasing process on the dyeing and fatty processes in the technology of processing ostrich skins were carried out. Modern, highly efficient and environmentally friendly chemical materials were used in studies to reduce the technogenic impact on the environment. In the process of degreasing, a surfactant (surfactant) that meets the requirements of the European REACH regulation was used to reduce the volume and harm of wastewater from the tanning industry on the environment. By determining the residual amount of natural fat during the defatting process, the dependence of the defatting effect on the chemical materials used was established. In the work, the physicochemical properties of the finished ostrich skin are determined and recommendations for their use are given.

KEY WORDS*:* ostrich skin, ostrich leather, technology, degreasing, dyeing, fatliquoring, process, properties.

I. INTRODUCTION

Currently, exotic leather 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 is given by a characteristic pattern due to large follicles from feathers, good wear resistance and plasticity [1]. The originality of the texture of the ostrich skin made it possible to create exclusive leather products, which ensured a high demand for semi-finished ostrich products in the global fashion industry and a high price compared to other types of leather.

In the middle of the last century, out of 196,000 ostriches in the world population, 160,000 birds lived in South Africa. Since the 1960s, ostrich skin has acquired particular importance and in 1986 the volume of exports of ostrich skins and skins from South Africa amounted to 90,000 pieces. In ostrich farming, the production of skins brings 40-50% profitability. Despite the high prices, the potential annual global demand for ostrich skins is estimated at between 100,000 and 750,000 [2,3].

Currently, one of the priority directions for improving the dyeing and fatty liquid processes is the development and study of the possibility of using new and modern chemical materials, the introduction of which will contribute to the intensification of processing, improve the quality of leather, environmental safety and economic efficiency of production.

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Correct implementation of the dyeing and fatty processes must ensure sufficient and uniform quality throughout the entire thickness and area. Insufficient and uneven processing of a semi-finished product in dyeing and fatty processes can cause roughness of the facial surface of the skin in subsequent processes or the appearance of rigidity [4].

The conducted research was aimed at studying the effect of the degreasing process on the dyeing and fatty processes in the technology of processing ostrich skins. In order to reduce the level of technogenic impact of the applied chemicals on the environment, an environmentally friendly surfactant (surfactant) and highly effective modern chemical materials were used, which is very important for obtaining high quality leather and preserving the ecological system.

II. MATERIALS AND METHODS

The object of the study was the skins from the body and limbs of a black African ostrich. In experimental studies, 20 sets of ostrich skins were processed. The birds were 12-14 months old at slaughter. Ostrich skins were received for experimental processing in a wet-salted canning method, the average weight of a set of skins was 4-6 kg, and the area was 140-160 dm^2. Removal and primary processing of skins was carried out on a joint Uzbek-British farm «Straus farm»[5]. Experimental studies were carried out at the Tashkent Textile Institute of Light Industry at the Department of Technology and Design of Leather Products, in the private enterprise «Ulkan Laziz» and in the joint venture «Ozbek-Turk Test Markazi» LLC [6, 7].

At present, in the leather industry, much attention is paid to the use of environmentally friendly non-ionic and ionic surfactants (surfactants), since industrial wastewater containing non-biodegradable surfactants complicates treatment 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 chemicals that meet the requirements of the European Chemicals agency (ECHA) and the European REACH regulation [8, 9]. In studies of the degreasing process, a surfactant - CH-22C was also used, which meets the requirements of the European regulations REACH and ECHA [10].

Organic solvent technical kerosene is a colorless or slightly yellow flammable liquid. It is a product of the distillation of oil. Consists of a mixture of hydrocarbons. It is used for degreasing leather and for emulsion fatliquoring of leather [11].

In studies, 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 research used the methods of analysis of the International Union of Leatherworkers and Chemists (IULTCS) [12]. During the scientific research, the following analytical methods were used: sampling and samples were taken using the IUC 2 "Sampling" method, the IUC 3 method was used for preparing the test material, the IUP 16 method was used for the determination of the welding temperature, the determination of fats and soluble substances in the dichloromethane solvent IUC 4, determination of volatile substances IUC 5, determination of moisture content SLC 11, determination of protein substances IUC 10, determination of ash IUC 7, determination of chromium oxide content IUC 8. Skin density was determined in accordance with IUP 5, softness in accordance with IUP 36, tensile strength in accordance with IUP 6, tensile strength in accordance with IUP 8, tensile cracking in accordance with IUP 12, water vapor permeability IUP 15.

The research results were processed by the method of mathematical statistics.

III. RESULTS AND DISCUSSION

In the production of hides from hides with a high natural fat content, great attention is paid to the degreasing process. In the skin tissue of such skins as the skins of sheepskin, pigs and other animals, natural natural fat is deposited in the sebaceous glands, hair follicles, between collagen fibers and between the fibers of the connective tissue of subcutaneous fat. The level of natural fat in the skin tissue of animal skins varies depending on many factors. These factors include the breed of the animal, age, gender, etc. Cattle skins contain 2-4%, goat skins 12-15%, sheep skins about 30% fatty inclusions. Natural fat contains 56% triglyceride, 23% glycerol, 6% phospholipid, 5% cholesterol and 10% fatty acids [13].

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In the skin tissue of the body of an ostrich, the average content of natural natural fat is on average 15-17% [14,15]. Due to the presence of natural fat during the processing of skins, the hydrophilic activity of the chemical materials used decreases, the process of fleshing of the skin tissue becomes more difficult, mechanical and bacteriological defects are formed, along with many processes, dyeing and fatty processes are complicated.

Today, the issue of the use of environmentally friendly non-ionic and ionic surfactants (surfactants) is also acute, since industrial wastewater containing non-biodegradable surfactants complicates treatment 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 chemical materials.

In the production of leather with the processing of leather raw materials with a high content of natural natural fat, lipolytic enzyme preparations, surfactants, organic solvents and a combination of these substances are used in the degreasing processes. According to the researchers Marsala [16] and Palop [17], when degreasing other types of skins, a high degreasing efficiency was achieved, for example, the efficiency rate reached 89% and 94%. However, an overly strong defatting effect is considered disadvantageous in providing high quality leather. According to researchers, the presence of 2-4% residual fat in the skin tissue is acceptable [18].

The technological process of degreasing and washing when processing ostrich skins for dressing ostrich skins is shown in Table 1.

Table 1. The technological process of degreasing and washing when processing ostrich skins

Operation and process name	Applied chemicals	Temp. ^0C	Quantity (%) or gr/L	Duration (min)
Degreasing	Water Kerosene Surfactant, CH-22C	25	30-50 X=1,0; 2,0; 3,0; 4,0 and 5,0 2,0	60 min
Washing (2-3 times)	Water Sodium chloride, NaCI	25	100 3,0-4,0	30 min (3° Be ')

In order to reduce the consumption of the organic solvent of kerosene, the surfactant CH-22C was used with a consumption of 2%. In studies it was found that with a decrease in the consumption of organic solvent in the order of 5%, 4%, 3%, 2% and 1%, the indicators of the remaining amount of fatty inclusions in the skin tissue were 1.75%, 2.05%, 2.82% , 3.96% and 5.52%.

When analyzing the skin tissue of ostrich skins for moisture content before and after the degreasing process, indicators were obtained in the range of 65-68%.

The processing of skins from the body of an ostrich was carried out similarly to the developed technology of processing ostrich skins by the Turkish researchers Afsar A., Gulumser G., Ozgunay H. and Akyuz F [19]. The processing of parts of the ostrich skin (drumstick skin, neck skin and wing skin) were also processed according to the same technological sequence.

The sequence of technological processes and operations for obtaining a tanned semi-finished product (Wet blue) is shown in Fig. 2.

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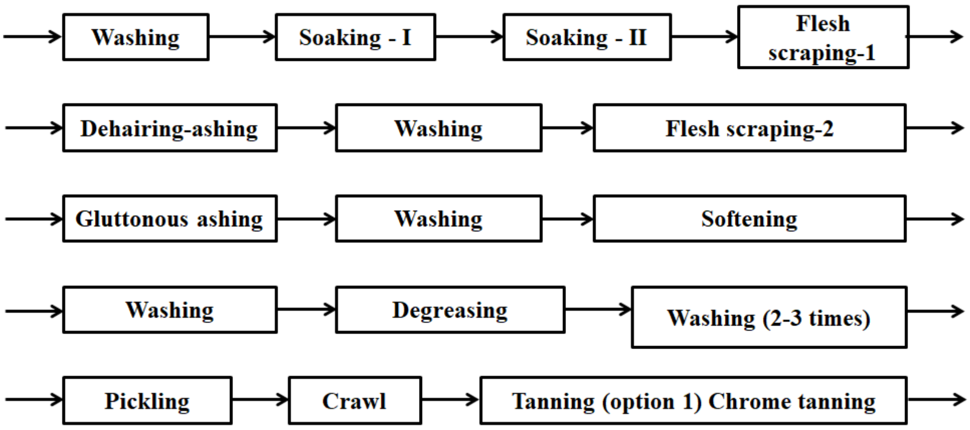

Fig. 2. The sequence of technological processes and operations for obtaining Wet blue from ostrich skins.

At the present time in the leather industry, the issues of intensification and improvement of processing in dyeing and fatty processes and improving the quality of the resulting leather are the subject of increased attention. Most of the technologies that are used in tanneries are very long and involve high technological costs. Hence, there is a need to develop tools and methods to reduce the processing time while improving the quality characteristics of the finished leather with minimal technological costs.

In the leather industry, considerable attention is paid to the dyeing and fatty processes, since it is this stage of processing that determines the main characteristics of the finished product (strength, elasticity, porosity, and other properties). Distinctive features of dyeing and fatty liquid processes are their duration, the use of a large amount of chemical materials and water, which have a significant impact on the operation of treatment facilities and cause environmental problems. In this regard, the search for new processing methods and the improvement of existing technologies seem to be one of the most priority areas of scientific research.

The processing of a tanned semi-finished ostrich product in dyeing and fatty processes was similar to the following technology developed by Turkish researchers [19, 20]. In contrast to this technology, chemical materials from the Russian company Shebekinskaya Industrial Chemistry (SHIH) were used for intensification in the dyeing and fatty processes [10]. Before the dyeing and fatty processes, parts of the ostrich's skin (parts of the body, wing, neck and legs) were sorted according to their intended purpose and weighed on the scales. Tanned semi-finished products in the main parts of the torso and lower legs with a thickness of 1.1-1.2 mm were selected to obtain leather for the upper of shoes, and parts of hides with a lesser thickness were selected to obtain haberdashery leather and leather for accessories. Parts of the skins have gone through the processes of washing, retanning, neutralization, dyeing-filling (dyeing), fatliquoring, dyeing and washing.

Technological parameters of dyeing and fatty processes are shown in Table 2.

Table 2. Technological parameters of dyeing and fatty processes when processing ostrich skins

Operation and process name	Applied chemicals	Temp. ^{0}C	Quantity (%) or gr/L	Duration (min)
Washing	Water Surfactant - CH-22S	40	100 1-2	2
Washing	Water	40	150	0,5
Retanning	Water, Formic acid, Chrome oak (in terms of Cr_2O_3), Sodium formate	40	100 1 1 1	3-4

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	Sodium вicarbonate		0,5	(pH=3,0-3,8)
Washing	Water	40	150	0,5
Neutralization	Water	40	100	2
	Ecomin NS		1	
	Sodium formate		1	
	Sodium вicarbonate		0,5	(pH=6,0-6,5)
Washing	Water	40	150	0,5
Dyeing-filling	Water	30	100	3-4
	Eurosyntan RSN-B40		2	
	Ekodisp		1-2	
	Acid dye		2	
	Eurosyntan MV		1-2	
	Eurosyntan D		1-2	
	Mimose NT		1	
	Quebracho		1	
Fattening	Water	55-60	150-200	3-4
	CMX – 470 люкс		2	
	CMX – 476		2	
	CMX – 480		2	
	CMX – 6		1	
	CMX – Э		1	
Dyeing	Water	55-60	150-200	2
	Acid dye		1	
	Formic acid		1	
	Acid dye		1	
	Formic acid		1	
Washing	Water	30	150	0,5

On the basis of the studies carried out on the dyeing and fatty processes, samples of dyed leather - crust were obtained. After passing through the processes of free convective drying, rolling and stretching, ostrich skin crust can be directed to various finishing methods (aniline, semi-aniline and other types of finishing). Accordingly, the resulting exotic ostrich skin can be used for various purposes. To determine the purpose of the parts of the ostrich crust, their physicochemical and mechanical properties were determined. These results are shown in table. 3.

Table 3. Physicochemical and mechanical properties of ostrich crust

Name of physicochemical and mechanical indicators	Ostrich skin parts				Upper Leather [21]	Galante-Ray Leather [21]
	Neck	Bootleg	Wings	Torso		
Leather surface, dm^2	10-12	14-16	21-24	125-130	120-150	65-75
Average density, g/cm^2	0,50- 0,52	0,75-0,80	0,60-0,64	0,65-0,68	-	-
Welding temperature, ^0C	92,8-97,5	92,5-94,8	92,4-97,2	92,6-97,4	-	-
Tensile strength, MPa, not less	10,0±0,50	59,0±0,80	50,5±0,60	55,4±0,70	18	10
Elongation at a force of 10 MPa,%	15,0±0,14	20,0±0,50	20,0±0,80	22,0±0,70	15-35	15-35
Mass fraction of chromium oxide (Cr_2O_3)%	3,9±0,10	3,8±0,10	3,9±0,12	4,0±0,15	4,3	3,0
Moisture content,%	9,8±0,40	10,3±0,30	12,0±0,30	11,8±0,40	10-16	10-16

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It is known [22] that the purpose of finished leather is determined by physical and chemical parameters. Based on the obtained physicochemical indicators of the parts of the ostrich crust of the trunk, wing, neck and lower leg, it will be possible to make a recommendation for their use. For this, the physicochemical parameters of ostrich crust revealed in the course of research were compared with the standard parameters of galaterian and shoe leather established by. Ostrich crust obtained from a part of the trunk and lower leg in combination can be used as leather for the upper of shoes, and parts of the skin of the neck, wings and lower leg as haberdashery leather.

IV. CONCLUSION

On the basis of the studies carried out to study the effect of the degreasing process on the dyeing and fatty processes in the technology of processing ostrich skins, the technological parameters of these processes and the technology of dyeing the tanned semi-finished ostrich product were improved. The use of an environmentally friendly surfactant (surfactant) and highly effective chemical materials improves the quality of finished leather, reduces production costs and wastewater volumes. The results of the studies carried out on the dyeing and fatty processes will become the basis for the development of a new competitive technology for processing ostrich leather raw materials.

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