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The Use of Esterificate for Fattening of Leather for Shoe Uppers

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Abstract

The article presents a new composition for fatliquoring the leather obtained from local secondary products and a stepwise method of fatliquoring process. It was determined that with stepwise fattening, the fatliquoring composition can be added stepwise: in the processes of pickling, tanning, dyeing, retanning and fatliquoring. It was revealed that the introduction of etherification in the composition and stepwise method of fatliquoring of the leather, will allow a uniform distribution of the fatliquoring agents in the skin structure, providing an improvement in the performance properties of the finished product.

Keywords

Fattening Process, Fattening Material, Leather, Etherified, Alcohols, Distilled Fatty Acids, Fusel Oil, ISO Amyl Alcohol, Oleic Acid

1. Introduction

The leather industry is one of the most chemical capacious industries, which means that the competitiveness of the skin depends primarily on the chemical materials and technologies used. A large number of chemical companies compete with each other, offering tanneries different combinations of chemical materials and technologies.

Skin fattening is one of the most important stages of leather production, in which the structure is finally formed, including elastic-plastic properties of the skin for various purposes. In the process, fattening increases the elasticity of the leather, increasing indicators such as water resistance and wear resistance. The parameters of the fattening process, the nature and properties of the materials used affect the skin during its subsequent processing and in the manufacture,

storage and operation of leather products.

It is well known research work [1] to obtain fattening components with different functionality. The skin-technological properties of fat emulsions have been studied. The disadvantage of these emulsions is the use of animal fats, *i.e.* fats of marine animals (whales, seals), which are becoming increasingly scarce. In addition, these fats have an unpleasant smell, the presence of which is unacceptable in leather and fur products, and elimination is associated with long and time-consuming processing of products. And also, due to the acute shortage of imported fat components and the high cost of natural fats, the possibility of using naphthenic acids of local origin in the process of fattening of leather materials was studied [2].

The technological properties of the materials used in fattening depend on the composition, their consistency and physical and chemical parameters. So, they should be fusible and have a melting point not higher than 32˚C - 34˚C [3].

Representing esters of fatty acids [4], their ethylene glycol esters were obtained from tallic fatty acids of the PL brand, which were then sulfated. To ready neutralized sulfopropyl content sulfogroup associated with the organic portion was 2.6% and 4.6%, respectively. The obtained products had a good emulsifying ability at their content of 20% - 40% in the composition with synthetic fat, spindle oil and other fat substances.

It was found [5] that sulfo chloride fat substance forms water emulsions of white color, resistant to the action of various electrolytes in the pH range 2 - 9, including tanning compounds of chromium. The stability of the emulsion can be purposefully changed. This property of fat allows to use it in the process of phase fattening.

The increase in the softness of chrome leather for the upper of the shoe, as a rule, in the practice of leather production is achieved due to the fat content in the leather. The negative consequences of increasing the consumption of fat are the weighting of the leather, the deterioration of fat processing in the fat bath, and blockage of the pores, leading to a deterioration in the sanitary and hygienic properties of the skin and reduce adhesion, *i.e.* increased fat consumption, which can turn the fat process into a process of filling the leather with fat. And also, the unbound fatty substance remains in the waste bath, polluting the wastewater to an elevated state.

To create more effective fattening agents and the development of significantly improved technological processes, it is advisable to use in the process of leather fattening esters, which ensures uniform distribution of fat on the skin structure.

The authors of [6] consider the possibility of using derivatives of esters for skin fattening. Esters of one, two, or three atomic alcohols and one-dibasic fatty acids interact with polyethylene glycol followed by sulfation. There are products with good fattening effect that bind firmly to the leather. According to test results [7] the use fatliquoring compositions based on esters improves the efficiency of fattening and contributes to the improvement of physic mechanical properties of yuft leather.

2. Method

Objects and Methods of Researching the Fattening Process

The use of an environmentally acceptable fat-based ester has many advantages. They are biologically non-toxic, derived from renewable resources, and have an acceptable cost compared to other synthetic fats.

In this study, the esterification product is, distilled fatty acids of cotton soapstock and fusel oil as a fattening agent for skin fattening. Fusel oil, a byproduct of the alcoholic fermentation process of industrial alcohol production, is an alcohol mixture having a boiling point of 80˚C - 130˚C.

Distilled fatty acids (LFA) of cottonseed oil have an increased melting point of 20˚C - 30˚C. The study of the composition and structure of distilled fatty acids revealed the presence of essential, fatty acid, hydroxyl functional groups that play with the collagen of the dermis. In this study, the esterification product distilled fatty acids and fusel oils were presented as a fattening material for the first time skin fattening.

Distilled fatty acids are valuable products that are used in various areas of the economy. One of their sources is the waste of alkaline refining of vegetable oils, so-called soapstocks, which are concentrated aqueous solutions of Soaps and organic impurities. The composition of distilled fatty acids from soapstock includes 73% unsaturated acids from soapstock C16-C18 with an average molecular weight of 276. A mixture of fatty acids with an acid number of 206 mg of potassium hydroxide includes lauric (0.43%), myristic (16.7%), palmitic (55.3%), stearic (10.4%) and oleic (17) acids.

For the experiment used the fusel oils obtained from hydrolysis alcohol plant "Biochemistry plant stock Company". Fusel oil is a byproduct of alcohol production, its average composition is 10% ethanol, 13% n-propanol, 15% Isobutanol, 51% of amyl alcohol, 11% mixed alcohols and water. Its main component is ISO amyl alcohol, which can form compounds of ester.

Fusel oil appearance transparent liquid, with shaking not mutneyuschee; color—light yellow; odor—characteristic fusel oil odor. Relative density 0.837 g/cm^3, refractive index 1.395 n20D.

To increase the amount of ester formed and shift the balance of the esterification reaction, one of the reacting substances—fusel oil (more available) was taken in excess, acid:alcohol 1:2. With an excess of alcohol, almost all the acid can react.

3. Result

The requirement for a more rational process of fattening, reducing the amount of fatty substances consumed in waste baths, including wastewater, eventually led to the development of a stepwise fattening method.

When step fattening, in contrast to the traditional methods of fattening, fattening composition can be added stepwise: in the processes of pickling, tanning,

dyeing, retanning and fattening.

Step-by-step greasing enables more efficient use of greasing agents, which contributes to the reduction of fats in processed solutions. And also, it is possible to achieve a uniform distribution of fat and chromium salts, which plays an important role in improving the quality of the skin.

On this basis, a study was conducted of the stepwise method of fattening chrome tanned leather. For work were taken experimental and control parcels half shabrack. Liquid processes were carried out in suspended drums.

For the study took fatliquoring agents according to the composition shown in Table 1.

In this study, the test object was the raw material of a buoy of light weight of 23 kg. Consumption, fattening compositions amounted to a total of 12% by weight of the scythe (in the pickling and tanning processes), from the mass of planning leather (in dyeing and retanning) and from the mass of wringing leather (in the fattening process). The pH of the fattening composition was 7.5 - 7.8; the duration of the process is 2 hours.

The flow rate, fattening compositions with stepwise fattening and greasing by the traditional method are given in Table 2.

All processes and operations of control and experienced leathers were carried out according to the chrome-tanned leather production method used in the association for the top of the shoe.

4. Discussion

The process of fattening the test and control batches of the leather proceeded normally. However, using the stepwise fattening method, as indicated above, the fattening composition was added stepwise at the end of the processes. A difficulty in their conduct was not observed.

In order to determine the extent of the influence of the composition of the fattening mixture on the quality of the finished leather, chemical analyzes and physical and mechanical tests of the test and control skins were carried out (Table 3). Sample preparation and test procedures were consistent with current standards.

In Table 3, it was found that the strength of the front layer and the leather as

Table 1. Experimental and control fatting agents for fatliquoring leather for upper shoes.

No.	Fatliquoring agents	Consumption, mass %	
		Experienced option	Control option
1.	Technical fat	15	-
2.	Spindle oil	20	-
3.	Hide fat	15	-
4.	Etherified	50	-
5.	Synthetic fat	-	80
6.	Sulfated fish oil	-	20
	Subtotal	100	100

Table 2. The consumption of the fattening composition in the sequence of processes.

Options	Fat consumption composition, %					
	Picklings	Tannings	Dyeings	Retannings	Retannings	Subtotal
Experienced option	10	10	15	15	50	100
Control option	-	-	-	-	100	100

Table 3. Chemical, physical and mechanical indicators of control and experimental chrome leather produced with the use of the certificate.

Samples	Indicators						
	Moisture, %	Ash,%	Fat content, %	Chromium oxide, %	Average thickness, mm	The voltage at the appearance the surface layer, 10 MPa	The limit of the tensile strength 10 MPa
Test	13.9	7.1	8.9	5.1	1.37	1.71	2.32
Experimental	14.3	6.3	9.7	4.9	1.26	1.92	2.49

a whole, and has a higher reading tensile strength. These data confirm that the strength of the leather depends not only on the amount of fat injected, but also on the nature of the fat, its polarity, providing an improvement in the physical and mechanical properties of the finished leather.

5. Conclusions

Experienced leather after fattening was evaluated organoleptically. After fattening they were soft, and filled, and had a more bright and clean back compared by the control option. Fattening substances worked out well; salinity of semi-finished product was not observed. And also, experienced leather had a greater output area than the control options.

The resulting etherified compared to other fattening substances advantage is the use of waste oil extracting and hydrolytic production. Based on preliminary calculations, we believe the cost of production is much lower than the currently used synthetic and natural fats.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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