

ANNOTATION

Dissertation work of Mirzamuratova Rosa Shamuratovna on the topic «Investigation of the effect of natural extracts used as dyes on the properties of the leather during the finishing process», submitted for the Doctor of Philosophy (PhD) degree of in educational program 8D07230 - "Innovative technologies in light industry"

General characteristics of the work. The dissertation work is aimed at improving the finishing technology in order to improve the properties of the leather, directing the production of leather to the ecosystem.

In the first part of the dissertation, information was analyzed on the state of production development, modern leather finishing technologies, factors affecting the quality of leather, ways to reduce the amount of hexavalent chromium in chrome-tanned leather, on the preparation and composition of natural extracts that improve the properties of leather and are capable of staining.

The second part describes the object of research and the materials used, the method of obtaining natural extracts, the method of obtaining the composition of natural extracts, methods of studying the properties of the leather.

In the third section, a statistical analysis was carried out based on the results of complex leather finishing with natural extracts, physical and mechanical properties of the leather, hygroscopic properties of the leather, the composition of the extracts obtained, changes in the structure of the leather, the stability of the coloring of materials and the amount of color after the wear process, the activity of natural extracts to reduce the content of Cr (VI) in the leather.

Relevance of the research topic.

The work is aimed at improving the properties of cattle leather using natural extracts as dyes.

Leather treatment is a complex process consisting of a number of operations. Each additional chemical used in leather treatment is harmful to the environment and the human body, and involves additional production costs.

Solving emerging problems in the field of nature protection, ecology, considering ways to use plants in the leather industry as dyes and reducing the content of heavy metals that are particularly dangerous to health using natural extracts is one of the main prerequisites in the leather industry.

Natural plants contain large amounts of flavonoids, flavonols, antioxidants and phytochemicals. It has also been found that plant waste can be used as a dye or antioxidant in the production of leather. There has been an increased interest in the use of natural dyes in the dyeing process. Studies have shown cases where natural dyes attracted the attention of specialists due to the presence of a good protective effect, improves leather strength, in addition to coloring properties.

Cr (III) chromium salts are used in the tanning process. The advantages of the chrome plating method are numerous. More than 90% of the world's industries use this method. When processing, storing, transporting and using chrome-tanned leather, there is a risk of transition from trivalent chromium Cr (III) to hexavalent chromium Cr (VI). Hexavalent chromium Cr (VI) leads to the development of

many dangerous diseases. Scientists are constantly conducting research to prevent this condition. It has been found that natural plants and extracts also have Cr (VI) lowering properties.

Therefore, the replacement of chemical pigments with natural extracts in order to protect the environment, protect human health, improve leather properties, and reduce the content of heavy metals in the leather is one of the urgent tasks.

Goals and objectives of the work.

Improving the technology and improving the quality of finishing the leather of cattle with the use of natural extracts.

To achieve this goal, the following research tasks have been solved in the work:

- a systematic analysis of current problems, traditional and environmental technologies for processing leather materials;

- development of a complex of leather finishing with the preparation of natural extracts of onion peel, walnut shell, oak bark;

- development of a leather finishing method using a complex containing natural extracts;

- analysis of the composition of natural extracts;

- determination of the physical and mechanical properties of leather materials that have been finished using natural extracts;

- determination of the stability of leather coloring obtained using natural extracts;

- study of the antioxidant properties of colored leather using natural extracts during the finishing process.

The object and materials of the study.

The process of finishing the leather with a complex with the addition of natural extracts. Cattle leather chrome tanned at the company of «Turan Skin»; natural extracts from onion peels, walnut shells, oak bark and a finishing complex containing natural extracts.

Research methods.

Obtaining natural extracts; preparation of a complex for finishing works; formation of finishing techniques; experimental and theoretical work based on the results of a study of the physico-mechanical, hygienic, coloristic, antioxidant properties of the leather that has been finished.

The preparation of the material for the study is carried out at the production of «Turan Skin» factory, Shymkent, Republic of Kazakhstan. Experimental studies were conducted in the testing regional laboratory of engineering profile "Structural and biochemical materials" of the M. Auezov University of South Kazakhstan; the vast majority of research work on this material was carried out in the laboratory «Leather engineering» department of the University of Turkey, Ege, and in the laboratories of Ege Matal.

Scientific novelty of the research.

- the technology of a finishing complex based on a natural extract from onion peel (*Allium Cepa*), walnut shell (*Juglans regia*), oak bark (*Quercus cortex*) has been prepared and developed for use in finishing works of leather materials;

- it has been proven to increase the physical and mechanical properties of the skin, finished with complexes based on natural extracts;
- it has been proven that leather samples finished with complexes based on natural extracts remain color-resistant even after the wear process;
- after finishing chrome-tanned leather materials with natural extracts, a decrease in the value of hexavalent chromium, which affects Cr (VI) free radicals in the composition of the leather, was revealed.

Scientific and practical significance of the work.

To obtain leather materials with high properties, natural extracts made from onion peels, walnut shells, and oak bark are used as a dye during the finishing process.

In order to protect the environment and consumer health, one of the important decisions is the effective use of natural resources in the production of waste in the Republic of Kazakhstan. Based on the research results, the manufacture of leather materials with improved physico-mechanical, hygienic, and antioxidant properties increases consumer demand.

The basic rules for the defense.

Obtaining natural extracts; preparation of a complex for finishing process; formation of finishing techniques; experimental and theoretical work based on the results of a study of the physico-mechanical, hygienic, coloristic, antioxidant properties of the leather that has been finished.

Personal contribution of the dissertation to the generalization of the results of scientific work submitted for defense.

To carry out work on the chosen topic, a plan was drawn up that corresponds to the tasks of the work, leather materials were developed for the purpose of conducting research, and methods of experimental research of finished materials were determined. In the course of the work, production and experimental tests were carried out, scientific conclusions and results obtained after the tests were analyzed. He considered a way to obtain leather with high properties and use natural extracts as an environmentally effective dye on the way to achieving this goal. The obtained results were processed using mathematical modeling. The scientific results obtained during the dissertation work have been put into production.

The criticality of the work. The author took an active part in the publication of the obtained results in domestic and foreign publications. 17 scientific papers have been published on the topic of the dissertation, of which 1 article was published in a publication included in the list of the Committee for Quality Assurance in the field of science and higher Education of the Ministry of Science and Higher Education of the Republic of Kazakhstan, 5 articles were published in journals included in the Web of Science/Scopus database, and 1 article was accepted for publication. 11 articles have been published in the materials of international and national conferences. In addition, 2 patents for the invention have been filed with the National Institute of Intellectual Property of the Ministry of Justice of the Republic of Kazakhstan.

1) Mirzamuratova R., Bayramoğlu E.E. et.al. Investigation of the influence of walnut shell extract on chromium (VI) content in leather. Textile Research Journal. DOI: 10.1177/00405175241246736 accepted for publication (quartile - **Q2**)

2) Mirzamuratova R., Bayramoğlu E.E. et.al. Investigation of the Effect of a Natural Extract from Oak Bark on the Properties of the Leather, Fibres and Textiles in Eastern Europe, 2024, 32(1), P.83-89 DOI: 10.2478/ftce-2024-0010 (quartile - **Q3**)

3) Mirzamuratova R., Bayramoğlu E.E., Kaldybayev R. Application of some plant extracts as biocolorants for leather during finishing process. Journal of American Leather Chemists Association 2024, 119(1), P.3-12.

DOI: <https://doi.org/10.34314/jalca.v119i1.8289> (quartile - **Q3**)

4) Mirzamuratova R. et.al. Reduction of Cr (VI) Formation in Leather with Herbal Extracts. Journal of the American Leather Chemists Association 2024, 119(2), P.71–79 **DOI:** <https://doi.org/10.34314/jalca.v119i2.8324> (quartile - **Q3**)

2 articles have been published in journals included in the Scopus database:

1) Mirzamuratova R.Sh., Kaldybayev R.T., Bayramoğlu E.E. Dyeing of Natural Leather with the Use of Plant Extract. Izvestiya Vysshikh Uchebnykh Zavedenii, Seriya Tekhnologiya Tekstil'noi Promyshlennosti. 2023; 408 (6): 54-59. DOI 10.47367/0021-3497_2023_6_54

2) Mirzamuratova R.Sh, Kaldybayev R.T, Bayramoğlu E.E., Temirshikov K.M., Baiseitova I.S. The Effect of Natural Extracts on the Strength of Leather. Izvestiya Vysshikh Uchebnykh Zavedenii, Seriya Tekhnologiya Tekstil'noi Promyshlennosti. 2023; 406 (4): 81-86. DOI 10.47367/0021-3497_2023_4_81

1 article was published in the publication, which is included in the list of the committee for quality assurance in the field of Science and higher education of the Ministry of Science and higher education of the Republic of Kazakhstan:

1) Mirzamuratova R.Sh, Kaldybayev R.T, Bayramoğlu E.E., The effect of walnut shell (*juglans regia*) on colour fastness of leather. «The Journal of Almaty Technological University», Almaty, 2024, Volume 143, №1, P.223-230.

<https://doi.org/10.48184/2304-568X-2024-1-223-230>