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PROTECTING KERATIN FROM DAMAGE CAUSED BY INSECTICIDES

Islamova Zulaykho Shukhratovna[1], Matkarimova Dilnoza Baxodirovna[2], Ibrokhimova Yulduz Zhonibekovna[1]
[1]Tashkent Institute of Textile and Light Industry,Uzbekistan, Tashkent
[2]Urgench State University named after Abu Raykhon Beruniy, Urgench
E-mail: zulayho.islamova@mail.ru

ANNOTATION

This article presents research on imparting mole-proof properties to wool fiber of the local Karakul breed with a diameter of 58.86 microns and a length of 11-14 mm, which serves as the object of research. Unlike traditional technologies, an extract of a natural repellent - Lamiáceae - was used to impart moth-proof properties to wool fiber in order to ensure occupational safety and environmental safety. Due to the presence of a number of difficult-to-degrade compounds in the essential oil of Lamiáceae (26.14-57.07% linalool and 9.08-24.45% linalyl acetate), it was possible to protect the keratin protein of wool from moth larvae. After isolating Lamiáceae, a lavender extract, using the SOX406 installation, aqueous solutions of various concentrations were prepared from it. When dyeing samples of wool blend fabrics, a two-stage periodic and continuous dyeing method was proposed by combining the use of natural dye - Carmine and essential oil of the Lavender plant (Lamiaceae). Depending on the concentration of Lavender aqueous extract, the mole-protective properties of mixed fibrous fabric were assessed by tissue weight loss and damage to samples in accordance with ISO 3998:1977.

Key words

wool fabric, mothproof finishing, final finishing, color intensity, composition, dyeing, concentration, strength.

Introduction

Innovative skills aimed at saving resources, protecting the environment, producing environmentally friendly and compliant products, as well as achieving economic and social efficiency, are today one of the main and pressing issues of economic growth and industrial development of the country [1]. Therefore, the mixture of known composition and quantity of substances used in finishing, called dressing, is divided into two groups: washable and non-washable. Washable finishes disappear after the first wash of the fabric, while non-washable finishes disappear after 5 washes. Although washable finishes are lost during the first wash, they are widely used in industry. In addition, coatings that do not require rinsing are very often used. They contain synthetic resins, thermoplastic polymers and elastomers. These substances are used in the form of emulsions [2]. The quality of a fabric after final finishing is measured not only by its external characteristics, but also by the extension of the service life of this fabric.

Theoretical research

Some alkaloids are recommended for moth-proof finishing of woolen products, for example, quinine, nicotine, brucine, and caffeine. These compounds, which belong to the class of terpenes, are promising for imparting a moth-proof finish. Plant-based dyes containing biologically active compounds [3], in addition to coloring, can impart antibacterial, UV-protective, antioxidant and other beneficial properties to fabric [4].

Chemical reagents used to protect wool from insects are aimed at increasing its resistance to pests. These substances help protect the surface of the wool fiber by killing pests, especially insects and bacteria. Typically, various compounds are used to impart moth-proof properties to wool: Pyrethrins (Pyrethrins), Permethrin (Permethrin), Deltamethrin (Deltamethrin), Carbamates (Carbamates), Lindan (Lindane), Phosphorus insecticides (Organophosphates),

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Diatomite (Diatomaceous Earth), Azadirakhtin (Neem Oil Extract), Bifenthrin (Bifenthrin), Cedar oil (Cedarwood Oil). Research is currently underway to explore the possibility of combining the dyeing and finishing processes of wool to improve the efficiency of the moth-proofing process. [5].

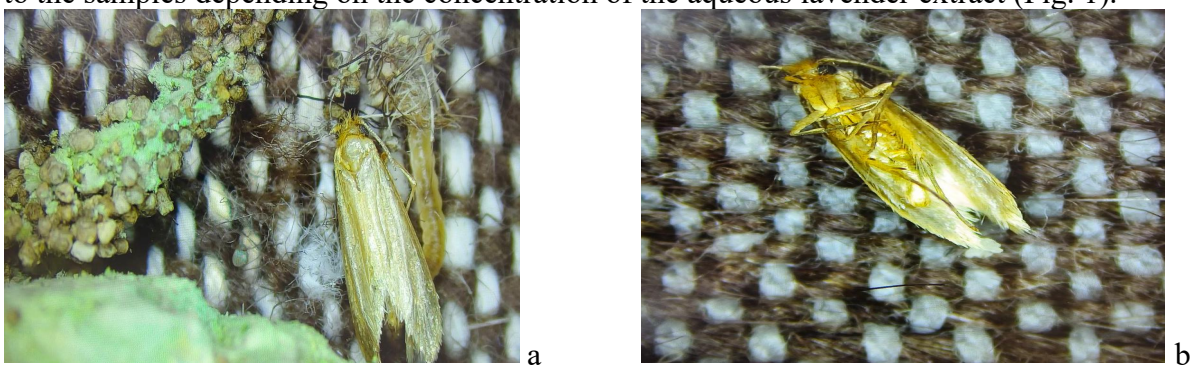
Methodological part

Dyeing wool fiber with natural dyes and imparting moth-proof properties DL-2003; Implemented on the device – Water Bath Shaker. All strength and quality characteristics were determined under laboratory conditions "Kor-Uz Textile Texnopark". The lightning protection properties were assessed according to ISO 3998:1977.

Results and discussion

The object of this research work is the wool fiber of the "Karakul" breed. The fat content of the fiber is 11.2%, the amount of waste is 2.4% and the moisture content is 5.3%.

Experiments were conducted to study the possibility of imparting moth-proof properties to wool fibers using natural preparations and classes of dyes that form durable colors on wool. Lavender is commonly used at home in the form of essential oil to protect woolen items from moths. However, substances with a strong odor, such as esters, cause allergies, leave stains where they come into contact with clothing, and, due to their volatility, reduce the moth-proofing properties of wool. Unlike previous methods, in this study, the moth-proofing treatment was carried out during the process of dyeing the wool with a natural dye. By using a combined technology of dyeing with natural dyes and a moth-proof finish, positive results were achieved in terms of colour fastness and moth-proof properties to washing using Lamiáceae essential oil, which contains a number of difficult-to-decompose, organic and aromatic compounds. After the extraction of Lavender - Lamiáceae using the SOX406 apparatus, aqueous solutions of various concentrations were prepared from it. In accordance with ISO 3998:1977, the properties of a fabric made from a fibre blend were assessed based on the weight loss of the fabric and damage to the samples depending on the concentration of the aqueous lavender extract (Fig. 1).



a b

Figure 1. Wool fiber fabric treated with lavender aqueous extract.
a – Unprocessed; b – Processed Lavender extract - Lamiáceae

Treatment with lavender aqueous extract was carried out using periodic and continuous methods. The results of the experiment are shown in diagram 1.

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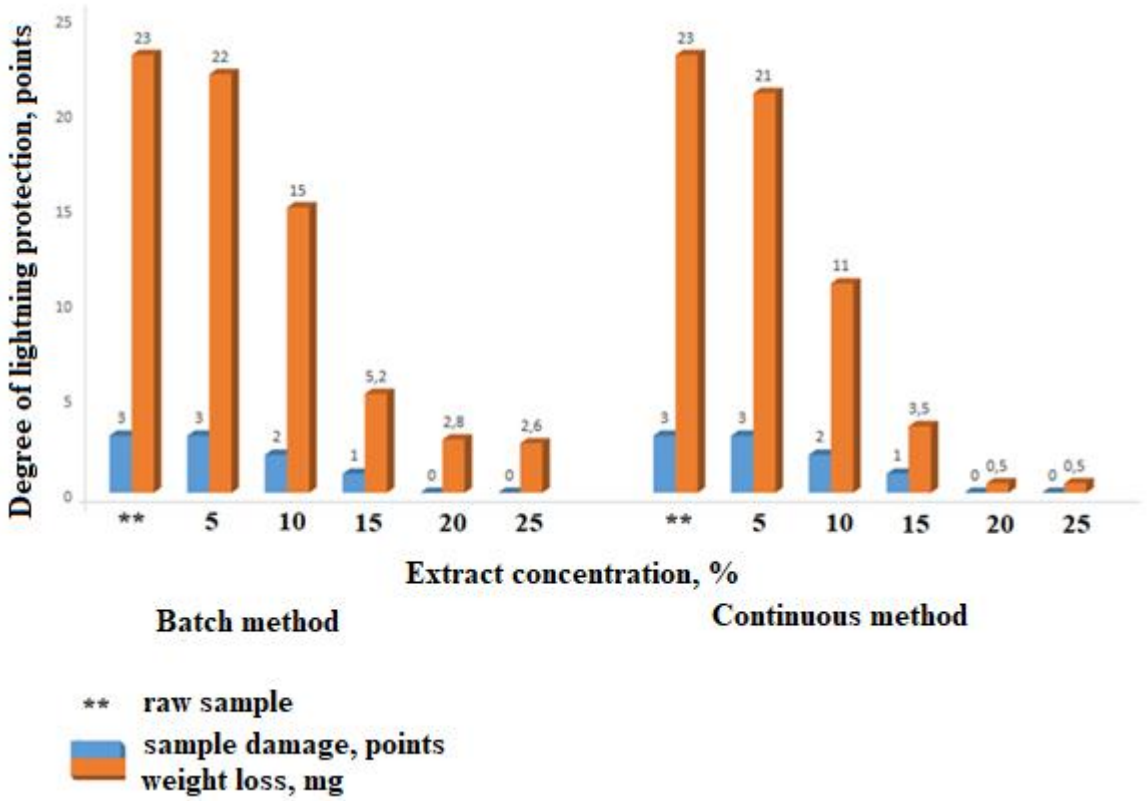

Diagram 1. Dependence of the moth-proof properties of blended wool-based fiber fabric on the concentration of the aqueous lavender extract

The results of the experiments show that, in comparison with the samples treated with aqueous solutions of lavender extract, the damage to the fiber and the reduction in tissue weight by up to 4.3% in untreated samples indicate the complete destruction of the protein part of the wool fiber - keratin under the influence of digestive enzymes contained in the gastric juice of moth larvae. Due to the fact that exceeding the extract concentration by more than 20% had practically no effect on the moth-proof properties of the fabric, a 20% concentration of an aqueous solution of lavender extract was adopted for further research. The continuous method of combined dyeing and finishing of wool fibres gave slightly better results than the periodic method, since the continuous method includes a steaming operation, as a result of which the amino groups of wool keratin bind with the groups Linalool -$C_{10}H_{18}O$, Linalyl acetate - $C_{12}H_{20}O_2$ lavender extract, which leads to the joining and cross-linking of two polypeptide chains and, as a consequence, to an increase in moth-proofing properties, since Linalool and Linalyl can have antibacterial and antioxidant effects due to the formation of biologically active compounds with wool fiber (Fig. 2).

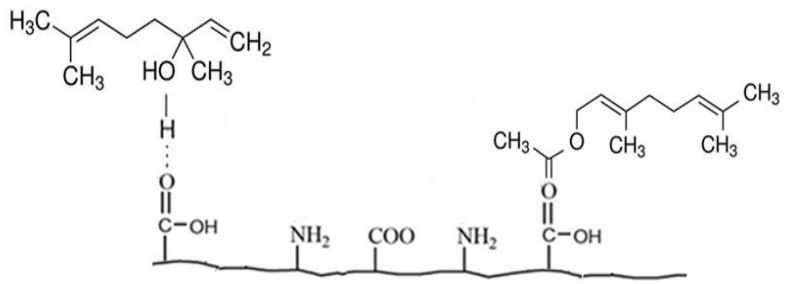

Figure 2. Diagram of the bonds that form between Linalool and Linalyl acetate and wool keratin

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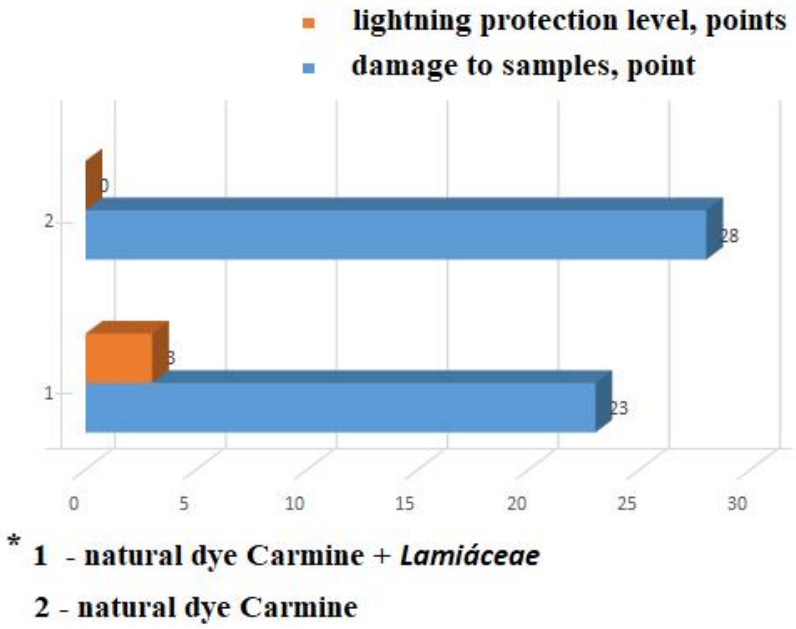
In subsequent studies, experimental work was carried out to determine the moth resistance of painted samples. The painted samples are kept in a thermostat with moth at a temperature of 24.5+1°C and humidity of 65±8% for 14 days.

The moth resistance of the treated samples was assessed according to ISO 3998:1977. The obtained experimental results are presented in diagram 2.



* 1 - natural dye Carmine + *Lamiáceae*

2 - natural dye Carmine

Diagram 2. Qualitative indicators of samples with moth-proof properties

The presented results show that the use of a moth-proof extract in the dyeing process does not reduce the color fastness of the samples to washing and friction. During the dyeing process with natural dye Carmine, the wool did not achieve moth resistance. When lavender extract was introduced into the process, no damage to the fibre was observed at all. Weight loss decreased by 87.8-89.2%, respectively, and wool resistance to moths was achieved.

Conclusion.

Thus, the experimental results show that the proposed method ensures the effectiveness of the stability property by combining the process with painting. Thus, the results of the experiment demonstrated the effectiveness of the proposed method of imparting moth-proof properties in conjunction with painting. The proposed scheme of combined dyeing and moth-proof finishing with natural preparations ensures labor safety and environmental safety. The combined dyeing method of blended wool-based fabrics with natural dyes and a moth-proof finish with lavender extract ensures a resource-saving process.

References:

1. Khusniddin Ismoilov, Sachin Chauhan, Mingxing Yang, Islamova Zulaykho, Quan Heng. Preparation and Application of Anionic and Cationic Waterborne Polyurethanes and Graphene-Cellulose Nanocrystal as an Antistatic Agent for Cashmere // Scientific Research Publishing «Graphene» New York-2019, Oct. 8. – 19-31 p.p.
2. H.N.Ismoilov, H.Quan, D.B.Matkarimova, Z.Sh.Islamova Improvements of the Antistatic and Antipilling Properties of Cashmere Fabric by Applying Foam Finishing Agents Based on Waterborne Polyurethane and Graphene Web of Semantics: Journal of Interdisciplinary Science 2 (4), 187-192

pISSN:2349-5707 Volume:13,Issue 4, April -2026 eISSN:2349-5715

3. Amirova N.S. “Development of effective processes for obtaining rich and durable colors on natural silk”, dissertation of candidate of technical sciences – Tashkent 2010, - 93-121 p.
4. Menghan Jia, Xinhua He, Jingluan Wang, Longxiang Zhu, Zhu-Bao Shao //Effects of durable antibacterial, UV-resistant cotton fabrics with differentiated polydopamine metal complexes // Materials Letters Volume 355, 15 January 2024, 135495
5. Iroda Nabiyeva, Dilnoza Matkarimova, Zulaykho Islamova, Anvar Abdumajidov // Properties of wool fiber, and environmental problems and solutions of its finishing // E3S Web of Conferences 538, 04006 (2024).