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ANTIBACTERIAL MATERIALS IN THE PRODUCTION OF SPECIAL FOOTWEAR

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The article substantiates the need to develop antibacterial materials for the production of special footwear. The impact of fungal bacteria on leather properties is examined. A biocidal agent is proposed to prevent the spread of bacteria and fungi.

Keywords: Charml, industry, footwear, material, hygienic properties, military personnel, chromium salts, bactericidal properties

В статье обоснована необходимость разработки антибактериальных материалов для производства специальной обуви. Рассмотрено влияние грибковых бактерий на свойства кожи. Предложено биоцидное средство для предотвращения распространения бактерий и грибов.

Ключевые слова: Charml, промышленность, обувь, материал, гигиенические свойства, военнослужащие, соли хрома, бактерицидные свойства

Maqolada maxsus poyabzal ishlab chiqarish uchun antibakterial materiallarni ishlab chiqish zarurligi asoslanadi. Qo'ziqorin bakteriyalarining teri xususiyatlariga ta'siri tekshiriladi. Bakteriyalar va zamburug'larning tarqalishini oldini olish uchun biosidal vosita taklif etiladi.

Kalit so‘zlar: Charml, sanoat, poyabzal, material, gigienik xususiyatlari, harbiy xizmatchilar, xrom tuzlari, bakteritsid xususiyatlar

The protection of workers' health, the provision of safe working conditions, and the elimination of occupational diseases and industrial injuries constitute one of the primary concerns of the State.

By the Decrees of the President of the Republic of Uzbekistan dated September 15, 2016, No. PP-2592, the "Program of Measures for the Further Development of the Leather and Footwear Industry for the Period 2016-2020" was approved, and by Decree No. PP-2800 dated February 27, 2017, "On Measures to Streamline the Mechanism for Developing, Standardizing, Approving, and Manufacturing Uniforms for Ministries, Agencies, and Organizations of the Republic of Uzbekistan" was adopted. Consequently, the need arose for the development and production of special clothing and footwear for security forces that meets all modern international standards, taking into account the climatic features of Uzbekistan.

The history of footwear dates back thousands of years. Footwear is an essential part of clothing, and its primary purpose is to protect the feet from moisture, dirt, extreme temperatures, and mechanical damage [1].

Special-purpose footwear must meet requirements for reliability and wear resistance during its designated service period, maintaining its properties throughout storage. Increasingly important are the consumer characteristics of footwear, such as properties that regulate heat, gas,

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and moisture exchange between the lower extremities and the external environment, as well as the external shape and internal configuration of the product, its weight and flexibility, cushioning, and friction properties of the sole, among others.

In recent years, the requirements for special-purpose footwear have expanded to include biocidal properties. At the same time, hygiene standards have become more stringent. All these requirements, imposed on footwear, are directly related to the upper and lining materials, as well as the internal materials of the shoe's lower part. These materials are in direct contact with the foot, and their hygienic properties determine the overall characteristics of the footwear itself [2].

Over the past 20 years, there has been an increase in the number of cases of fungal foot infections — mycoses — worldwide. In 2012-2013, at the request of the Ministry of Defense of the Republic of Uzbekistan, anthropometric studies were conducted among the Republic's military personnel to identify new sizing standards for military footwear. During these studies, 1,300 conscripted soldiers from the lower ranks were examined, and it was found that 25% of the surveyed servicemen were affected by fungal foot infections [3].

Fungal diseases belong to the group of infectious diseases caused by pathogenic fungi. These fungi affect the human body and can reside both on the skin's surface and on the mucous membranes of internal organs. The most common cases involve fungal infections of the feet, which cause discomfort and hinder the normal functioning of military personnel.

The issue of microorganism infestation in footwear made from natural leather is highly relevant. The process of biological contamination can result in the premature deterioration of footwear and, in many cases, negatively impact the health of the person wearing it. This may include foot infections caused by conditionally pathogenic microorganisms, the development of allergies triggered by saprophytic mold fungi, and other related issues.

The intensive contamination of footwear materials, primarily by bacterial and fungal microflora, is facilitated by temperatures ranging from 25-32°C and humidity levels of 75-90%. Additionally, the skin of the feet itself serves as an ideal nutrient medium for the development of microorganisms due to the presence of moisture, fats, proteins, vitamins, and microelements. While bacterial cultures tend to perish quickly, fungal organisms, on the contrary, continue to proliferate intensively. This phenomenon can be attributed to the composition of chrome-tanned leather, which is predominantly used in footwear production. Although chromium salts in this type of leather exhibit bactericidal properties, they lack fungicidal activity.

Leather factories produce footwear leather for both the upper and lining using traditional technologies. This process involves soaking, liming, tanning, dyeing, and fatliquoring procedures. To achieve an attractive appearance, proper texture, and the final formation of the leather's physical and mechanical properties, finishing operations are also conducted to ensure high-quality leather.

Today, biocidal treatment technologies for footwear leather are well-known. These technologies involve treating leather or semi-finished products during tanning, dyeing, and fatliquoring processes, as well as during finishing operations. Modified leather includes a collagen base with a multi-level structural organization, tanning and retanning agents, fatliquoring compounds, and a biocidal additive. Biocidal formulations are applied in the form of latexes, emulsions, or solutions.

The development of biologically active agents to prevent the emergence and spread of bacteria and fungi represents a global challenge that requires urgent solutions. In this regard, the issue of protecting natural leather from mold and fungal contamination is particularly relevant

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for our country, where warm and sunny days create favorable conditions for their rapid proliferation.

One of the most effective solutions to this problem is the use of specialized chemical agents for treating lining materials such as leather, fabric, etc., which provide footwear with enhanced comfort and protection against fungi, mold, and other harmful bacteria and microorganisms.

In this regard, derivatives based on heterocyclic compounds are of particular theoretical and practical interest due to their high reactivity and extensive application in medical practice as antimicrobial, antiseptic, and other therapeutic agents.

Heterocyclic compounds, being unique in their biological and practically significant properties, continue to attract the attention of numerous researchers worldwide who are engaged in the search for new biologically active substances. This is largely due to their wide application and synthetic potential. Extensive information on the modification and properties of heterocyclic compounds is covered in various literary sources. Nevertheless, the possibilities for their chemical modification are far from exhausted and hold broad prospects for the synthesis of new biologically active compounds.

Experimental studies were conducted at Tashkent Institute of Textile and Light Industry (TITLP) to explore the feasibility of using newly developed antibacterial fabrics as lining materials for military footwear. The ticking twill fabric was woven in the "Weaving" laboratory, while its dyeing was carried out using various formulations in the laboratory of the "Chemical Technology" department. The fabric was then treated with an experimental antibacterial solution at the Tashkent Institute of Chemical Technology laboratory.

The results of the studies, which assessed the impact of antibacterial treatment and fabric dyeing on the physical-mechanical and hygienic properties of the twill fabric in the TITLP certification laboratory, concluded that undyed ticking twill could be successfully used as the primary lining material and insole for military footwear.

Experimental studies were conducted on various structured lining materials produced by the Italian company "Siretessile." The primary composition of the lining material consisted of 100% polyamide with antibacterial treatment, combined with knitted and polyester films of varying structures, bonded through flame or heat methods.

The results of the conducted studies on the thermal conductivity, water permeability, and air permeability of these antibacterial lining materials enabled the identification of the composite material’s structure, its main composition, and the relevant production technologies, providing a basis for determining future research directions.

Thus, due to the absence of antibacterial material production for footwear manufacturing in the Republic, the primary objective of this study is to develop a method for obtaining synthetic preparations based on heterocyclic compounds and to create a technology for producing antibacterial materials for footwear manufacturing enterprises within the Republic.

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