RESEARCH OF DAMAGE TO WOOL FIBERS USED IN THE CARPET INDUSTRY.

Ismatullaeva H.Z.,

Candidate of Technical Sciences, TSPU named after Nizami,

Kadirova N.A., Tajibaeva M.Z.,

2nd year undergraduates of TSPU named after Nizami

Аннотация. Рассмотрены проблемы повреждения шерстяных волокон используемые в ковровой промышленности в процессе хранения, переработки и эксплуатации. Указана роль бактерий и микроскопических грибов в повреждении волокон.

Abstract. The article discusses the problems of damage during storage, processing and use of wool fibers used in the carpet industry. The role of bacteria and microscopic fungus in fiber damage has been shown.

Ключевые слова: биоповреждения, волокна, шерстяные, текстильные материалы, бактерии, грибки, биостойкость, пиллинг, кератин, цистин, кортекс.

Key words. biological damage, fiber, wool and textile fabrics materials, bacteria, fungus, bio-stability, pilling, keratin, cystine, cortex.

The properties of the yarn are determined by the properties of the raw material and the methods of its processing. In this regard, studies of yarn production are divided into two groups: selection of raw materials and technology of yarn production. The works of Gusev V.E., Slyvakov V.E. are of great interest in this area. and many other authors. Based on the research, it has been established that the main criteria for assessing fibers for carpet production are: strength, elongation, elastic properties, bending resistance, wear resistance, dyeing strength. Along with these indicators, an important characteristic is tortuosity. It has been proven that fibers with stable crimp allow to increase the coverage of the pile surface, provide good resistance of carpets to wrinkling and abrasion, which is one of the most important characteristics of the operational properties of products, allowing to increase their service life. The entire assortment of carpets is divided into three main groups by purpose. For carpets of the first group, which include: carpets of mass production, the main criteria for the selection of fibers are properties, affecting economic indicators with appropriate quality. These indicators

include: the cost of raw materials and production costs for its processing, profiled cross-section, the bulk which is achieved due to the large thickness and the dyeing method. The main requirements of this group of carpets are uniformity of properties, resistance to bending, wear resistance, strength of pile fixation, resistance to pilling, resistance to moth and microorganisms, resistance to dirt, ease of cleaning, resistance to washing, decorative and aesthetic properties.

When selecting fibers for the production of carpets of the second group (extra class), special attention is paid to decorative and aesthetic indicators, compliance with the needs of consumers, uniformity of color, the ability to maintain its original appearance (resistance to pilling, dirt, resistance to bending, dyeing strength, antistatic properties, fire resistance, durability). The main criteria for carpets of the third group, i.e. carpets supplied for the foreign market, researchers Negin and Mumford calculate the indicators characterizing the average cost per square meter, taking into account their service life. Therefore, the group of requirements for fibers here is much wider and includes indicators that affect the cost of carpet products and their durability. When examining carpets, it is considered necessary to pay special attention to the physical, mechanical and quality indicators of fibers.

Guseev V.E. and Slyvakov V.E. studies on the selection of fibers for carpets indicate the need to consider primarily the length and thickness of the fibers. Researchers rightly believe that these characteristics increase the exploitation properties of carpets. Work is underway to create a raw material base, select raw materials for yarn production and use new types of chemical fibers and their modification, developed specifically for carpet production in accordance with the requirements developed for them, as well as using mixtures of various types of fibers. In recent years, the carpet industry has processed pilot batches of almost all types of synthetic fibers (polypropylene, polyacrylonitrile , polyester, polyvinyl chloride, etc.), produced by the chemical industry, as well as modified artificial fibers (methylene , crimped frosted viscose fiber, and so on). The structure of textile raw materials is gradually changing towards an increase in the proportion of chemical fibers. Synthetic fibers prevail in the raw material balance of the foreign carpet industry. The efficiency of using chemical fibers of various types in carpet production is far from the same, Therefore, one of the most important tasks is the correct choice of raw materials, the quantitative ratio of the mixture components, ensuring the production of carpet products with high performance properties.

A distinctive feature of carpets and rugs is their high strength, high-quality colorful colors. This is facilitated by the use of various types of raw materials and processing methods.

The main raw material used in the production of carpets is wool.

Carpet wool should be characterized by good dyeability, sufficient elasticity, ability to resist felting, pilling and resistance to repeated bending under operating conditions. The use of low-fineness fibers for the production of carpet pile yarn ensures the stability of the pile surface of the carpet. In carpets with split pile, the absolute strength of the fiber and elastic properties are of particular importance. Classic carpet wool meets all these requirements. The combination of valuable properties of PAN fibers makes it possible to produce high-quality carpet products from them.

Among the various types of synthetic fibers, polyacrylonitrile fibers are of great interest for carpet production, and in recent years there has been a great demand for them. This is explained by the fact that PAN fibers have important deteriorating properties: wool-like, low thermal conductivity, low density, hydrophobicity, etc.

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PAN fibers belong to the group of fibers resistant to microbiological influences. They are not destroyed by bacteria and microorganisms, insects and moths. Its use in a mixture with other fibers improves their properties, increases the

resistance of products made of them to the action of microorganisms. The disadvantage of the fiber is its fragility and poor fire resistance.

Wool is the name for the hair of animals, which is widely used in the textile and light industries. By its structure and chemical composition, woolen fiber differs significantly from all other types of fibers and is characterized by a great variety and heterogeneity of properties. Sheep, camel, goat, rabbit, llama, angora and others wool are used as raw materials for wool.

In Uzbekistan, mainly the karakul breed of sheep is bred to obtain karakul (smushka) and wool fiber

A number of studies have established that the chemical feature of wool is a high content of various amino acids. It is known that wool is a copolymer of at least 17 amino acids, while most synthetic fibers are copolymers of two monomers.

The different content of amino acids in woolen fibers determines the peculiarities of their chemical properties. Of great importance is the amount of cystine, which contains almost all sulfur, which has a great effect on the properties of wool fiber. The higher the sulfur content in wool, the better its technological properties, the higher resistance to chemical and other influences, the higher the physical and mechanical properties. Wool fibers have a complex histological structure.

The layers of wool fiber, in turn, also differ in sulfur content: there is more sulfur in the cortical layer than in the core. Of all textile fibers, wool has the most complex structure. Fine merino wool fiber consists of two layers: the outer scaly or cuticle, and the inner cortex - the cortex. Coarser fibers have a third core layer. Coarse fibers predominate in karakul wool.

The outer layer of wool fiber consists of flattened cells (scales) that are tightly bound to each other and to the inner cortical layer.

The cortical layer - the cortex is located under the cuticle and constitutes the bulk of the fiber, and therefore determines the basic physical, mechanical and many other properties of wool. The cortex is built of spindle-shaped cells that are tightly pressed against each other. There is also an intercellular protein substance between the cells. The cells of the cortical layer are built from densely spaced cylindrical filamentous macro fibrils with a diameter of about 0.05-0.2 microns. The macro fibrils of the cortical layer are built of micro fibrils, the average size of which is about 7-7.5 nm in diameter [5]

According to the British researcher J.D Leeder, wool fiber can be considered as a collection of squamous and cortical cells held together by a cell-membrane complex, which thus forms a single continuous phase in the keratin substance of the fiber.

The core layer is present in coarser wool fibers and the core cell content can be up to 15%. The location and shape of the cells in the core layer varies significantly depending on the type of fiber. This layer can be continuous (running along the entire length of the fiber), or it can be interrupted into separate sections. The scaffold of the cells in the core layer is built of a protein similar to that of the microfibrils of the cortex.

Of all the amino acids contained, only cystine forms a transverse layer, their presence largely determines insolubility. wool in many reagents. The destruction of cystine bonds facilitates damage to the wool by sunlight, oxidants and other reagents; cystine contains almost all sulfur contained in wool fibers. Sulfur is essential for the quality of wool, since it affects the chemical properties, strength and elasticity of the fibers.

According to its chemical composition, wool belongs to the category of proteinaceous or proteinaceous substances. The main substance that makes up the basis of wool is keratin. Keratin is formed during the biosynthesis of amino acids in the cells of the epidermis of the hair follicle in the skin. By its structure, keratin is a complex containing bundles of high molecular weight chains. In this regard, it is of great importance to study the damage to woolen fiber during growth, storage, and processing. To study the damage to the wool, samples of karakul wool were taken at the indicated transitions and after technological processing. The work was carried out according to the method developed by academician M.A. Khadzinova at the testing laboratory Tashkent Institute of Textile and Light Industry in multiple replication. Based on the tests carried out, the main types of damage to the woolen fiber were identified. Growth injuries: hungry tone, bloating, bilateral bloating. During storage, swellings formed under the influence of microorganisms, mechanical damage during processing. The main types of damage are listed below. Damage leads to a deterioration in the quality of the fiber, and therefore to the quality of the manufactured products.

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Fiber Dissertation M. 2020

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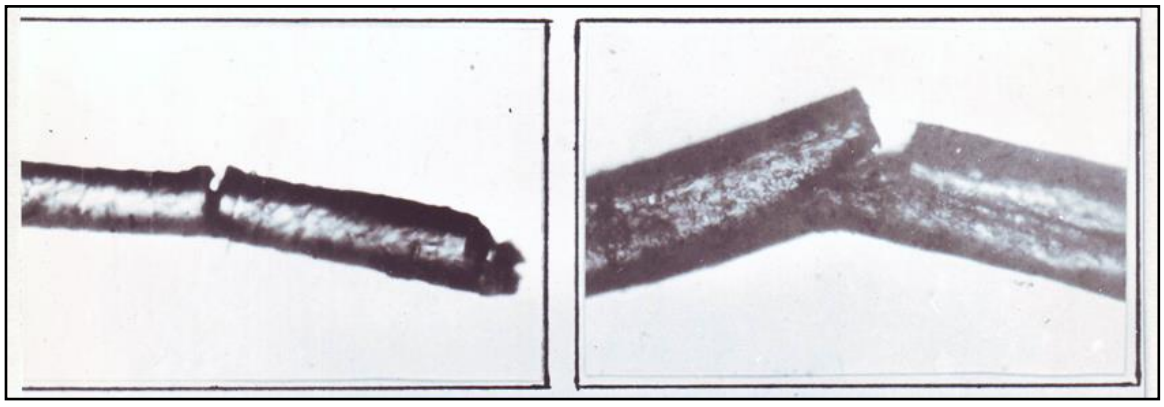
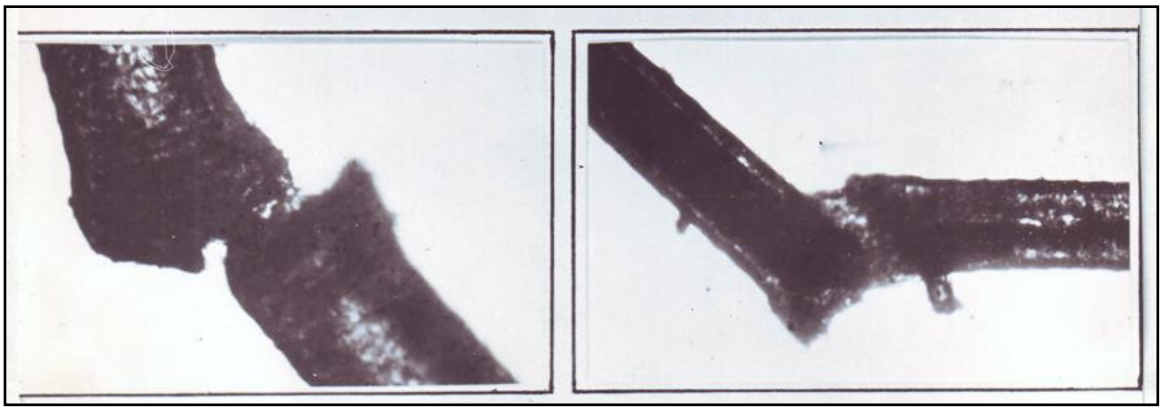
1. Typical mechanical damage to woolen fibers during processing

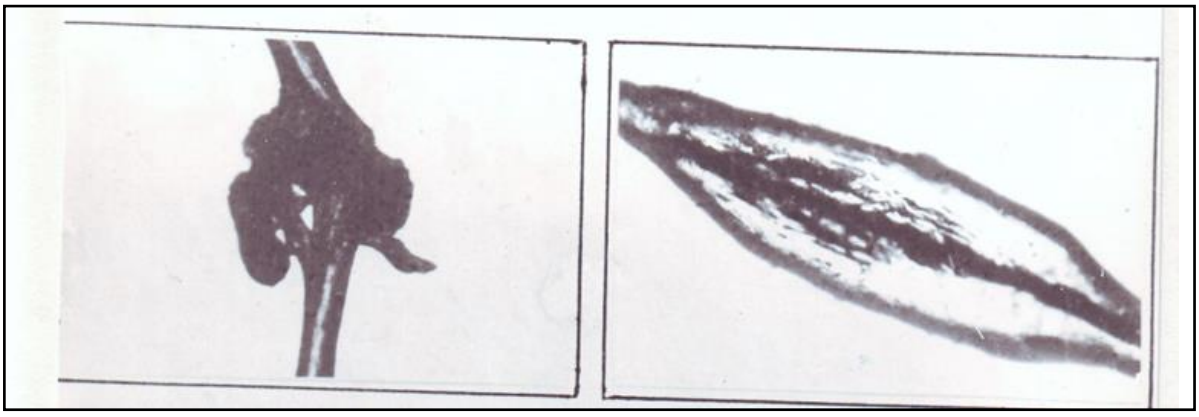
a) initial – after primary processing



b) recycled fiber after combing machine



2. Typical types of biological damage to wool fibers occurring during storage



Bloating

Bloating from accumulation/

fungi and bacteria

Strong bloating

Strong air fiber with a loosened structure

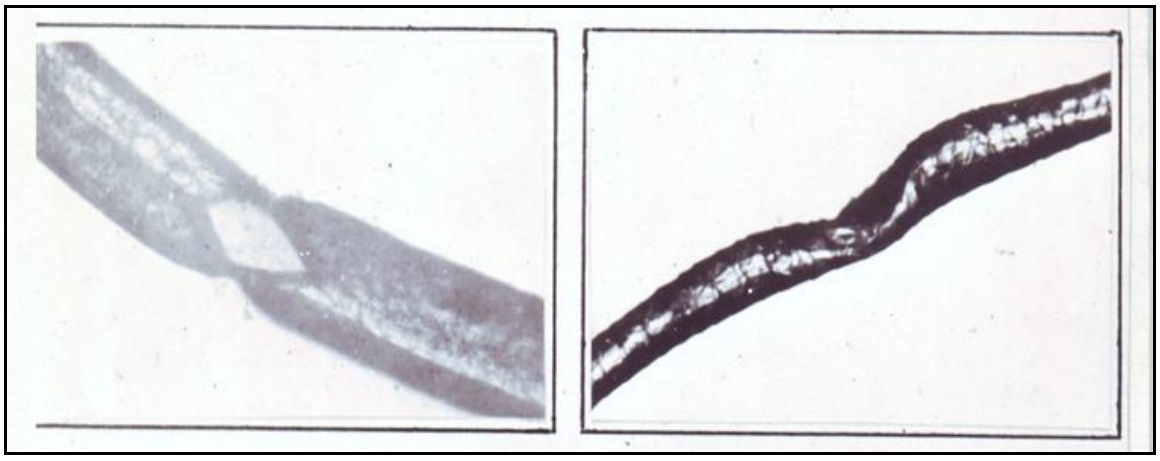
from the action of microorganisms

Strong bloating/

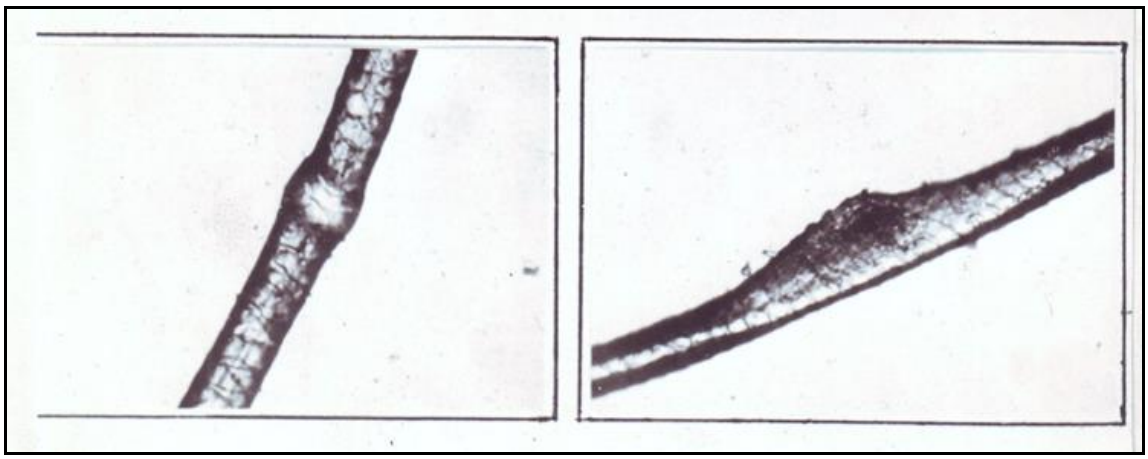
Bloating/

Fibers with strong bacterial swelling Fiber with swelling and wall rupture - combined

3. Typical types of biological damage to wool fibers arising during the growth of an animal



Hungry tonin



Bloating Unilateral bloating