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ANALYSIS OF RESEARCH ON PHYSICAL CHEMICAL COMPOSITION AND CLASSIFICATION OF WOOL FIBER

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Abstract
This article analyzes the physico-chemical composition, structure, classification, types, fields of application and similar indicators of wool fiber.

Keywords: Wool, fiber, dirt, roughness, variety, grade, fineness.

Introduction

Wool fiber is obtained from local sheep, goats and camels and is one of the important branches of the textile industry. Gauzes, knitwear, blankets, carpets, technical fabrics, yarn and other products are obtained from wool fiber. China, Australia, New Zealand, the USA, Argentina, Iran and European countries are the leading countries in the production of wool fiber. There are more than 500 breeds of sheep in the world, from which wool fibers with different characteristics are obtained. On average, 6 kg of wool can be obtained from one head of sheep, this indicator also depends on the increase in fiber diameter, the age and sex of the sheep. Depending on the breed of sheep, there may be 1,600 to 12,000 fibers on the skin surface of sheep.

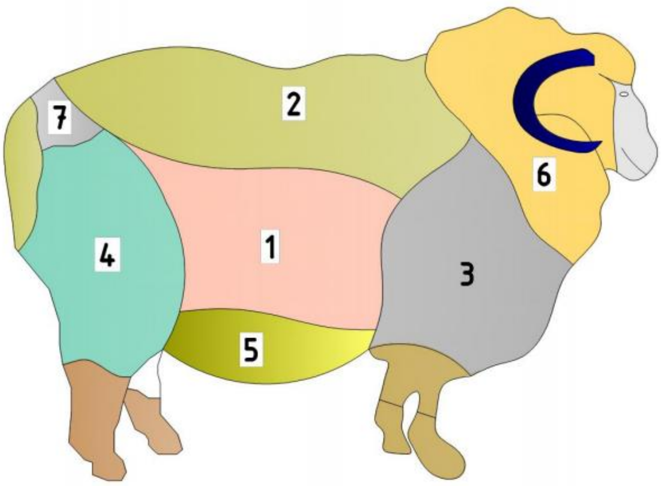

Figure 1. Zones of wool fiber placement

1st row; 2 waist; 3rd spade; number 4; 5-belly; 6th neck; 7-back parts.

Currently, Australia is the world leader in the production of woolen clothing. in Australia in 2014-2015 More than 70 million sheep were shorn and 322 million kg of greasy, unrefined wool was obtained, from which 225 million kg of clean wool fiber was obtained [9]. According to its chemical composition, wool fiber consists of protein compounds that belong to the complete keratin group. A special feature of keratin wool is that the sulfur content in it is much higher than that of other proteins (from 3% to 5%). For example, the wool of Cape Merino sheep of the 1st grade contains 4% sulfur, Australian Merino wool - 3.82%, New Zealand - 3.22%, Lincoln - 3.10% sulfur. The technological properties of wool are largely related to its sulfur content. Keratin in wool fiber consists of different amino acids.

Physico-mechanical properties of wool fiber include: thickness, length, twist, strength, color, elongation at break, hygroscopicity, luster, thermal conductivity and electrical properties.

The characteristics of wool fiber are divided into two large groups.

a) technological characteristics of fiber spinability, wettability and dyeability;

b) its physico-chemical properties mean its effect on various substances (water, hot air, acid, alkali, etc.).

Depending on the thinness of wool fibers, it is divided into the following 4 groups.

1. Soft wool (up to 25 μm thin) - consists of fluffy fibers;
2. Semi-soft wool (thickness from 25 to 34 microns) — consists of fluffy and intermediate fibers;
3. Semi-coarse wool - this is one variety and many varieties. There is a variety - medium thickness (up to 34-40 microns). It is taken once in the spring. Multivariate - it consists mainly of fluffy, coarse fibers and is collected twice a year, in the spring and autumn seasons.
4. Coarse wool (thicker than 40 μm) - contains all kinds of fibers.

Wool is divided into classes according to thickness, and mixed wool is divided into varieties.

3 layers according to wool fiber structure:

The granular layer consists of horn-shaped granules that cover the fiber body from the outside, protects it from decay, softens the fiber and improves the compressibility of the fibers.

The pith layer consists of cells that form the wool fiber and is the main layer that determines its hardness, elasticity and other qualities.

The core layer is a fiber-filled layer lying between the wool fibers.

The granular layer (cuticle) acts as a shell and protects it from external influences and is divided into 3 parts: endocuticle, exocuticle and epicuticle. Due to the orientation of the beads, the friction is greater at the fiber root than at the tip, and is known as the directional friction effect.

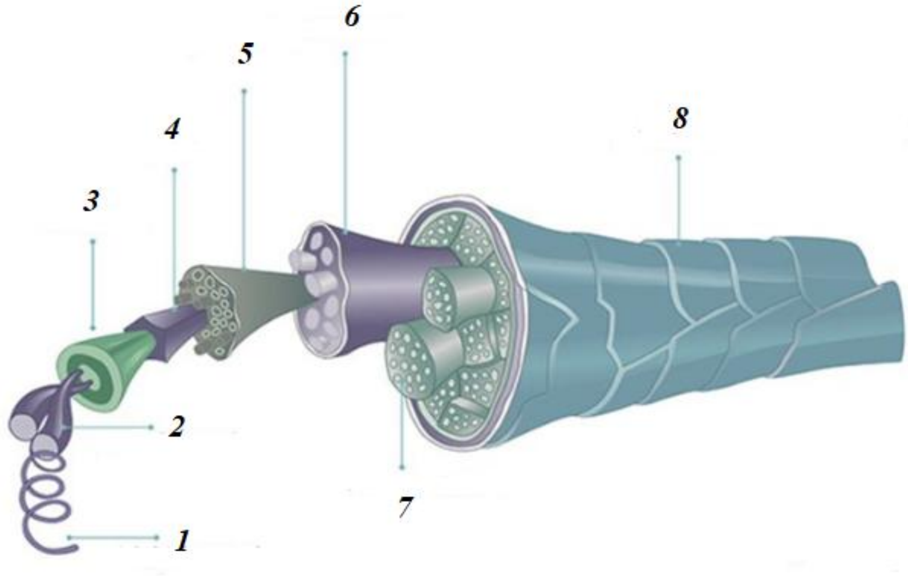

Figure 2. The structure of wool fiber

1-alpha helix; 2-protofibrils; 3-microfibrils; 4th matrix; 5-macrofibrils;
6th cortex cell; 7th orthocortex, paracortex; 8-cuticle (epicuticle, exocuticle, endocuticle).

The thinness of the wool fiber is determined by the cross-sectional surface and orgonoleptic method, with the help of measuring tools (microscope or devices for measuring the average diameter in the air layer). The organoleptic method is compared with standard samples during grading and sorting at enterprises. In laboratory conditions, the thinness of wool is studied using an optical microscope. The graded division of the eyepiece micrometer is checked using a control scale 1 mm long (Fig. 3). When determining the thinness of the fiber under the microscope, the following indicators are also calculated: average thinness, μm and average square deviation, μm. When determining the fineness of wool, the arithmetic mean of all measurement values is found:

$$M_{o'r} = \lambda_l \frac{A+KC_1}{n} \tag{1}$$

The mean squared deviation is determined using the following formula:

$$\pm\delta = \pm k\lambda/\sqrt{n\sqrt{S_2}} - S_1/n, \tag{2}$$

Where: A is the half-sum of the class limit; *K*-is the range of scale division classes in the ocular micrometer; *n*-is the number of measurements; *λ*-is the estimate of the division of the ocular micrometer, mkm; S_1 and S_2-are additional amounts.

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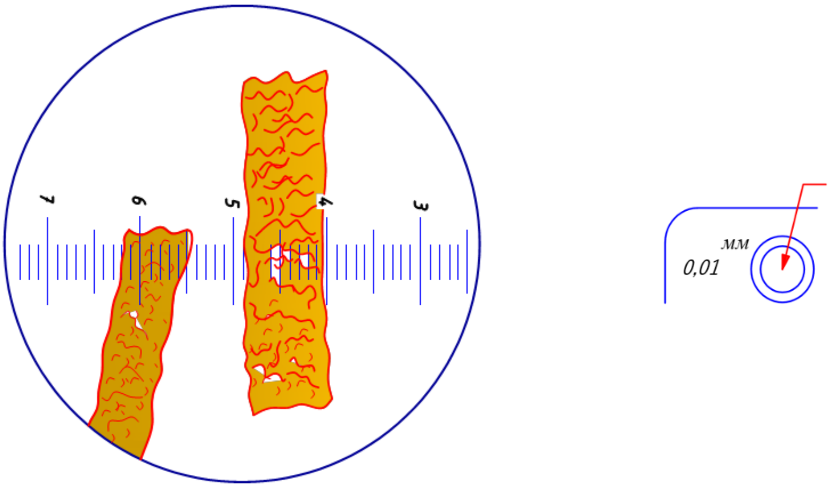

Figure 3. Ocular scale and objective micrometer view

The total number of wool-bearing animals in Uzbekistan is 13.0 million. jaydari sheep - 6.0 million., hisori sheep - 0.7 million., pomesi sheep-0.5 mln., Brown sheep - 5.8 million., the goats raised 3.0 million. and camels are 19.0 thousand.

1.1-table. Quality indicators of wool fiber

Sheep breeds	Wool type	Weight, $1m^3$, kg	Length mm	Color	Scope of use
1	**2**	**3**	**4**	**5**	**6**
karakul	semi-soft coarse	1,7-2,1 kg	9-17	white black brown	carpet felt
jaydari	rough	2,1-2,6 kg	8-16	white, black, brown, red, blue	non-woven fabrics others
history wool	rough	0,9-1,3 kg	6-9	different	non-woven fabrics

In a number of regions of our country, Karakul Sheep are bred and carpets are produced from 20% of wool fibers, while more than 60% of wool is not processed. A diagram is presented on the thinness and length of wool fibers (Figure 4).

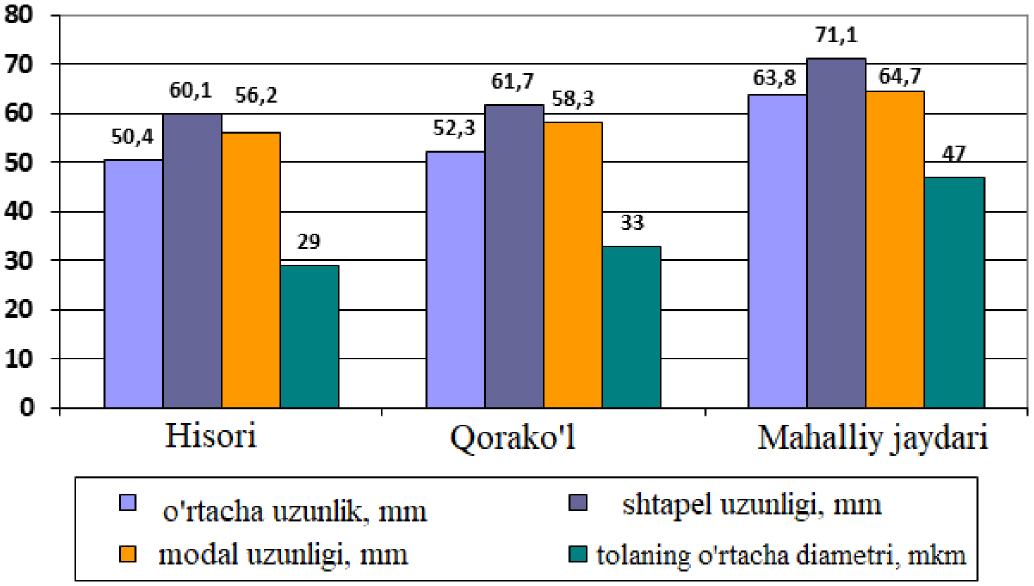

Figure 4. Length and thinness of sheep wool of different breeds change in terms of performance

Conclusion

Nowadays, the demand for textile fibers is increasing day by day. In textile fibers, wool fiber is distinguished by its strength, resistance to external influences, compliance with hygienic indicators. In addition, the cost of wool raw materials is distinguished from other natural fibers by its low cost. On the territory of Uzbekistan, there is an opportunity to process wool fibers and obtain import substitutes, export products.

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