The Study of Certain Types of Natural Fibers Determination of Their Properties by Organoleptic and Laboratory Methods

Rashidov Asamiddin Zayniddinovich

National Institute of art and design named after K. Bekhzod
Lecturer and docente at the Department of Fashion Design

ABSTRACT

This article discusses the study of certain types of natural fibers, the determination of their properties by organoleptic and laboratory methods - distinctive features in the study of the structure of natural fibers using light and a microscope.

Keywords: Natural fibers, cellulose fibers, cotton, linen, wool, immature (dead) fiber, intermediate feather, coarse feather.

Enterprises in the textile industry supply various types of pads for sewing garments of various shapes, bobbins used in sewing. As a result, the garment industry produces garments for the public and all sectors of the economy, which relate to seasonal, modern items that meet economic requirements. This is because workers in the industry need to be well versed in the receipt, properties, physical and mechanical properties, and the range of materials for the effective use of sewing materials, making quality trinkets. Because, the properties of sewing materials depend on what fibers, threads they are composed of, weaving, finishing, and other indicators.

Fibers come in different forms and are divided into groups according to their appearance, their production, and their chemical composition. Fibers are divided into two large groups: natural fibers and chemical fibers.

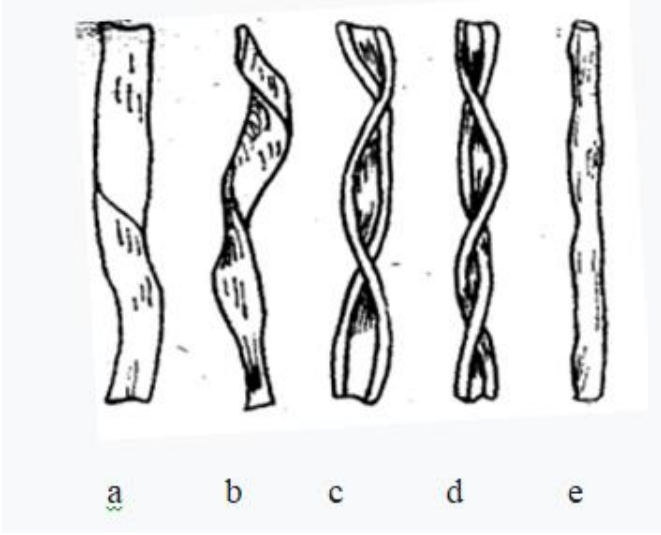
Fibers present in nature are called natural fibers, factory-extracted fibers are called chemical fibers.

Natural fibers include fibers of plant origin (cellulose fibers - cotton, linen, hemp wool, etc.), fibers of animal origin (protein fibers - wool, natural silk), and fibers of mineral origin (asbestos).

When the structure of natural fibers is examined using light and a microscope, the following distinctive features become known.

The cotton fiber looks like a tube with varying degrees of silliness (picture №1). The thickness of its walls depends on the maturity of the fiber. We can see that immature cotton fibers are flat, ribbon-like, thin-walled, and have a wide channel in the middle. As the fibers mature, the cellulose accumulates on the walls and the walls thicken, the channel narrows and the fibers become sinuous. The longitudinal appearance of mature fibers consists of spiral, twisted, flat tubes.

The mature fibers are cylindrical in shape, with a thin channel in the middle. The cross-section of the fibers varies in shape: the immature fiber is sharply silky and ribbon-like; the medium-ripened and mature fiber is bean-like; the overripe fiber is elliptical or almost circular.



Picture №1.

The appearance of cotton plaque under the microscope (picture №1).

a) completely immature (dead) fiber;

b) raw fiber;

c) well-digested fiber;

d) boiled fiber;

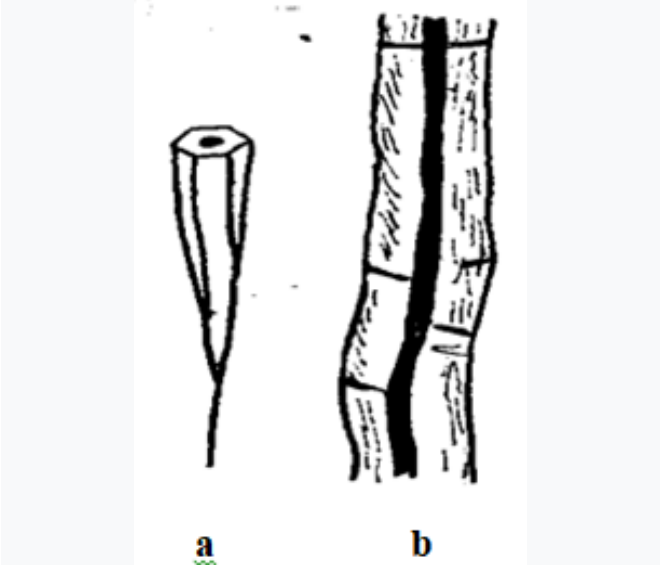
e) cellulose that has undergone maturation.

The length and thickness of the fibers depend on each other and vary according to the variety of cotton.

Short-staple cotton is processed into thick and fluffy yarns; it is used to make baizes, flannel, papoose, and other cotton products. Medium-numbered cotton yarn is made from medium-length cotton fibers; it is used to make chintz, satin, and other cotton fabrics. Long-staple cotton is spun into the finest and smoothest yarn; it is used to make high-quality fine cotton fabrics such as batiste, marquisette, delicate satin, and others.

A linen fiber in cross-section consists of 5-6 regular polygons with a channel in the middle. The length of the elementary fibers is 15-25 mm. Technical fibers are extracted from the flax stems during primary processing. The flax fiber forms a plant cell with a narrow channel in the middle and thickened elbows. The fiber ends are sharp and the channel is twisted on both sides (picture №2).

Technical fibers consist of a bundle of elementary fibers bonded together with special substances (pectin and lignin). The average length of a technical fiber is 35-90 mm.



Picture №2.

The appearance of an elementary linen fiber under the microscope (picture №2).

a) Appearance and cross-section;

b) A longitudinal cut.

The color of linen fibers varies from light grey to dark grey. Flax is particularly silky because the surface of the fibers is smooth. The physical and chemical properties of flax are similar to those of cotton. Flax's hygroscopic capacity under normal conditions is 12%. Flax quickly absorbs moisture and quickly excretes it. Under the influence of water, the strength of elementary fibers increases, but the strength of technical fibers decreases as pectin substances soften and the connection between some fiber bundles becomes friable. One of the characteristics of flax is its good thermal conductivity. This is why linen fibers cause coldness in the fingers when palpated.

The valuable hygienic properties of linen, namely its good hygroscopicity, ability to absorb moisture quickly, to evaporate quickly, and to transmit heat well, allow it to be used for making summer clothes.

Acids and alkalis affect linen in a similar way to cotton. Dyeing and bleaching linen fibers are more difficult than dying and bleaching cotton. The reason is that the natural color of linen is intense and the fibers are thick and have a narrow grip channel. Mercerizing linen fibers is ineffective because it retains the natural shine.

Pectin substances dissolve when linen fibers are boiled in soap and soda solutions (solutions of weak alkalis). The fibers become whiter and softer, and the ripeness of the technical fibers is reduced.

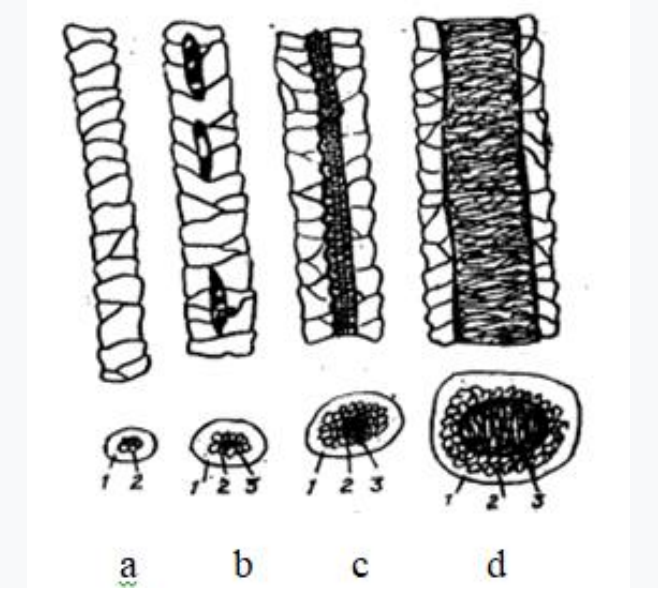
Flax takes well to a heated metal surface (iron) as it is more hygroscopic than cotton.

When exposed to direct sunlight for 990 hours, linen's strength is reduced by 50%, which means that its lightfastness is slightly higher than that of cotton. Flax burns like cotton.

Wool fibers. depending on their thickness and structure, wool fibers are divided into the following types: down fiber, intermediate fiber, coarse feather, and dead fiber.

View of wool fibers under a microscope (picture №3).

a) down, b) intermediate feather, c) coarse feather, d) dead fiber; 1-coin layer, 2-coat layer, 3-center layer.



Picture №3.

Fluff is the finest curly (wispy) fiber, the cross-section of which is circular in shape. The puff consists of two layers: an outer layer, the coin covering, and an inner layer, the shell covering. The coin coating consisted of interlaced rings (coins) with irregular edges. The shell layer is spherical

The intermediate fiber has a third layer, the kernel, in addition to the coining and sheathing layer. It is located in the middle of the fiber layer and has an annular arrangement. The loose skin layer - consists of lamellar cells that penetrate inside. The space between the cells is filled with air, oil, and other substances.

The coarse feathering is much coarser and thicker, with almost no curls. It consists of three layers: a lamellar coin layer, a shell, and a solid, well-developed skin layer.

Dead fiber is the fiber that is the coarsest, thickest, and has no folds (curls). Its mint layer consisted of massive plates. The shell layer is narrowly rounded and the eyes are strongly developed.

The cross-section of coarse feathers and dead fibers has an irregular oval shape.

For the wool spinning process, the length and curl of the wool fibers play a major role.

Properties of wool fibers. The length of wool fibers varies from 20 to 450 mm. Homogeneous wool is divided into short-fiber (up to 55 mm) and long-fiber (over 55 mm) varieties.

Wool fluffiness (curliness) is expressed by the number of curls per 1 cm of fiber. The thinner the fiber, the more curls per 1 cm of fiber. Depending on the height of the fold, wool is divided into normal, high, and oblique varieties.

Short fiber wool with high twist ability is used to make yarn produced in the spinning and feathering system.

Long-staple wool with oblique curls is used to make fine, smoothly combed strands.

Dry fibers stretch up to 40% when torn. Slippery and highly elastic strains account for a significant proportion (up to 7%) of the total stretch, so wool products crease little and retain their appearance well.

The wool of fluffy sheep is white, slightly yellowish; coarse and semi-coarse wool can be grey, red, or black.

The size and shape of the coins will determine the strength of the wool. Densely placed large coins spoil the coat considerably. Coins that move from tiny fibers make it dull.

Elasticity is the property of wool in the process of pressing to form felted bedding. Thin, stringy, curly wool is highly elastic.

Under normal conditions, fluffy wool has a moisture content of 18%, rough wool 15%. The hygroscopicity of wool is higher than that of other fibers: it slowly absorbs moisture and slowly expels it. Under the influence of heat and moisture, the fiber becomes elastic up to 60% or even more. Wool can be shortened, lengthened, decanted when ironed wet, as its elasticity tends to change and penetrate.

Wool is highly tolerant of all organic solvents used in dry-cleaning applications. Wool has amphoteric properties, i.e. it can react both with acids and alkalis.

When wool is boiled, it can be dissolved in a 2% solution of caustic soda. Dilute (up to 10%) acids will slightly increase the fluffiness of the wool. Under the influence of concentrated nitric acid wool turns yellow, under the influence of concentrated sulphuric acid it turns into charcoal.

The lightfastness of wool is higher than that of vegetable fibers. When properly exposed to sunlight for 1120 hours, the strength of wool fibers is reduced by 50%.

When the wool burns, the fibers stick together, stop burning when removed from the flame, the fiber ends to round off and darken, and the smell of burnt feathers appears.

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