DEVELOPMENT OF A METHOD FOR OBTAINING POLYMER COMPOSITIONS BASED ON COLLAGEN TO INCREASE THE STRENGTH PROPERTIES OF THREADED JOINTS IN SEWING PRODUCTS

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Abstract: The article presents a new composition of the polymer composition. Experimental methods were applied: to determine the physical, mechanical and operational results. The technical characteristics of the device and its determination of the spreading of threads in tissues are presented.

Keywords: line, device, polymer composition, sewing machine, collagen, expandability, fabric, load, seam, device, hardness.

A new composition of the polymer composition has been developed. In this case, a 40% aqueous viscous solution of collagen was used. It belongs to rigid-chain polymers, has a skin-like property, better air permeability, high strength and adhesive properties. Materials based on it are well formed and slightly penetrate onto highly porous substances.

Acrylic emulsion is a product of emulsion copolymerization of butyl acrylate, methyl acrylate and methacrylic acid in a ratio of 55:45:20. When treated with alkali, it goes into solution. The choice of an acrylic emulsion is due to the fact that it belongs to thermosetting plastic soft polymers, which provides a homogeneous film-forming structure in the polymer composition being created.

Polyvinyl acetate amorphous transparent colorless polymer, readily soluble in ketones, esters, methanol, worse - in ethanol with a density - 1,19 g/sm^3. Moisture permeability (2,5-5,8)$\cdot 10^{-14}$ kg/(m$\cdot$s$\cdot$Pa), gas permeability H_2 56$\cdot 10^{-15}$ m^3/(m$\cdot$s$\cdot$Pa). When the consumption of polyvinyl acetate is less than 25 mass. % the stability of the polymer composition decreases, and more than 40 mass % the cost of finished products increases.

Water was added to a density of 1.08 g/cm^3. At a water flow rate of less than 25 mass % the viscosity of the polymer composition decreases, and more than 40 mass % the viscosity of the finished product increases.

The resulting composition based on collagen - polymer systems is a homogeneous substance. In the initial state, it mixes well with water, precipitates in acetone and ether. In the presence of heavy metal salts, it coagulates. As the temperature rises, the viscosity decreases and the concentration increases. The dry residue of the original composition at the time of use is 53-56%.

Table 1
The composition of the collagen-based polymer composition in mass. %

№	Components	Experienced options				control
		1	2	3	4	
1	Collagen (40%)	10	15	20	25	-
2	Acrylic emulsion - 20%	10	15	20	25	-
3	Polyvinyl acetate	40	35	30	25	60
4	Water	40	35	30	25	40
Total		100	100	100	100	100

Experimental methods: Experiments were carried out in the certification laboratory "CentexUZ" to determine the physical, mechanical and operational abra fabric adras treated with a polymer composition.

Requirements for the polymer composition and the conditions for its application include low viscosity, environmental safety, stability during long-term storage, stability of the fixation effect in the structure of the textile material and preservation of the topography of application during subsequent technological operations [1-6].

In accordance with the requirements for a thread seam treated with chemical compositions, a program and methodology for researching a number of physicochemical and mechanical indicators have been developed. These include resistance to sliding, low rigidity, resistance to dry cleaning, washing and ironing, air permeability, stability of the fixing effect in the structure of the textile material. These quality indicators can be determined using existing standard techniques.

The determination of the spreading of threads in the fabric is carried out in accordance with the conditions set forth in GOST 22730-77 "Silk and semi-silk fabrics and piece goods. Method for determining thread spreading ".

Expandability is characterized by the magnitude of the compressive force that causes the shear of one system of threads relative to the other. The device records the compressive force of rubber abrasives (sponges), between which the tissue sample moves. The operation of the device stops at the moment when there is a visible displacement of the threads when various loads are applied to the fabric.

The norms for the spreading of the threads of fabrics, expressed in the power load, do not give a sufficient qualitative assessment of garments, for which a quantitative characteristic of the spread of the threads is necessary.

This technique is based on the effect of a tensile load on a tissue sample with a seam (the load is applied in the direction perpendicular to the seam). The tissue sample is stretched on a tensile testing machine. After stretching the sample, measure the width of the sparse areas of the fabric near the seam.

On the basis of experimental data, it has been established that fabrics can be easily movable, for the spreading of threads by 4 mm, a load of no more than 7 daN must be applied, and medium-movable, for which this load should be more than 7 daN.

The described method makes it possible to determine the amount of thread spreading in the fabric, but does not fully reflect the effect of external forces on the fabric when used in clothing made of it. In this case, there is no friction that can affect the spreading of the threads in the fabric. In addition, the lack of standards for the amount of tissue spreading near the seam does not allow a qualitative assessment of the tissue.

When measuring the width of a rarefied tissue area, it is necessary to take into account the metrological requirements for the method of measuring its accuracy. If the sparse area is carefully measured with a dashed measure of length with a scale of 1 mm, the measurement error will be + 0.5 mm, i.e. half the division value. Added to this is the division error of the measure itself. To increase the measurement accuracy, it is necessary to use line measures with a lower division value or gauges with an optical device to increase the reading scale.

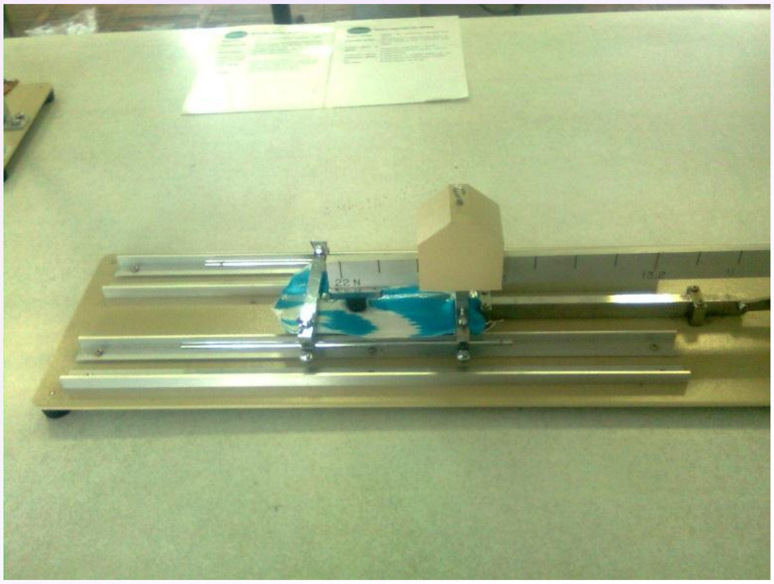


Fig.1. Device for determining the spreading of threads in fabrics - SD-1.

This device is designed to measure the spreading of warp and weft threads in fabrics under the influence of friction.

BRIEF TECHNICAL CHARACTERISTICS OF THE DEVICE.

1) Hardness of the abrasive drum: 60 ± 5 degrees.

2) Abrasive drum dimensions: 19Æ x 25 (L) mm (Upper).
19Æ x 25 (L) mm (Bottom).

3) Weight of the friction load: 450 ~ 2300g (At the place of pressure).

4) Tensile load: 22 ± 0.22 N (2.3 ± 0.02 kgf).

5) Friction distance: 25mm.

6) Test piece dimensions: 100 (W) x 200 (D) mm.

The device SD-1 is mechanical. Before starting the tests, it is necessary to check the correct operation of all mechanical parts of the device.

To check the sample on the SD-1 device, the sample is loaded into a special frame and fixed with a certain tension. For this, a special device is used. The frame is then inserted into the SD-1 between the two abrasive drums. Then it is necessary to shift the weight by the weight specified in the GOST (depending on the fabrics, this value may be different) and use the rotation knob to set the frame in motion, as a result of which the sample rubs between two rubber drums [7,8,9,10].

It was found that the spreading of the threads occurs mainly not in the fabric, but in the seams (Fig. 2). Usually, the threads move apart in the seams of the armholes of the sleeves, reliefs, back, darts, i.e. in places where tissues are under a certain tension

Fig. 2. Seam with strands apart

In accordance with the developed technique, two strips of fabric 380 mm long, 90 and 130 mm wide are cut out for the test. Samples are cut along the web (if the weft threads are spread apart - across). Then the strips of material are ground in pairs along the long side. At a distance of 25 mm from the beginning of the line, by pulling the threads out of the fabric, marks are made alternately at a distance of 50 and 20 mm from each other (Fig. 3). Samples of seams are cut out along the lines obtained for testing.

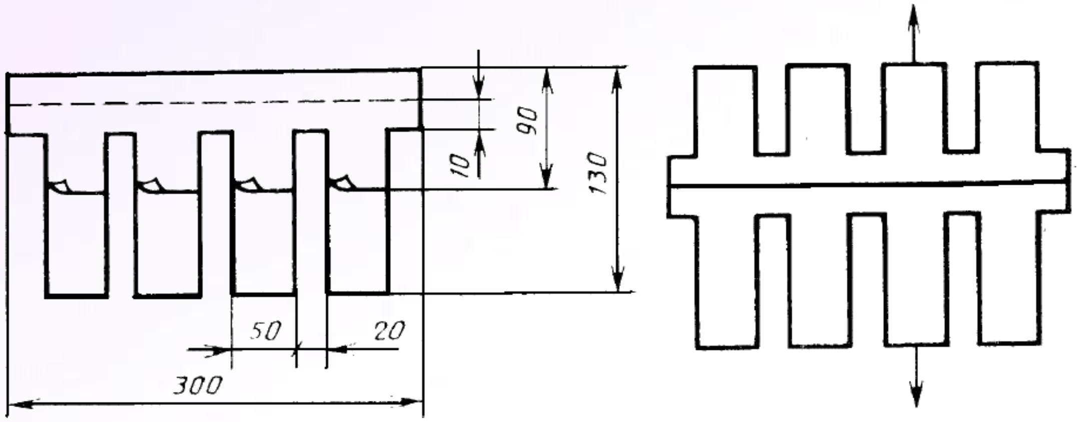
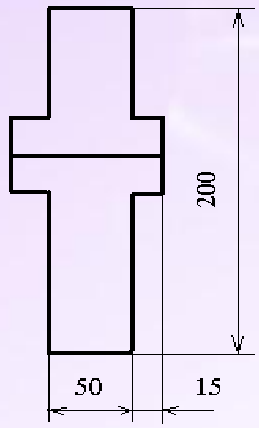


Fig. 3. Scheme for cutting seam samples

It is allowed to make elementary samples of seams, including from products subjected to aggressive influences in accordance with GOST 12.4.126 or other regulatory and technical documentation, with a size of 50x200 mm.



The determination of the spreading of the threads in the seam is carried out on pendulum-type breaking machines with a load scale of not more than 50 daN and a lower clamping speed of 100 mm / min, equipped with a device for recording diagrams. A short part of the seam test (90 mm) is inserted into the upper clamp of the tensile testing machine, and a long one (130 mm) into the lower clamp, on which a pre-tensioning weight of 0.49 N (50 gf) is attached. The seam is positioned at the same distance from the upper and lower clamps. Break the material.

The lowering speed of the lower clamp of the tensile testing machine when tested is 100 mm / min.

After filling in the seam sample, the tensile testing machine is turned on and the load is brought until the seam is completely destroyed. The test is carried out by recording the fracture curves on a chart device.

As a result of the research, it was found that the optimal amount of thread shift in the seam is 4 mm (2 mm in each side of the seam line). The criterion for assessing the resistance of the fabric to the spreading of the threads in the seam is the force that causes the threads to shift in the seam by 4 mm.

For this, at the end of the seam test process, the pen of the chart recorder is returned to the zero position, that is, to the point where the seam sample rupture diagram begins. Then a tissue sample 50X200 mm in size is fixed in the clamps of the tensile machine, a preliminary tension is applied to the sample and the material is broken.

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