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PHYSICO-MECHANICAL CHARACTERISTICS OF SACKED YARN WITH SYNTHETIC POLYMERS

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Abstract

An attempt was made to use sericin in order to increase the efficiency of cotton yarn sizing. The effect of sericin on the viscosity properties of sizing polymer compositions and the main sizing parameters was studied. The ways of reducing the starch content in adhesive compositions without reducing the quality of sizing are considered. The authors analyze studies of the influence of the nature and concentration of sericin on the physical and mechanical properties of cotton yarn. The article reveals the physical and mechanical properties of dressing and sized yarn.

In the current conditions of the formation of market relations, improving the quality and competitiveness of products is one of the key tasks in the textile industry, solved by creating effective resource-saving technologies that can significantly reduce the consumption of starch food and expensive imported, imported chemical materials.

Throughout the history of the development of textile production, starch has played a leading role as the basis for dressing compositions due to its low cost, availability and smooth production. Currently, despite the presence of a number of synthetic products for sizing, the situation has not changed fundamentally. The proportion of starch sizing compositions reaches about 75%. In the conditions of the economic crisis, a special place is occupied by the issue of creating polymer composite materials and the search for new types of dressing compositions that reduce starch consumption and meet the technological requirements in the world market.

In this regard, it becomes extremely urgent to find ways to reduce the starch content in adhesive compositions without reducing the quality of sizing.

In this regard, the aim of this work is to develop and physico-chemical justification of the technology of sizing cotton yarn using PVA and GIPAN as dressing preparations in order to reduce the consumption of valuable food starch.

The starch content in the dressing composition was varied in the range from 4 to 6%, PVA from 1.0-3.0% (in terms of the weight of starch).

Like the dressing of the polymer composition, the PVA plays the role As one would expect, the introduction of PVA into the composition of the polymer composition leads to a decrease in the mobility of the starch macromolecule, i.e., limitation of their thermal motion, an increase in the structure of the system and the formation of a more rigid chain, and, as a result, the viscosity of the system rises. In addition, the addition of PVA to starch pastes leads to the transition of an elastic-brittle system to an elastic-plastic one, i.e., the plastic properties of plasticizer films increase. As one would expect, the plasticization process of dressing polymers significantly affects the physicomechanical properties of cotton yarn.

Solutions of polymers, including starch, are not structureless. The substructure of solutions is understood as the mutual arrangement of solvent and polymer molecules, the conformation of macromolecules, and the interaction between polymer macromolecules.

Starch and their derivatives for sizing cotton yarn are hydrogels obtained by gelatinization of starch suspended in water in the presence of textile auxiliary reagents. These reagents are sodium hydroxide, an oxidizing agent, hydrotropic substances (polyhydric alcohols), emollients (vegetable oils, animal fats, and paraffin), wetting agents (soaps, surfactants such as arylsulfonates), etc. There is no single recipe and size of the dressing; each company has its own carefully selected composition, the properties of which are oriented to a specific assortment of yarn, a specific type of starch, type of weaving equipment, and subsequent fabric finishing operations [1-5]. must satisfy a number of basic requirements:

- Adhesive properties to the processed fiber, characterized by strength. The adhesion strength in the range of 2.5 - 5 MPa is considered sufficient;
- the film-forming ability of the dressing necessary to create a strong and flexible film with a low coefficient of friction on the yarn;
- the ability of the dressing film to withstand a set of stresses during friction, bending, twisting and drawing the yarn to which it is exposed on sizing machines and looms;
- solubility inwater;
- uniformity and the presence of a certain viscosity of the solution to ensure the penetration of the dressing into the interfiber space and uniform distribution on the surface of the yarn;
- stability of the dressing film during the passage of yarn through the drying device of the sizing machine (dressing films should not soften, melt or decompose when heated to 360 - 380K;
- Antistaticity of the film, preventing the accumulation of static electric charges on the fiber, the presence of which causes additional licentiousness of the yarn. Good antistatic properties are possessed by materials with a specific surface electric resistance of no higher than 107 - 108 Ohms;
- a neutral reaction of dressing solutions, i.e., the hydrogen index (pH) should be in the range of 7.5 - 8.0;
- economic expediency;
- the ability of dressing to be removed from the fabric of the pre-dressing, bleaching and not cause difficulties when finishing the fabric; - dressing should not cause corrosion of equipment;
- low foaming combined with good wetting ability; - low toxicity and good biodegradability;
- the relative elongation of the dressing films is not lower than this indicator of yarn; Acrylic polymers, which have high adhesion to almost all natural and synthetic fibers, irrespective of their chemical nature and physical structure, have gained the greatest practical interest in recent years [6-

9].

From the above it follows that the main factors determining the desired result of yarn sizing are the concentration of the sizing component and its viscosity. Therefore, the study of the possibility of using a dressing polymer composition based on starch, PVA and HIPANA to increase the efficiency of sizing - it is advisable to identify the effect of the concentration of synthetic polymers on the relative viscosity of the sizing compositions, while the concentration of starch used in the sizing compositions of cotton yarn was varied in the range of 4-6% mass

The use of PVA and GIPAN as the main componentthe sizing polymer composition has the following advantages:

- ✓ chemical stability of the dressing, which allows its reuse;
- ✓ high adhesion and adhesive ability, due to which a strong film is formed with high wear resistance;

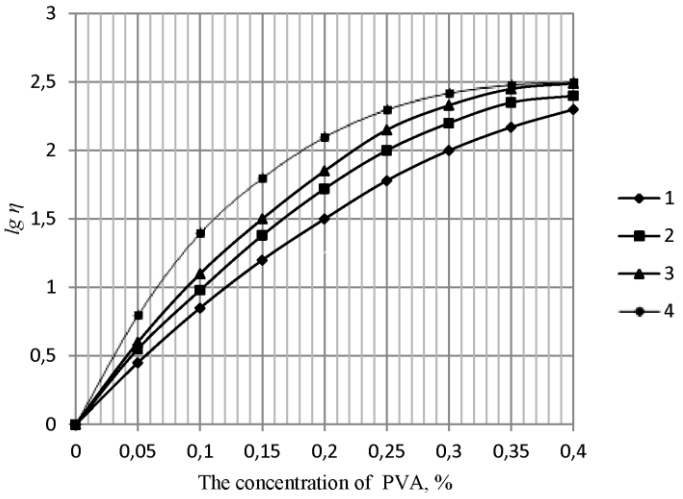
In terms of its sizing properties, PVA and GIPAN are significantly superior to starch and Na-CMC, since PVA and HIPAN solutions are characterized by high film-forming properties. The strength and elongation of the yarn, lined with PVA and GIPAN, is higher, and the breakage in weaving is lower than that of yarn lined with starch dressing.

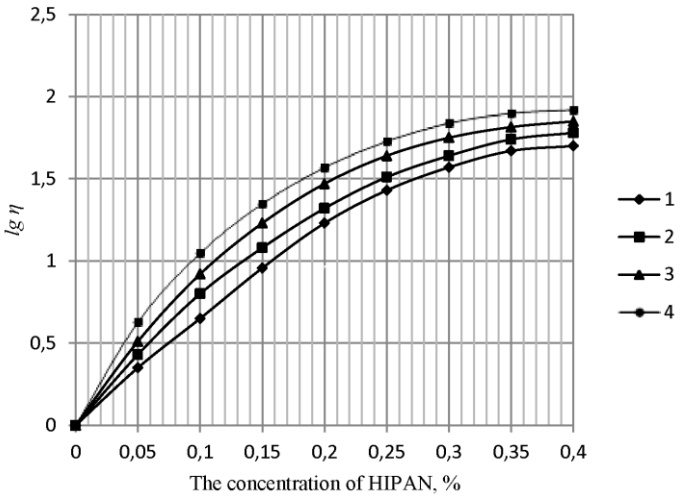
Preliminary experiments showed that at a PVA concentration of more than 0.3%, even with a low starch content (5.0%), viscous adhesives are formed in the adhesive composition, sufficient for sizing cotton yarn. In this regard, the studies adopted the optimal concentration of PVA, equal to 0.3%. In order to provide elasticity and flexibility of the sizing film forming on the surface of the yarn, as well as deeper penetration into the depth of the yarn, in addition to starch and PVA, hydrolyzed polyacrylonitrile (HIPAN) was introduced in the amount of 0.1-0.2%. The starch content varied in the range from 4 to 6%, which is characteristic of compositions for sizing cotton yarn with a linear density of 29.4 tex.Since there are still no reasonable approaches to the selection of the concentrations of the above polymers in starch dressing compositions, we have focused on those that are most often used in production recipes for the specified type of yarn. A series of starch hydrogels were prepared with constant starch content (4.5%, 5.0% and 5.5%) and PVA and HIPAN variables. The step in changing the concentration in both polymers was no more than 0.1%, which ensured the reliability of the study of the entire concentration range.

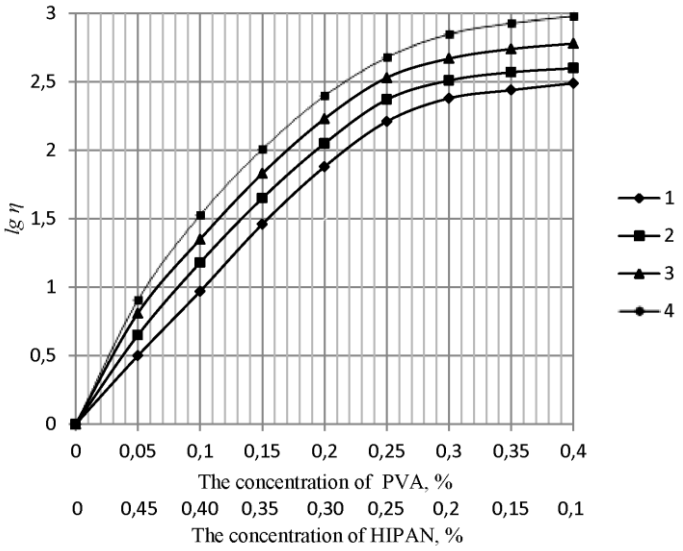
The dependence of the viscosity of the dressing compositions on the content of PVA

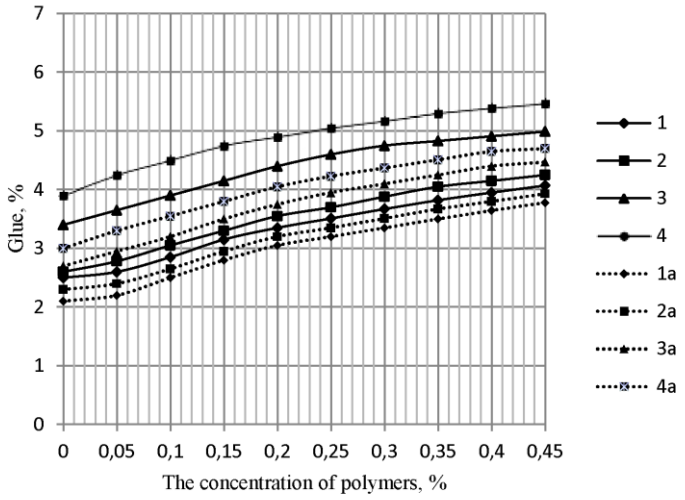
(a), HIPAN (b) and with the joint presence of PVA and HIPAN (c), starch concentration,%: 1-4; 2-4.5; 3-5.0; 4-5.5

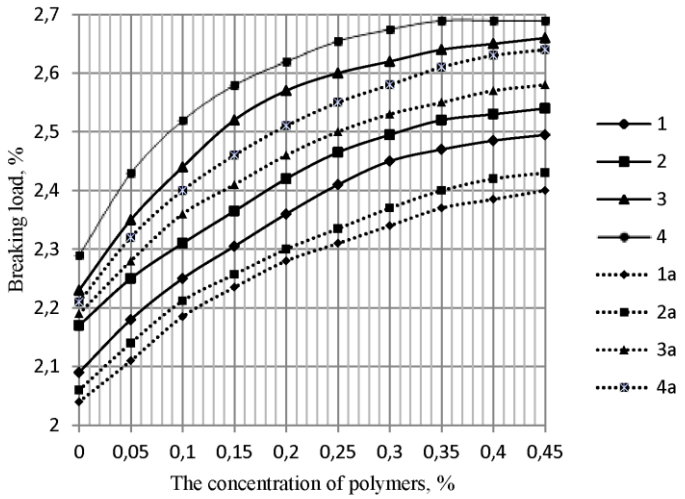
As can be seen, on all lines of relative viscosity there is an increase with the contents of PVA and HIPAN. Moreover, a significant effect on increasing the viscosity of the sizing composition is provided by PVA in comparison with HIPAN. So, for example, the logn value at a PVA concentration of 0.3% is 2.25, and at the same concentration of HIPAN it is 2.0, and the starch concentration in both cases is 5.0%.It should be noted that in the case of the combined use of PVA and HIPAN in starch gels, the viscosity increases sharply and at a concentration of PVA 0.3% and HIPAN 0.2%, a value of logη reaches 3.1. And this fully satisfies the requirements for dressing preparations, and the consumption of starch is reduced by 25-30% compared with factory compounds.

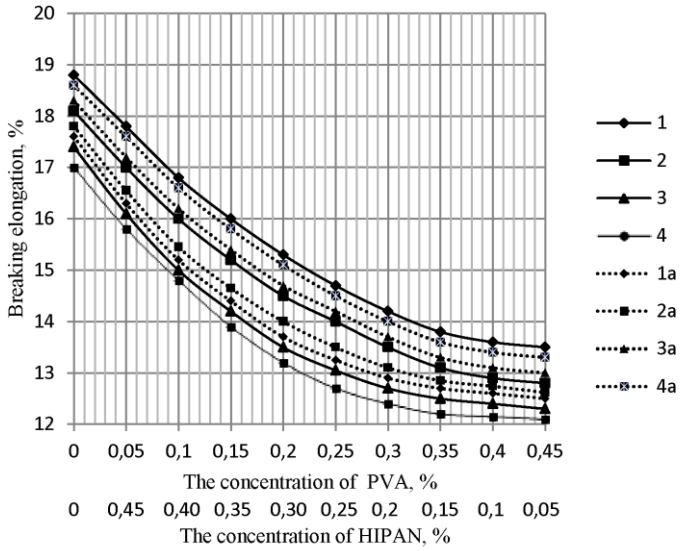












The effect of the concentration of PVA and HIPAN in the sizing composition on the main parameters of the sieved yarn

The concentration of starch,%: 1-4; 2-4.5; 3-5; 4-5.5 (1a, 2a, 3a, 4a - starch dressing without PVA and GIPAN)

Confirmation are the dependencies in Fig. 2.9. (a, b, c), which reflect the significant effect of the content of PVA and HIPAN in the dressing on the main characteristics of the tested bases. As can be seen, the introductionof small amounts of PVA and HIPAN into starch compositions leads to a significant improvement in all indicators. So, true glue increases by 15-20%, breaking load - by 11-14%, and breaking elongation decreases, from 19-20% to 13-14%.

Based on the data obtained, summarized in Figs. 2.8 and 2.9, it can be concluded that the optimal concentration of PVA and HIPAN, which provides the most required viscous compositions (namely, they; as shown, are most effective in sizing), is the concentration of PVA-0 , 3%, the concentration of HIPAN 0.2%. Since the introduction into the sizing hydrogels of PVA and HIPAN has a positive effect on all target parameters of the technological process, the required sizing result is also achieved with a lower starch content in the composition. This is clearly demonstrated by the data table.

As can be seen, the use of a dressing polymer composition based on starch, PVA and HIPAN at a concentration of 5.0; 0.3 and 0.2%, respectively, allows you to get lined yarn of better quality than under normal factory conditions (starch concentration equal to 7%).

The main indicators of the effectiveness of starch compositions in the sizing of cotton yarn

Typeofyarn	Concentration,%			$\eta_{отн.}$ (80^{o})	Yarnqualityindicators		
	starch	PVA	HIPAN		Breakingload	Tensileelonga-tion	Trueglue
Soft	-	-	-	-	2,0	24,2	-
Dressed with standard starch composition	7	-	-	200	2,3	16,3	5,14
Lined with starch-PVA-HIPAN compounds	4	0,3	0,2	1,42	2,6	13,5	5,58
	5	0,3	0,2	1,64	2,8	12,8	6,35

Thus, we analyzed the reasons for improving the quality of the polymer coating formed on the cotton yarn when not applying a composition based on starch of polyvinyl alcohol and hydrolyzed polyacrylonitrile [10-14]. It has been established that PVA and HIPAN increase the work of contact adhesion withdressing, which is more Improved properties of the developed composite film compared to conventional starch film play a decisive role in providing a technical effect in the sizing of cotton yarn.

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