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Article



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## PROPERTY OF YARN TREATED WITH MODIFIED STARCH

**Abstract:** This article presents the results of a study of the physical and mechanical properties of yarn based on modified starch.

**Key words:** starch, sizing, sodium carboxymethyl starch, Hydrolyzed polyacrylonitrile, polymer composition, viscosity, adhesion, rheology.

**Language:** English

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### Introduction

The viscosity of sizing agents is one of their main indicators, which should be within the optimal value, as a result of which a protective film is formed on the surface of the yarn, which gives the yarn strength and elasticity[1-3]. The results of changing the viscosity of the solution at various concentrations are shown in table 1.

The study of the dependence of the viscosity of the composition containing 5-7% starch, 0.4-0.7% HPAN and 0.03-0.06% Na-CMS showed that all the studied solutions have the required viscosity. In this case, changing the concentration of Na-CMS from 0.03% to 0.06% significantly affects the structural and mechanical properties of starch-based compositions[4-6].

**Table 1. Change in the viscosity of the solution depending on the content of modified starch (T=298K, cottonseed oil 0,03 %).**

Rice starch, %	HPAN, %	Change in solution viscosity at different concentrations (%) Na-CMS, (Pa.s)			
		0,03	0,04	0,05	0,06
	0,4	1,10	1,17	1,26	1,40

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5	0,5	1,19	1,28	1,44	1,70
	0,6	1,36	1,51	1,65	2,05
	0,7	1,75	1,93	2,25	2,61
6	0,4	1,21	1,33	1,44	1,62
	0,5	1,34	1,50	1,72	1,95
	0,6	1,55	1,68	1,93	2,20
	0,7	1,78	2,13	2,41	2,71
7	0,4	1,32	1,41	1,55	1,72
	0,5	1,44	1,64	1,91	2,11
	0,6	1,71	1,82	2,13	2,35
	0,7	2,01	2,23	2,64	2,89

The sizing process affects the breaking of the yarn under force, i.e. the strength of the sized yarn increases compared to conventional yarn. Thus, in the course of the study, differences were revealed between the rupture of sized and non-sized yarns under the action of force. The results obtained are presented in table 2.

The results show that not only the amount of starch and HPAN, but also, to a certain extent, the amount of Na-CMS depends on the breakage of the sized yarn.

For example, the yarn breaking under force is 391 cN in the presence of 6% -starch, HPAN-0.5% and 0.04% Na-CMS, with an increase in the concentration of starch to 7% and Na-CMS to 0.05%

force breakage increases to 398 cN. Thus, the study of the dependence of the physicochemical and physico-mechanical properties of sized yarn on the chemical nature and concentration of the components satisfies the requirements for adhesive and film-forming components of modified starch with HPAN and Na-CMS. According to the work performed, it can be concluded that the composition with good rheological and physical and mechanical properties of the yarn consists of the following components: 6% rice starch, 0.5% HPAN and 0.04% Na-CMS.

As can be seen from Table 3, the physical and mechanical properties of modified starch yarn meet all the requirements for the weaving process.

**Table 2. Physical and mechanical characteristics of sized yarn with modified starch (cottonseed oil 0,03 %)**

Composition of modified starch ,%			pH	Force break, P,cN	Elongation, E, %	Gluing, K,%
Starch	HPAN	Na-CMS				
5	0,4	0,03	7,2	347	20,63	3,01
	0,5	0,03	7,0	380	22,68	3,52
	0,6	0,03	6,9	395	23,85	4,28
6	0,4	0,04	7,3	375	22,68	4,49
	0,5	0,04	7,0	391	23,93	4,77
	0,6	0,04	6,8	414	24,15	5,61
7	0,4	0,05	7,7	387	23,21	4,91
	0,5	0,05	7,3	398	25,28	5,94
	0,6	0,05	6,8	416	26,40	7,09

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**Table 3. Comparative physical and mechanical characteristics of yarn according to the composition of the sizing component**

Technological indicators	Size types		
	Corn starch	Rice starch	Modified starch
Sizing viscosity, Pa.s:	1,40	1,20	1,50
In the Chanda sizing bath	1,15	1,05	1,20
Breakage, %	0,38	0,50	0,35
Average strength, N:	262	250	267
Softly sized	383	373,7	393
Medium elongation, %	2,80	3,00	2,65

The breakage of yarn sized on a loom is lower than the breakage of yarn sized by other types of starch, with this in mind, it is recommended to introduce the development into production[7-9].

The treatment of yarn with the proposed compositions increases their technological characteristics, i.e. allows you to reduce the number of breaks on the loom by 8-12%.

The decrease in yarn breakage during sizing is due to the high permeability of the modified starch solution and the formation of a strong smooth film[10]. Due to these properties, the solution is easily absorbed by the yarn, gives the yarn strength and elasticity after drying and protects them from mechanical damage.

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