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European Journal of Advances in Engineering and Technology, 2019, 6(10):45-48

Research Article ISSN: 2394 - 658X

Rheological Properties of Aqueous Solutions of Polymer Composition and their Influence on the Dressing Effect

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ABSTRACT

The article analyzes the rheological properties of aqueous solutions of the polymer composition. Characterized by a change in the physical and mechanical properties of yarn when sericin is introduced into the dressing.

Key words: Synthetic component, physical and mechanical properties, starch concentration

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INTRODUCTION

Significant improvement of technological properties of the coated yarn due to partial replacement of starch products in the dressing with a water-soluble synthetic polymer (PVA, PEG, etc.) is of great interest. But a serious obstacle to the practical use of such mixtures is the incompatibility of starch with most synthetic polymers. Incompatibility is the cause of delamination of the starch-based mixture dressing containing more than 20% of the synthetic component when stored without stirring. For practical purposes, as a rule, it is not necessary to achieve full compatibility of polymers in the thermodynamic sense. In this regard, the concept of operational compatibility, one of the criteria for increasing which can serve as an improvement in the physical and mechanical characteristics of water-soluble polymer composite materials.

Water-soluble polymer compositions were prepared by mixing 5% starch gel with 0.5% aqueous solutions of sericin and polyacrylamide in a given proportion. The content of water-soluble polymer polyacrylamide in mixtures did not exceed 0.05%.

For all water-soluble polymer compositions studied in the work, the mechanical and optical properties of films that were cast from solutions of the polymer composition were investigated. For all compositions of the polymer composition, an increase in the strength and transparency of the films with an increase in the concentration of sericin in the composition was observed.

Fig 1 shows the dependence of the breaking load and the optical.

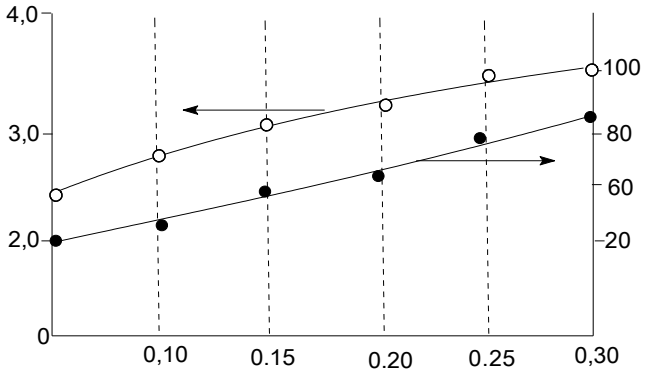

Fig. 1 Dependence of the breaking load and optical transmission of films of the composition on the concentration of sericin

Transmissions for films cast from a polymer composition starch:sericin--Polyacrylamide.

Mixing two thermodynamic compatible polymers results in dispersion of one polymer in the matrix of the other. Dispersion, morphology and adhesion between the phases depend to varying degrees on the interfacial energies, which play an important role in the formation of the mechanical properties of multiphase polymer mixtures. The presence of interfacial surfaces causes a "negative" deviation of physical and mechanical characteristics of multicomponent polymer materials from additive values. Thus, an increase in the strength of films cast from a polymer composition indicates an increase in the compatibility of polymer components. The introduction of sericin into the polymer composition leads to a decrease in interfacial energies. An increase in the transparency of the mixed films may also indicate an increase in the compatibility of the components.

The increase in compatibility can also be judged by the change in the viscosity of the composition as a result of the introduction of sericin. It is known that for solutions of incompatible polymers there is a compression of the structural elements of each polymer and, as a consequence, a negative deviation of the viscosity from the additive values. For fig 2 the dependences of the viscosity of the polymer composition solution on their composition are presented.

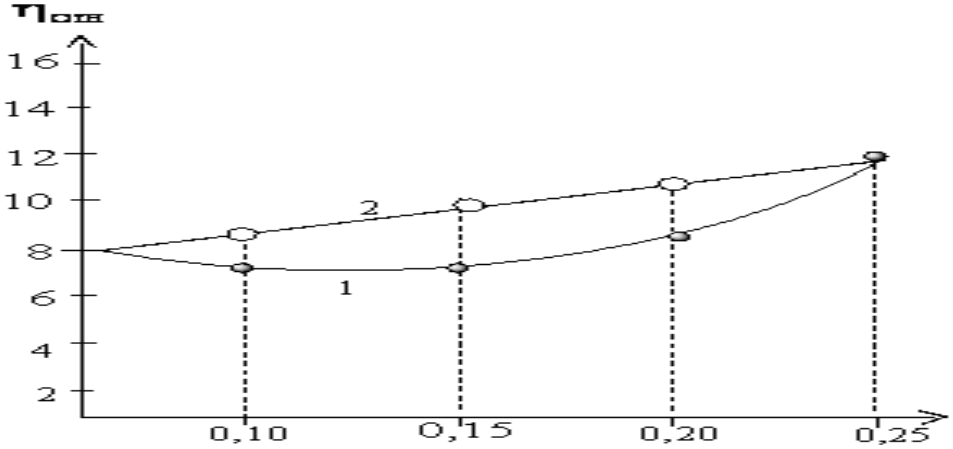

Fig. 2 *Dependence of relative viscosity of starch (1) and polymer composition (2)*

Sericin concentration, % by weight of dry starch

The dotted line in the figure shows the dependence built on the values of viscosity calculated by the rules of additivity:

$\eta_{см}=c_1\eta_1+(1-c_1)\eta_2$,

where C_1-the proportion of starch in the mixture,

η_1 and η_2 – relative viscosities of aqueous solutions of starch and sericin.

A decrease in the negative deviation of the viscosity of solutions from the calculated additive values also indicates an increase in the compatibility of the components as a result of chemical treatment.

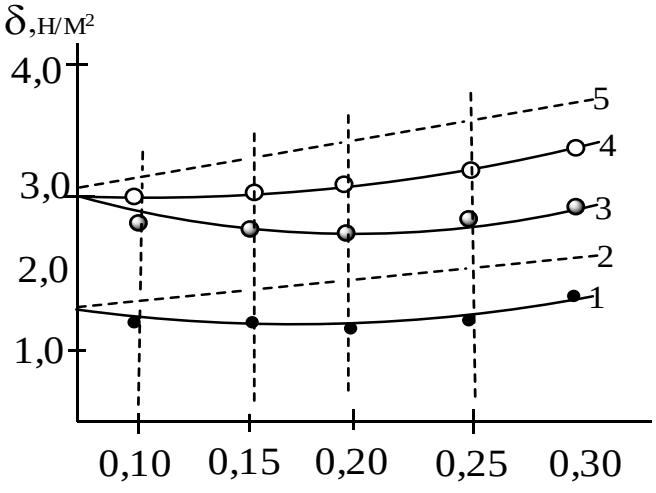

Fig. 3 Dependence of the breaking load of films on the composition

The concentration of starch

For starch films (1), for starch films-sericin (3) and for starch films - polyacrylamide-sericin (4).2.5-effective ratio for the initial starch (2) and polymer composition (5).

As can be seen from figure 3, the negative deviation of the breaking loads from the additive values for films cast from starch and the sericin-polyacrylamide, more than for films of starch - sericin. The figure also shows that in the case of a polymer composition, the deviation from the additive dependence is less than in the case of individual components before mixing. One of the reasons for this experimental fact can serve as homogenization of the mixture and increase the level of dispersion of the system as a whole.

Table -1 Changes in physical and mechanical properties of yarn when sericin is introduced into the dressing. The polyacrylamide content in the composition is 0.05%

Sizing composition composition, %		The ratio of starch and preparations in the dressing, %	Bursting load P, sN	Tensile elongation E, %	Glue K, %
Starch	Sericin				
5	-	100:0	356	3.7	5.7
	0.1	99.5:0.5	381	3.1	5.6
	0.2	99.0:1.0	388	3.1	5.3
	0.3	98.5:1.5	402	3.4	5.4
6	-	100:0	365	3.4	6.6
	0.1	99.4:0.6	386	3.5	6.0
	0.2	98.8:1.2	392	4.0	5.2
	0.3	98.2:1.8	404	4.4	5.2
7	-	100:0	382	4.5	5.5
	0.1	99.3:0.7	410	4.5	5.6
	0.2	98.6:1.4	422	4.6	5.8
	0.3	97.9:2.1	434	4.7	5.9

The content of starch and sericin in the dressing depends on the type and properties of the cotton yarn, as well as on the conditions of its processing. Therefore, the initial study was aimed at selecting the concentrations of starch, polyacrylamide and sericin in the composition. The results of tests of cotton yarn with starch, polyacrylamide and sericin are given in table 1.

As can be seen from this table 1, the values of tensile strength, tensile elongation and adhesive are significantly dependent on the composition of the dressing. The use of the developed polymer composition based on rice starch, polyacrylamide and sericin in the dressing of cotton yarn allowed to increase its strength, reduce the tensile elongation, and this, in turn, helps to reduce the breakage of the yarn.

Viscosity of dressing systems is one of its main characteristics.

Table -2 Composition and change of solution viscosity at 298 K

Starch rice, %	PAA, %	The viscosity of the starch solution and PAA, PA · s	The change in the viscosity of the solution (Pa · s) at a concentration of sericin,% by weight of dry starch			
			0.10	0.15	0.20	0.25
5	0.03	0.90	1.10	1.21	1.30	1.45
	0.05	1.03	1.24	1.34	1.47	1.76
	0.07	1.18	1.36	1.57	1.70	2.11
	0.10	1.52	1.72	1.98	2.33	2.72
6	0.03	1.05	1.20	1.34	1.52	1.70
	0.05	1.22	1.41	1.56	1.78	2.04
	0.07	1.33	1.52	1.69	2.01	2.20
	0.10	1.53	1.77	2.11	2.47	2.70
7	0.03	1.25	1.29	1.48	1.58	1.82
	0.05	1.28	1.51	1.71	1.93	2.18
	0.07	1.58	1.69	1.92	2.18	2.42
	0.10	1.78	1.98	2.24	2.71	2.94

It should be within the optimal values at which the formation of a protective film on the surface of the yarn, giving it strength and elasticity.

The composition and data on the change in the viscosity of the solution of the composition at different concentrations of the components are presented in table 1. The study of the dependence of the viscosity of 5-7%

starch paste and 0.03-0.10% polyacrylamide containing sericin in the range of 0.10-0.25% showed that all the studied solutions have sufficient viscosity. However, increasing the concentration of sericin from 0.10 to 0.25 % in starch paste it was shown in Khafizova A. R. and Amon R. M. there is a significant change of structural–mechanical properties of the system **[**5-10].

For example, if the breaking load of cotton yarn at a starch content of 5%, 0.03% polyacrylamide and 0.15% sericin is 271 sN, then at the same starch content and polyacrylamide and increasing the sericin content to 0.25%, the breaking load will increase to 302 SN, i.e. 24 %. Thus, it was experimentally established that the compositions based on starch, polyacrylamide and sericin meet the requirements for adhesive and film-forming components of the dressing.

REFERENCES

[1]. Aggarwal V.K. Evaluation of starch and acrylic size. "Indian J. Text. Res.", -1997.- 12. -№ 2. - p.97-99

[2]. Rokita B., Biskup R., Ulanski P., Rosiak J.M. Modification of polymers by ultrasound treatment in aqueous solution // J. E-polymers, 2005, No 024.

[3]. Bachman S., Witkowski S., Pietka H. Effect of ^{60}Co radiation on some chemical changes in potato starch pastes and gels.// J. Radioanal. and Nucl. Chem. 2007. 118. №3. P.185-191.

[4]. Lipatova I.M., Padokhin V.F., Morganov A.P. Mechano-Chemical of polysaccharide solutions and gels combined with processes of textile polysaccharide preparations production.// IIV Int. Conf. The problems of solvatation and complex formation in solutions. June 29 – Jule. 2018. Ivanovo. Russia. p. 397.

[5]. Amonov M.R., Khafizov A.R., Davirov Sh. N. Investigation of the effect of compositions for sizing cotton yarn on its quality // Journal of Composite Materials. 2012.-№2. -FROM. 35-36.

[6]. Amonov M.R., Khafizov A.R., Davirov Sh.N. Development of a polymer composition for sizing yarn // Journal of Composite Materials. 2012. -№2. -FROM. 25-26.

[7]. Amonov M.R., Khafizov A.R., Davirov Sh.N. Studying the adhesive properties of polymer sizing compositions // DAN RUz. 2012. -№5. -FROM. 27-30.

[8]. Amonov M.R., Yariyev O.M., Khafizov A.R. Physicochemical principles of developing the composition of sizing components // Plastics. –M., 2013. -№6. -FROM. 32-34.

[9]. Amonov M.R., Davirov Sh.N., Kazakov A.S., Yariyev O.M. Synthetic polymer composition for sizing cotton yarn // J. Tex. Prom.- 2011. No. 6.-C.21-23.

[10]. Amonov M.R. Water-soluble polymer compositions based on local raw materials for use in the production of cotton fabrics and the technology for their production: Dis. ... Doctor of Technical Science: -T., 2005.-8-10s.