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Polymers Functionalized by Wood Resin and Oil-Gasoline-Resistant Rubber Based on Them

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Abstract
Butadiene-nitrile (NBR-40) rubber and a functionalized polymer composition based on the biopolymer, which was formed in fruit trees and is called tree gum, was obtained, and the production of oil-gasoline resistant rubbers of this composition was investigated. For this purpose: the optimal recipe based on NBR-40 and tree gum rubber mixture was prepared based on optimal recipes and the mixture was vulcanized. In the composition prepared on the basis of NBR-40, wood cypress was used. As a result of IKS analysis of wood gum, which is a biopolymer, it was determined that it contains functional groups (COOH, OH, etc.)
Based on NBR-40+polyvinyl chloride (PVC) and biopolymer, the optimal recipe of the composition and the optimal vulcanization mode were studied and the optimal vulcanization mode was found.
Oil-gasoline resistance of rubber mixture and vulcanizate was studied;
Key words--functionalized polymers, biodegradable polymers, biocompatible polymers, biopolymer, modification, rubber, butadiene-nitrile rubber, aggressive environment, vulcanization

1.Introduction

The compatibility of block and co-polymers with biopolymers and the preparation of polymer compositions based on them is the most urgent problem today [1-4]. The formation of elastomers and their mixtures by using gum from fruit trees is of great scientific importance.

In the oil extraction and oil refining industry, it is of great importance to make sealants and additives from rubber [5-8]. Due to the fact that the additives and sealants used in the oil extraction and oil refining industry and a number of parts work in a very aggressive environment, they do not withstand the operating conditions and quickly deteriorate. Today, oil , gasoline, kerosene, acid, alkali and other aggressive environment, there is a great need to prepare rubber parts that can work for a long time [9-10]. The purpose of this work is to obtain rubbers that can work in an aggressive environment for a long time in the oil refining industry in oil extraction[11-12]. Based on NBR-40 rubber, it is possible to obtain rubbers that can work in oil-gasoline and other aggressive environments and to achieve their application on an industrial scale[13-14], but rubbers that can fully respond to operating conditions have not been obtained. Taking these into account, modifiers with new functional groups should be used to ensure the lacking mechanical strength of the elastomers used. increase the operational properties of the product and make the product long-lasting. As can be seen from the current literature and the analysis of the conducted scientific research works, when Butadiene-nitrile rubber (BNR-40) based rubbers that can be used in oil-gasoline and other aggressive media and their application on an industrial scale have been achieved [15-16], but rubbers that can fully meet the operational conditions have not been obtained. to ensure its strength, modifiers with new functional groups should be used. The functional groups contained in the biopolymer allow to increase the amount of functional groups in the received composition and increase the operating properties of the received polymer product, making the product long-lasting. As can be seen from the literature of the period and the analysis of the conducted scientific-research works, the immiscible elastomers (BNR-40, ethylene-propene synthetic rubber terpolymer-EPSRT-60-, butyl rubber,-BR.) (), polyvinyl chloride -PRX AND polychloroprene (PCP) are added, it is observed that the properties of compositions based on them improve.[17-18]

As can be seen from the literature review, CAPP, SXAPP, CPE and CBR mixtures of BR were hardly used in the preparation of heat-resistant compositions. Only in recent years, it can be shown that large-scale research works in this field have been carried out in the Department of Organic Materials and Technology of the National Academy of Sciences of the National Academy of Sciences of Azerbaijan [19-20].

1.1 Properties of compositions based on modified polymers

The complex physical and mechanical properties of polymers modified by graft copolymerization are explained by the heterogeneous nature of the chemical modification process that takes place on the surface of their structure. .Increasing the amount of polyvinyl chloride (PVC-) in the modified ethylene-propylene copolymer increases the melting temperature of the copolymer. Axma-141.5 in EPSRT-60 at 200℃; -185℃ in EPSRT-60+PVC (13% mass); It becomes EPSRT-60-. It reduces the rate of thermal destruction of the modified polymer. The rate constant of destruction of PVC in the temperature range of 140-180℃ increases from .105 0.3 to 20.3. In the modified copolymer, this indicator changes as follows. EPSRT-60- -PVC (PVC-63% mass)-from 9.14 to 13.8; EPSRT-60- PVC-PMA (PVC-37 ; PMA polymethyl methacrylate-95% mass)-from 0.2 to 13.2; EPSRT-60-Polyvinylidene chloride-PMA(PVC-50, PMA-13.5% by mass) - varies from 0.2 to 12.5, which means that the thermal destruction of the copolymer is significantly delayed.

The recovery of EPSRT-60 from modified copolymers with a PVC mass fraction of 53 and 63% decreases significantly after 48 hours and is at the same level as the extraction rate of vulcanizes based on EPSRT-60. In this modified copolymer, the formation of an intermediate structure was confirmed as a result of the chemical interaction of the polymers of the system. Experiments showed that to improve the chemical resistance of polymer compositions it is necessary to modify them with components that contain at least two functional groups

2. Method

In order to carry out these research works, the optimal recipe shown in Table 1 was accepted and a composition mixture was prepared based on it.

The composition mixture was obtained by mixing in a laboratory roller at a temperature of 90-120 ° C for 12 minutes until a homogeneous system was obtained. The obtained rubber mixture was subjected to a vulcanization process at the Baku Rubber-Technical Products Factory.

The mixture affects the chemical nature and microheterogeneity of rubbers. This can be seen more clearly in Table 1.

Table 1 Characterization of the structure of polymer mixtures in a 1:1 ratio

	Rubber compounds	Muni Viscosity ML4-100	The price of micro volumes MKM
1	NBR-40	90/53	6
2	PVC	50/53	0,5
3	Tree gum	53/50	2

The tree gum used in the composition is apricot, peach, cherry, etc. in the Abyeron valley of the Republic of Azerbaijan. We collected from cherry trees in August 2023. The tree gum collected and used in this scientific study (sometimes we call it birch resin or gum)

Tree resin is also called gum. This is the glue with which trees heal themselves: when a crack appears on the trunk, drops of resin appear in the damaged area. At first the resin is liquid, then it gradually turns into a jelly-like substance, then hardens.

The dried sap of cherry and apricot trees can easily pass for a medicine. Cherry gum contains arabinose and galactose. That is why the gum has an enveloping property and can be used to treat inflammation of the mucous membranes of the stomach and intestines.

All animals know about the healing properties of gum! The hares gnaw it down to the rest, the birds fly in and peck it off. Moose have a habit of rubbing against the resin trunk to heal small wounds. Bees collect fresh gum; it is part of proposes. Tree resin has plenty of useful qualities! You can even lose weight with the help of gum. Arabinose, $C_5H_{10}O_5$ is a simple carbohydrate (monosaccharide) from the pentose group, related to aldoses. In the Fischer formula, the D(+) form has a hydroxyl group near the 2nd carbon atom on the left. The name comes from atrazine, the main component of gum Arabic and the saccharide name suffix -oz.(a)

Properties

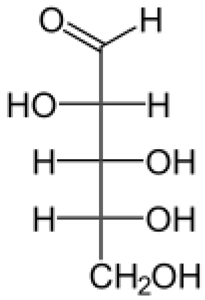
Colorless crystals, sweet in taste, soluble in water. It exists in two stereo isomeric forms: (−)-arabinose and (+)-arabinose. Specific rotation of the aqueous solution is +104.5°. Not fermented with yeast. Upon oxidation, it forms carbonic acid; upon reduction, it forms the pent hydric alcohol

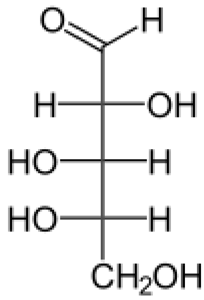
.$C_5H_{10}O_5$— chemical formula

Physical properties—

Molar mass—150.13 g/mol

Density—1.585g/cm3


D-Arabinose


L-Arabinose

Prevalence in nature

Arabinose is widely distributed in plants [mainly (−)-arabinose], especially in fruits. (+)-arabinose is part of many complex sugars (polysaccharides) of plant origin - gums (gum arabic, cherry glue), mucus, hemicelluloses (araban), pectin substances, as well as glycosides (saponins, flavonoids). For some bacteria, arabinose is the only source of carbon.

Formed in plants by decarboxylation of galacturonic acid

. **2.1. Composition preparation technologies**

The composition was prepared in a laboratory roller. First, polymer was added to the space between the balls of the roller and mixed at a temperature of 120℃, after adding plasticizer and bringing the temperature to 167℃, after adding wood resin to the roller and mixing for 3 minutes, adding other components, the biking system was obtained in 12 minutes.

If the viscosities of the mixed polymers are fundamentally different from each other, then a highly inhomogeneous system is obtained. To reduce the plasticity of solid polymer, it is necessary to add oil to its composition. Regardless of the nature of the mixed rubbers, the softer polymer usually forms a continuous phase, which is distributed in the form of discrete particles in the second polymer. The size of the micro volumes is influenced by the nature of the rubber and the relative viscosities of the mixed rubbers (polymers). taking into account the fact that the process was carried out very accurately and according to the optimal parameters we found.

Taking into account that it was used for the first time in the composition obtained with the participation of NBR-40 rubber and other ingredients, an IKS analysis was carried out in order to find out what functional groups are present in the tree resin we used, and the obtained result is shown in figure 1

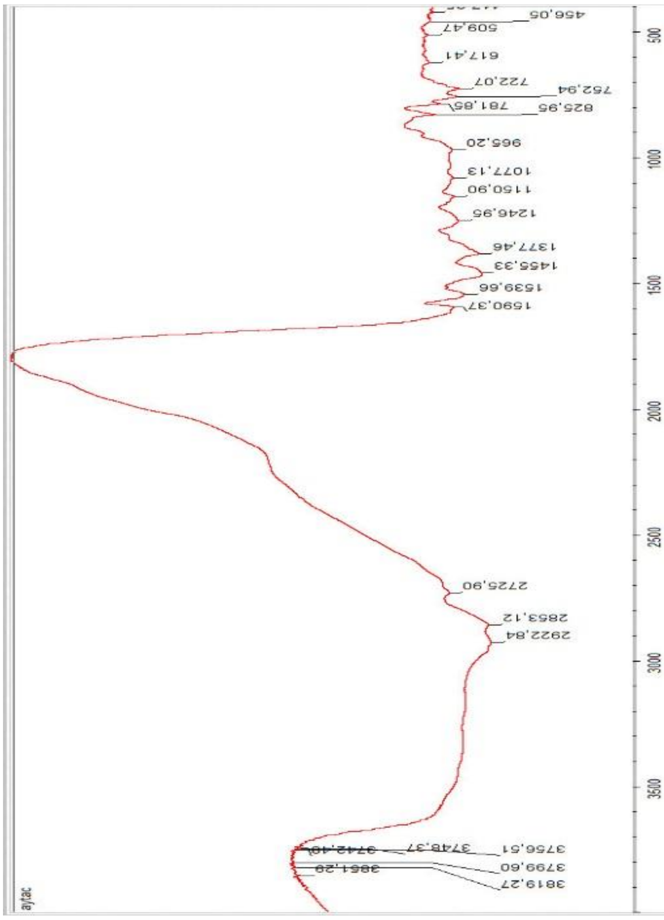


Figure. 1. IKS analysis of a wooden trailer

2922.84 -CH2-, - CH groups, 2853.12 -CH group, 2725.90 -NH, 1246.95

3. Discussion Experimental part: 3. Result

3.1 Compositions based on NBR-40 +Kamed +PVC mixtures

Polymers with polar groups, including PVC, mix well with NBR-40 rubber and relatively poorly with rubber. Therefore, NBR is used to improve the properties of NBR-40 rubber due to its high resistance to heat and ozone effects. -40 - Construction mixtures were studied. Vulcanizates based on NBR-40 rubber with high chemical resistance, which is widely used in the preparation of rubber-technical products used in the oil industry, have a low brittleness temperature (low elasticity), low resistance to ozone and heat. The specified properties NBR It limits the use of technical rubber products based on -40 rubber, causing them to quickly fail. Taking this into account, Kamed was added to rubber mixtures based on NBR-40 in the amount of 10-12 parts by mass. PVC was used as an additive to improve the joint mixing of rubbers. that vulcanizates based on NBR-40 -+Kamed+-PVC (80:10:10) mixture, compared to only SKN-40M vulcanizates, high deformation (relative elongation-45%, hardness-75 conventional units., low brittleness temperature-18℃) indicators, resistance to heat and ozone effects. Other physical-mechanical indicators are at the level of indicators of NBR-40 (100 mass parts.) vulcanizates. As can be seen from the obtained results, it was possible to overcome the shortcomings inherent in NBR-40 rubber through construction rubber.

We adopted the recipe shown in table 1 for obtaining oil-gasoline-resistant compositions based on butadiene-nitrile elastomer. The received composition is intended to be used to purchase rubber-technical products. In the composition based on butadiene-nitrile elastomer, 5-70 mass parts of NBR-40, 30-95 mass parts of NBR-40 with 1.0 to 5.5% double bonds remaining, 4-8 mass parts of vulcanizing agent 0.5-2.0 peroxide, 40-60 mass parts technical carbon, 1-3 mass parts stearic acid and 1-3 mass parts mass part k.h. contains antioxidants. It is obtained by mixing the composition in rollers.

Our research has shown that as the amount of acrylonitrile incorporated in butadiene-nitrile rubber increases, the resistance of the vulcanizate based on it to oil-gasoline and aggressive environment increases, but the elasticity property and frost resistance decrease. In this work, we have taken NBR-40 rubber and modified its shortcomings with functional group polymer.

Table 1 Properties of vulcanizates based on NBR-40 rubber

Indicators	NBR-18(17-20)	NBR -26(27-30)	NBR -40(36-40)
Tensile strength MPa	25	28	30
Brittleness temperature ℃ (taken from literature)brittleness temperature ℃ (taken from literature)	-62	-54	-35
Friction resistance, cm3/(kw.s)	330	250	200

In Vardana, the composition was obtained by mixing at a temperature of 30-60℃ for 12 minutes.

3.2. Study of the vulcanization process of the prepared rubber mixture

Vulcanization was carried out at a temperature of 155℃ for 25 minutes.

Physico-mechanical properties of polymer mixtures and compositions prepared in laboratory conditions and in production were determined according to standard norms, respectively.

The following properties of vulcanizates based on polymer mixtures were determined: breaking strength limit, relative elongation at break, relative residual deformation, tensile stress limits - modulus, breaking strength at high temperatures (all DUIST 270-75), strength of connection with cords (DUIST 7912-74), connection with metals strength (DUIST 209-75), resistance to tearing (DUIST 267-73), resistance to repeated tensile fatigue (DUIST 261-79), resistance to burning (DUIST 21793-76).

The composition of the tree sapwood is both an antioxidant and a reduction of residual deformation at high temperatures. The recipe we used in the study is given in table 2.

Table 2 A recipe for an oil-gasoline-resistant composition mixture made on the basis of butadiene-nitrile rubber resistant to atmospheric conditions

№	The name of the components	quantity, part by mass
1	NBR-40	88
2	Tree gum	2
3	PVC	10
4	Altax	2.01
5	Captax	2.01
6	Zinc oxide	2.67
7	Magnesium oxide	2.04
8	Sulphur	3.68
9	Stearin	2.04
10	Technical Carbon n-324	63.52

The composition was prepared in the laboratory. The mode of preparation of the composition is defined as follows (Tables 3 and 4)

Table 3 The recipe for giving composition ingredients

№	Materialların verilmə ardıcılığı	Mixing mode time, min
1	NBR-40	1-2
2	Captax, Altax ,Technical Carbon n-324	3-4
3	Magnesium oxide ,zinc oxide	14
4	Stearin	16
5	Tree gum	22
6	Sulphur	24
7	Cut	26

Table 4 Duplicate control norm

Vulcanization Mode		Ringing		Special crowd	Plasticity	Strength according to Shor
Time, min	T, °C	d/f	norm	gram/sm^3		
15	150±1	3/2	1,0-3,0	1,20	0,2	60-70

Butadiene-nitrile rubbers are relatively sensitive to water absorption (2.1mg/cm2).

We studied the kinetics of butadiene-nitrile rubber with polyvinyl chloride. The vulcanizatiokinetics showed that the plasticizer added to the mixture is important. In order to overcome this problem, it isnecessary to use a reactive oligomer or polymer. By adding 10 mass parts of PVC to thecomposition, it was possible to lower the vulcanization temperature from 160°C to 135°C.

Table 5 Physical and mechanical indicators

Vulcanization mode		Tear resistance	Elongation in %		Strength according to Shor
Time, min	T, °C	kg /sm^3	relative.н/m	residue, n/m	
25	150±1	100	300	20	60-70

For practically all samples, the vulcanization process is faster in the initial stage. The sample with a ratio of 90/10 has 20-40% vulcanization in the initial process. However, at the end of the process, the vulcanization rate drops sharply, which is related to the heterogeneous nature of the process. The composition is NBR-40 When the vulcanization mode is 120°C-125°C when the ratio of -40 and PVC is 80/20, the process is very slow in the initial stage. The subsequent increase in temperature eliminates this deficiency and the optimal vulcanization reaches 30-50% depending on the time.

Physical and mechanical properties of vulcanizate are given in tables 6, 7, 8 and 9.

Table 6 Physical and mechanical properties of vulcanizates of NBR-40 +PVC mixtures

.	Composition of the mixture, mass part						
NBR-40	100	97,5	95	92,5	90	87,5	85
PVC	-	2,5	5	7,5	10	12,5	15

1	2	3	4	5	6	7	8
Properties of vulcanizates							
Tensile strength MPa	20,7	21,5	22,9	22,1	20,2	19,2	17,6
100% tensile stress MPa	3,6	3,6	3,5	3,54	3,2	2,8	2,0
300% tensile stress MPa	13,6	13.7	14,0	14,0	13,3	12,1	11,7
Relative elongation,%	380	450	475	470	470	450	410
Relative residual deformation,%	14,0	18,0	19,5	20,5	21,6	24,0	26,0
Tear resistance kN/M	32,9	39,5	45,9	51,0	49,5	49,0	45,5
Elasticity,%	40,0	40,0	40,5	39,7	40,1	38,0	35,0
Conventional unit of hardness according to TM-2	70,0	70,0	69,0	69,0	69,5	70,0	71,0
for 138 hours at 120℃ aging coefficients on on	0,76 0,41	0,79 0,41	0,81 0,40	0,86 0,41	0,89 0,42	0,92 0,33	0,97 0,24
Multiple tensile fatigue strength (=200% =250 cycles/min,=23℃ thousand cycles.	1,150	1,99	2,450	2,500	2,580	1,750	1,150
Swelling rate% for 120 hours at 23℃ Burning time	114,0 X 292	115,0 X 300	115,0 X 320	117,0 X 390	120,0 X 97	125,0 X 60	139,0 X 35
Aggressive environment and contact strength with metal							
Chemical resistance % by degree of swelling for 32 days at room temperature Solid Solid Solid (40% solution)	31,13 9,18 22,3 0,014	31,4 9,25 22,7 0,014	33,2 9,46 23,5 0,0199	31,7 9,50 23,8 0,013	32,3 9,38 22,9 0,0095	31,9 9,40 24,0 0,0105	32,5 9,35 23,7 0,095
Metal bond strength	1,45	1,48	1,52	1,65	1,99		1,58

Table 7 Physico-mechanical properties of vulcanizates of NBR-40+PVC/wood veneer mixtures

Composition of the mixture, mass part							
NBR-40	100	95	93	91	89	87	85
PVC	5	5	5	5	5	5	5

Tree gum	-	-	2	4	6	8	10
antioxidant		-	2	4	6	8	10
Properties of vulcanizates							
Tensile strength MPa	20,0	20,7	22,1	21,9	20,1	19,4	18,1
100% tensile stress MPa	3,6	3,5	3,4	3,0	3,0	2,6	2,1
300% tensile stress MPa	12,9	13,0	13,4	13,3	12,9	12,0	11,5
Relative elongation,%	380	475	495	515	525	530	420
Relative residual deformation,%	14,0	19.5	20	21,8	22,0	24,5	26,8
Resistance to tearing, kN/m	35	41	47	50,5	49,2	48,9	44,0
Elasticity,%	38	38	38,5	39	38,5	37,5	34
Conventional unit of hardness according to TM-2	70	69	68	66	65	62	
Heat aging coefficients for 138 hours at 120°C On fm εrelative On	0,76 0,42	0,81 0,41	0,85 0,42	0,81 0,40	0,79 0,38	0,78 0,36	0,77 0,30
Fatigue resistance in repeated tension (ε =200% v=250rpm,t=23°C)	1,150	2,450	2,85	2,80	2,65	2,00	1,45

Table 9 Physical and mechanical properties of vulcanizates of NBR-40+PVC + Tree gum mixtures

Composition of the mixture by mass								
NBR-40 100 97,5 95 90 80 90 80 70 PVC - 2,5 5,0 10 20 - - - Tree gum - - - - - 10 20 30								
Number of samples								
1	2	3	4	5	6	7	8	9
Properties of vulcanizates								
Tensile strength MPa	24,2	23,4	22,5	21,2	17,8	25,1	25,3	24,8
300% tensilestressMPa	0,78	0,78	0,82	0,82	0,86	1,10	1,18	1,20
Conditional stress at 500% elongation, MPa	1,71	1,70	1,79	1,86	2,12	2,28	2,30	2,35
Relative elongation,%	880	870	860	840	810	900	910	900
Relative residual deformation,%	8,4	8,6	9,0	12,0	16,0	14,0	16,0	18,0
Resistance to tearing, kN/m	36,2	39,0	45,5	33,5	28,9	40,1	38,5	38
Elasticity,%	68,0	71,0	69,0	67,0	65,0	67,0	56,0	45,0
Conventional unit of	35,0	34,0	35,0	37.0	41,0	38,0	37,0	36,0

hardness according to TM-2								
Heat aging coefficients for 72 hours at 100°C On On	 0,88 0,81	 0,92 0,90	 1,02 0,91	 1,12 0,90	 0,80 0,93	 1,08 0,93	 1,04 0,91	 1,08 0,92
Fatigue resistance in repeated stretching (=200%=250 cycles/min,=23°C)	58,10	40,50	28,2	18,2	9,2	22,17	40,85	70,18
Bond strength of rubber to metal.MPa	0,97	1,0	1,14	1,20	1,75	1,16	1,46	1,95
Fatigue resistance of 17 B rubber connection in compression in repeated tension (=250 cycles/min compression 30% Tensile-20% thousand cycles.	6,81	5,75	3,18	3,75	4,20	9,850	10,72	20,875

The plasticity of the mixture varies in the range of 0.72-0.76

3.3. Study of the structure of rubber mixtures used in the research work

Our scientific and research studies have shown that the films of the polymer mixtures obtained by the mechanical method have a very rough structure. However, when these mixtures are taken in a rubber mixer or a roller, the structure becomes more homogeneous. By changing the mixing temperature and mixing time in the roller, the mixture can be made homogeneous.

The chemical nature of the mixed rubbers affects the microheterogeneity of the mixture. This can be seen more clearly in table 10.

Table 10 Characterization of the structure of polymer mixtures in a 1:1 ratio

	Rubber compounds	Muni Viscosity ML4-100°C	The price of micro volumes MKM
1	NBR-40	90/53	6
2	PVC	50/53	0,5
3	Tree gum	53/50	2

NBR-40 - Compositions based on Kamed two-PVC (80:4:16) mixtures, which are widely used in the preparation of rubber-technical products for the oil industry, have higher resistance to heat and ozone compared to compositions based on NBR-40 and polychlorprene (PVC). , due to their low brittleness temperature and low density, were used in the preparation of shaped products used in drilling equipment. (Table 11)

Table 11 Properties of compositions based on NBR40-kamed-PVC mixture

Names of indicators	Indicators				
Tensile strength MPa	20	19	19	19	21
Relative elongation at break, %	450	350	340	280	340
Residual elongation,%	20.0	16.0	16.0	12.0	12.0
. Hardness on TM-2, conventional	75	80	84	85	82

unit					
Resistance to tearing, kN/M	72	68	60	65	74
. Resistance of rubber to metal, MPa	6.0	5.8	6.0	5.5	6.2
Brittleness temperature, °C	-18	-22	-12	-10	-11
. Friction resistance m3/KC	66.6	37.3	54.7	75	58.3
. Mass change in swelling (20°C, 24 hours), mass % isooctane-toluene (1:1)	14	23.1	22	30	12
. Heat resistance coefficients (100°C 48 hours) Kσ	1.04 0.60	0.85 0.70	1.05 0.77	1.03 0.64	0.95 0.64
Elasticity %	10	11	10	10	10
Ozone resistance 25°C, 72 hours, deformation - 20% C03=0.01% um.	it doesn't fall apart at all	it doesn't fall apart at all	it doesn't fall apart at all	it doesn't fall apart at all	Disintegrate scompletely within 27 hours

1. NBR-40 + rubber + PVC (80:2:18) 2. NBR-40 + SEWING + PVC (80:4:16)
3. NBR-40 + rubber + PVC (80:6:14) 4. NBR-40 + SEWING + PVC (80:8:12)

The composition of the mixture is NBR-40 per 100 mass parts of PVC
Technical stearin-1.0; thiuram-1.5; captax-0.5; zinc oxide-5.0; technical carbon П-324-50; Sulfur-2.0; Vulcanization process 150°C, 30 minutes
The swelling of the biopolymers we use has been studied in different environments. The oil-gasoline resistance of the prepared compositions and vulcanizates was studied, and the obtained results are given in table 1 2 and fig. 1.
The swelling of the vulcanizate in aggressive environments was calculated as follows

$$\alpha = \frac{3{,}33-3}{3} \cdot 100 = 11$$

$$\alpha = \frac{3{,}34-3}{3} \cdot 100 = 11{,}33$$

$$\alpha = \frac{3{,}35-3}{3} \cdot 100 = 11{,}66$$

$$\alpha = \frac{3{,}36-3}{3} \cdot 100 = 12{,}5$$

Kerosine
Transform. oil

$$\alpha 1 = \frac{3{,}57-3}{3} \cdot 100 = 0{,}19 \qquad \alpha 1 = \frac{4{,}1-4}{4} \cdot 100 = 0{,}025$$

$$\alpha 2 = \frac{4{,}71-3}{3} \cdot 100 = 0{,}57 \qquad \alpha 2 = \frac{5-4}{4} \cdot 100 = 0{,}25$$

$$\alpha 3 = \frac{5{,}55-3}{3} \cdot 100 = 0{,}85$$

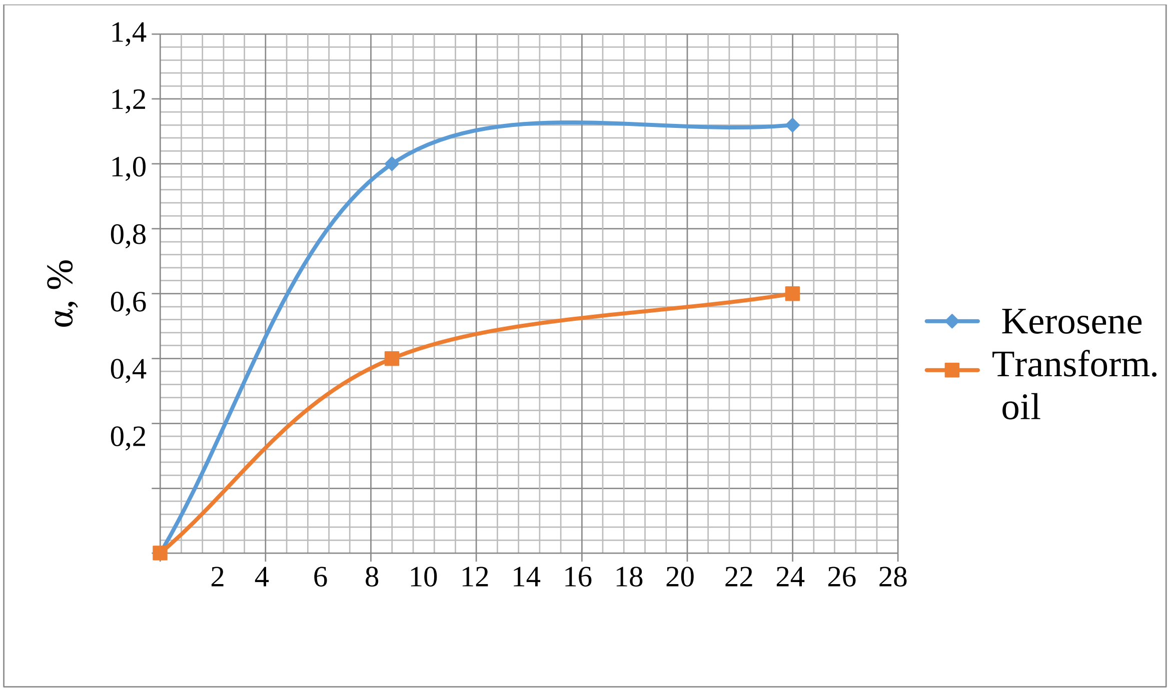
$$\alpha 3 = \frac{5{,}68-4}{4} \cdot 100 = 0{,}42$$

$$\alpha 4 = \frac{6{,}15-3}{3} \cdot 100 = 1{,}05$$

$$\alpha 4 = \frac{6{,}2-4}{4} \cdot 100 = 0{,}55$$

$$\alpha 5 = \frac{6{,}24-3}{3} \cdot 100 = 1{,}08$$

$$\alpha 5 = \frac{6{,}36-4}{4} \cdot 100 = 0{,}59$$



Timr,hour

Figure 1. Swelling of the biopolymers we use in different environments

After vulcanization of the composition prepared on the basis of the optimal recipe in the prescribed vulcanization mode, the chemical resistance of the vulcanizate in an aggressive environment for six months was determined and the main results obtained are given in table 12.

. Table 12. Durability of vulcanization in an aggressive environment for six months

Ingredients	*Solving*
Benzene	A little swollen
Tolol	Swollen
Butyl alcohol	There is no solution
Dimethylformamide	It dissolves completely after heating
Dioxane	little has been resolved
Heptane	It swells

5.Conclusion

1. A composition has been developed for the purchase of thickeners and aragats used in oil extraction and oil refining equipment and working in an aggressive environment.
2. A composition based on NBR-40, PVC and biopolymer was prepared and the optimal mode of its vulcanization was determined. The vulcanization mode was confirmed to be 155°C and 25 minutes.
3. It was determined that functional groups (COOH, OH, O) are present in the biopolymer we used by the IKS analysis method.
4. As a result of building reactions during vulcanization, the formation of a spatial structure in the macromolecule of the polymer ensures that the received rubbers are resistant to aggressive environments.
5. Due to the formation of polyfunctional vulcanization nodes as a result of vulcanization, it has been confirmed that the resistance of rubbers to oil and gasoline has improved significantly.
6. Condensers prepared as a result of optimal recipe and vulcanization process were proposed for use in oil extraction equipment.

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