Preparation and Study of a Composition Based on Butadiene-Styrene Polymer using Wood Tar

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ABSTRACT

This work is devoted to the topic of preparation and study of a composition based on butadiene-styrene polymer using wood tar.

An optimal recipe for obtaining a rubber mixture using butadiene-styrene rubber and wood tar (which we will sometimes call Kamden in the future) was selected and each component was justified. The rubber mixture was prepared in a mixer located in the laboratory of Bakrezin JSC and the mixing mode was set at a temperature of 1200C for 14 minutes, and the obtained homogeneous dispersed system was cooled to 800C, sulphur and accelerators were added to it. Then the kinetics of the vulcanization process was found. The vulcanization mode was determined as follows: T-1580C, P -12MPa, t - 26 minutes.

The physical and mechanical properties of the vulcanization were studied and it was shown that the indicators of the obtained product meet the requirements of the standard. To determine the durability of these rubber products obtained, the physical and mechanical properties of the vulcanization were determined and the sample had the following characteristics: Tensile strength, 22 MPa, Elongation at break 340%, Residual elongation 12%. Hardness according to TM-2, 85 conventional units.

Keywords: wooden stone styrene butadiene rubber, modification, vulcanization, rheology, IKS-analysis, vulcanization.

INTRODUCTION

Recent studies have shown that rubber and its ingredients affect various properties of rubber and vulcanize rubber mixtures differently [1-8]. Since in each specific case, not all, but only specific properties of rubber compounds and vulcanizes are important, when designing a compound, the ingredients that have the greatest influence on these properties are first selected. Studies have shown that the ingredients that dominate the properties of various rubber compounds and vulcanizes should be different, and these components have a significant effect on the vulcanization of the rubber mixture.   Table 1 [9-14].

METHOD

In order to carry out this work, we took components in different proportions based on BSK and determined the optimal recipe by analyzing the samples prepared from them. Then, based on the components included in the recipe, we calculated the components needed to prepare the rubber mixture in a single batch, and the results are given in Table 1.

Table 1 Calculation of components needed to prepare the rubber mixture in a single batch

Main indicators	Part by mass per 100 mass of rubber	Mass %	density of components kg\ kg/m³	Volume of components, m³ 5	Volume %	, Quantity of components to be prepared at one time, kg
1	2	3	4	5	6	7
SRBS-30ARKM-15	100,00	53,19	960	0,10417	63,40	1,220
This radical sulfur	1,50	0,80	2050	0,00073	0,44	0,018
Sulphebamide -Ц	2,50	1,32	1300	0,00192	1,17	0,030
Zinc oxide	3,00	1,60	5470	0,00055	0,33	0,037
Stearic acid	2,00	1,06	950	0,00210	1,28	0,024
Pre-vulcanization reducing agents	0,50	0,27	1500	0,00033	0,20	0,006
Petroleum tar SPP	5,00	2,66	1000	0,00500	3,04	0,061
Oil softener	17,00	9,04	970	0,01753	10,67	0,208
Anti-aging agent	0,50	0,27	1150	0,00043	0,26	0,006
Kamed (Tree resin-derived from cherry tree)	1,00	0,53	1010	0,00099	0,60	0,012
HAF type technical carbon	55,00	29,26	1800	0,03056	18,61	0,672
Total	188,00	100,00	–	0,16431	100,00	2,294

n this work, for the first time, tree resin was used as a modifier (this resin is called Kamerd). The kamerd was collected in August from an area called Novkhani Baghre, located 30 km from Baku city, and its general characteristics are shown in Figure 1.

Figure 1. Results and Discussions

RESULTS OF EXPERIMENTAL RESEARCH

Study of rheological properties

A homogeneous rubber mixture obtained in laboratory cylinders for 14 minutes at 1200C and 12 minutes was vulcanized in the optimal vulcanization mode (T-1580C, P -12MPa, t - 26 minutes) and the main properties of its

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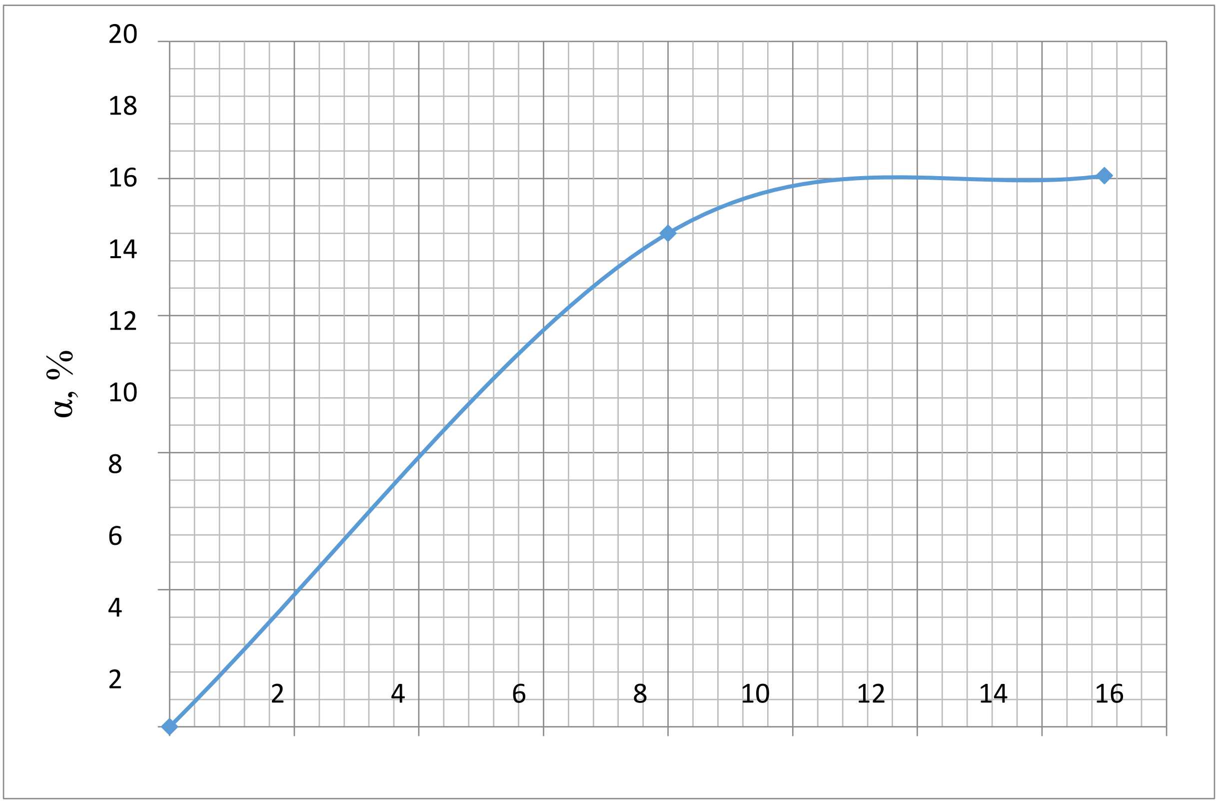
vulcanizate were determined (Table 4)

Table 4 Main properties of the vulcanizate of a rubber mixture based on butadiene-strol and wood resin

Names of indicators	Indicators				
	1	2	3	4	5
1. Tensile strength, MPa	16	19	20	24	21
2. Relative elongation at break, %	330	370	380	390	360
3. Residual elongation,%	11.0	13.0	14.0	19.0	16.0
4.TM-2 hardness, conventional unit	71	79	85	87	82
5. Tear resistance, kN/M	66	68	71	76	72
6. Rubber-to-metal bond strength, MPa	3.9	5.1	5.8	7.4	6.9
7.Frictionresistancem3/kg force	-13	-18	-15	-19	-22
8 Friction resistance m3/kgC.	61.1	56.4	68.1	71,0	62.6
9. Mass change during swelling (20°C, 24 hours), % mass isobutane-toluene (1:1) 10. Thermal resistance coefficients (100°C, 48 hours) Kσ	19	24.9	29	34	18
10. Heat resistance coefficients (100°C 48 hours) Kσ	0,95	1.10	1.35	2.08	1.78
11.Elasticity %	10	8	9	8	8
12. Ozone resistance 25°C, 72 hours, deformation - 20% C03=0.01% wt.	does not fall apart	does not fall apart	does not fall apart	does not fall apart dağılmır	Completely decomposes in 109 hours

Since our goal is to obtain rubbers with chemical resistance and mechanical strength in various aggressive environments based on BSK, we prepared samples of rubbers obtained as a result of vulcanization and examined them in acid, gasoline, oil, kerosene transformer oil and other environments, and the obtained results are given in Figures 2, 3 and 4.



Şəkil.3.BSK+Kamed əsasında alınmış rezinin benzində həllolması qrafiki

Həllolma aşağıdakı kimi hesablanmışdır

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$$\alpha = \frac{4{,}18-4}{4} \cdot 100 = 4?5$$

$$\alpha = \frac{4{,}33-4}{4} \cdot 100 = 13{,}45$$

$$\alpha = \frac{4{,}515-3}{3} \cdot 100 = 8{,}25,$$

$$\alpha = \frac{4{,}61-4}{4} \cdot 100 = 15{,}25$$

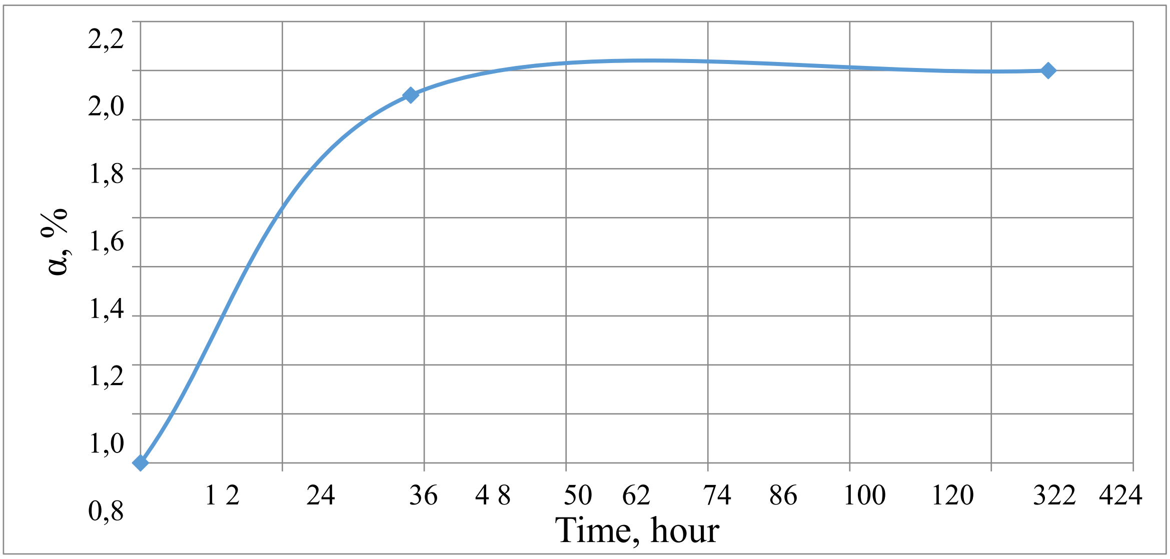

Figure.4 Solubility graph of the sample in nitric acid

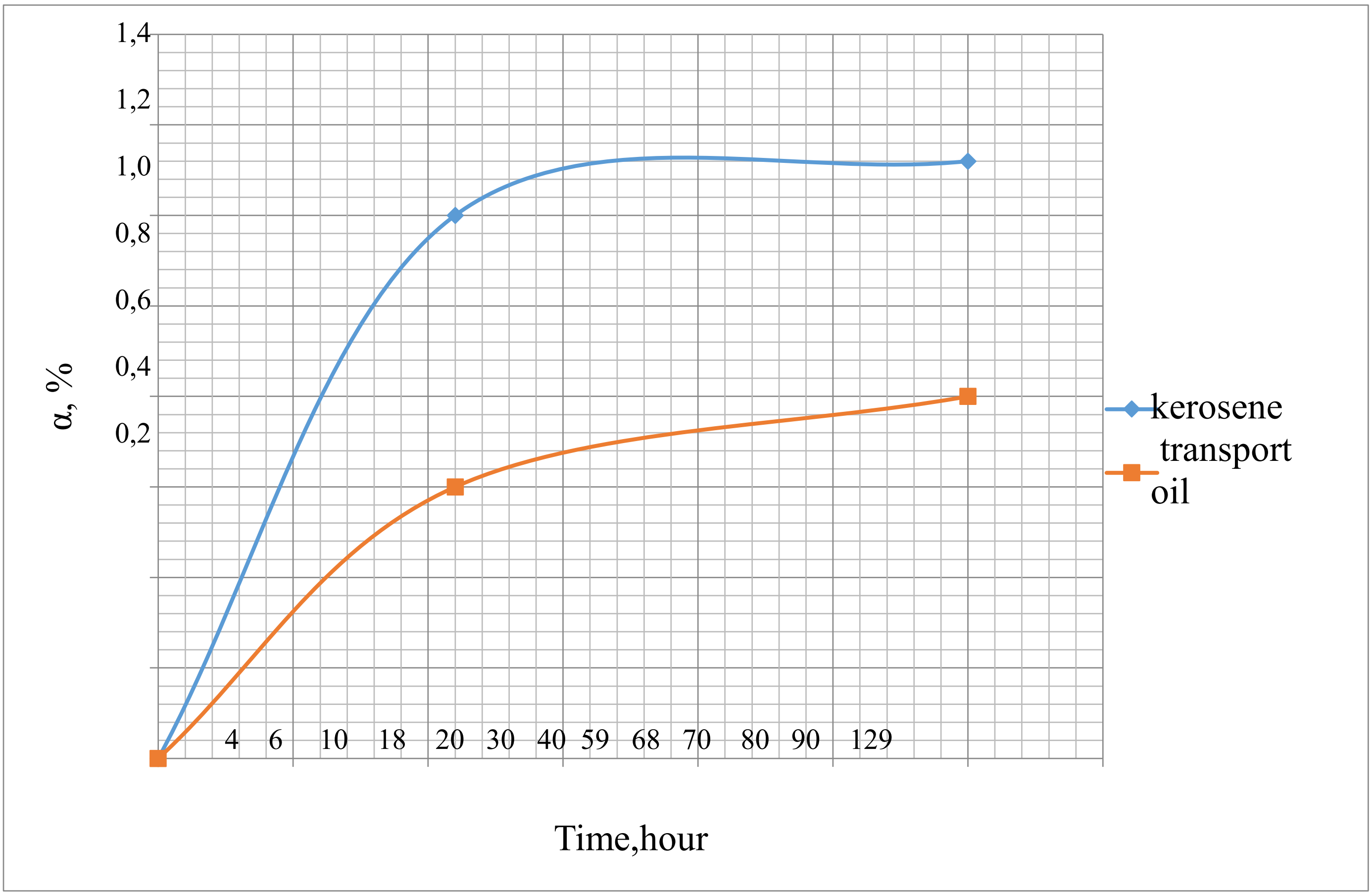

Figure.5. Solubility graph of the sample in kerosene and transformer oil

The report gave the following results

$\alpha 1 = \frac{4,33-3}{3} \cdot 100 = 0,19$ $\alpha 1 = \frac{4,33-4}{4} \cdot 100 = 0,825$

$\alpha 2 = \frac{5,44-3}{3} \cdot 100 = 0,57$ $\alpha 2 = \frac{5,44-4}{4} \cdot 100 = 0,365$

$\alpha 3 = \frac{6,41-3}{3} \cdot 100 = 0,85$ $\alpha 3 = \frac{6,41-4}{4} \cdot 100 = 0,6025$

$\alpha 4 = \frac{7,11-3}{3} \cdot 100 = 1,05$ $\alpha 4 = \frac{7,11-4}{4} \cdot 100 = 0,7775$

$\alpha 5 = \frac{8,19-3}{3} \cdot 100 = 1,08$ $\alpha 5 = \frac{8.19-4}{4} \cdot 100 = 1,0477$

RESULTS

1. In order to obtain rubbers resistant to oil, gasoline and aggressive environments based on butadiene-styrene rubber, an optimal recipe was prepared based on .-butadiene-styrene; A rubber mixture was prepared based on optimal recipes; The rubber mixture was vulcanized and the resistance of its vulcanizate to oil, gasoline and other aggressive environments was studied.

2. For the first time, we obtained a nanomaterial of wood resin and used it in the modification of butadiene-styrene rubber, thereby obtaining rubbers with high mechanical properties

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