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# RHEOLOGY OF 1,2- DICHLOROETHYL BENZENE / SKEPT-60 MIXTURES

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**Abstract**

Rheology was studied by obtaining binary mixtures based on 1,2-dichloroethyl benzene, taken as a polyfunctional alkylaromatic compound, and SKEPT-60 ethylene-propylene-diene (EPDM) elastomer as a high molecular compound. It has been found that the functional compound embedded in the elastomer can act in different ways depending on the amount and conditions in which it is incorporated. By adding 1,2-dichloroethyl benzene, the plasticization and construction of ethylene-propylene-diene elastomer can be carried out under the influence of different temperatures and loads. A two-roll mill was used to add 1,2 – dichloroethyl benzene to the polymer matrix. Double mixtures were obtained by the gradual addition of 1,2-dichloroethyl benzene to the elastomer in the temperature range of 30 – 50º C. The flow properties and rheology of the alloys of the binary mixtures obtained were investigated. The effects of processing conditions and 1,2-dichloroethyl benzene were determined by examining rheology. The rheology study allows to determine the optimal processing conditions, which is important for determining the method of obtaining higher quality mixtures. The effect of a functional compound such as 1,2-dichloroethyl benzene on SKEPT-60 was found to be significantly dependent on the applied voltage and temperature conditions.

**Keywords:** modification, functional combination, rheology, adhesion, functional rubber, modification of EPDM, EPDM compositions, SKEPT, 1,2 – dichloroethyl benzene, styrene dichloride, special – purpose polymers.

## 1. Introduction

With the development of industry, new requirements arise in which technical materials as well as polymer compositions play a role. The development of industry and research centers leads to the emergence of materials with new properties. Obtaining predetermined polymer compositions remains a topical issue. In order to determine the appropriate composition according to the expected properties and to determine the appropriate processing conditions for the composition to be obtained on the basis of this composition, the relevant issues as a scientific research subject should be resolved[1-5].

The purpose of obtaining new materials by mixing substances is undoubtedly to strengthen, combine and make them economically viable. The main targets are listed below.

• Improving the performance of polymeric materials by incorporating functional compounds

• Improve many properties of a material

• Obtaining materials that meet operational requirements

• Obtaining more environmentally friendly and long-lasting polymer materials

In order to obtain an ideal mixture, the physical and chemical properties of the compounds that make up the main component of the mixture should be well known. The most difficult task in the production of polymer compositions is to develop all the properties of the composition to be obtained.

To obtain binary and composite mixtures, the compounds must be mechanically or chemically added to the polymer matrix. With this approach, it is possible to obtain polymer-based materials that are much easier to synthesize than new, functional polymers. In chemical modification, a chemical reaction occurs and the chemical structure of polymers (elastomers) changes. For example, elastomers that are normally thermoplastic but contain alkenyl groups are subjected to the formation of sulfur, which significantly alters their properties. It is not available in a single polymer and can be obtained by changing any polymer property [6-8].

Elastomers are a type of polymer with high elasticity. They are widely used in the production of rubber-technical products that can be operated in a wide temperature range due to their very low glass temperature. Elastomeric materials produced for general and special purposes are also called rubber. Special purpose elastomers should have several properties. One of the rubbers that can be used for both general and special purposes is ethylene-propylene rubber[9,10].

There are different types and brands of propylene rubber. Ethylene - propylene rubber is an elastomer that can be vulcanized with sulfur in the presence of a third diene monomer. This elastomer, which has high resistance to temperature, environmental effects and ozone, is modified by adding various compounds due to its low viscosity and difficulty in adapting to other materials.

## 2. Experimental part

In this research study, 1,2 - dichloroethyl benzene SKEPT - 60 brand ethylene - ethylene - propylene - diene elastomer was investigated under different temperature conditions (100, 130, 150, 170º C) and different loads (11.75, 20.85, 26.1, 32.6 kg) , SKEPT-60 elas-

tomer brand-based compositions were investigated under this stress condition on their structural structure, various properties and properties.

Table 1

Binary mixtures were prepared by adding 1,2-dichloroethyl benzene to SKEPT-60 ethylene-propylene-diene elastomer using a two-roll mill in an amount of 2-8 mass portions.

| № | Code of mixture / Composition | 1R | 2R | 3R | 4R | 5R |
|---|---|---|---|---|---|---|
| 1 | SKEPT – 60 | 100 | 100 | 100 | 100 | 100 |
| 2 | 1,2 – dichloroethyl benzene | - | 2 | 4 | 6 | 8 |
| | Total | 100 | 102 | 104 | 106 | 108 |

The flow of the binary mixtures at the rates shown in the table above was examined in the IRT-5 device and the flow times of the binary mixtures through the 2 mm capillaries were determined under the above-mentioned loads and temperature conditions.

Based on these indicators, the volume consumption of alloys is calculated on the basis of the following formula for different loads and temperature conditions.

$$Q = \frac{S}{t} * \frac{\pi {D_s}^2}{4}$$

Here: Q - volume consumption of binary mixtures under different temperature conditions and suitable loads, $cm^3$/san.

S - the length at which the alloy flows, cm.

t - is time spent in flow, sec.

DS - the size of the diameter of the cylindrical chamber of the device, cm.

SKEPT - 60 / 1,2 - Optimum processing conditions can be determined by studying the rheological properties of dichloroethyl benzene mixtures at different temperatures and at different voltages. The selection of suitable conditions in extruders, pulleys, as well as injector systems has a significant impact on the composition and properties of the product to be obtained.

**3. Results and discussion**

The same amount of double mix samples is included in the viscometer to determine flow rates under standard voltages. The study found that at 100° C and 130° C, the volume consumption of the alloys increased as the amount of 1,2-dichloroethyl benzene in the binary mixture increased, and the volume consumption continued to increase dynamically as the voltage increased. This indicates that 1,2-dichloroethyl benzene in binary mixtures penetrates macromolecules and increases their mobility. In other words, at these temperature ranges of 2 - 8 mp (mass portion), the amount of 1,2 - dichloroethyl benzene acts as a plasticizer for SKEPT - 60. The volume consumption of binary mixtures containing 2 - 6 mp to 1,2 - dichloroethyl benzene under a load of 32.6 kg at 150° C increases with the amount of functional compound. However, unlike the previous conditions at 170° C, the dynamic increase deteriorates under all loads. The volume consumption of samples with 4 - 6 mp 1,2 - dichloroethyl benzene decreases sharply under all loads, even under a load of 26.1 kg The flow of binary mixtures with 6 mp 1,2 - dichloroethyl benzene stops due to the structure macrochains . 8 mp 1,2 - the presence of dichloroethyl benzene again increases the volume consumption, which is an indicator of the plasticizing effect of hyperfunctional compounds.

The graphs showing the dependence of the logarithmic value of volume consumption on the amount of 1,2 - dichloroethyl benzene are shown below.

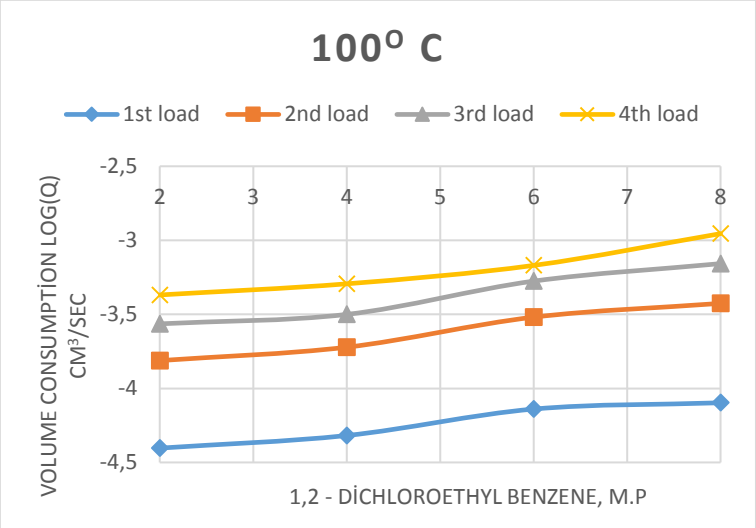


*Figure 1. Dependence of the logarithmic value of volume consumption at a temperature of 100° C on 1,2 - dichloroethyl benzene.*

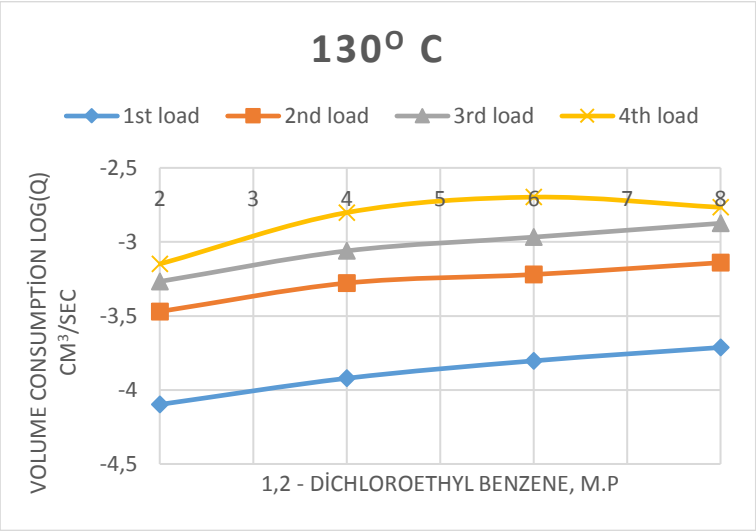


*Figure 2. Dependence of the logarithmic value of volume consumption at a temperature of 130° C on 1,2 - dichloroethyl benzene.*

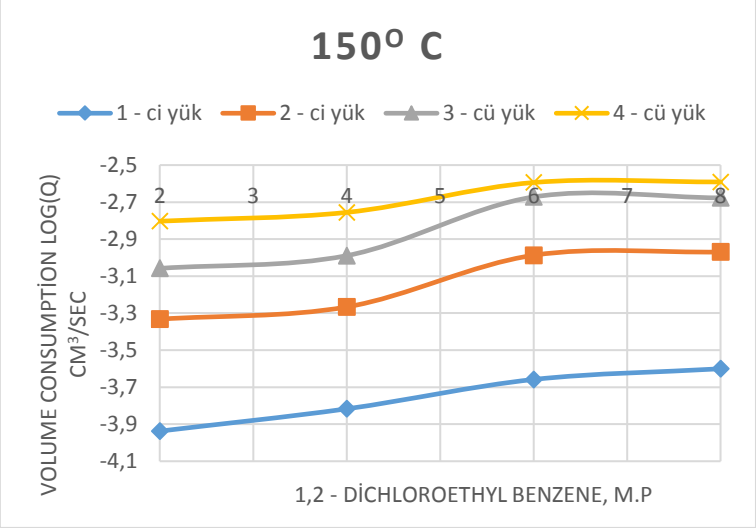


*Figure 3. Dependence of the logarithmic value of volume consumption at a temperature of 150° C on 1,2 - dichloroethyl benzene.*

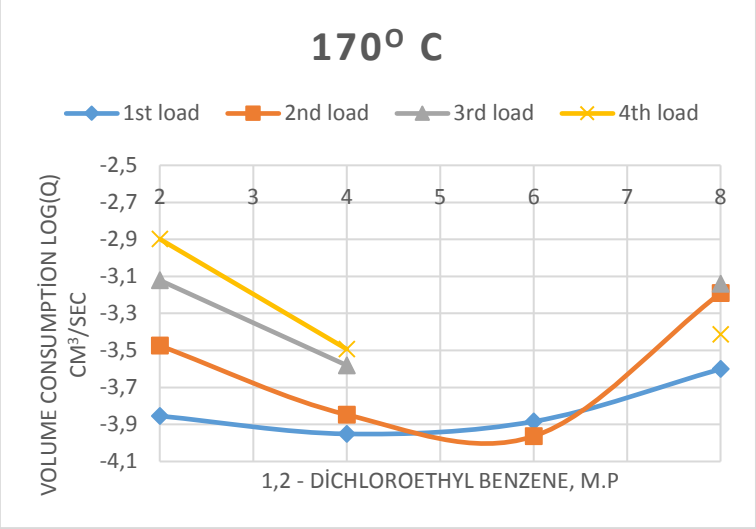


*Figure 4. Dependence of the logarithmic value of volume consumption at a temperature of 170° C on 1,2 - dichloroethyl benzene.*

It can be seen from the graphs that the production of SKEPT-60 ethylene-propylene-diene elastomer takes place under the influence of 1,2-dichloroethyl benzene at 170° C. Finally, it can be concluded that 1,2-dichloroethyl benzene amount should be taken to 4-6 m.p. and the mixtures should be processed at 150° C in order to obtain SKEPT-60 / 1,2-dichloroethyl benzene based compositions. Under these conditions, a polyfunctional alkylaromatic 1,2-dichloroethyl benzene and high molecular compound SKEPT-60 ethylene-propylene-diene elastomer can be processed to make a material that is durable and easily compatible with other materials.

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