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ECONOMIC AND ENVIRONMENTAL ASPECTS OF MODIFICATION OF ELASTOMERIC MATERIALS DURING OPERATION IN HOT CONDITIONS

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Abstract: In order to save imported multifunctional materials, local raw materials and waste products were used in this work – gossypol resin in place of dibutyl phthalate. The developed high-molecular antioxidant compares favorably with the low-molecular antioxidant neozone D in rubber mixtures. The usual antioxidant (imported) used for comparison (neozone D) is removed during extraction and migration, as a result of which the sample after aging turns out to be too fragile for testing. This in turn leads to a deterioration of the environmental situation.

Keywords: Elastomeric material, composition, raw materials, waste, antioxidant, stabilization, rubber compound.

Introduction.

Recently, for the economic and environmental development of the country, it is necessary to continue work on wider involvement in the economic turnover of local materials and industrial waste [1-4].

Depending on the purpose of the products in the specific conditions of their operation, it is necessary that composite elastomeric materials have a certain set of specified properties.

One of the most important features of elastomeric materials is their use in harsh climatic conditions.

The problem of stabilization of composite elastomeric materials is very relevant, since extending the service life of products made of them is equivalent to increasing their production in a hot climate, where they are operated under conditions of intense exposure to solar radiation, heat and other climatic factors.

Despite the large number of works on the destruction of composite elastomeric materials, there are still many unresolved issues in this area.

Therefore, the purpose of this study is to study the economic and environmental aspects of the modification of elastomeric materials during operation in hot conditions.

Objects and methods of research. For the study, we used rubber mixtures based on SKI-3 and SKMS-30 ARKM-15 rubbers. As a stabilizer, a polymer

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antioxidant is polythiobenztiazole methacrylate (PTBTM). The waste of fat-and-oil production, gossypol resin (GS), was used as a plasticizer.

Pol and thiobenztiazole methacrylate were synthesized according to method [5].

The influence of polythiobenzthiazole methacrylate on the thermal stability and on the physico-mechanical properties of the rubber mixture has been investigated.

Vulcanization was carried out at a temperature of 416 K for 0,5 hours, thermal aging at a temperature of 372 K for 24 hours.

The results obtained and their discussion.

A study of the physico-mechanical properties of vulcanizates showed that the introduction of poly thiobenztiazole methacrylate increases resistance to thermal aging (Table 1).

High-molecular compounds containing antioxidant compounds in the main chain of the macromolecule are widely used in production to produce various polymer materials with high thermal stability, as well as improved physical, mechanical and operational properties.

Table 1

Physico-mechanical properties of modified vulcanizates based on SKI-3 and SKMS-30 ARKM-15 rubbers

Indicators	Standard	Modified
Tensile strength, MPa	12,6	15,2
Relative elongation, %	417	452
Residual elongation, %	22	18

A serious disadvantage of conventional antioxidants is that they are lost from the composite matrix either during solvent extraction or due to volatility, which leads to an increase in the rate of destruction and an increase in the fragility of the composition [6]. This disadvantage can be overcome by the use of high-molecular antioxidants. In this regard, the conduct of vulcanizates under the influence of solvents, as well as the constant effect of antioxidants under these conditions, has been investigated.

An azeotropic mixture of methanol-acetone-chloroform (28:35:29 ml, boiling point 330,5 K) was used as an extraction solvent.

The results shown in Table 2 show that vulcanizate stabilized with polythiobenzthiazole methacrylate and subjected to solvent extraction retains largely physical properties after aging at a temperature of 373 K for 24 hours.

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Conclusion.

Thus, in order to protect the environment and conserve resources, the disposal of household waste is one of the most important problems of modern civilization. The most promising solution to this problem is the creation of new low-waste technologies for the production of various household and industrial materials using recycled raw materials. There are significant achievements in the field of utilization of gossypol resin, but, despite this, it is necessary to search and develop new directions for the use of gossypol resin waste in various industries.

Table 2

Non-migrating and common antioxidant in vulcanized rubbers SKI-3 and SKMS-30 ARKM-15

Indicators	Non-extracted		Extracted	
	initial	after aging	initial	after aging
Stabilization with neozon D				
Tensile strength, MPa	13,0	9,3	8,3	Too fragile
Relative elongation, %	420	354	300	Fragile
Residual elongation, %	22	24	24	Fragile for testing
Stabilization with polythiobenzthiazolmethacrylate				
Tensile strength, MPa	14,0	13,2	12,0	
Relative elongation, %	487	476	400	350
Residual elongation, %	20	18	12	12

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