PHYSICAL AND CHEMICAL CHARACTERISTICS OF THE CARBON MATERIAL OBTAINED BY THE PYROLYSIS OF RUBBER-TECHNICAL PRODUCTS

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Abstract: *the paper presents the results of a study of the physicochemical characteristics of carbon black obtained by pyrolysis of worn automobile tires. Determined are bulk density, ash content, pH, moisture mass fraction and particle size distribution of ground carbon black. It has been established that a decrease in the particle size of carbon black leads to an increase in bulk density, acidity, humidity and practically does not affect the ash content. According to the results of thermal analysis, the temperature range of the decomposition of carbon black residues in the range of 150-900^0 C is determined.*
Keywords: *carbon black, bulk density, ash content, used car tires, anchor, pyrolysis.*

ФИЗИКО-ХИМИЧЕСКИЕ ХАРАКТЕРИСТИКИ УГЛЕРОДИСТОГО МАТЕРИАЛА, ПОЛУЧЕННОГО ПИРОЛИЗОМ РЕЗИНО-ТЕХНИЧЕСКИХ ИЗДЕЛИЙ

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Аннотация: *в работе приводятся результаты исследования физико-химических характеристик технического углерода, полученного пиролизом изношенных автомобильных шин. Определены: насыпная плотность, зольность, pH, массовая доля влаги и гранулометрический состав измельченного технического углерода. Установлено, что уменьшение размера частиц технического углерода приводит к увеличению насыпной плотности, кислотности, влажности и практически не влияет на зольность. По результатам термического анализа определен температурный диапазон разложения остатков технического углерода в диапазоне 150 - 900 ^{0}C.*
Ключевые слова: *технического углерода, насыпная плотность, зольность, изношенных автомобильных шин, анкерита, пиролиз.*

The number of motor transport complexes is increasing annually in the world, which, naturally, leads to the formation of used tire dumps. According to statistics from the European Association, tire recycling in Europe produces more than 9 million tons of shock-absorbed car tires. In the USA, the amount of used tires is about 1.5 million tons, in the UK almost 500 thousand tons of used tires are formed annually, of which 34% is recycled, 26% is recovered, 15% is burnt and 6% is transported to landfills burial places. About 96 million used tires are formed in Japan, 88.5% of them are processed, more than 400 thousand tons in France, 460-510 thousand tons in Germany, and more than 1 million tons of used tires are formed in Russia, of which it is processed no more than 10%. According to statistics in our republic, about 1.0 thousand tons of used tires are accumulated annually in NMMC alone (2018 y.) [1-3].

Among the existing methods for the disposal of used car tires, the best method is thermal decomposition - pyrolysis.

The use of waste-obsolete tires as a raw material base is relevant both from an economic and environmental point of view. Car tire is a valuable secondary raw material containing rubber - 65-70%, carbon material -15-25%, metal cord- 10-15%. Among these products, carbon materials are of great importance. Therefore, the physicochemical characteristics of this product have been studied in detail [4, 5].

The microscopic analysis of carbon material was studied. It was determined that the carbonaceous material is a relatively fragile, lumpy black with a grayish

tint, an unpleasant odor substance, in some pieces of which there are metallic inclusions. Before use, the carbonaceous material was crushed by a lab 600 CV 600 laboratory jaw crusher. The particle size distribution of the ground carbon material was determined. It was found that particles of carbon material in a fraction with a size of 0.063 mm, which is 63.0% of the total content of particles, particles with a size of 0.25 mm is 24.0 mass %. Also, particles with a size of 0.5 mm make up about 9.0 mass %.

The use of a carbon material having ground metallic inclusions as a filler of rubber products adversely affects the quality of rubber products. Magnetic separation is used to extract these metallic inclusions.

The physicochemical characteristics of the carbon material of the initial (before grinding UM-1) and ground (UM-2) are studied are presented in Table 1

Table 1. Physico-chemical characteristics of the carbon material of the source (before grinding UM-1) and ground (UM-2)

Specifications	$\rho_н$, g/sm^3	pH	A^d, %	W^a, %
UM-1	0,408 ± 0,02	6,5-5,4	22,70 ± 0,44	0,40 ± 0,05
UM-2	0,323 ± 0,02	6,5	22,65 ± 0,44	0,24 ± 0,05

An analysis of the results of the study (Table 1) shows that a decrease in the particle size of the carbon material leads to an increase in bulk density, acidity, moisture and practically does not affect the ash content.

The composition of the carbon material was also studied by x-ray phase analysis. It is established that an analysis of the results of the research according to the Rietveld method shows that the carbon material consists mainly of amorphous carbon (88.4%), calcite (7.59%), ankerite (1.21%), zinc oxide (1.14%) and other components.

The thermal stability of carbon black was also studied by derivatography. Thermal analysis of the samples was carried out on a Labsys evo SETARAM TG DTA DSC + 1600 instrument in the temperature range 30–950 ° C with a heating rate of 5 deg/min.

It was determined that the DTGA curve consists mainly of two sigmoid cells, which the process occurs in two stages. The first stage occurs in the temperature range from 150 °C to 640 °C, while the mass loss is 3.46%.

The second stage takes place in the temperature range from 650 °C to 900 °C, while the mass loss is 15.7%. Analysis of the TGP curve shows that the rate of decomposition of carbon black in the temperature range 800-880 °C is maximal and amounts to 1.88 mg / min.

The structure of carbon black obtained by the pyrolysis of worn automobile tires was also studied by the IR spectroscopic method. It is established that the

structure of the carbon material formed after the pyrolysis of worn automobile tires.

Thus, the obtained carbon-containing material according to physico-chemical characteristics can be recommended for obtaining filled elastomeric compositions.

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