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IMPROVING THE AUTOMATED CONTROL SYSTEM FOR RUBBER HEAT TREATMENT

The problem of environmental pollution is becoming more and more acute every day. Since the decomposition period of many products far exceeds their useful life, and recycling methods are still underdeveloped, this issue remains relevant. In addition, there is a limited supply of exhaustible resources, so in addition to disposal, the issue of recycling and reuse of waste is even more pressing. One of the most common types of waste is rubber waste. According to research, most of the waste rubber is made up of worn-out tires. Tire recycling is a global problem that is growing as the vehicle fleet grows. It is estimated that the annual global production of tires is about 1.5 billion units, which amounts to about 17 million tons of worn tires [1], and the rate of production continues to increase as demand for tires in countries is growing rapidly. Tires must be properly disposed of to reduce their environmental impact; however, most of the time, disposal is by incineration, which is the fastest and easiest disposal procedure. Incineration of tires produces a large number of emissions, including a wide range of hydrocarbons. It also produces liquid waste containing toxic chemicals and heavy metal compounds that can cause adverse health effects [2]. Based on this, various ways of handling rubber waste have been analyzed in recent years. The most common of which are landfilling, reuse as an energy source, regeneration and processing to obtain useful substances. According to research by the European

Tyre and Rubber Manufacturers Association, the latter method is gaining popularity [3].

Thus, the aim of the research is to improve the automated control system for rubber thermal processing.

In order to improve the processing process, it is necessary to use a comprehensive process control system. For this purpose, the development of an automated plant control system was carried out. At the early stages of work, a functional automation scheme was developed. It made it possible to identify significant technological solutions for the presented plant. After that, the selection of technical means for the implementation of the ACS was carried out. At this stage of work, it was decided to give preference to foreign control and measuring devices. The next step was to develop and implement a SCADA system. This made it possible to understand the specifics of the process more accurately, and even more accurately monitor the operating parameters.

When analyzing the gas-phase combustion products (CO , CO_2 , NO_x , and SO_2) for samples of liquid hydrocarbons obtained as a result of steam gasification of worn-out automobile tires, in contrast to oil fuel oil, lower values of the concentration maximums of the release of these gas-phase compounds were recorded. This is mainly due to the different elemental composition of the groups of the studied samples, as well as the difference in the kinetics of their combustion process.

The paper presents a comparative analysis of the technical characteristics and combustion process of single drops of liquid hydrocarbons obtained by the method of steam gasification of worn-out automobile tires with traditional liquid energy fuel - oil fuel oil.

Based on the results of determining the characteristics and composition of the studied samples of liquid hydrocarbons, it can be concluded that the fuels obtained as a result of steam gasification of worn-out automobile tires, in comparison with oil fuel oil, are characterized by comparable calorific value, lower density,

viscosity, and sulfur content, which indicates the possibility of their use as boiler fuel. When single drops of the investigated liquid hydrocarbon samples were ignited at a heating medium temperature of up to 700 °C, it was found that at T = 450 °C, the ignition delay time of the samples compared to petroleum fuel oil was on average 15 % higher. With an increase in the temperature of the heating medium to 700 °C, the ignition delay time of all the samples under consideration decreases exponentially. At the same time, in the temperature range of 550 - 700 °C, the ignition of liquid hydrocarbon samples, unlike oil fuel oil, is faster by an average of 56 %.

Thus, steam gasification can be considered as an effective method of recycling worn-out tires to produce liquid hydrocarbon fuel that can be used as boiler fuel.

References:

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