THE INVESTIGATION OF CHARACTERISTICS OF OIL-CONTAINING COMPOSITES BASED ON BIRCH PHLOEM

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One of the main types of raw materials for forest production is birch. It is widespread in the northern hemisphere, especially in Eurasia, and occupies a significant part of forest areas in countries with a temperate climate, such as Russia, Finland, Sweden, and others. Birch phloem is the inner part of the bark. It constitutes a small proportion of the total mass of the tree (8,6 %), but it has limited application.

The purpose of the work is to study the parameters of the thermal decomposition of pellets as an alternative energy source based on birch phloem and its composites included oil-containing waste. Such analysis allows us to identify prospects and difficulties in using pellets as fuels. In addition, this is relevant and interesting for the purpose of developing model representations of the behavior of multifuel systems to describe the processes of combustion, gasification, and pyrolysis of organic solid-phase fuels, as well as for a deeper understanding of the conditions for forming and conversion of biofuels.

The objects of study in this work are fuel pellets based on birch phloem and its composites with the addition of oil-containing waste (OCW). The development and implementation of new methods and technologies for the disposal and processing of oil waste is an important task of modern science and industry contributing to sustainable development and environmental preservation. Since oil waste is a complex and danger class of materials that may contain a mixture of heavy hydrocarbons, metals, sulfur, and other impurities, it requires a careful and individual approach to disposal and processing. In this regard, as part of the work, the change in the thermophysical characteristics of pellets with the addition of OCW was studied with the prospect of using a new approach for recycling materials by forming composite energy fuels.

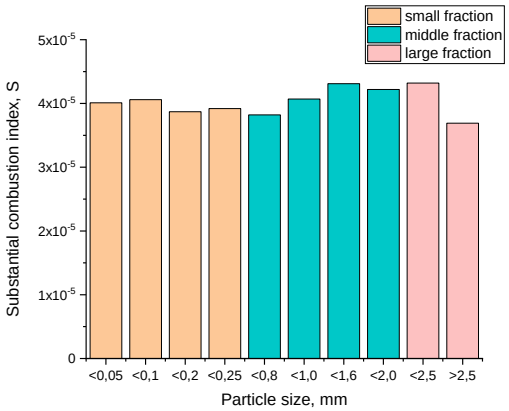

Fig.1. The substantial combustion index estimated for birch phloem-based pellets with the same ratio of phloem/OCW components in dependence on particle size fraction.

The characteristic temperature ranges of thermal decomposition of the materials from which pellets formed were identified. The rates of mass loss and activation energy at the main stages of thermal decomposition were evaluated. And the combustion indices of composites were determined (fig.1). By evaluating activation energies for each stage of sample decomposition, the limiting influence of certain stages of the thermal destruction process was established.

Evaluation of combustion indices made it possible to identify trends in their dependence on the fractional composition of the biomaterial. Based on the analysis of the calculated complex combustion indices, it was established that the studied pellets with the composite composition OCW:phloem = 1:3 generally have good combustion characteristics (regardless of the fractional composition), which makes them suitable for use as solid fuel. However, it was revealed that the fraction of pellets larger than 2.5 mm tends to incomplete burnout and sintering during the combustion process.

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