THERMAL OXIDATION OF COMPOSITE FUEL PELLETS WITH CARDBOARD AND LIGNITE ADDITIVES

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Abstract: The article presents the results of an experimental study of thermal oxidation characteristics of composite fuel pellets based on sawdust, cardboard, and lignite. The thermal oxidation characteristics were determined using a METTLER-TOLEDO TGA/DSC 3+ thermogravimetric analyzer. It was found that an increase in the proportion of cardboard in the pellet composition led to an increase in the maximum rate of weight loss of the studied samples. It was shown that the use of lignite and cardboard additives leads to a decrease in the activation energy of thermal oxidation of composite fuel pellets. Compared to pellets without additives, the use of cardboard in the composition of pelletized fuels leads to a decrease in the average activation energy by up to 36% with the addition of cardboard and 74% with the addition of lignite.

Keywords: pelletized fuels; activation energy; heating rate; thermogravimetry

DOI: 10.30826/CE25180309 **EDN:** DUJEMI

Figure Captions

Figure 1 Thermogravimetric (left column) and differential thermogravimetric (right column) curves of the studied fuel pellets: *1* — sawdust 100%; *2* — sawdust 90%, cardboard 10%; *3* — sawdust 70%, cardboard 30%; *4* — sawdust 90%, lignite B2 10%; and *5* — sawdust 70%, lignite B2 30%

Figure 2 Thermogravimetric (left column) and differential thermogravimetric (right column) curves of the studied fuel pellets at different heating rates (*1* — 10 °C/min; *2* — 20; and *3* — 30 °C/min): (*a*) sawdust 70%, cardboard 30%; and (*b*) sawdust 70%, lignite B2 40%

Figure 3 Average activation energy (*a*) and the value of activation energy at different degrees of conversion (*b*) of the studied fuel pellets: *1* — sawdust 100%; *2* — sawdust 90%, cardboard 10%; *3* — sawdust 70%, cardboard 30%; *4* — sawdust 90%, lignite B2 10%; and *5* — sawdust 70%, lignite B2 30%

Table Captions

Table 1 Proximate and ultimate analyses of fuel components

Table 2 Composition of the raw materials used [21,22]

Table 3 Characteristics of thermal decomposition of the studied fuel pellets

Table 4 Average activation energies and preexponential factors of thermal oxidation of the studied fuel pellets

Acknowledgments

The study was carried out with financial support from the Russian Science Foundation (grant No. 23-79-10098).

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Received November 27, 2024
After revision May 12, 2025
Accepted May 12, 2025

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