Pyrolysis of mixed and slurry fuels

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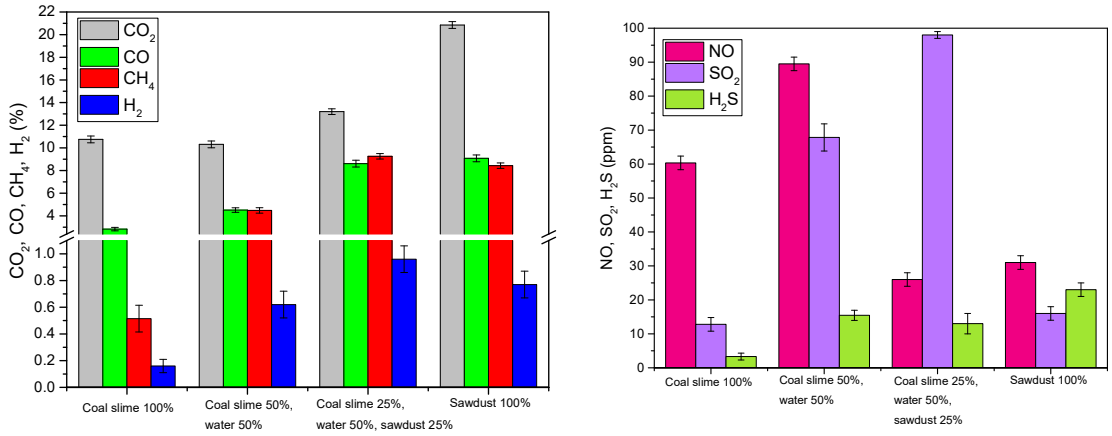
Gasification and pyrolysis are environmentally promising waste treatment technologies, as they produce less pollution in comparison with combustion, in particular, by SO_x and NO_x emission. Currently, a significant number of studies have been carried out on pyrolysis and gasification of conventional energy sources such as coal and biomass. However, the methods of thermal conversion of mixed waste-derived fuels to obtain fuel gas and other valuable pyrolysis products (char, oil) are less studied. This research presents the results of experimental studies on the pyrolysis of mixed and slurry fuels prepared based on wastes of different origins.

Typical biomass (sawdust), coal processing wastes (coal slime) and mixtures based on them were considered as fuel components. The experimental setup included sealed electric furnace (temperature range 20–700 °C), control unit (regulator), gas analyzing system Test 1 («Boner», Novosibirsk), personal computer and service equipment (holders, scales and others).

Fig. 1 shows the concentrations of gas components during the pyrolysis process of biomass, coal slime in dry and wet state and their mixture (coal slime 25 wt%, sawdust 25 wt%, water 50 wt%).



(*a*) (*b*)

Fig. 1. Average values of gas concentrations during fuels pyrolysis: (*a*) CO_2, CH_4, CO, H_2; (*b*) NO, SO_2, H_2S

According to the obtained data (Fig. 1), the pyrolysis of the coal slime 50 wt%, water 50 wt% intensified the gas output in comparison with the coal slime 100 wt% in dry state. The water in slurries promoted an increase in the gas yield. At fast heating, water reacted with volatiles or coal, contributing to the formation of additional gaseous products. The concentration of CO, H_2 и CH_4, increased by 33%, 89% and 75%, respectively. The water promoted the water gas shift reaction. However, it was found that when replacing 25% of the coal slime with sawdust, it is possible to additionally increase the concentration of combustible gases up to 2 times. Pyrolysis of sawdust in its pure form was also characterized by high concentrations of combustible gases, but CO_2 emissions were 1.5 times higher than the established values for coal slime 25 wt%, sawdust 25 wt%, water 50 wt%. This allows us to conclude about the efficiency of utilization of industrial wastes and biomass in the composition of mixed and slurry fuels their pyrolysis.

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