INFLUENCE OF THE ENVIRONMENT AND METHOD OF SUPPLYING MIXED FUEL ON THE COMPOSITION OF FLUE GAS DURING COMBUSTION

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Abstract: The article presents the results of experimental studies on the effect of the environment and the method of feeding mixed fuel on the composition of the flue gas during combustion. Grade D coal was the base component in the mixtures. Water, waste motor oil, and sawdust were added to the coal. The high-temperature environment in which the fuel was burned was enriched with water vapor or flue gases obtained during the thermal decomposition of coal. It was found that when burning the fuel components in a mixed form, the concentrations of NO and SO_2 in the flue gas decrease by 25%–50%. The effect of the environment on the component composition of the flue gas was determined. Using water vapor and flue gases as an environment modifier led to a 1.5- to 2-fold decrease in the concentrations of flue gas components. Technological solutions for using mixed fuels in boiler units to reduce anthropogenic impact are proposed.

Keywords: anthropogenic emissions; water steam; flue gas; coal; combustion; composite fuel

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Figure Captions

Figure 1 Experimental setup

Figure 2 Trends in the concentration changes of anthropogenic emissions for fuel compositions burned with separate supply of components: (*a*) 90% coal and 10% used motor oil; (*b*) 90% coal and 10% sawdust; and (*c*) 60% coal and 40% water

Figure 3 Average concentrations of flue gas components (air temperature 1000 °C) during thermochemical conversion of coal-based fuels: (*a*) with addition of water; (*b*) with addition of waste motor oil; (*c*) with addition of sawdust; *1* — 100% coal; *2* and *3* — 60% coal and 40% water (*2* — unmixed and *3* — mixed fuel); *4* and *5* — 90% coal and 10% motor oil (*4* — unmixed and *5* — mixed fuel); *6* and *7* — 90% coal and 10% sawdust (*6* — unmixed and *7* — mixed fuel)

Figure 4 Average concentrations of flue gas components generated during the heating of coal-based fuels with varying oxidation environments: (*a*) 100% coal; (*b*) coal–water slurry (60% coal and 40% water); (*c*) mixed fuel with the addition of motor oil (90% coal and 10% motor oil); and (*d*) mixed fuel with the addition of sawdust (90% coal and 10% sawdust); *1* — air; *2* — air and water vapor; and *3* — air and flue gas

Figure 5 Technological schemes for changing the oxidative environment in the boiler during thermochemical conversion of mixed fuels and their components: (*a*) supply of premixed components to the combustion chamber; and (*b*) supply of components to the combustion chamber in an unmixed form

Table Captions

Table 1 Properties of the solid components of mixed fuels

Table 2 Properties of used motor oil

Table 3 Characteristics of the Test-1 gas analyzer

Table 4 The CO_2/CO values when varying the method of supplying mixed fuel components into the combustion chamber

Table 5 The CO_2/CO ratio of the studied fuel mixtures when varying the composition of the gas medium

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