

6th International Conference on

GREEN ENERGY AND EXPO

August 29-31, 2018 | Toronto, Canada

Energy, environmental and economic prospects of waste derived composite fuels combustion in a form of slurry and granulate

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A lot of industrial waste is generated annually throughout the world. The extractive and processing industries are traditional leaders in the field of waste generation. According to the minimum estimates, several hundred million tons of coal processing and refining wastes are generated every year in the world. More than 2 billion tons of these wastes have already been accumulated. An important global goal is the effective, large-scale and safe recycling of industrial wastes. One of the ways to achieve this goal is to develop useful technologies of combustion of industrial wastes as composite fuels. Fuels prepared on the basis of coal processing waste, rapeseed oil, used turbine oil were considered in the study. We tested three forms of waste derived fuels: slurry, dried slurry (after storage) and granulate. Energy, environmental, economic aspects of the use of these fuels were under study. We determined the time and temperature parameters of ignition and combustion of the tested fuels using a laboratory muffle furnace (at 350–1000°C). The concentrations of dangerous sulfur and nitrogen oxides, contained in combustion products, were also measured. It was established that the granulated fuels have minimum ignition temperatures and ignition delay times (50-80% lower than for the slurry and dried slurry). However, the combustion of waste derived slurries is characterized by minimum concentrations of NO_x and SO_x (by 18-75% lower than in the granulated state). Taking into account the cost, we calculated the efficiency of the tested fuel's combustion in comparison with traditional coal. According to the integral relative parameters, the use of waste derived slurries is most attractive. The results of the research can be used in the thermal engineering to develop efficient (by energy, environmental and economic indicators) heat and power generation technologies for the combustion of composite fuels derived from industrial waste.

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