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Abstract

To control pollutant emissions from the combustion of both domestic stoves and small-capacity industrial boilers, an artificial solid fuel called biobriquette has been developed. It is manufactured from a mixture of coal, biomass (sawdust), and desulfurizer under a high compression pressure. In this study, the combustion experiments were performed to elucidate the ignition and combustion characteristics of biobriquette. Comparisons were made between coal briquettes and biobriquettes for their combustion efficiencies and pollutant emissions in existing domestic stoves. Byproduct in the gas welding industry was used as a new desulfurizer in the biobriquette, and its desulfurization characteristics were studied. The experimental result shows that the biobriquette has a lower ignition temperature and a higher combustion efficiency than the coal briquette. The new desulfurizer was found to be more effective in desulfurization than the other two desulfurizers, limestone and scallop shell. It is also found that the biobriquette combustion in domestic stoves gives lower CO2 emission than the normal coal briquette. The developed biobriquette provides a simple, economical, and efficient way for coal utilization and pollutant control in some developing countries.

Notes

Research Notes

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Figure

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Kim, Heejoon
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2006
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Combustion Characteristics and Pollutant Control by Eco-fuel from Polyurethane Foam
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Abstract
Around the world, thousands of tons of polyurethane (PU) foam waste accumulate in municipal dumps from sources such as car disposal industries. Due to its low density and high volume, polyurethane foam waste is difficult to treat and dispose of in landfill. In this study, we developed a novel and environmentally friendly disposal method for PU waste by mixing it with coal to produce a new composite fuel called Eco-fuel. Eco-fuel is made by briquetting a mixture of PU with coal (10:90 by weight) under high pressure. The combustion characteristics and emission gases of Eco-fuel were compared with those of biobriquette (a 20:80, by weight, briquette of biomass and coal). The combustion characteristics of Eco-fuel briquette fuel were improved with the addition of PU foam. Although PU has a higher nitrogen content (6 wt %) compared to biomass (1.4 wt %) and coal (1 wt %), the emission of NOx from the combustion of Eco-fuel did not increase. We discovered that the combustion of PU results in the conversion of nitrogen to NH3, and then NH3 reacts with NOx to neutralize to N2.
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Abstract

A new kind of biobriquette, with scallop shell as desulfurizer, was developed in this study, and its self-desulfurization behavior was studied by combustion experiments. For comparison and further understanding on the self-desulfurization characteristics, the biobriquettes with Tsukumi limestone and calcium hydroxide as desulfurizers were also investigated experimentally. The influence of the furnace temperature, types of coal and desulfurizer, and structure of added desulfurizer on the behavior of desulfurization was elucidated by measuring the time concentration history of SO2 emission in combustion flue gas and calculating the desulfurization efficiency. The desulfurization efficiency was not sensitive to the temperature in the range 9731173 K. However, the efficiency was strongly affected by coal type, and it changed from about 25 to 67% for the eight tested types of coals under the same experiment conditions. The desulfurization efficiency has been found to also be a function of the calcination temperature of desulfurizer. On the basis of experimental results, a shrinking-core reaction model was used to simulate the desulfurization process during the char combustion of biobriquette by a finite volume numerical method. The calculated results generally agreed with the experimental results. Finally, an improvement on the biobriquette structure, namely dual layered biobriquette, was proposed and tested in order to improve the desulfurization efficiency.

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