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Oxygen Enriched Co-Combustion of Sub-Bituminous Coal/Biomass Waste Fuel Blends

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Abstract : Computational Fluid Dynamic analysis of co-combustion of coal/biomass waste fuel blends is presented in this study. The main objective of this study is to investigate the effects of biomass portions (0%, 10%, 20%, 30%: weight percent) blended with coal and oxygen concentrations (21% for air, 35%, 50%, 75% and 100 % for pure oxygen) on the combustion performance and emissions. The goal is to reduce the air emissions from power plants coal combustion. Sub-bituminous Nigerian coal with calorific value of 32.51 MJ/kg and sawdust (biomass) with calorific value of 16.68 MJ/kg is used in this study. Coal/Biomass fuel blends co-combustion is modeled using mixture fraction/pdf approach for non-premixed combustion and Discrete Phase Modeling (DPM) to predict the trajectories and the heat/mass transfer of the fuel blend particles. The results show the effects of oxygen concentrations and biomass portions in the coal/biomass fuel blends on the gas and particles temperatures, the flow field, the devolitization and burnout rates inside the combustor and the CO2 and NOX emissions at the exit from the combustor. The results obtained in the course of this study show the benefits of enriching combustion air with oxygen and blending biomass waste with coal for reducing the harmful emissions from coal power plants.

Keywords : co-combustion, coal, biomass, fuel blends, CFD, air emissions
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