Gasification and modeling of coal/biomass in a dual circulating fluidized bed reactor

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The effects of reaction temperature (750-900℃), steam/fuel ratio (0.5-0.8) on coal and biomass gasification characteristics have been determined in a dual circulating fluidized bed reactor (combustor, 0.04 m × 0.11 m × 4.5 m high; gasifier, 0.04 m × 0.285 m × 2.13 m high). Indonesian Tinto sub-bituminous coal and Quercus acutissima sawdust were used as the coal and biomass, respectively. A three-stage steady state model (TSM) was applied for coal and biomass gasification in a dual circulating fluidized bed reactor to calculate the product gas composition, gas yield, carbon conversion, calorific value, and cold gas efficiency.
Using TSM incorporating empirical model, the product gas composition, gas yield, carbon conversion, calorific value, and cold gas efficiency of coal and biomass shows good agreement with experimental data. The solid circulation rate was also calculated based on the heat and mass balance of gaisifer and combustor. The product gas yield, carbon conversion, and cold gas efficiency from gasification of biomass are higher than those of coal with increasing temperature and steam/fuel ratio. The model can be used to study and optimize the operation of dual circulating fluidized bed gasifier.