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Multifluid Computational Fluid Dynamics Simulation for Sawdust Gasification inside an Industrial Scale Fluidized Bed Gasifier

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Abstract : For the correct prediction of thermal and hydraulic performance (bed voidage, suspension density, pressure drop, heat transfer, and combustion kinetics), one should incorporate the correct parameters in the computational fluid dynamics simulation of a fluidized bed gasifier. Scarcity of fossil fuels, and to fulfill the energy demand of the increasing population, researchers need to shift their attention to the alternative to fossil fuels. The current research work focuses on hydrodynamics behavior and gasification of sawdust inside a 2D industrial scale FBG using the Eulerian-Eulerian multifluid model. The present numerical model is validated with experimental data. Further, this model extended for the prediction of gasification characteristics of sawdust by incorporating eight heterogeneous moisture release, volatile cracking, tar cracking, tar oxidation, char combustion, CO_2 gasification, steam gasification, methanation reaction, and five homogeneous oxidation of CO, CH_4, H_2, forward and backward water gas shift (WGS) reactions. In the result section, composition of gasification products is analyzed, along with the hydrodynamics of sawdust and sand phase, heat transfer between the gas, sand and sawdust, reaction rates of different homogeneous and heterogeneous reactions is being analyzed along the height of the domain.

Keywords : devolatilization, Eulerian-Eulerian, fluidized bed gasifier, mathematical modelling, sawdust gasification
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