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Effects of variable feedstock particle size on Birchwood gasification: A CFD approach

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Gasification is a complex process and determining gasification characteristics experimentally is a time-consuming process. Using CFD models to predict and examine about gasification characteristics, in the various scenario can be time saving and safe. This paper primarily discusses the results of a CFD model, which simulates gasification characteristics of Birchwood. During the work, a variation of producer gas yield, syngas composition and cold gas efficiency of the syngas were investigated with a variable biomass particle size. A 3D CFD model of a fixed bed downdraft gasifier has been developed. Euler –Euler approach has been used to model the gas phase reactions while Lagrangian approach has been used to model the solid- gas reactions. For the simulations, biomass (Birchwood) particles with two different diameter sizes were used. They were 11.5 mm and 9.18 mm. In this work, gasification parameters were examined within the equivalence ratio (ER) range from 0.2 to 0.5. The simulated results were validated using the actual fixed bed downdraft gasifier available at UIA, Norway. CO, CO_2, CH_4 and H_2 mass fractions of the syngas were measured along with the calculated values of syngas yield and cold gas efficiency (CGE). With the 9.18 mm diameter birchwood particle, CGE has shown an average maximum value of 59.4% at the ER value of 0.5, which is a 4% improvement over the 11.5 mm diameter biomass particle. In addition, Syngas yield has also shown an average maximum value of 2.8 Nm3/h with the 9.18 mm wood particle, which is an improvement of 0.1 Nm3/h over the 11.5 mm biomass particle.

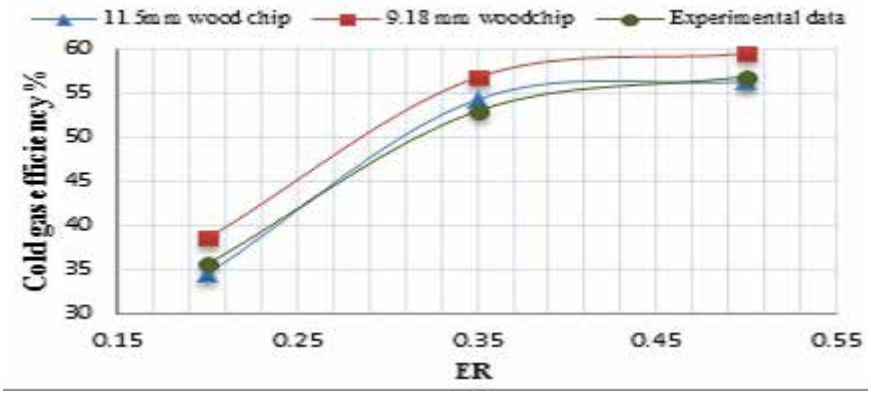

Figure 1: Variation of CGE as an effect of biomass particle size

Biography

Souman Rudra is currently working at the University of Agder, Norway as an Associate Professor since 2013. He conducts research and teaching within renewable energy technology - related to biomass conversion process and thermal energy systems and analysis of energy conversion systems in general. He has his expertise in design, modeling, and simulation of the different energy system specially bio-energy system. Several articles have been published in this area. Energy and exergy analysis, LCA analysis has also done for several of his design energy systems. Based on those analyses, he has proposed a quad-generation model for producing power, heat, cooling and SNG (synthesized natural gas).

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