Effect of Equivalence Ratio on the Performance of the Downdraft Gasifier – An Experimental and Modelling Approach

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Abstract:

In the present work, experiment and modeling work was carried out for different Equivalence Ratio (ER) to investigate the downdraft gasifier performance. A 10kWe atmospheric pressure downdraft gasifier was used for the experimentation purpose. Lignite and sawdust briquette (70:30, %wt.) were used as feedstock. Experiments were carried out with seven different ER (0.24 to 0.386). Fuel consumption, air consumption, and gas yield were calculated and found to be in the range of 0.54 kg h-1 to 11.1 kg h-1, 0.59 kg h-1 to 19.5 kg h-1 and 2.27 Nm3 kg-1 to 2.99 Nm3 kg-1, respectively. ER 0.386 was found optimum with respect to gasifier performance and emission. Lower Heating Value (LHV) and Cold Gas Efficiency were found to be 4.91 MJ Nm-3 and 80.03% respectively at optimum ER. Tar and PM were found in the range of 516 mg Nm-3 to 565.3 mg Nm-3 and 47.86 mg Nm-3 to 57.29 mg Nm-3 respectively for different ER. A thermo-equilibrium model was prepared to investigate the producer gas composition and LHV. Overall Root Mean Square Errors were found to be 2.69 and 2.58 when the results from the model were compared with the results of experiments and literature respectively.

Biography:

Darshit Upadhyay is working as Assistant Professor in Mechanical Engineering Department, Institute of Technology, Nirma University, Ahmedabad, India since 2012. He has 3 SCI indexed international journal publications and presented more than 10 conference papers. He has successfully completed 2 minor research projects. He has received Early Career Academic Grant from the Association of Commonwealth University, United Kingdom in 2016 for an international travel. There are two awards in his credit. He has attended International Summit as keynote speaker and session chair in USA (2019). Prof. Upadhyay is the reviewer of SCI indexed journals in the fields of renewable energy.

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