

Fluidised Bed Gasification of Multiple Agricultural Biomass-Derived Briquettes

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Abstract : Biomass briquette gasification is regarded as a promising route for efficient briquette use in energy generation, fuels and other useful chemicals, however, previous research work has focused on briquette gasification in fixed bed gasifiers such as updraft and downdraft gasifiers. Fluidised bed gasifier has the potential to be effectively sized for medium or large scale. This study investigated the use of fuel briquettes produced from blends of rice husks and corn cobs biomass residues, in a bubbling fluidised bed gasifier. The study adopted a combination of numerical equations and Aspen Plus simulation software to predict the product gas (syngas) composition based on briquette's density and biomass composition (blend ratio of rice husks to corn cobs). The Aspen Plus model was based on an experimentally validated model from the literature. The results based on a briquette size of 32 mm diameter and relaxed density range of 500 to 650 kg/m³ indicated that fluidisation air required in the gasifier increased with an increase in briquette density, and the fluidisation air showed to be the controlling factor compared with the actual air required for gasification of the biomass briquettes. The mass flowrate of CO₂ in the predicted syngas composition, increased with an increase in the air flow rate, while CO production decreased and H₂ was almost constant. The H₂/CO ratio for various blends of rice husks and corn cobs did not significantly change at the designed process air, but a significant difference of 1.0 for H₂/CO ratio was observed at higher air flow rate, and between 10/90 to 90/10 blend ratio of rice husks to corn cobs. This implies the need for further understanding of biomass variability and hydrodynamic parameters on syngas composition in biomass briquette gasification.

Keywords : aspen plus, briquettes, fluidised bed, gasification, syngas

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