

Prediction and optimisation of syngas production from air gasification of napier grass via stoichiometric equilibrium model

ABSTRACT

Napier grass is a promising candidate as a potential solid biofuel due to its wide availability, high growth rate, carbon neutrality and high volatility. Syngas is produced from gasification of Napier grass which can be further utilised for production of renewable fuel and other chemicals. The quality of the syngas produced from gasification of Napier grass is dependent on various factors such as operating temperature and pressure, gasification medium, biomass versus air ratio and moisture content. The optimisation of process parameters is important due to productivity and economic reasons. Experimental investigations to determine optimum conditions for gasification process are cost intensive and time consuming, rendering these techniques to be impractical. Thus, in this study, a stoichiometric equilibrium model for simulation of air gasification of Napier grass is developed. The model is modified to include correction factors at a series of temperatures and ERs which are multiplied with equilibrium constants to improve the accuracy of the model in predicting syngas and carbon compositions. The predicted values are in good agreement with experimental measurement, validating the model as a reliable tool for simulation of gasification performance. The modified model is further utilised to determine optimum operating conditions for maximum hydrogen production.

Keyword: Napier grass; Gasification; Stoichiometric equilibrium model; Energy crop; Optimisation