

Gasification of lignocellulosic biomass to produce syngas in a 50 kW downdraft reactor

Minhaj Uddin Monir^{a,b}, Azrina Abd Aziz^{a,*}, Risky Ayu Kristanti^a, Abu Yousuf^c

^a Faculty of Engineering Technology, Universiti Malaysia Pahang, 26300, Gambang, Malaysia

^b Department of Petroleum and Mining Engineering, Jessore University of Science and Technology, Jessore, 7408, Bangladesh

^c Department of Chemical Engineering and Polymer Science, Shahjalal University of Science and Technology, Sylhet, 3114, Bangladesh

A B S T R A C T

Lignocellulosic biomass gasification shows a pronounced prospective to replace fossil fuels. In this study, the gasification of coconut shell with charcoal using a 50 kW downdraft reactor was investigated. The controlling parameter of temperature and pressure were used to verify the production of gas during the gasification process with air. The higher contents of cellulose and hemicellulose than lignin in the sample were found to gasify better, as evident from structural analysis. The gasifier produces a combustible gas with a H₂, CO, CO₂ and CH₄ concentrations of 8.44, 15.38, 5.38 and 1.62 mol.% respectively, at a total flow of air of 30 m³ h⁻¹. The results revealed that 30 wt% charcoal in the feedstock was effectively gasified to generate syngas comprising over 30 mol.% of syngas with a lower heating value of 3.27 MJ/Nm³. Thus, the co-gasification of lignocellulosic biomass with charcoal may contribute to affordable and environmentally friendly syngas energy.