ABSTRACT

This paper investigates the integrated catalytic adsorption (ICA) steam gasification of palm kernel shell for hydrogen rich gas production in pilot scale atmospheric fluidized bed gasifier. The effect of temperature (600-750 °C) and steam to biomass ratio (1.5-2.5 wt/wt) on hydrogen yield, product gas composition, gas yield, char yield, gasification and carbon conversion efficiency, and lower heating values are studied. The results show that maximum hydrogen composition of 82.11 vol% is achieved at temperature of 675 °C and negligible CO_2 composition is observed at 600 °C and 675 °C at a constant steam to biomass ratio of 2.0. In addition, maximum hydrogen yield of 150 g/kg biomass is observed at 750 °C and at steam to biomass ratio of 2.0. A good heating value of product gas i.e. 14.37 MJ/Nm^3 is obtained at 600 °C and steam to biomass ratio of 2.0. Temperature and steam to biomass ratio both enhanced hydrogen yield but temperature is the most influenced factor. Utilization of adsorbent and catalyst produced higher hydrogen composition, yield and gas heating values as demonstrated by biomass steam catalytic gasification and steam gasification with in situ CO_2 adsorbent systems.