Biomass gasification of oil palm fronds (OPF) and Koompassia malaccensis (Kempas) in an entrained flow gasifier: A performance study

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ABSTRACT

Tests were carried out using air as the gasification agent in a laboratory-scale entrained flow gasifier at atmospheric pressure and temperature between 700 and 900 °C, and equivalence ratio (ER) from 0.2 to 0.4 for both oil palm frond (OPF) and Koompassia malaccensis (Kempas), which are biomass wastes from palm oil mill and forest residues, respectively. This study was performed to explore the potential of biomass in Malaysia as an alternative energy for conventional fossil fuels through gasification technology. The syngas produced from the gasification process consisted of hydrogen (H2), carbon monoxide (CO), and carbon dioxide (CO2), which were identified through gas chromatography (GC). Moreover, the rise in temperature from 700 to 900 °C led to the increase of H2 and CO production, subsequently decreasing the CO2 release for Kempas. ER showed a significant effect on gas composition and production. In addition, the HHV for OPF and Kempas were from 0.24 to 0.41 MJ/ m3 and 0.75–0.93 MJ/m3, respectively. The optimum ER was 0.3 for OPF and 0.35 for Kempas, corresponding to the highest CGE values of 2.18 and 4.98 MJ/m3, respectively. Thus, using OPF and Kempas biomass for gasification process has the potential to produce high energy value syngas to be applied in transportation fuel, electricity generation, and specialty chemicals production.

KEYWORDS: OPF; Kempas; Gasification; Equivalence ratio; Entrained flow gasifier

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