

Co-gasification between coal/sawdust and coal/wood pellet: A parametric study using response surface methodology

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ABSTRACT

This study had compared raw biomass and pre-treated biomass co-gasified with coal with the aim of investigating the reliability of pre-treated biomass for enhancing gasification performance. Sawdust (SD) and wood pellet (palletisation form of sawdust - WP) and blends of these two feedstocks with sub-bituminous coal (CL), were gasified in an air atmosphere using an external heated fixed-bed downdraft gasifier system. Response surface methodology (RSM) incorporating the central composite design (CCD) was applied to assist the comparison of all operating variables. The three independent variables were investigated within a specific range of coal blending ratios from 25% to 75%, gasification temperature from 650 °C to 850 °C and equivalence ratio from 0.20 to 0.30 against the dependent variables, namely the H₂/CO ratio and higher heating value of the syngas (HHV_{syngas}). The results revealed the H₂/CO ratio and a higher heating value of the syngas of more than 1.585 and 6.072 MJ/Nm³, respectively. Findings also showed that the H₂/CO ratio in the syngas from CL/WP possessed a higher value than the CL/SD. In contrast, CL/SD possessed a higher heating value for syngas with about 1% difference compared to the CL/WP. Therefore, co-gasified coal with wood pellets could potentially be a substitute for sawdust.

Keywords: Co-gasification; Coal; Sawdust; Wood pellet; RSM

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