Counter-flow air gasification of woody biomass pellets in the auto-thermal packed bed reactor

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Abstract

Counter-flow packed bed gasification was carried out featuring a combination of downdraft and updraft operation modes. A column reactor of inside diameter 102 mm and 1000 mm height was used. Downdraft and updraft air supply were varied while the total air supply was maintained constant. Counter-flow gasification with downdraft air supply at 12 L/min and updraft air at 4 L/min offered optimal conditions, producing syngas with 4.28 MJ/m3 N LHV and 5.84 g/m3 N tar content. Under similar operating conditions, cold gas efficiency was about 77% while carbon conversion reached 88%. Increasing the updraft air flow resulted in reduced tar generation and increased carbon conversion, however, the syngas LHV and cold gas efficiency were affected adversely.

Keywords: Biomass; Gasification; Packed bed; Tar; Carbon conversion