

Comparative Techno-Economic and Exergetic Analysis of Circulating and Dual Bed Biomass Gasification Systems

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Abstract

In this work, the techno-economic and exergy analyses of two gasification technologies with integration into heat and power combined cycles are presented: *i). Circulating fluidized bed (CFB) and ii). Dual fluidized bed (DFB) systems. As feedstock, lignocellulosic biomass (sugarcane bagasse, SCB) was considered.* The gasification process of the fluidized-bed systems (circulating and dual bed) and the syngas conversion were performed using Aspen Plus[®] software. The process design includes biomass drying and gasification, syngas cleaning, combustion, power generation, and heat recovery. The SCB-DFB system has the lowest irreversibility rate and, as a result, the highest overall performance and power generation (achieving 32% in the gasification system and 53% of exergy efficiency when coupled with the combined cycle). From the techno-economic assessment, the SCB-DFB system has the lowest total production costs per unit of energy. Hence, the dual fluidized bed systems could be a more competitive technology for the agro-industrial sector to generate power from lignocellulosic materials.

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