

Gasification of torrefied biomass in dual fluidized bed reactor

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Gasification is a common thermochemical conversion of biomass at high temperatures and in a controlled oxidative environment to yield product gas which consists of mainly H₂, CO, CH₄, and other combustible gases. The product gas can be used directly as a gaseous fuel or upgraded to syngas (i.e., H₂ + CO) for production of other liquid biofuels and chemicals. However, gasification of raw biomass is challenging due to inherent fuel properties of the feedstock. Torrefaction, a thermal pretreatment at 200–300 °C in inert atmosphere, is a promising method to upgrade the fuel properties of raw biomass and thus make the torrefied biomass more suitable for gasification.

In this study, a biomass gasification process with a dual fluidized bed technology employing torrefied biomass as feedstock is constructed in Aspen Plus software. The model can provide in details the performance of the gasification process in terms of product gas distribution and heating value as well as the process efficiency. The results show that torrefied biomass gasification offers higher product gas heating value and higher cold gas efficiency than raw biomass gasification.