Gasification characteristics of woody biomass in the packed bed reactor

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Abstract

Gasification technology is recognized as one of the possibilities for utilizing biomass effectively. This study focused on woody biomass gasification fundamentals, using a bench-scale packed-bed reactor. In this experiment, pellets of black pine were gasified, using air as the oxidizing agent. Gasification tests were carried out under both updraft and downdraft conditions. Temperature distributions and compositions of syngas inside the gasifier were continuously monitored during gasification experiments at several ports on the wall of the reactor. The syngas at the exit of the gasifier was also sampled to estimate the amount of tar. Lower heating values of the syngas under updraft and downdraft conditions were 4.8 and 3.8 MJ/m3N, respectively. It was easier to control the height of the packed bed under the downdraft condition than under the updraft condition. Under the updraft condition, a bridging phenomenon occurred. Tar generation under the downdraft condition was lower than that under the updraft condition. This is because tar passes through a partial combustion zone or higher temperature zone in the downdraft gasifier.

Keywords: Woody biomass; Gasification; Packed bed; Tar