A Study on the Torrefaction and Gasification of Biomass

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ABSTRACT

Due to the issue of disposal of normal waste and huge agricultural waste, development of resource reuse technology has drawn much attention, in corresponding to the retirement schedule of domestic incinerators. Of which, application of low temperature decomposition (known as torrefaction) with biomass material to production of solid alternative fuel is an important method of reuse. There is large amount of biomass fiber and agricultural waste existing in trash, such as straw and wooden chips, they are good source of fiber. This study employed Thermo-gravimetric Analyzer (TGA) and lab-scale decomposition system to investigate torrefaction of wooden chips, straw, and biomass fiber under differential conditions. Research findings show that wooden chips, straw, and biomass fiber have better torrefaction at temperature and time at 290°C and 40min, 260°C and 30min, 280°C and 40 min respectively. Percentage of solid, liquid and gas products generated by torrefaction process are: wooden chips have 48.43%, 30.84%, and 19.72%; straw has 51.48%, 22.87%, and 25.56%; biomass fiber has 67.56%, 17.82%, and 14.62%, respectively. The biochar produced during torrefaction could not only be added to coal for co-burning, it also underwent gasification experiment under conditions 700°C and 850°C of temperature, 2% and 10% of oxygen content, and 0, 30, and 60 min of duration in this study, in order to investigate the effect of reaction of biomass materials with and without being treated by the experiment of torrefaction gasification. Conditions of gasification were determined based on volatility of organics and heat generated from gas. Gasification temperature 700°C effectively gasified the organics in the biomass but failed to gasify the biomass after torrefaction, thus the best gasification temperature was 850°C. Oxygen content was 10L which was determined based on heat value of gas. Heat value of three biomass materials generated from gasification ranked as straw > wooden chips > biomass fiber.

Keywords : biomass、torrefaction、low temperature decomposition、biochar、heat value、gafication

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