Investigating pyrolysis and combustion characteristics of torrefied bamboo, torrefied wood and their blends

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Investigating pyrolysis and combustion characteristics of torrefied bamboo, torrefied wood and their blends

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Abstract:

Bamboo and masson pine was torrefied with 300℃ of temperature for 2.0h of residence time using GSL 1600X tube furnance in the argon atmosphere. Torrefied bamboo and masson pine particles were uniform mixed with different weight ratios. Pyrolysis and combustion characteristics were investigated through thermogravimetry (TGA). The results showed that pyrolysis and combustion process of all samples included three steps even though their characteristics were different. Torrefied biomass had a higher pyrolysis and combustion temperature, due to moisture and volatile removal and thermal decomposition of hemicelluloses, cellulose and lignin during torrefaction process. Torrefaction also increased high heating value, ash content and C/H and C/O ratio of biomass. The synergy of torrefied bamboo and torrefied mason pine was not found during pyrolysis and combustion process of blends. The results from this research will be very important and helpful to develop and utilize the wastes of masson pine and bamboo for energy products.

Key words: Biomass; Bamboo; Masson pine; Combustion; pyrolysis

1. Introduction

The world is presently confronted with energy crises and environmental degradation due to excessive use of fossil fuel (Gill et al., 2011). Biomass is known as a type of “carbon neutral” renewable resource and its production in the world is estimated at 146 billion metric tons a year (Chew and Doshi, 2011). It currently accounts for 15% of primary energy consumption. Especially for some developing countries, it provides about 35% of energy consumption. The potential of biomass to meet the world energy demand has been widely recognized. However, problems such as low bulk density, high moisture content and relatively low calorific value, make