IMPACT OF TORREFACTION ON THE GRINDABILITY AND FUEL CHARACTERISTICS OF FOREST BIOMASS

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ABSTRACT

Combustion and co-firing of biomass with coal in natural form has become a major hurdle, primarily due to low energy density, structural heterogeneity and wide moisture variations. Thermal pretreatment or torrefaction of biomass under anoxic condition can address the above issues and transform into an energy dense and consistent quality solid biomass fuel. This paper investigated the torrefaction of pine wood chips and logging residues at temperatures ranging from 225°C to 300°C and 30 min residence time using a laboratory scale batch torrefaction reactor. Change in mass loss, chemical compositions, moisture content and heating value of biomass after each torrefaction condition was determined. Grinding performance of torrefied biomass was evaluated by determining energy required for grinding; particle size distribution and average particle size produced and were compared with raw biomass and coal. Specific energy consumption for grinding of torrefied biomass decreased significantly with increase in torrefaction temperatures. It was reduced to as low as 24 kWh $t^{-1}$ at 300°C torrefaction temperature due to brittle nature of torrefied biomass. The energy density of torrefied biomass increased with increase in torrefaction temperature. Torrefaction of biomass clearly showed the improved fuel characteristics and grindability of biomass closer to coal.

Keywords: Torrefaction, wood chips, logging residues, grinding energy consumption, fuel characteristics, coal.