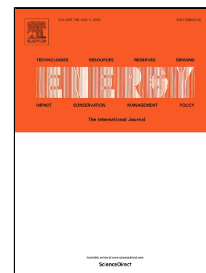


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Unconventional biomass fuels for steam gasification: kinetic analysis and effect of ash composition on reactivity

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Abstract

Twelve commercial and unconventional biomass fuels were evaluated in steam gasification; these include samples of hard biomass (wood, almond, olive and pine kernel wastes) and soft biomass (miscanthus, switchgrass, coffee, cocoa and grape wastes). Gasification tests at 700-1000 °C of biomass chars obtained from a bubbling fluidized bed reactor were performed in a TG analyzer. Steam gasification kinetics were extensively analyzed: an index of key parameters for the twelve biomasses and the correlation to biomass ash composition were developed. The random pore model (RPM) described the experimental reactivity best, with activation energies of 59-196 kJ mol⁻¹. The study of their reactivities provided a ranking of fast-, medium- and slow-kinetics fuels. The influence of alkaline and alkaline-earth metals (AAEM) on reactivity revealed that K, Na and Mg had a positive effect while Si, P and Ca had a negative influence.

Keywords: Biomass; Steam gasification; TGA; Kinetic parameters; Ash inorganic elements

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