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Discernment of Synergism in Pyrolysis of Biomass Blends using Thermogravimetric Analysis

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Abstract

This study reports pyrolysis kinetics of biomass blends using isoconversional methods, viz. Friedman, FWO and KAS. Blends of three biomasses, viz. saw dust, bamboo dust and rice husk, were used. Extractives and volatiles in biomass and minerals in ash had marked influence on enhancement of reaction kinetics during co-pyrolysis, as indicated by reduction in activation energy and increase in decomposition intensity. Pyrolysis kinetics of saw dust and rice husk accelerated (positive synergy), while that of bamboo dust decelerated after blending (negative synergy). Predominant reaction mechanism of all biomass blends was 3-D diffusion in lower conversion range ($\alpha \leq 0.5$), while for $\alpha \geq 0.5$ pyrolysis followed random nucleation (or nucleation and growth mechanism). Higher reaction order for pyrolysis of blends of rice husk with saw dust and bamboo dust was attributed to catalytic effect of minerals in ash. Positive ΔH and ΔG was obtained for pyrolysis of all biomass blends.

Keywords: Co-pyrolysis, Thermogravimetric analysis, Isoconversional method, Kinetic parameters, Solid state reaction

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