

A Numerical and Experimental Study on Fast Pyrolysis of Single Wood Particle

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Abstract : A one-dimensional heat transfer model coupled with the kinetic information has been used to predict the overall pyrolysis mass loss of a single wood particle. The kinetic parameters were determined experimentally and the regime and characteristics of the conversion were evaluated in terms of the particle size and reactor temperature. The order of overall mass loss changed from $n=1$ at temperatures lower than 350 °C to $n=0.5$ at temperatures higher than 350 °C. Conversion time analysis showed that particles larger than 0.5 mm were controlled by internal thermal resistances. The valid range of particle size to use the simplified lumped model depends on the fluid temperature around the particles. The critical particle size was 0.6-0.7 mm for the fluid temperature of 500 °C and 0.9-1.0 mm for the fluid temperature of 100 °C. Experimental pyrolysis of moist particles did not show distinct drying and pyrolysis stages. The process was divided into two hypothetical drying and pyrolysis dominated zones and empirical correlations are developed to predict the rate of mass loss in each zone.

Keywords : pyrolysis, kinetics, model, single particle

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