COMPARISON OF MULTI-COMPONENT KINETIC RELATIONS ON BUBBLING FLUIDIZED-BED WOODY BIOMASS FAST PYROLYSIS REACTOR MODEL PERFORMANCE

Poupak Mehrani, Department of Chemical and Biological Engineering, University of Ottawa
161 Louis Pasteur Street, Ottawa, ON, K1N 6N5, Canada
poupak.mehrani@uottawa.ca
Johnny Matta, Jules Thibault, Department of Chemical and Biological Engineering, University of Ottawa
161 Louis Pasteur Street, Ottawa, ON, K1N 6N5, Canada
Benjamin Bronson, Peter E.G. Gogolek, Natural Resources Canada, CanmetENERGY
1 Haanel Drive, Ottawa, Ontario, K1A 1M1, Canada

Modelling of the thermochemical conversion process of biomass has been widely studied in the past. However, most of the work pertaining to fast pyrolysis is focused solely on the behavior of biomass particles. Only a few works have been devoted to modelling pyrolysis at the bubbling fluidized-bed reactor level. Different types of models have been developed, each varying with respect to the compromise between computational efforts and prediction accuracy and potential. They are primarily sorted according to the adopted fluid-dynamic simplifications, ranging from simple Black-Box Models (BBM) to Fluidization Models (FM) to Computational Fluid Dynamic Models (CFDM). The selection depends on the desired outputs and available experimental information. Undeniably the most significant shortfalls of these models lie within the implemented devolatilization schemes. This work in particular explores the improvements in multi-step and multi-component fast pyrolysis kinetic mechanisms and compares their impacts on reactor measurable outputs such as product (tar, gas and biochar) yields and distinctive compositional values. The model results are compared to the experimental results from the NRCan CanmetENERGY (Ottawa, Ontario) pilot-scale fluidized bed rapid pyrolysis (0.1 m in diameter) unit at a fixed operating temperature and gas residence time. Results generated from this research are aimed to further understanding of large-scale fast pyrolysis processes and assist in predicting reactor performance in a cost and time-effective fashion.