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## On-line analysis of primary tars from biomass pyrolysis by single photoionization mass spectrometry: Experiments and detailed modelling

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### Abstract

The pyrolysis of two woody biomasses (Douglas and oak) was investigated on both micro-fluidized bed reactor (MFBR) and fixed bed reactor (FBR) combined with a single photoionization (SPI) mass spectrometer. The soft ionization capability of SPI technique allows real-time and on-line analysis of the labile primary tars from biomass pyrolysis. The slow pyrolysis of wood powders is achieved in the FBR at 5 °C/min up to 500 °C. Final mass yields of permanent gases and major primary tars are measured by GC analysis, whereas the SPI allows monitoring the evolution of some primary tars as a function of time. The same on-line analysis is achieved for fast pyrolysis of biomass particles introduced in the MFBR maintained at 400 or 500 °C. In that case, the wood particles have different size and shape: powder, thin lamella or cylinder. These experimental results are presented and compared with predictions of a pyrolysis model that combines external and internal heat transfer in biomass particles and recently published detailed kinetics. The comparison indicates that the experimental and simulation results are mostly in agreement, but more detailed kinetic mechanisms still need to be developed to capture the complex biomass pyrolysis.

**Keywords:** micro-fluidized bed, reaction kinetics, photoionization mass spectrometry, biomass pyrolysis.

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