PRODUCT DISTRIBUTIONS FROM FAST PYROLYSIS OF 10 ECUADORIAN AGRICULTURAL RESIDUAL BIOMASS SAMPLES

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Biomass fast pyrolysis is a thermochemical route to produce alternative fuels and chemicals in a potentially economical way, and therefore, is an integral part of bio-based economy. Since agriculture is an important activity in Ecuador, the wastes thus generated can be used for the production of bio-oil. To design and optimize an industrial setup for the production of bio-oils, one needs to develop a deeper understanding of the decomposition of biomass components, viz. cellulose, hemicellulose and lignin. The existing vast literature comprises of pyrolysis data obtained from low-heating rate studies and the obtained product spectra are often incomplete. This causes mechanistic interpretations to be questionable.

To facilitate fast pyrolysis studies with detailed product identification, a single-stage micro-pyrolysis reactor has been connected to a comprehensive GC x GC coupled with a flame ionization detector (FID) and a time-off-flight mass spectrometer (TOF-MS). A part of the effluent gas is also analysed in a specially designed multi-column GC equipped with two thermal conductivity detectors (TCD) and a pulse discharge detector (PDD). The combination of both GCs allow separation and detection of heavy (C3+), light (C2-) molecules and permanent gases.

The present work focuses on the fast pyrolysis of 10 samples of agricultural residues generated in Ecuador. These 10 biomass residues cover a wide range of cellulose, hemicellulose and lignin compositions. The product yields obtained at three different temperatures (500C, 550C and 600) are calibrated externally by injecting mixtures of chemicals into the injection port and measuring the relative and absolute responses at the same conditions at which the biomass pyrolysis studies have been conducted. The calibration mixtures contained representatives of the following groups: sugars, light oxygenates, furans, phenols, guaiacols, syringols and aromatic hydrocarbons. The observed product distributions for all biomass samples are are compared to existing global biomass pyrolysis mechanisms to explore their predictive capabilities.

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