FUNDAMENTAL STUDY AND APPLICATIONS TO BIOMASS PYROLYSIS OF THE MECHANICALLY FLUIDIZED REACTOR

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Lignin has great potential for the production of aromatics currently derived from petroleum, since it is the most abundant source of aromatics in nature. At present, Kraft lignin is used as fuel within the pulping process but, alternatively, it could be converted to high-value chemicals using thermochemical processes such as pyrolysis. Kraft lignin, however, is a very cohesive and thermally sensitive powder with foaming and agglomerating tendency under reaction conditions. Consequently, a novel reactor design, designated as Mechanically Fluidized Reactor (MFR) has been developed to successfully process Kraft lignin.

In this work, Kraft lignin has been successfully pyrolyzed in the MFR. However, during the reaction, the bed material becomes cohesive and it is not possible to observe the bed aeration generated by the pyrolysis gas and vapours. Different bed materials were tested with the purpose of improving the Kraft lignin behaviour. All the materials capable of improving the processability, resulted in a watery bio-oil, most likely due to the catalytic enhancement of cracking reactions. Kraft lignin was also mixed with birch wood in different proportions. The liquid yield decreased linearly with Kraft lignin content in the initial feed, whereas phenolic compounds in the liquid product were found to increase linearly with increasing Kraft lignin content. The liquid product was analyzed in terms of alkyl phenols, guaiacols, catechols and syringols by GCxGC-TOFMS.

Hydrolysis lignin residues from bioethanol production were much easier to pyrolyze, as the bed material did not become cohesive. The high ash content of these feedstocks, when compared to Kraft lignin, reduced the liquid yield.