

Conversion of Biomass to Transportation Fuels via Pyrolysis and Upgrading

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Biomass can be transformed to an intermediate liquid via fast pyrolysis and catalytic pyrolysis. The resulting pyrolysis oils can be upgraded with refinery operations such as fluid-catalytic cracking (FCC) or hydrotreating (HT). Goals of the process are high overall mass and carbon yield, high fraction of distillates (jet fuel and diesel), minimal concentration of contaminants, and low cost. The oxygen in the biomass reduces the carbon yield of the process chain unless hydrogen, directly or indirectly, is employed. Fast pyrolysis provides the highest liquid yield, but the pyrolysis oil contains high amounts of oxygen and water, and the viscosity and reactivity make it difficult to transport, store, and feed into high-temperature reactors. A variety of modification, such as stabilization and extraction, exist that can improve the chemical and physical properties of the pyrolysis oil. Pyrolysis oils can also be co-processed in small quantities with petroleum feedstocks by taking advantage of synergistic properties. Catalytic fast pyrolysis can provide liquid intermediates with reduced oxygen- and water content, viscosity, and reactivity. This makes them attractive for processing or co-processing in HT or FCC. Potential disadvantages are a lower organic liquid yield, higher aqueous phase-, tail gas-, and coke yields, and alkali contamination of the catalyst during the pyrolysis. Examples of the processing of different pyrolysis oils in FCC and HT will be given.