Production of Green Aromatics and Olefins by Catalytic Fast Pyrolysis of Wood

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Astract

Catalytic fast pyrolysis (CFP) is a promising process for the direct conversion of solid biomass into gasoline range aromatics. This novel process has significant advantages compared to other technologies for biomass conversion including low capital and operating costs and it makes a product that already fits into existing infrastructure. The CFP of pine wood and furan with ZSM-5 catalyst was studied under different reaction conditions with several different reactors including a fluidized bed reactor, a fixed bed reactor and a semi-batch pyroprobe reactor to optimize CFP for aromatic production. The highest aromatic yield of 14 % carbon was obtained at low space velocity and 600 ^{o}C. The aromatic product consists mainly of benzene (24.8 % carbon), toluene (34.1% carbon), xylene (15.4% carbon) and naphthalene (14.9 % carbon).

The aromatic yield and selectivity is a function of reactor temperature. However, the olefin yield was not a function of temperature. The selectivity for benzene and naphthalene increases at temperature increases. The more valuable aromatics toluene and xylene are selectively produced at lower temperature. We also studied furan conversion in a fixed bed reactor to help identify the catalytic chemistry. Our results from the fixed bed indicate that furan is a good model compound to study CFP with wood. The maximum aromatic yield (24% carbon) from furan was obtained at 600 °C which is consistent with the fluidized bed results.

Olefins can be recycled to the reactor inlet to produce more aromatics. Co-feeding olefins with wood increases both the aromatic yield and conversion of feed. With co-feed the selectivity of small aromatics (such as toluene and benzene) increases while the selectivity for naphthalenes decreases. In this poster presentation we estimate the aromatic yields that could be achieved by CFP when we include olefin recycle.