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Feedstock Considerations for Thermochemical Biofuels Production Including a Case Study of Fast Pyrolysis and Catalytic Hydrodeoxygenation

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The production of renewable motor fuels from lignocellulosic biomass is a key part of the U.S. strategy to ease dependence on imported oil and reduce greenhouse gas emissions. For this strategy to be environmentally and economically sound, biomass resource and conversion technology developments must be coordinated so that cost-competitive biofuels can be produced using sustainable, low-cost, and diverse feedstocks. This presentation summarizes a case study of an integrated process to produce petroleum refinery blendstocks via fast pyrolysis and catalytic hydroprocessing using several commercially-relevant feedstocks, including softwoods, hardwoods, herbaceous materials, and blends. The results presented here show that feedstock choice has a significant impact on multiple conversion metrics, including bio-oil yield and composition, hydrotreating yield, H_2 consumption during hydrodeoxygenation, selectivity to fuel products, and biomass carbon-to-fuel efficiency.

Dr. Tyler Westover is a research engineer/scientist for the Idaho National Laboratory's Bioenergy Technologies Department. Dr. Westover leads the Feedstock/Thermochemical Conversion Pathways Integration project at INL that partners with the National Renewable Energy Laboratory (NREL) and Pacific Northwest National Laboratory (PNNL) to understand the 'field-to-fleet' implications of using different biomass feedstocks in thermochemical conversion processes, including fast pyrolysis, catalytic fast pyrolysis, hydrothermal liquefaction, hydrodeoxygenation, and gasification. Dr. Westover also leads a biomass multi-scale physical and structural particle mechanics project to model and improve biomass bulk solids feeding and handling performance. Before starting at INL, Dr. Westover performed post-doctoral research at Sandia National Laboratories studying thermal transport and breakdown of gallium nitride nanowires and carbon nanotubes. Dr. Westover holds a doctorate in mechanical engineering from Purdue University and also has expertise in the areas of scanning electron, transmission electron, and atomic force microscopies, as well as micro-photoluminescence spectroscopy, Raman spectroscopy, laser-induced breakdown, and low-energy electron spectroscopies.

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