Green Hydrocarbon Biofuels

A biofuel is a liquid transportation fuel made from biomass. A wide range of single molecule biofuels or fuel additives can be made from lignocellulosic biomass including:

• Ethanol or ethyl alcohol
• Butanol or butyl alcohol
• Hydroxymethylfurfural (HMF) or furfural
• Gamma valerolactone (GVL)
• Ethyl levulinate (ELV)

The production of hydrocarbon biofuels from biomass has many advantages:

- "Green" hydrocarbon fuels are chemically essentially the same as petroleum-based fuels. Thus modifications to existing engines and fuel distribution infrastructure are not required.
- "Green" hydrocarbon fuels are energy equivalent to petroleum-based fuels, thus no mileage penalty is encountered from their use.
- "Green" hydrocarbon fuels are immiscible in water. This allows the biofuels to self-separate from water which eliminates the high cost associated with water separation by distillation.
- "Green" hydrocarbon fuels are produced at high temperatures, which translates into faster reactions and smaller reactors. This allows for the fabrication and use of portable processing units that allow the conversion of biomass closer to the biomass source.
- The amount of water required for processing "Green" hydrocarbon fuels from biomass, if any, is minimal.
- The heterogeneous catalysts used for the production of "Green" hydrocarbon biofuels are inherently recyclable, allowing them to be used for months or years.

Additionally, "Green" gasoline or diesel biofuels, which are a mixture of compounds, can be synthesized from lignocellulosic biomass by catalytic deoxygenation. Green diesel can also be made via the catalytic deoxygenation of fatty acids derived from virgin or waste vegetable oils or animal fats.

Biofuels can be produced using either biological (e.g., yeast) or chemical catalysts with each having advantages and disadvantages. Chemical catalysts range from solid heterogeneous catalysts to homogeneous acids. Most biofuel production pathways use chemical catalysts.

Source: National Science Foundation. 2008. *Breaking the Chemical and Engineering Barriers to Lignocellulosic Biofuels: Next Generation Hydrocarbon Biorefineries*, Ed. George Huber. University of Massachusetts Amherst. National Science Foundation. Bioengineering, Environmental, and Transport Systems Division. Washington D.C.