New Diesel Feedstocks and Future Fuels

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First and Second Generation Biodiesel

• Today’s Fatty Acid Methyl Ester (FAME) diesel fuel blends are considered first generation biodiesel
  – Variation in Feedstocks
  – Specifications
• Second Generation Biodiesel based on Fischer-Tropsch type fuels, via high pressure hydrogenation of fatty acids, or thermolysis
  – Choren Energy “Sun Diesel”
  – Neste NexBTL
  – Changing World Technologies
Feedstocks for FAME-Based Biodiesel

• Chrysler Group, in cooperation with Next Energy, Bosch, Delphi, Biodiesel Energy Industries, TACOM, DoE, WSU, and MSU is evaluating the impact of feedstock type on various biodiesel parameters.

• Feedstocks can include:
  – Rapeseed, Canola
  – Soy
  – Palm Oil
  – Sunflower Seed
  – Jatropha
  – Tallow

• Feedstock can impact:
  – Stability
  – Cetane
  – Cold flow properties
  – NOx emissions
  – Boiling range
  – ............
Next Generation Biodiesel -- BTL

• Biomass to Liquids via Gasification and Fischer-Tropsch
  – Feedstock can be forest waste, purpose-grown crops, municipal waste
  – Low to zero sulfur, aromatics
  – High cetane
  – Lubricity, cold flow need adjustment
  – Example – Choren Energy

• High Pressure Hydrogenation of Fatty Acids
  – Saturate double bonds
  – De-esterification
  – Low or zero sulfur, aromatics
  – High cetane
  – Cold flow, lubricity?
  – Example -- Neste NexBTL

• Thermolysis
  – Feedstock can be anything from turkey processing waste to auto shredder residue
  – More questions than answers about product properties
Specifications

• FAME-Based Biodiesel
  – Specifications are in place in Europe and U.S. for 100% Biodiesel as a blendstock
    • The U.S. specification needs improvements -- Work is underway
    • There is no recognized specification for B20, which is a major EPACT fuel
    • Developing data for support of a strong B20 specification is a major focus of the Next Energy program
    • Specifications should be performance-based. e.g. Iodine number is a surrogate for stability, but can exclude some feedstocks. True measures of stability are preferred
  – Second Generation Biodiesels should meet existing commercial specifications
“XTL Fuels”

• Generally are fuels based on conversion of carbon to syngas and Fischer-Tropsch
  – GTL
  – CTL
  – BTL
  – Should meet existing commercial diesel fuel specifications
  – High cetane
  – Low or near zero aromatics, sulfur
  – Lubricity and cold flow concerns
  – High CapEx
Ethanol in Diesel

• The blending of ethanol in diesel fuel, “E-Diesel” has been explored
  – Concerns have been expressed regarding the low flashpoints of these blends. Current diesel product has not been developed in anticipation of fuel with flashpoints below ASTM standards
  – Fuel economy, peak power, lubricity, and wear/corrosion issues need to be examined
  – There is no consensus specification for “E-Diesel”
Viable HCCI and “Low Temperature Combustion” systems have yet to be clearly defined

- Definition of an appropriate fuel ahead of definition of the combustion regime may not be a good use of resources
- Viable deployment of advanced combustion regimes demands that they operate on currently available fuels
Conclusions

• The Chrysler Group supports the use of alternative and renewable feedstocks for diesel fuel
• There is an urgent need for a specification for FAME-Based B20
• Further R&D is needed to reduce the processing cost for GTL, CTL, BTL and other processes
• Attempts to “optimize” HCCI fuel may be premature
• Safety issues around E-Diesel may limit its application