Direct Conversion of Vegetable Oils to Diesel and Chemicals

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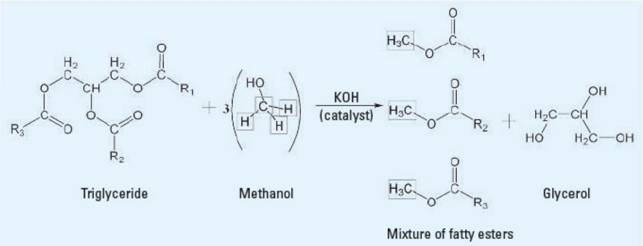
Introduction & Motivation



Fatty acid methyl esters (biodiesel)

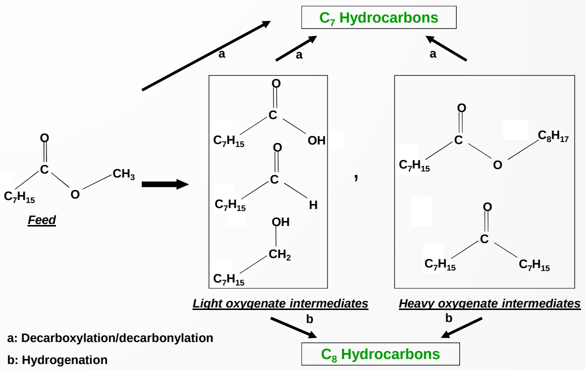
- ***Advantages***: high cetane number (CN) – renewable source domestic production
- ***Disadvantages***: high cloud point and pour point, low thermal and chemical stability, heat content 9-13 % lower than conventional diesel.
- ***Reason***: Presence of oxygen
- ***Possible solution*** **CATALYTIC DEOXYGENATION**
- ***Desirable operating conditions***
  - Mild temperature and pressure
  - Low hydrogen consumption

Objectives & Approach

- ***Vapor phase***: Reaction with methyl octanoate as model compound to screen catalysts and understand reaction mechanisms
- ***Liquid phase***: Reaction with real FAME feedstock, methyl stearate, to produce normal diesel substances

Experimental

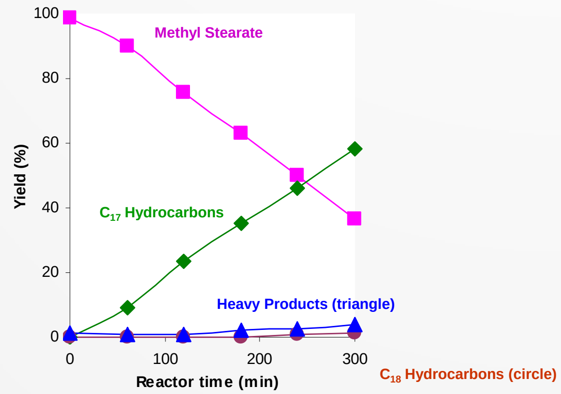
Vapor Phase



Working condition: P: 15 to 500 psig; T: 300 to 400 ºC; Flow of He or H_2; Catalysts: Supported Pt, Pd, Pt-Sn catalysts

Deoxygenated products: C_7 and C_8 hydrocarbons with high selectivity (>80%)

Liquid Phase



Reaction of methyl stearate in H_2 over Pt/Al_2O_3 catalyst

1000mL Parr reactor

Liquid phase reaction:

- The production of long chain hydrocarbons C_{17} from real fatty acid methyl ester feedstock was achieved with Parr reactor
- The reaction condition is mild: P< 100psig, T < 350ºC
- High C_{17} hydrocarbon selectivities were obtained with different tested catalysts, even under low H_2 consumption condition

Conclusions

1. Combination of vapor phase and liquid phase reactions enables us to screen effectiveness of different supported noble metal catalysts and produce high selectivities of diesel-range hydrocarbons from real FAME feedstock
2. Operating conditions are milder compared with hydrotreating option. Hydrogen consumption is optimized