The etherification of glycerol with tert. Butyl ether to produce mono-glycerol tert. Butyl ether

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INTRODUCTION
The etherification of glycerol into oxygen rich compounds that can serve as octane enhancers for fuel is an interesting way to make biodiesel viable.

 Etherification of glycerol:
• With isobutene or tert. butyl alcohol (TBA),
• In presence of an acid catalyst (Amberlyst, Beta Zeolite),
• Mixture of m-, d- and t-GTBE.

m-GTBE is not investigated as gasoline additive yet, despite its high octane number

EXPERIMENTAL

Step 1
Aim: optimization of etherification of glycerol with tert. butyl alcohol
Parameters:
- Reaction time (2 - 6h)
- Temperature (80 - 110°C)
- Catalyst ratio relative to glycerol mass (5 - 10%)

Step 2
Aim: isolation of m-GTBE from GTBE-mixture
Methods:
- Normal distillation
- Vacuum distillation

The etherification was carried out in a batch reactor under 10 atm. N2.

Step 3
Aim: effect of blending of m-GTBE with pure gasoline (mogas 92)
Percentages:
- 2.5 %
- 5 %
- 7.5 %

Beta Zeolite was used as a catalyst.

Step 4
Aim: determination of characteristics gasoline with m-GTBE as additive
Characteristics:
- Octane number (ASTM D2699)
- Oxygen content (ASTM D4815)
- Vapor pressure (ASTM D3945)
- Density (ASTM D1298)
- Boiling range (ASTM D86)

RESULTS

Optimization

Yield = 19.63 + 4.79 \cdot \text{Temperature} = 2.63 \cdot \text{Time} + 1.08 \cdot \text{Catalyst loading} - 1.45 \cdot \text{Temperature} \cdot \text{Catalyst loading} (Coded values only)

Characteristics

DISCUSSION AND CONCLUSIONS

• Optimal yield of m-GTBE: high temperature (110°C)
  low reaction time (2h)
  Temperatures higher than 110°C: more side reactions and lower conversion
  Commercial gasoline + m-GTBE: positive effect on ignition characteristics reduction of CO and hydrocarbon emissions

REFERENCES:

KU LEUVEN