Hydrodeoxygenation of guaiacol

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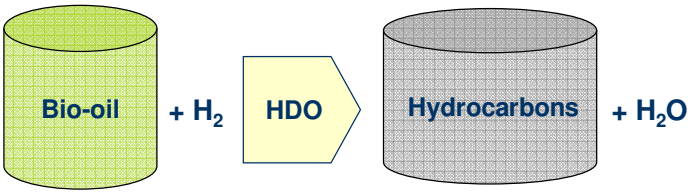
Background

- Bio-oils are considered as a source for traffic fuels and chemicals
- The upgrading of bio-oils is required to eliminate oxygenated groups, this improves
  → thermal stability
  → chemical stability
  → heating value
  → volatility
- Hydrodeoxygenation (HDO) is an alternative needing
  → high temperatures
  → high pressures
  → catalyst

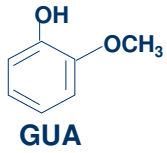


Purpose

- Compare the performance of noble metal catalysts in HDO
  → with commercial NiMo/Al_2O_3 and
  → with thermal cracking

Experimental

- Simulation of wood based bio-oils
  → 3 wt-% guaiacol (GUA) in n-hexadecane
- Batch reactor
  → 8 MPa
  → H_2/GUA 0.34 g/g
  → 300 ºC
  → 3h

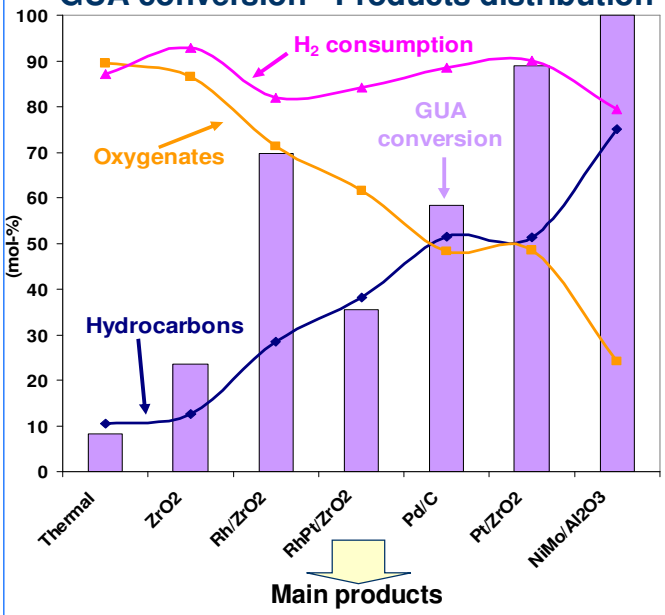


Main component of low molecular mass lignin fraction of wood based bio-oil

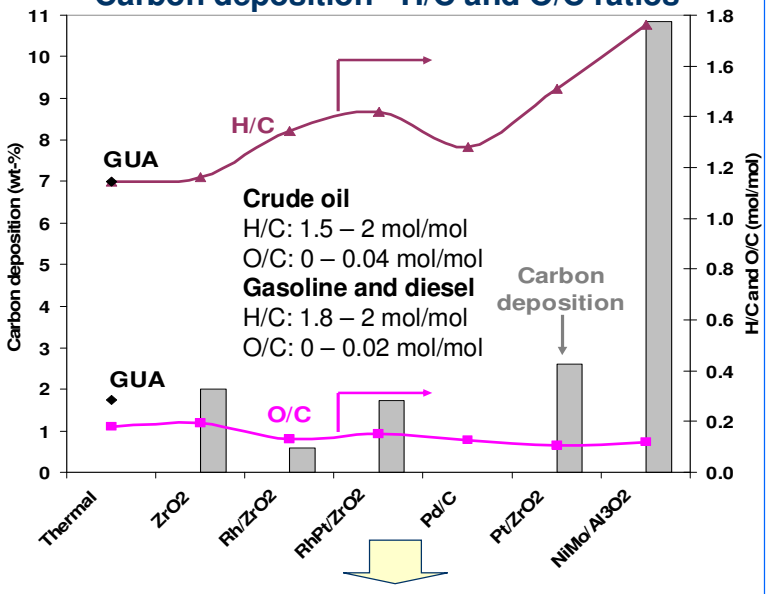
- Catalysts
  → ZrO_2-supported Pt, Rh and RhPt (total metal loading 0.5 wt-%)
  → 2 wt-% Pd/C
  → ZrO_2
  → commercial NiMo/Al_2O_3 catalyst (sulfided)

Results

GUA conversion - Products distribution



Carbon deposition - H/C and O/C ratios



Thermal cracking and ZrO_2
- Cyclohexanol
- Polycyclic structures

Catalytic reactions
- Benzene
- Cyclohexanol
- Polycyclic structures

- Thermal cracking slightly decreases the O/C molar ratio
- Lower carbon deposition on the noble metal catalysts than on the commercial NiMo/Al_2O_3

Conclusions

- Complete conversion of GUA at the experimental conditions only reached on the sulfided NiMo/Al_3O_2
- The Pt catalyst was suitable for HDO of GUA
  → pre-sulfidisation was avoided
  → higher GUA conversion and higher H/C and lower O/C molar ratios than with the other noble metal catalysts
  → similar O/C molar ratio than on the commercial NiMo/Al_2O_3 catalyst
  → lower carbon deposition than on the commercial NiMo/Al_2O_3 catalyst

Acknowledgments
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