The Transesterification of Hickory Nuts into Biodiesel Fuel
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Introduction:
- Biodiesel fuels can be produced from a fat and an alcohol via transesterification
- Hickory nuts have a high fat content (~60 % by weight)
- Can nuts from shagbark hickory (Carya ovata) be used to produce a biodiesel fuel using existing acid-catalyzed transesterification methods?

Methodology:
- Extraction of HKO:
  - Remove endosperm from nuts
  - Grind endosperm into a powder
  - Extract HKO using heptane
  - Filter solids & remove heptane using rotary evaporation
- Acid-catalyzed transesterification:
  - Heat HKO & methanol with < 1 % H₂SO₄ overnight
  - Wash product mixture to remove impurities & by-products
  - Dry HKOME product to remove residual H₂O
  - Remove excess methanol via rotary evaporation
  - Analyze HKOME product mixture using ¹H-NMR spectroscopy

Transesterification Reaction:
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\begin{align*}
\text{acylglycerol (from HKO)} & \quad \text{CH}_3\text{OH} \quad \text{cat. H}_2\text{SO}_4 \quad \Delta \\
\text{biomass (HKO methyl esters)}
\end{align*}
\]

Results:
- Integration data from ¹H-NMR spectra of product mixture was used to calculate % conversion
  - HKOME product was formed with 97.4% conversion

¹H-NMR Spectra of HKO & HKOME

Discussion:
- Acid-catalyzed transesterification methods were effective for the production of biodiesel fuel from hickory kernel oil
- NMR data show the HKOME product was formed in 97.4 % conversion.

Conclusion:
- Hickory nuts can be used for producing biodiesel fuel

Future Work:
- Repeat experiments using base-catalyzed transesterification
- Determine the fatty acid composition of the HKOME product mixture
- Improve HKO extraction methods

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References: