

The Transesterification of Hickory Nuts into Biodiesel Fuel

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16

S

32.064

9

F

18.998

33

As

74.913

92

U

238.030

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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:

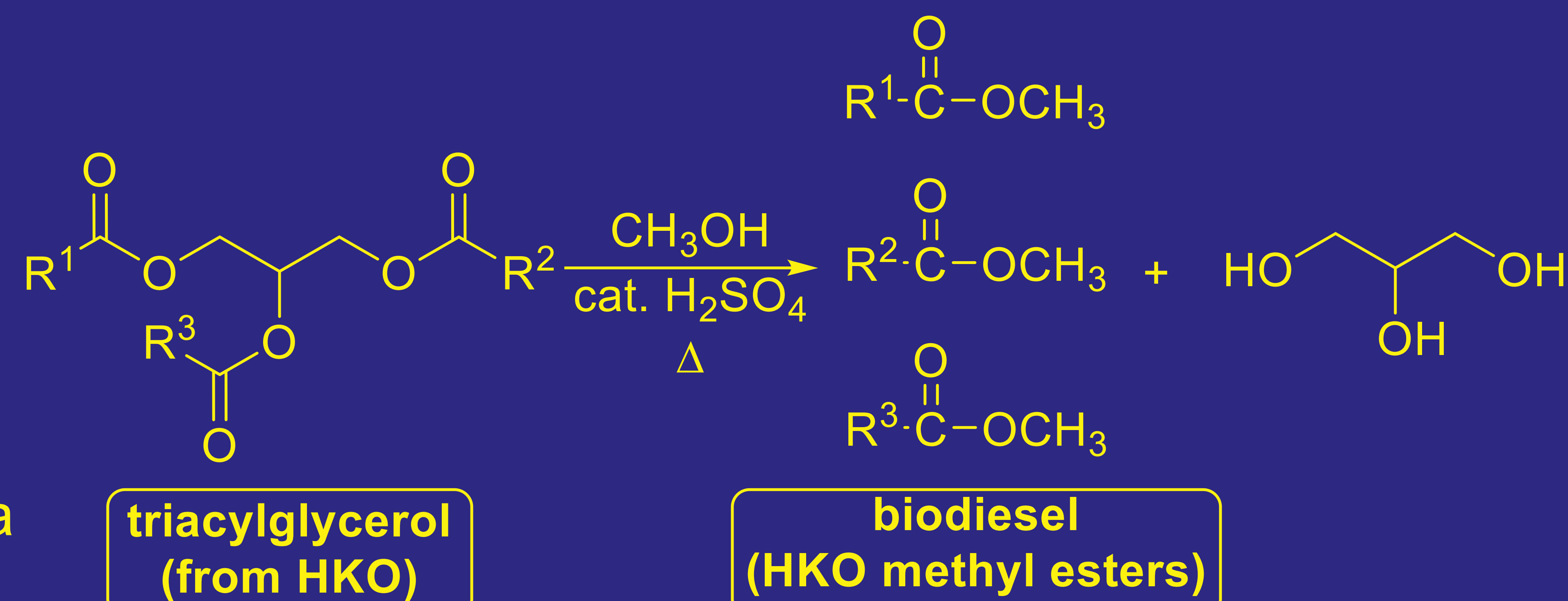
Extraction of HKO:

- 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

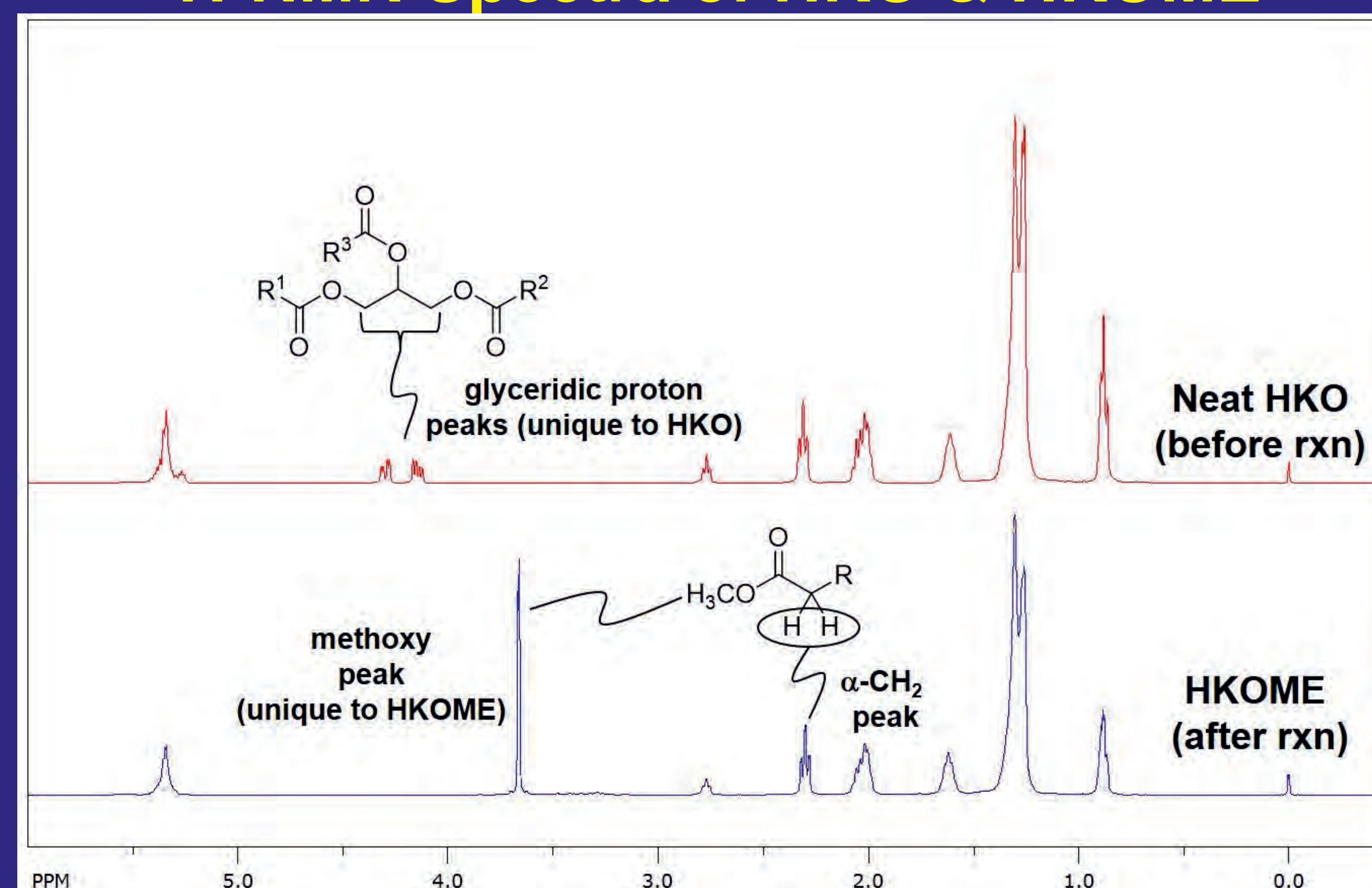
Transesterification Reaction:



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:

- Ataya, F., et al. *Energy Fuels* **2007**, *21*, 2450-2459.
- McCormack, R.H. *J. Am. Oil Chem. Soc.* **1947**, *24*, 299-303.
- Karabas, H. *Environ. Prog. Sustainable Energy* **2014**, *33*, 625-628.