Biocrude Al Dente: Determining Optimal Hold Time for Hydrothermal Liquefaction of Food Waste

Jay Turner (turnerjm@worcesterschools.net)
Advisors: Dr. Geoffrey Tompsett, Dr. Andrew Teixeira

Why turn waste to fuel?

- Over 250 million tons of Municipal Solid Waste (MSW) is produced yearly in the US
- Energy-rich molecules in MSW rot in landfills and contribute to atmospheric greenhouse gases

Hydrothermal Liquefaction (HTL) Process

*Dehydrated, ball-milled **food waste** and **deionized water***

*Parr **Reactor** 300˚C, ~1200 PSI*

***Aqueous separation** via vacuum filtration*

***Acetone wash** and **rotovap** to separate oil*

***HTL products: oil,** aqueous, and char phases*

UN Sustainable Development Goals

- Support **sustainable consumption and production patterns**
- Promote technological development **within the carrying capacity of the ecosystem**

Hydrothermal Liquefaction and Challenges

- **Hydrothermal Liquefaction converts waste into fuel precursors** via reactions at **high temperature and pressure**
  - Hydrolysis, Maillard reaction, condensation, decarboxylation, esterification
- No need to dry waste before reaction
- **Variables:** time, temperature, pressure, feedstock proportions, conditioning, catalysts

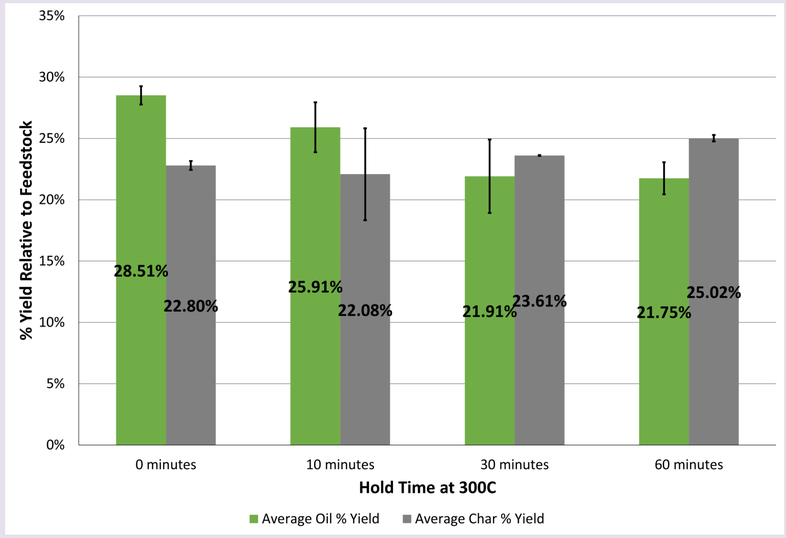
Optimize biocrude yield and quality

Waste storage

Variable waste composition

Process logistics

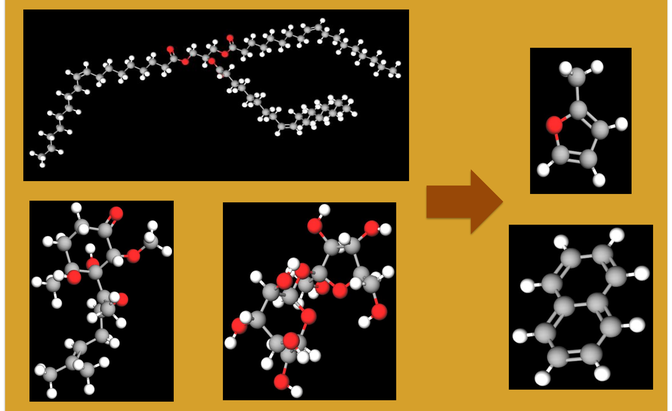
Study to Determine Optimal Hold Time for HTL of Food Waste



- **Goal:** test different hold times at 300C to determine time for highest oil yield
- Oil yield decreased as hold time increased
- Char yield increased with hold time
- **Next Steps:** study to **determine optimal hold temperature** (250C-400C)

Classroom Connections

- **Design and communicate solutions** for addressing school food waste
- **Create fuel molecules** from carbohydrate, protein, and lipid molecules **using molecular models**



- **Calculate the energy density** of macromolecules and newly formed fuel molecules

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