

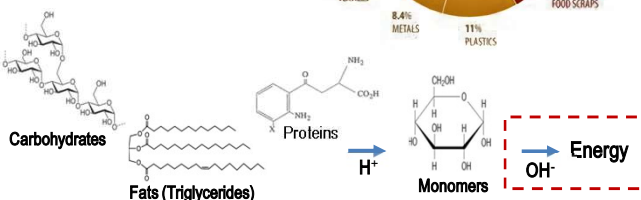
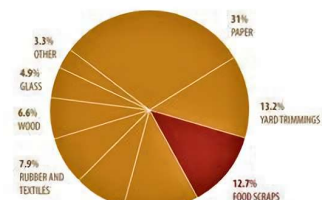
Understanding the effect of alkali addition on various lipid content food waste through HTL conversion to biocrude

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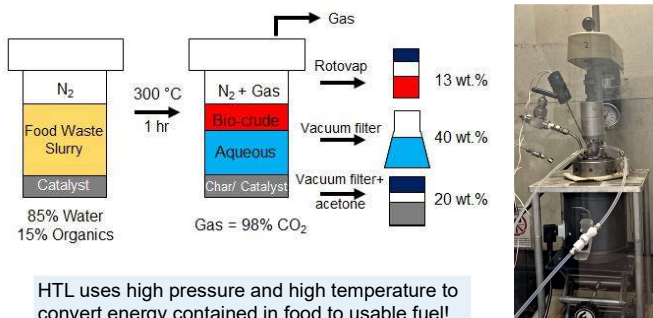
Food Waste Challenges and Opportunities

- HTL uses wet feedstocks to produce energy
- Food waste does not need to undergo drying processes to be a viable feed

WHAT GETS WASTED IN THE USA?



HTL Process



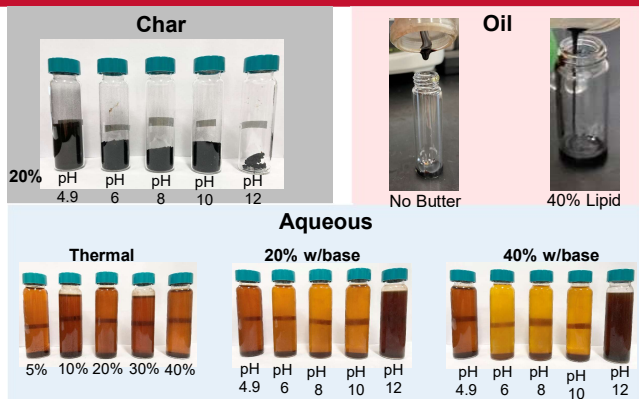
HTL uses high pressure and high temperature to convert energy contained in food to usable fuel!

Feedstock Lipid Content and pH

Feeds	pH
No Butter	4.9, 6, 8, 10, 12
10% Lipid	4.9, 12
Model Army Food Waste	4.9, 6, 8, 10, 12
20% Lipid	4.9
30% Lipid	4.9, 6, 8, 10, 12
40% Lipid	4.9, 6, 8, 10, 12



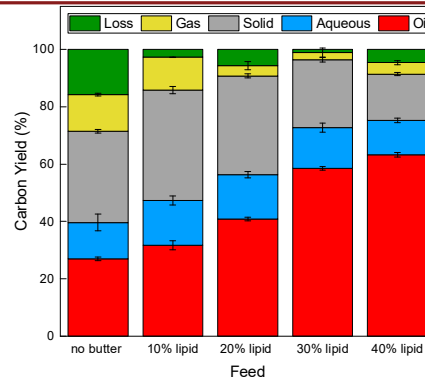
- Butter used to vary lipid content
- 1 M NaOH used to vary feed pH



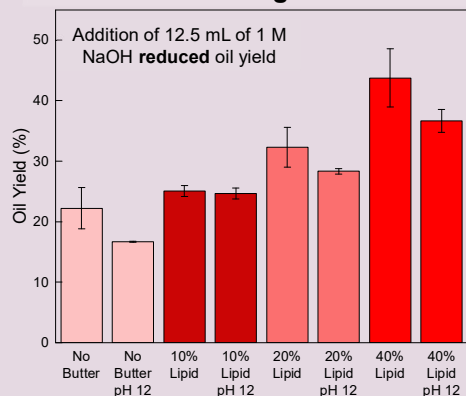
Increased Lipid Content Increases Oil

Thermal Experiments:

- Increased lipid content increases oil yield
- Char yield decreases with increased oil yield
- Aqueous phase carbon remains relatively unchanged

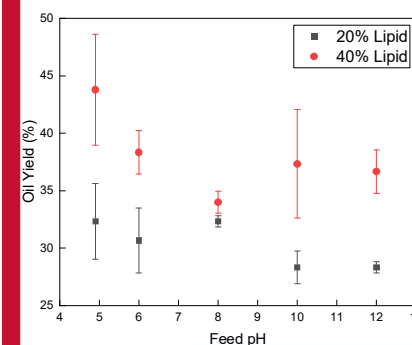


Addition of Homogeneous Base



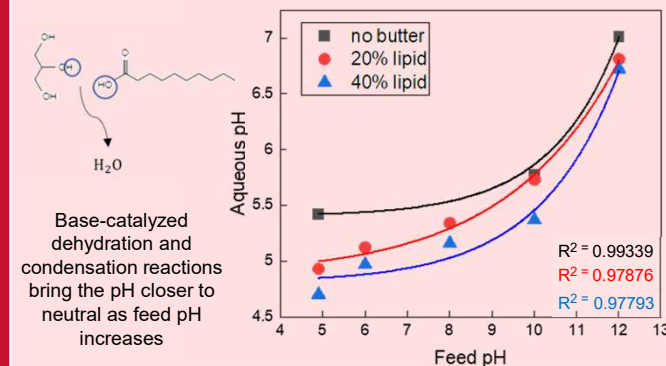
Hypothesis: Too much base reduces initial depolymerization in high lipid feeds, thereby reducing oil yield

Varying Base Amount



- Feed pH is not a suitable indicator of oil yield
- Oil yield reached an optimum at pH 8 for lower lipid feeds, but a minimum at high lipid feeds

Feed pH	20% Percent Change	40% Percent Change
4.9--> 6	-5.15	-12.44
4.9--> 8	0	-22.34
4.9--> 10	-12.37	-14.72
4.9--> 12	-12.37	-16.24



Base-catalyzed dehydration and condensation reactions bring the pH closer to neutral as feed pH increases

Conclusions

- Waste successfully converted to energy
- Increasing lipid content of the feed increases oil yield
- Addition of base reduces oil yield in high lipid feeds
- Addition of base does not improve oil yields in low lipid feeds
- Oil yields did not improve with varied pH feeds

HYDROTHERMAL LIQUEFACTION



References

- [1] U. of Toronto, F. Facebook, and T. Twitter, "The Impact of Food Waste on Climate Change (And Just About Everything Else)," *Treeshugger*, <https://www.treeshugger.com/the-impact-of-food-waste-on-climate-change-and-just-about-everything-else-4857493/> (accessed Jul. 29, 2021).
- [2] R. Posmanik et al., "Acid and Alkali Catalyzed Hydrothermal Liquefaction of Dairy Manure Digestate and Food Waste," *ACS Sustainable Chem. Eng.*, vol. 6, no. 2, pp. 2724-2732, Feb. 2018, doi: 10.1021/acscchemeng.7b04598.
- [3] "Indicat," *Indicat*, <https://www.indicat.com/> (accessed Jul. 15, 2021).

Acknowledgments



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