

Introduction

Around 67 million tons of food waste are generated yearly in the United States. Hydrothermal Liquefaction (HTL), a hydrolyzation process of macromolecules of wet biomass, gives us the opportunity to turn that waste into bio-oil.



HTL produces four main products

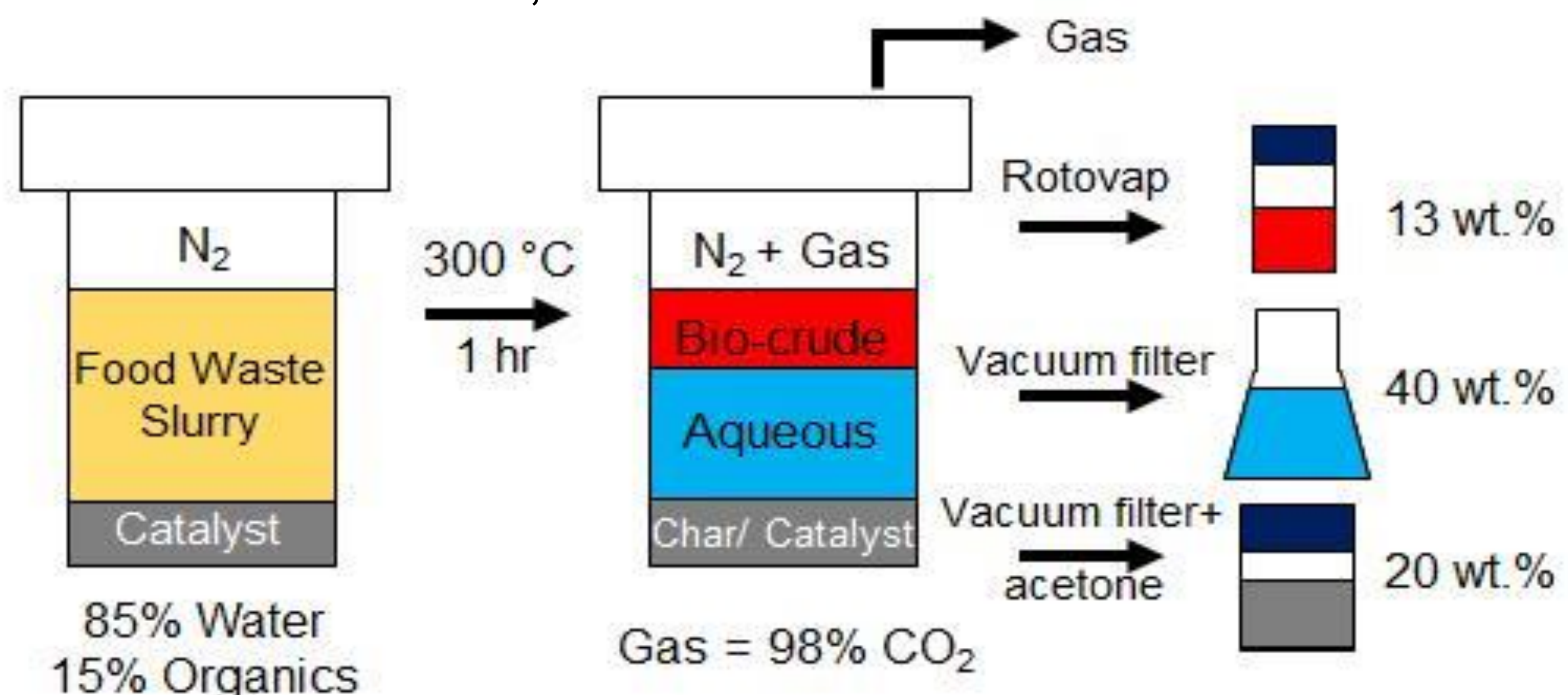


Char Aqueous Oil Gas

Goal: Maximize energy recovery and oil yield using acidic catalysts, basic catalysts, as well as liquid-liquid extractions of the aqueous phase.

HTL Method

A high temperature, high pressure reaction at 3000 psi, 300°C, and 1 hour reaction time

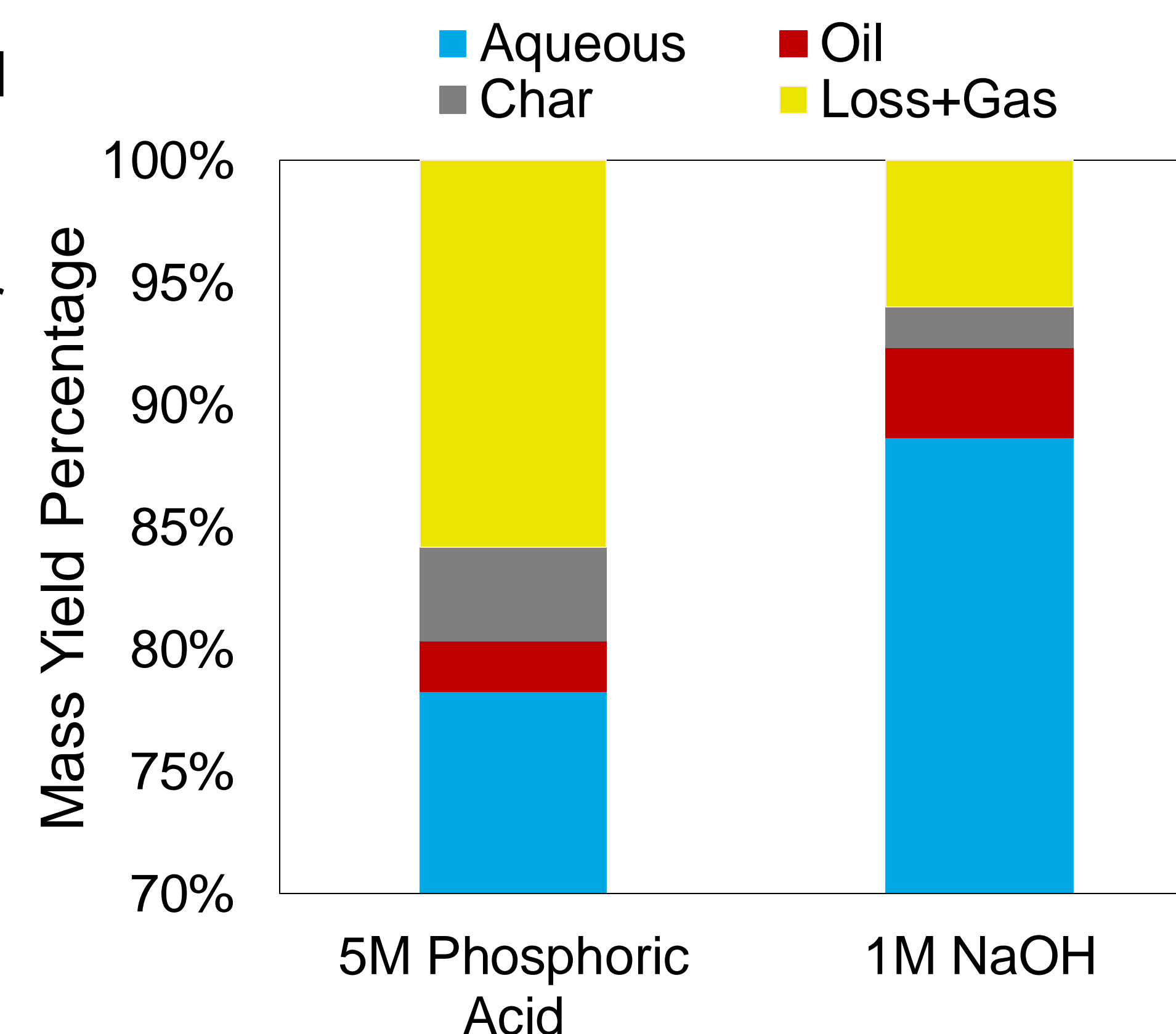


References

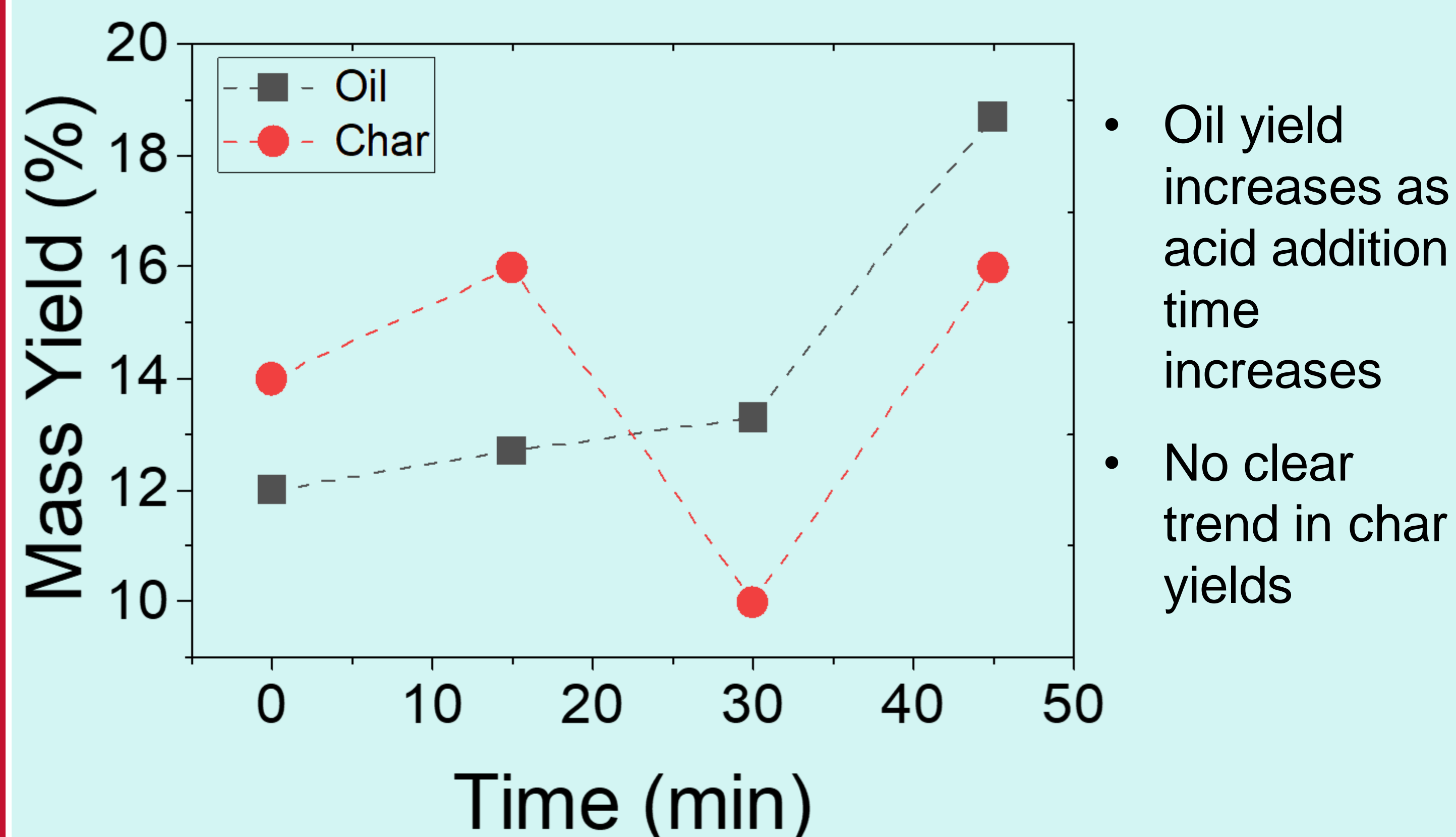
1. Nutrition, C. for F. S. and A. (2021). Food loss and waste. *FDA*. <https://www.fda.gov/food/consumers/food-loss-and-waste>
2. Posmanik, R., Martinez, C. M., Cantero-Tubilla, B., Cantero, D. A., Sills, D. L., Cocero, M. J., & Tester, J. W. (2018). Acid and alkali catalyzed hydrothermal liquefaction of dairy manure digestate and food waste. *ACS Sustainable Chemistry & Engineering*, 6(2), 2724

Acidic HTL Reaction Results

Homogeneous acid results in decreased oil yield and increased char yield!

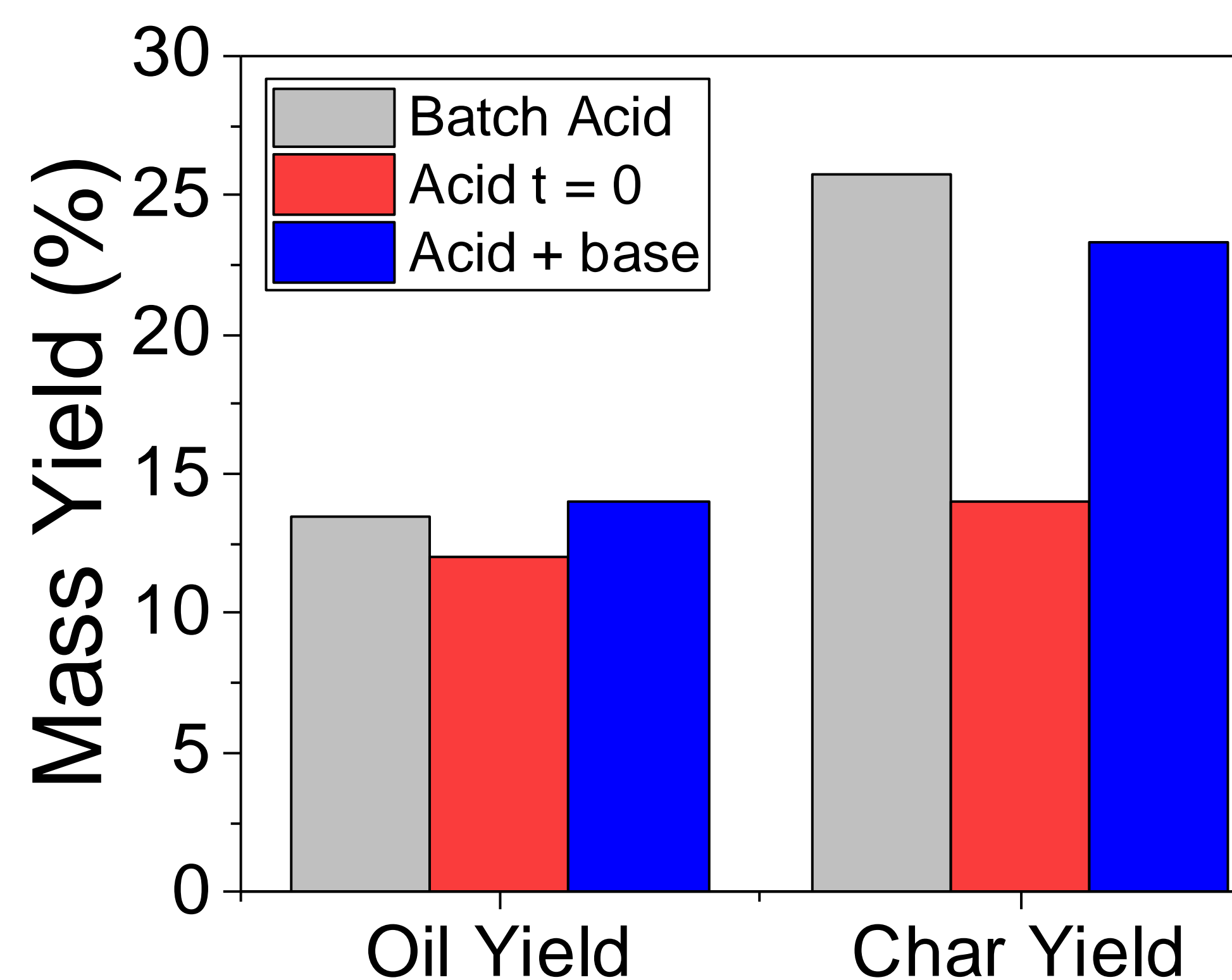


Hot Addition Acidic HTL Reaction Results

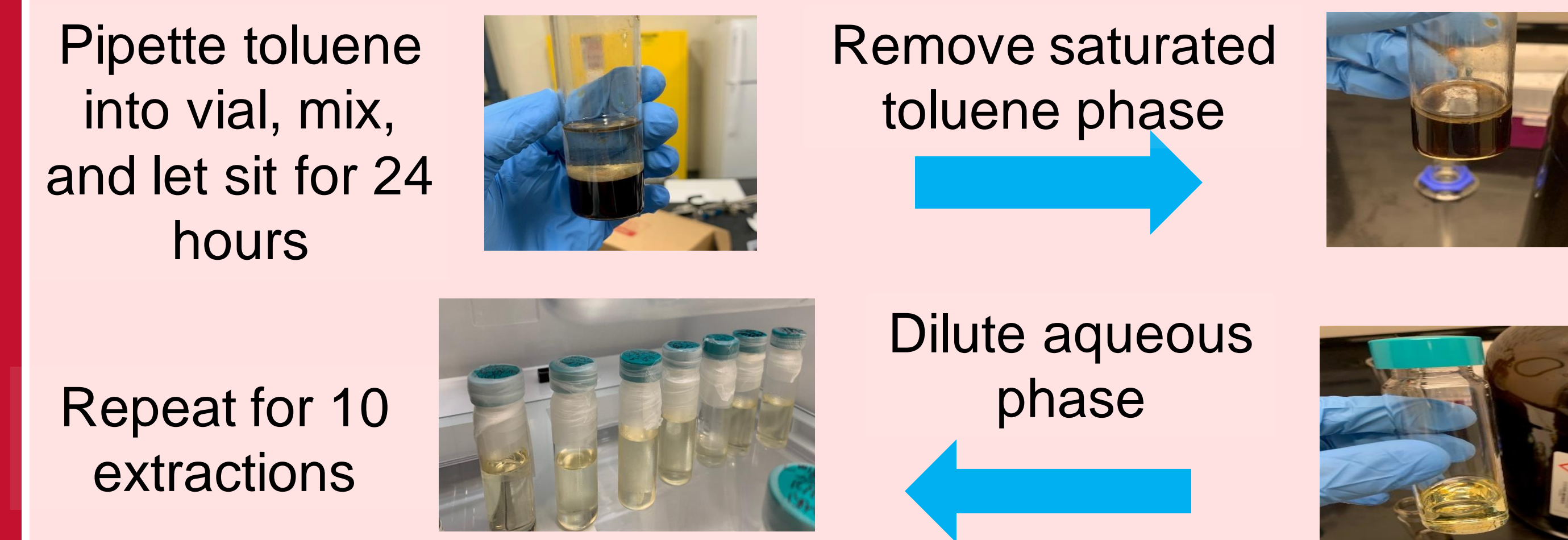


Acid-Base Reactions

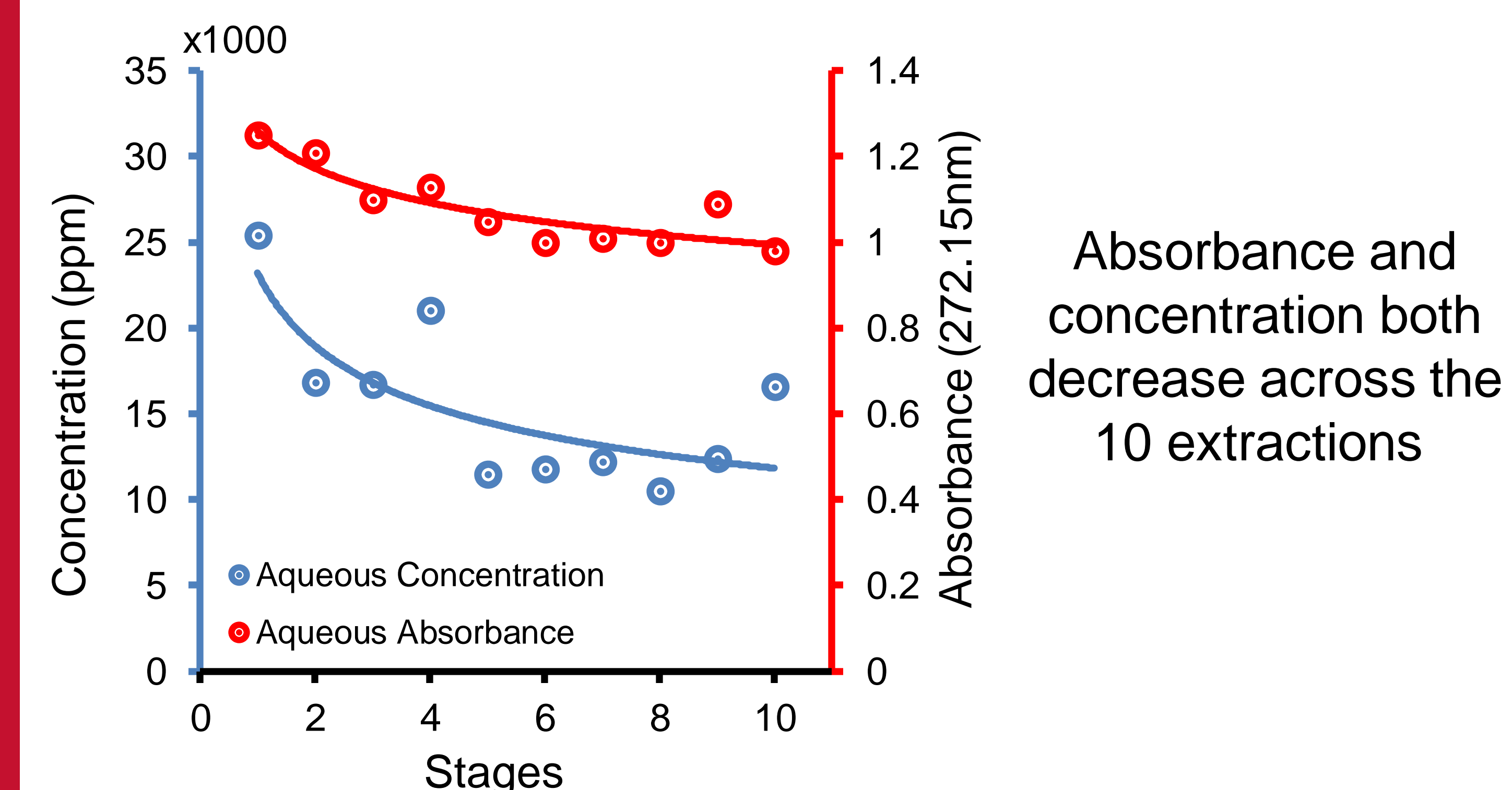
- Adding base to the reaction slightly increases oil yield.
- Having acid or base at the start of the reaction increases char yield.



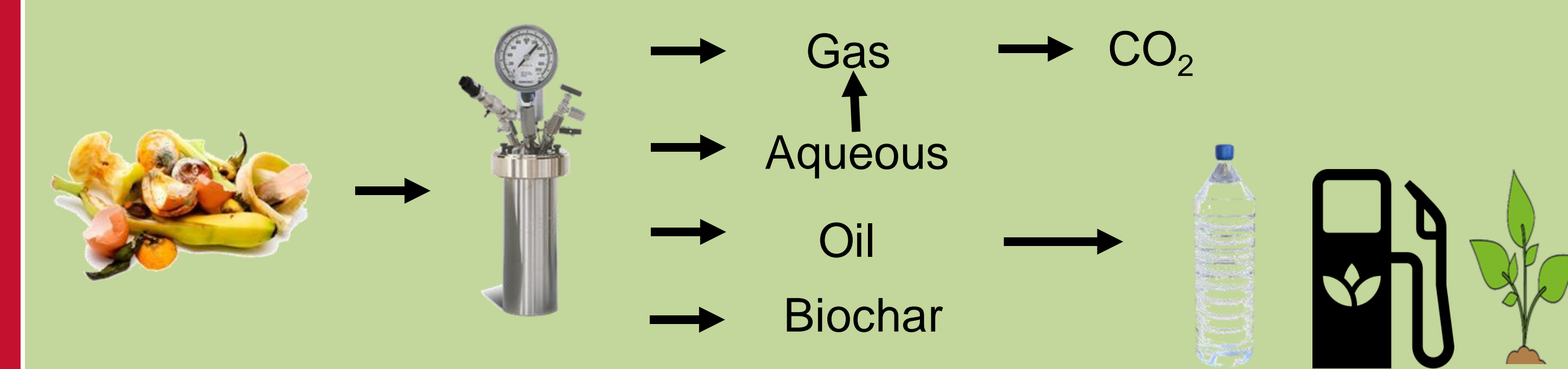
Toluene Separation Process



Toluene Decreases Carbon-Containing Compounds in the Aqueous Phase



Conclusions and Next Steps



- Toluene proves to be a strong and effective solvent in the extraction process.
- Adding base to an acidic feed decreases char yield while not impacting the oil yield much.

Next Steps:

- Run toluene phase in UV.
- Repeat experiments and finish fed-batch Acid-Base Experiments

Acknowledgments

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