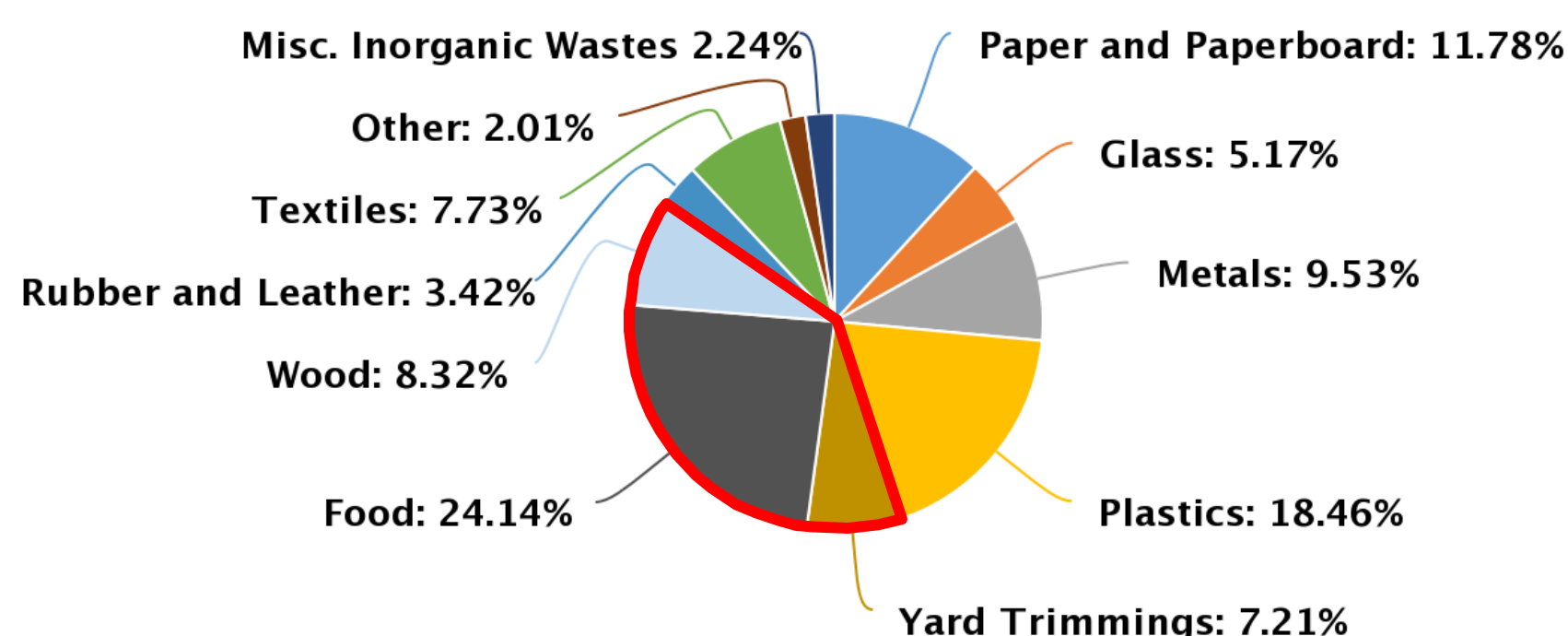




Motivation

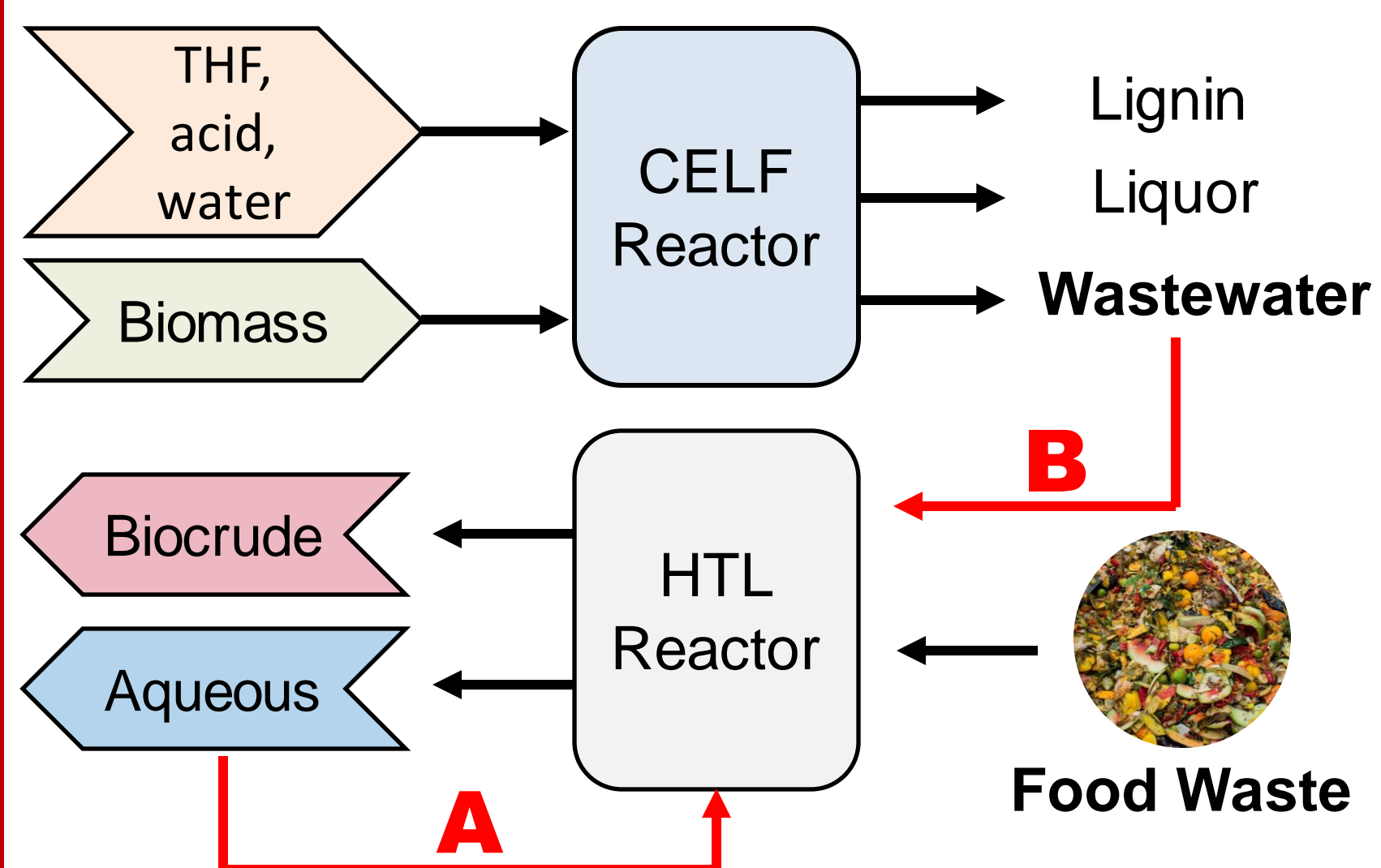
Total MSW Landfill by Material, 2018

146.1 million tons



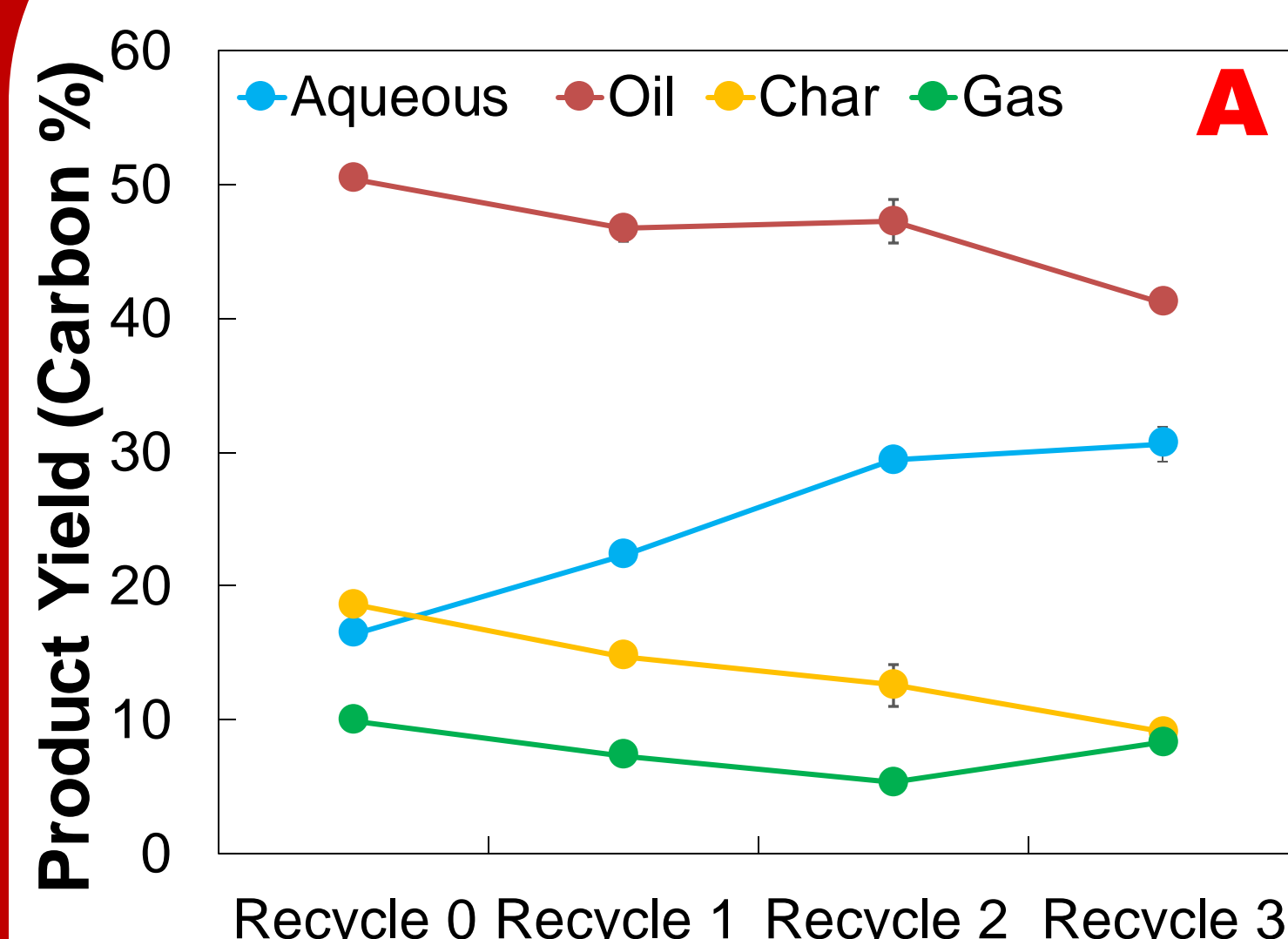
- Food and green waste comprise ~40% of materials in landfills
- U.S. food waste results in **170 million metric tons of CO₂** annually (excluding emissions from landfills)

Methods



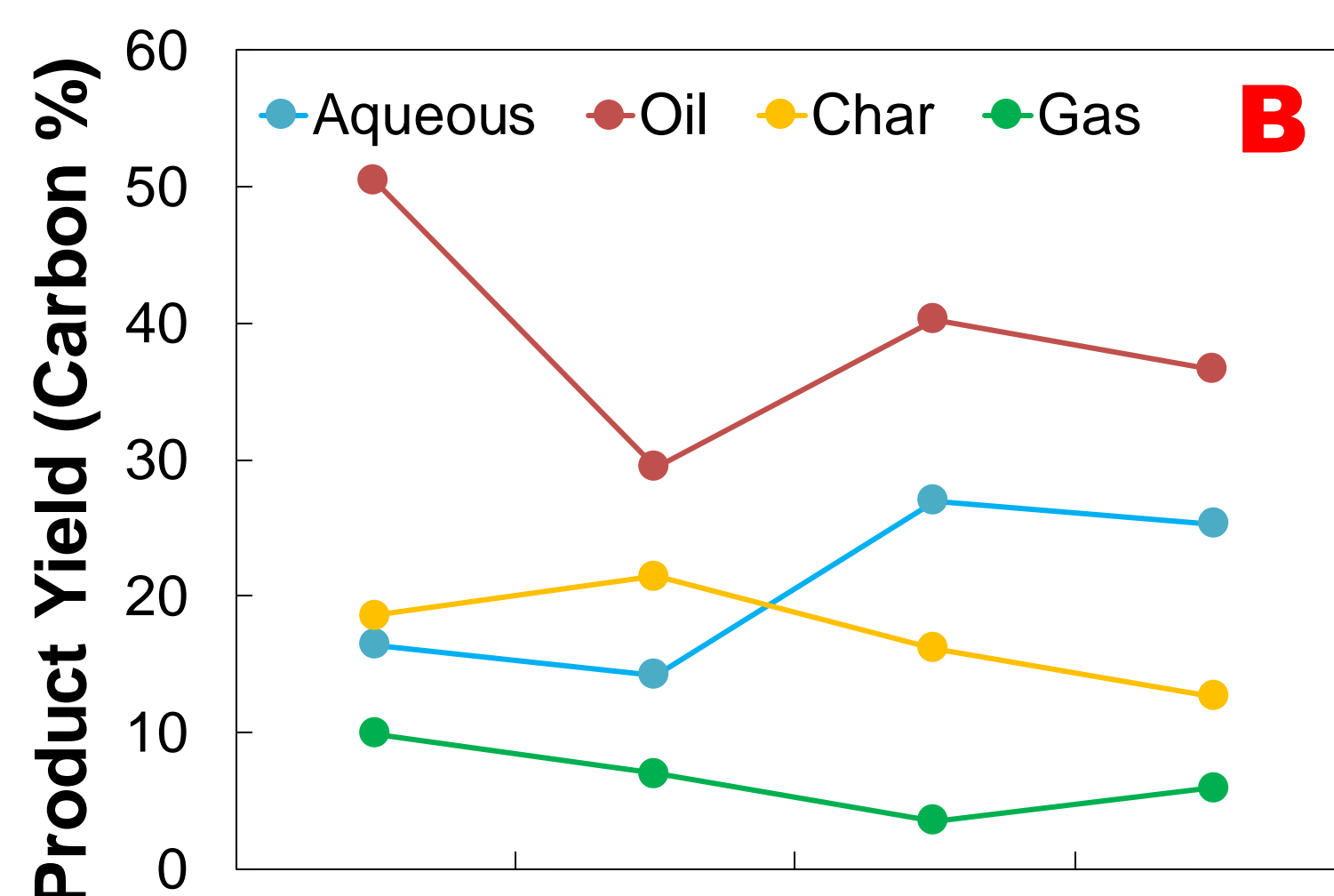
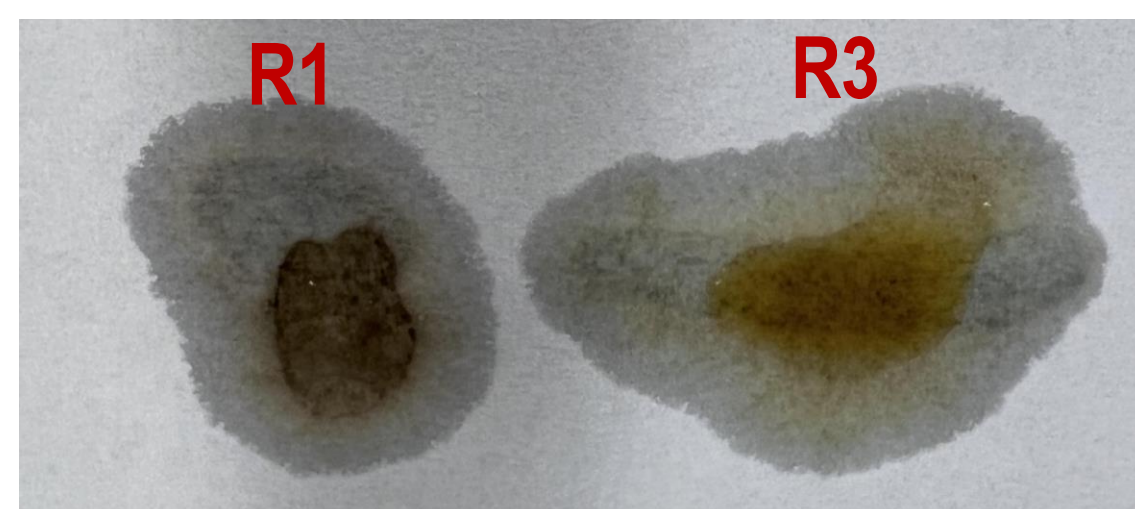
- HTL typically uses pure water as a feedstock alongside the organic feed
- The process produces wastewater that can be reused in the process rather than using pure water

Results



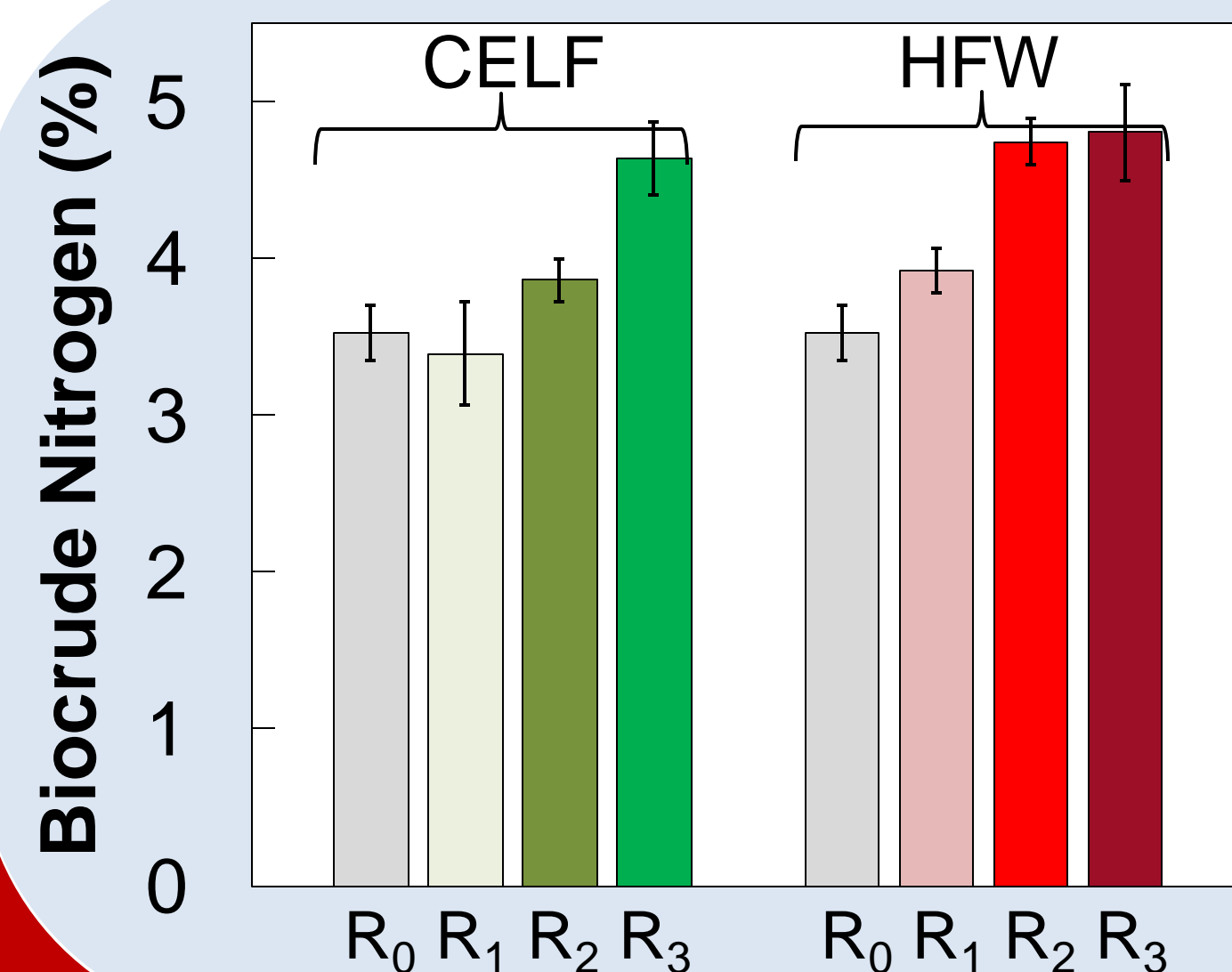
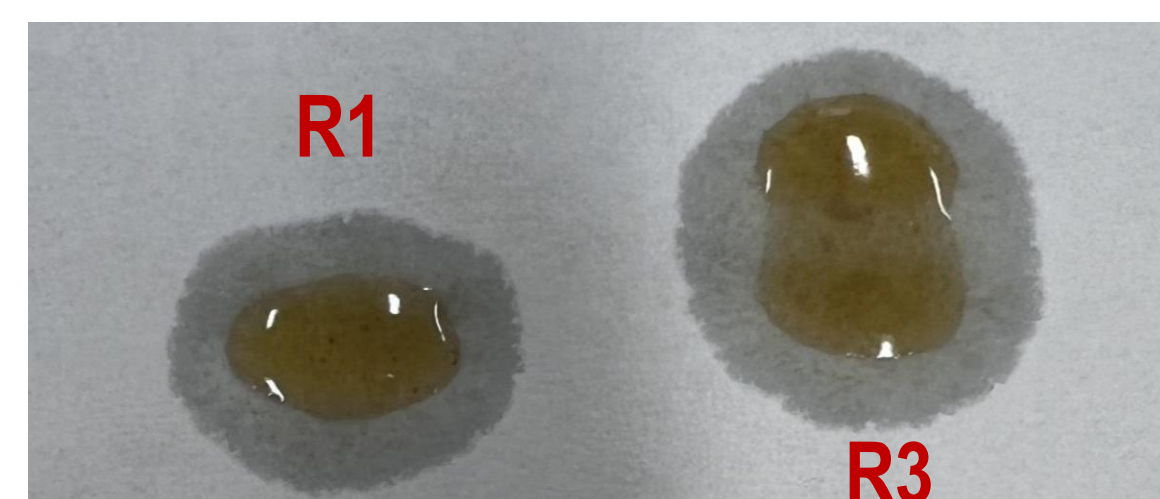
Food Waste Aqueous Recycle

- Recycling with CELF aqueous shows a significant decrease in oil yield when recycled with food waste
- There is a large amount of loss during the first recycle of the CELF aqueous phase using the current extraction procedure



CELF Aqueous Recycle

- Recycling with aqueous phase derived from food waste shows a decrease in oil yield as compared to using water
- Carbon accumulates in the aqueous phase with each recycle

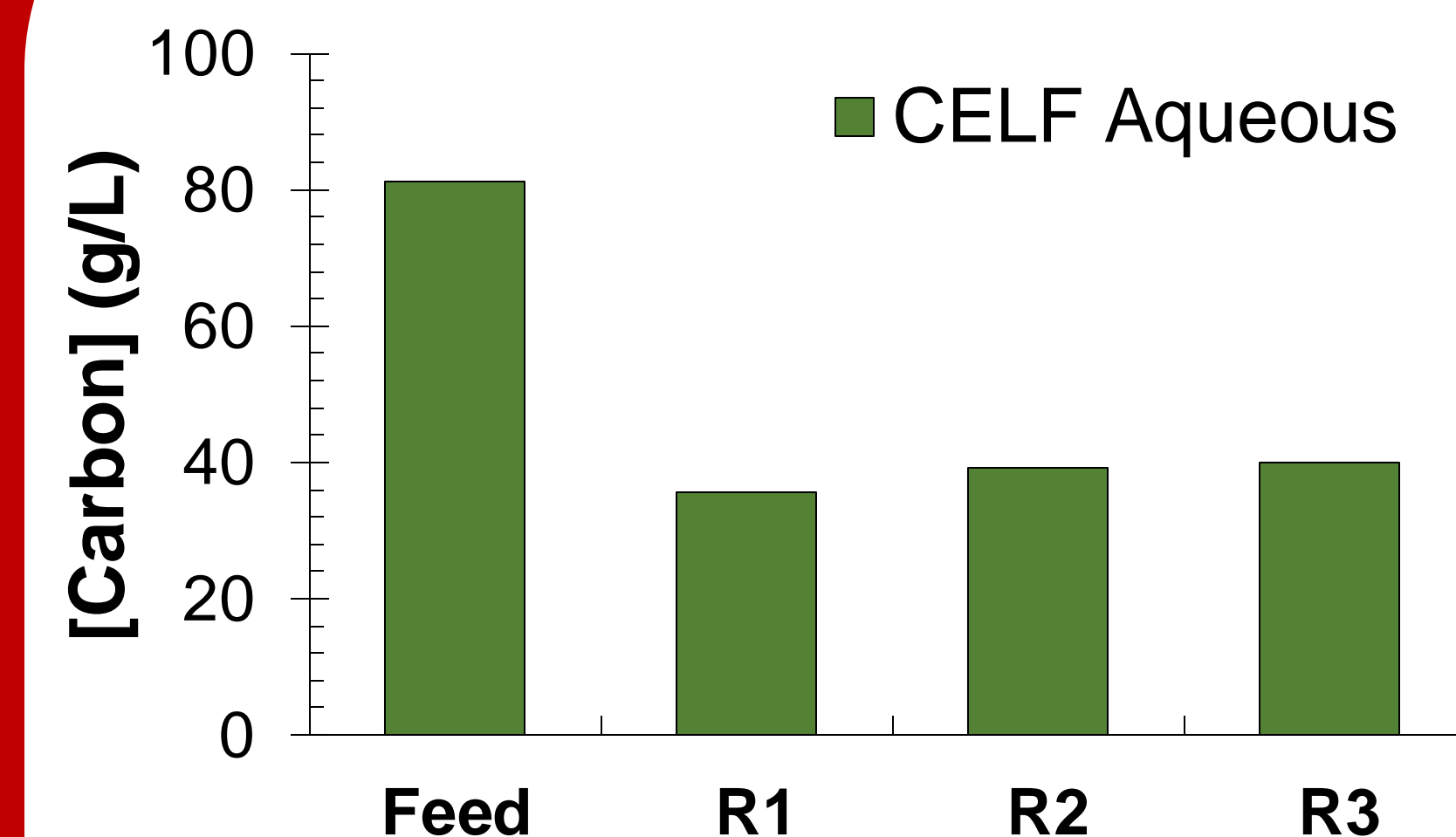


Nitrogen Accumulation in Biocrude

- As aqueous phase is recycled, nitrogen content in the biocrude oil increases, indicating a lower oil quality with each recycle
- Both feeds show this trend to similar degrees

$$HHV = \frac{[33.5C + 142.3H - 15.4O - 24.5N]}{100}$$

Aqueous Phase Carbon Reduction



Recycling CELF aqueous phase significantly reduces carbon content from the initial feed

Conclusion

- Recycling CELF aqueous in HTL is beneficial due to the decrease in organics in the aqueous phase
- Recycling food waste aqueous is not beneficial due to the decrease in oil yield and increase in aqueous phase organics

Future Work:

- Explore effects of aqueous phase recirculation with a catalyst
- Develop ways to avoid heteroatom accumulation in the oil phase
- Perform economic balance on process to determine commercial viability

References

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