COCPIT

HTL Microbatch Tests: Protein vs Lipid Rich Feedstocks

Design of the experiment (DOE)

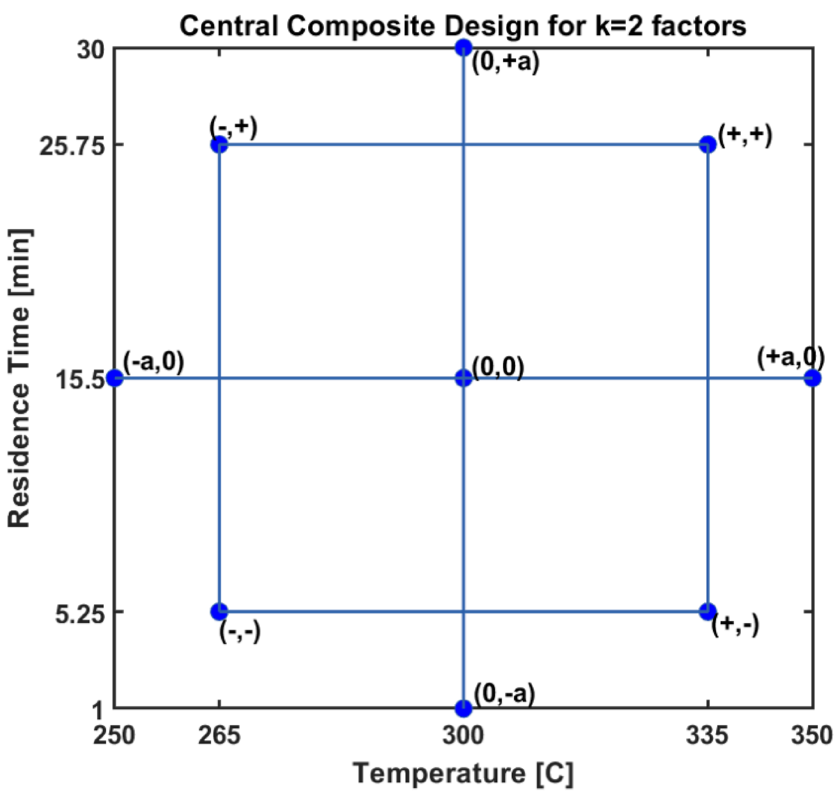
9 Experimental Points

7 Repetitions of the Central Point

3 Validation Points

CCD Repeated for each feedstock

Central composite design (CCD) was used to reduce the number of experimental points and predict the trend of changes in biocrude and hydrochar yields.



Microbatch Reactors

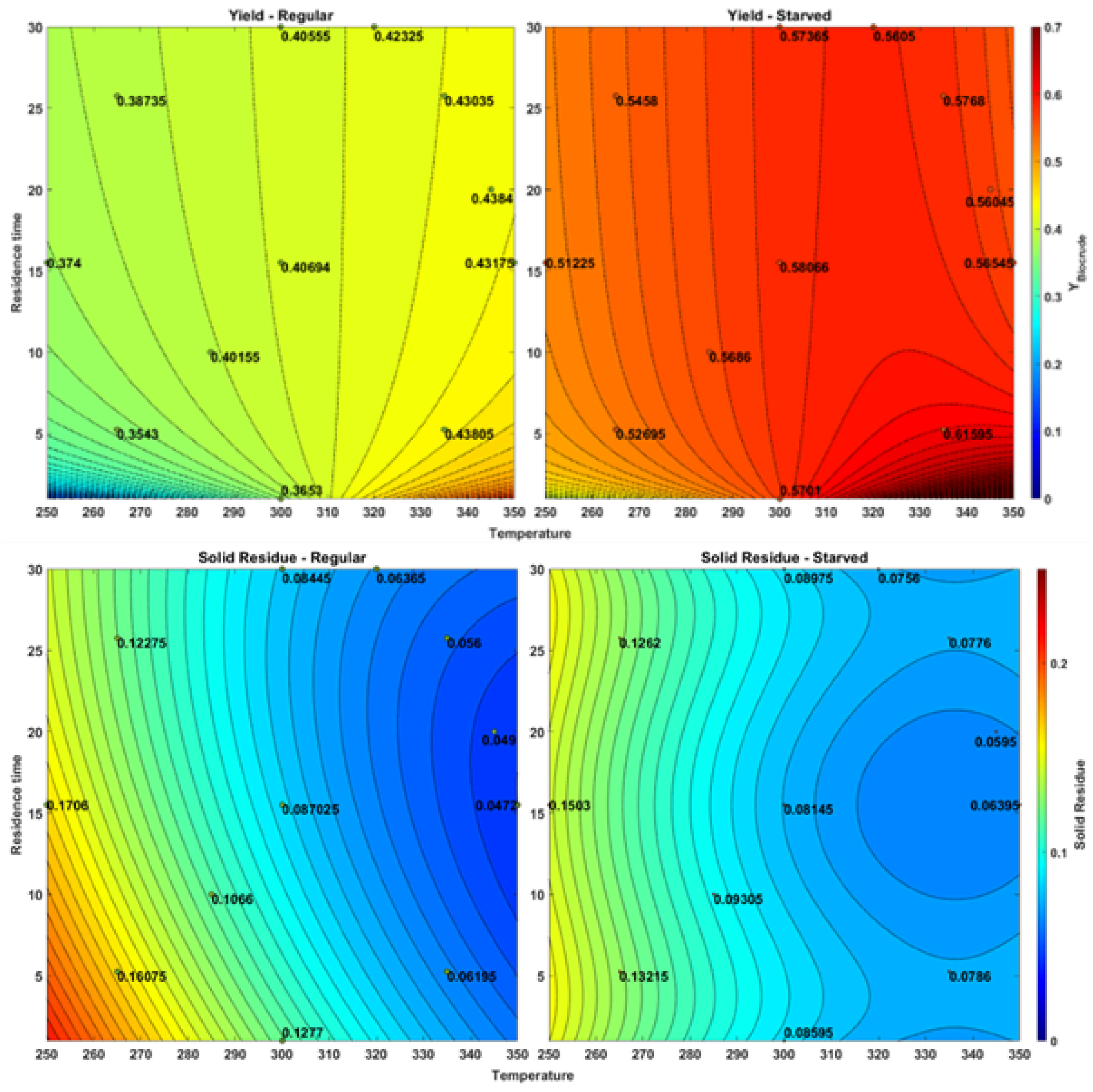
- Total volume: 13ml
- Slurry weight: 7g
- Fast heating using a sandbath
- Fast cooling using water

Product Separation

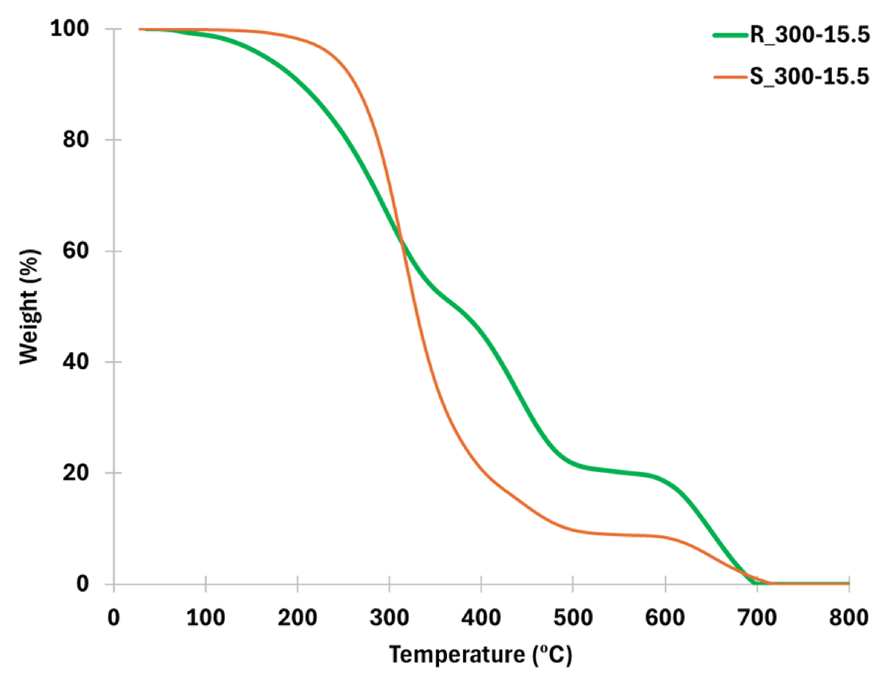
Filtration and acetone washing to separate the aqueous phase, the solid phase, and the biocrude.
Acetone evaporation and liquid-liquid extraction using DCM to purify the biocrude and remove remaining moisture.

Results – Product Yields

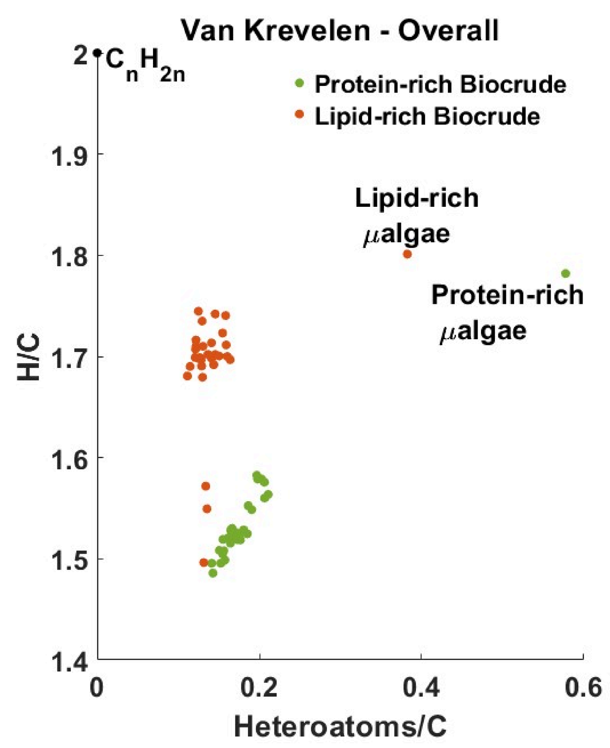
Protein-rich microalgae produce less biocrude and more solids than the lipid-rich ones.
The biocrude yield increases with temperature. At lower temperatures, the yield increases with residence time, whereas at higher temperatures it decreases, stabilizing in both cases after around 10 minutes.
The hydrochar yield is affected by the temperature more than the residence time, especially at high temperatures. The optimal operating conditions are 335 °C and 5.25 minutes for both feedstocks.



Results – Quality of the biocrude



The product of the lipid-rich microalgae is more homogeneous and contains less fixed carbon at the end.



The lipid-rich microalgae have a lower heteroatom content while maintaining a high hydrogen content.

Conclusion

The starved feedstock results in a larger quantity of biocrude that is of a higher quality; therefore, it is the better feedstock from an HTL point of view.

Prospective work

Optimal condition validation in continuous HTL
Overall process assessment from microalgae culture to biocrude hydrotreating.

WEBSITE

LINKEDIN

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