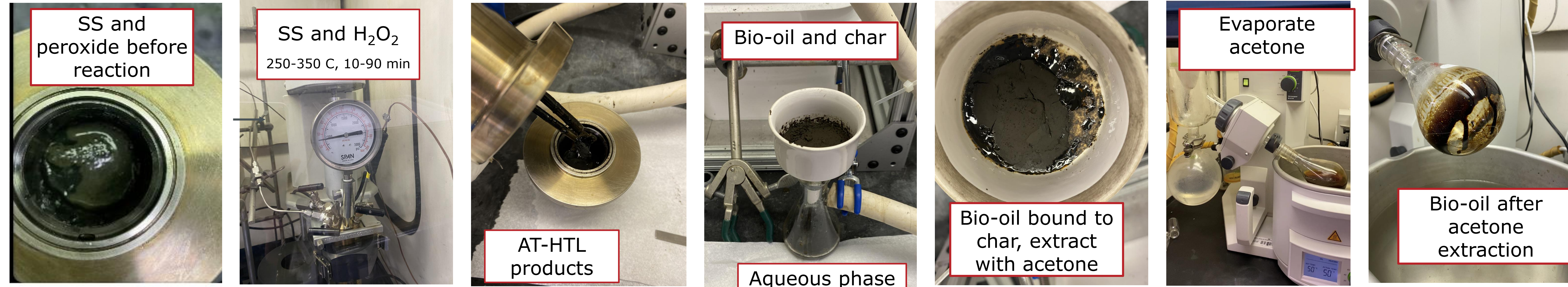


Conversion of Sewage Sludge (SS) to biocrude by autothermal hydrothermal liquefaction (AT-HTL)



Challenges to valorization of biocrude

- Traditional methods of HTL require drying SS (energy intensive process)¹
- SS contains a high percentage of ash (40-60%wt, corrodes reactors and interferes with bio-oil yield)²
- Catalysts have not been tested in AT-HTL or after pretreatment of SS to remove ash

These challenges all need to be addressed in order to make this a scalable and valuable process.

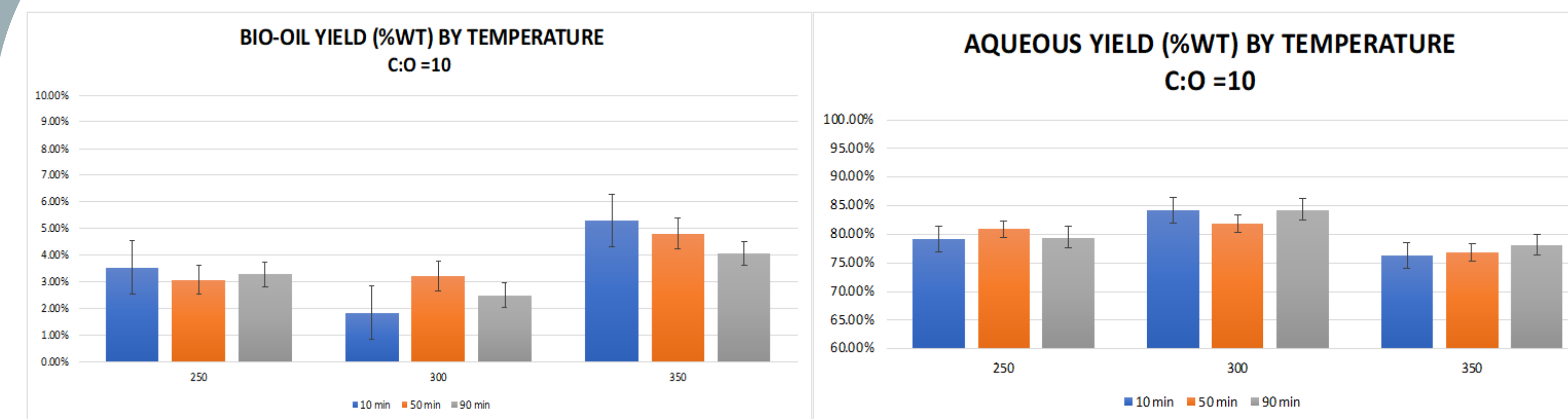
Proposed Goals and Solutions

- Optimize AT-HTL reaction: C:O ratio, residence time, reaction temperature
- Characterize AT-HTL products: TOC, elemental analysis, GC-MS; check carbon balances
- Test effect of catalysts on yields: 2 % NaCO₃, 5% FeSO₄^{3,4}

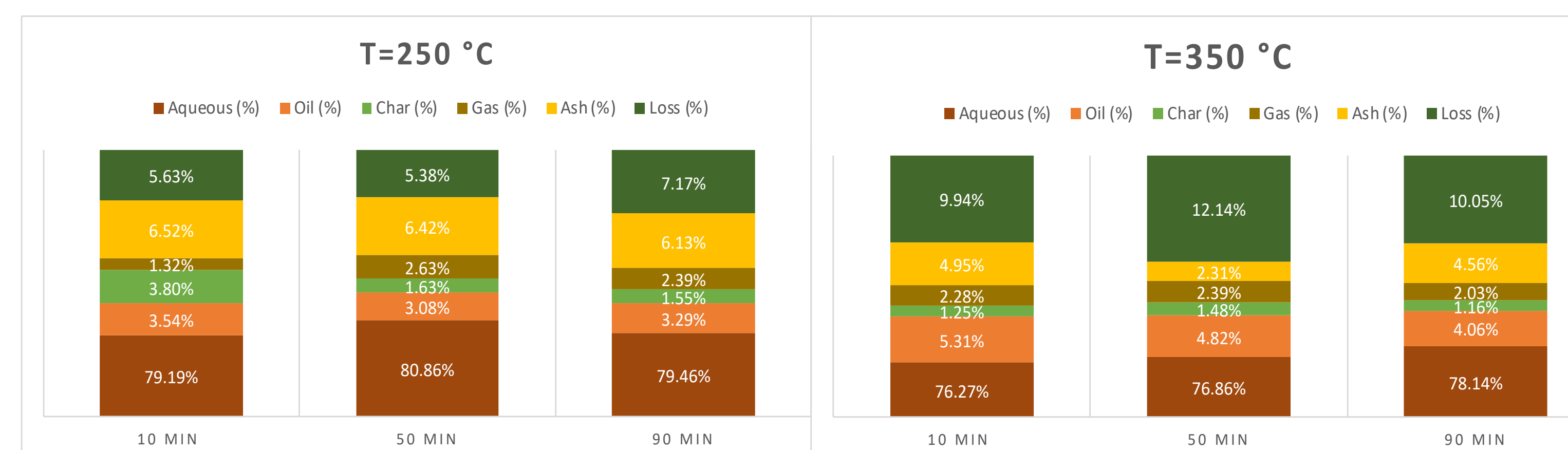
Acknowledgments

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Results



Biocrude yield via AT-HTL does not seem to be impacted significantly by temperature or residence time.



Considering the increased energy requirements and mass loss at 350°C, future experiments will be run at 250°C for ten minutes (pending carbon balance data).

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UN Sustainable Goals

- ✓ Renewable
- ✓ Easily available
- ✓ Affordable
- ✓ Ubiquitous
- ✓ Net-zero carbon emissions



SUSTAINABLE DEVELOPMENT GOALS

In the Classroom

Elements of this project will be used throughout the year as a real-world example for a variety of topics:

- Conservation of mass: How much SS needs to be converted to fuel a car?
- Separation of mixtures: How can we isolate bio-oil from a mixture?
- Ideal gas law: How much gas is formed in this process?
- Empirical formulas: What is the composition of bio-crude that is formed through AT-HTL?

Next Steps

- Experiments with catalysts to improve yield
- Experiments with pre-treatment/filtrations of SS to reduce ash