PhD Open Days

Flexible sustainable aviation fuel production: simulating how multiple feedstocks blend into a performant fuel

PhD in Chemical Engineering
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Motivation

Feedstock availability & cost → Blending feedstocks → Widen SAF supply via catalytic conversion

Scientific gap

How do chemically distinct feedstocks interact when converted together into fuel using hydrogen? Can these interactions be predicted?

Industrial gap

No open-source early feasibility tool → Extensive & costly experimental campaigns

Objectives & strategy

1. Map mixture effects experimentally
2. Build the kinetic model
3. Validate on industrial blends
4. Deliver the feasibility tool

What are mixture effects?

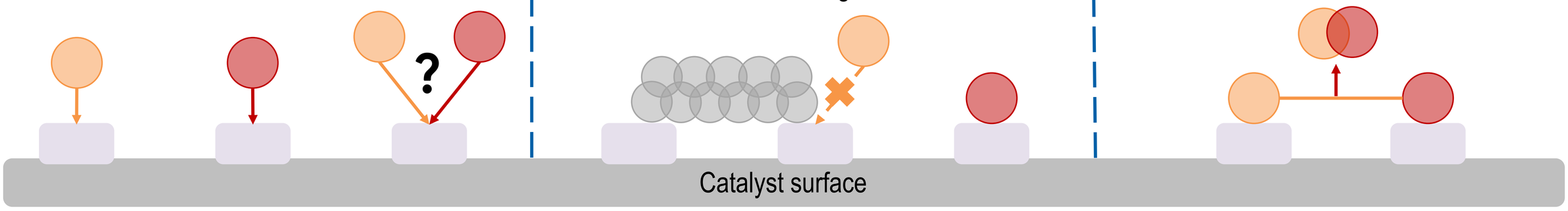
⚠ Impact deoxygenation efficiency & product composition

Lipid-derived · Biomass-derived · Coke · Active site

A Competitive adsorption
Both need the same active sites

B Accelerated coke deposition
Active site blockage

C Mixed-origin products
Products from both feedstocks



From model compounds to a feasibility tool

Experimental work
Computational work

Model: Blend composition + Operating conditions ⟶ Product composition

As binary model compound mixtures

Lipid-derived
Oleic acid, methyl laurate

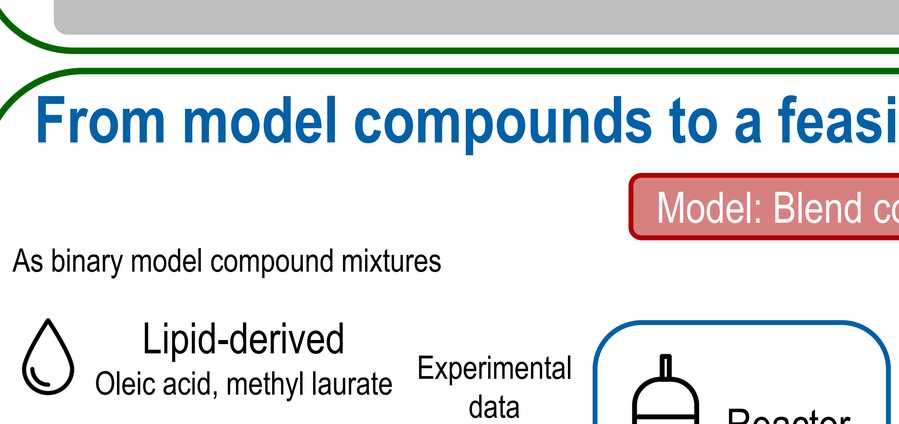
+

Biomass-derived
Guaiacol, 5-HMF, indole

Experimental data → Reactor (Fixed-bed $NiMo/Al_2O_3$) ⟷ Kinetic data / DoE → Model (Single-event microkinetic) → Experimental data → Validation (Unseen data + industrial feedstock blend) → Product composition → Blend-in SAF (ASTM D7566 compliant)

Experimental data feeds and validates the kinetic model

Expected industrial impact



Who benefits?

- **Suppliers** — New waste outlets
- **Producers** — Targeted pilot trials
- **Legislators** — Wider SAF deployment

Establish and model mixture effects → **Predictive tool for early industrial feasibility assessment**

Screen blends → Focus experiments → Diversify feedstocks → Support SAF deployment

Han. Y, et al. (2020). *Energy Fuels*, 34, 516-529 | Denson M. D., et al. (2024). Energy *Fuels*, 38, 6982-6991 | Poissonnier J., et al. (2022). *Fuel*, 308, 121940 | Kikhtyanin O., et al. (2026). *Fuel*, 406, 137144

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