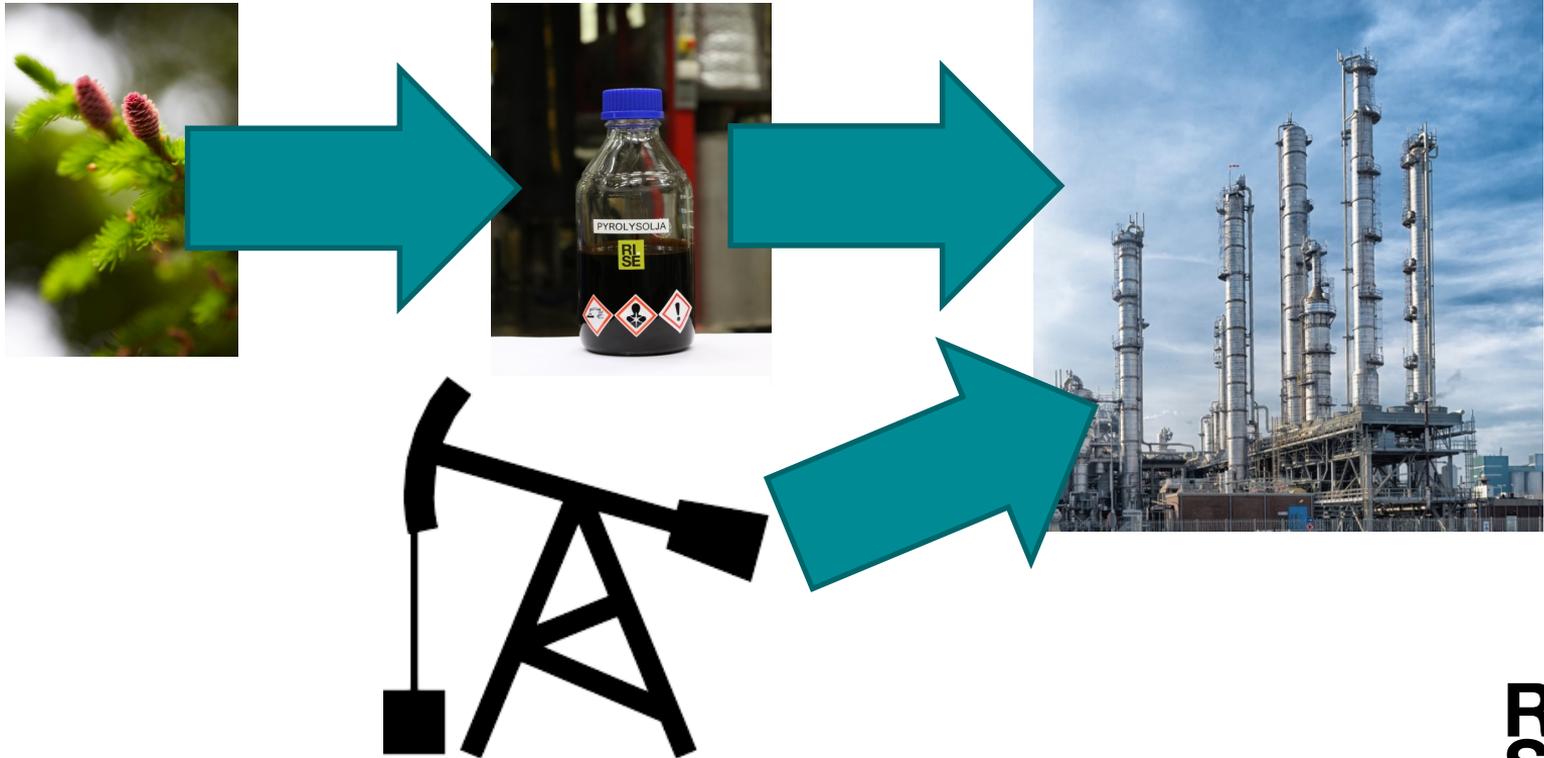


Co-refining of bio-based and fossil feedstock in a continuous slurry hydrocracking pilot plant

Linda Sandström, Niklas Bergvall,
Ann-Christine Johansson, Roger Molinder,
Olov Öhrman



Co-refining of bio-based and fossil feedstock



Slurry hydrocracking

- Important with efficient conversion processes of unconventional feedstocks when reserves are depleted.
- Higher environmental regulations lead to lower market demands on heavy petroleum products high in sulphur.
- Difficult feedstock – important to avoid coking, pressure drop, poisoning, hot spots etc. and ensure high conversion.
- Slurry hydrocracking has shown to be one process of high interest.
- Preem is performing a study for a large scale installation in Sweden. Approximate cost 15 000 MSEK.



How does it work?

- Slurry with dispersed homogenous catalyst
- 100 – 200 bar
- 400 – 500°C
- Catalytic hydrogenation and thermal cracking.
- 90 % conversion is state of the art.
- Often sulfided metal catalysts such as Co, Mo, W or Fe

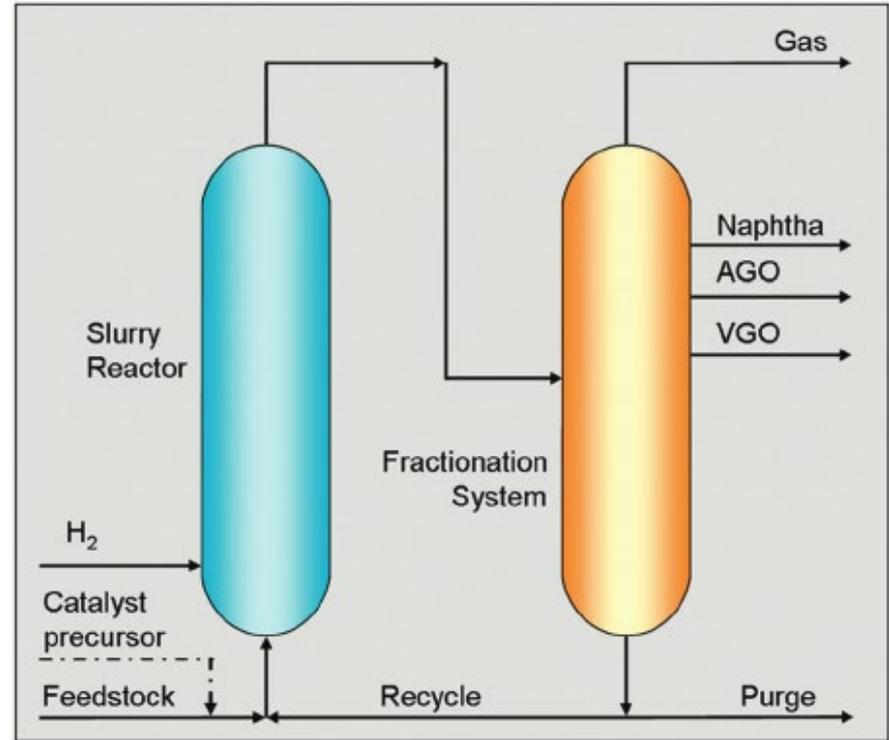
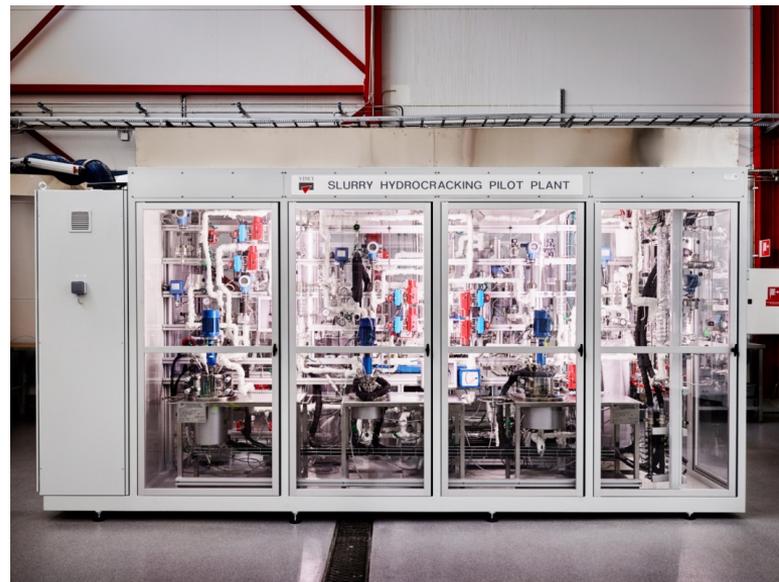


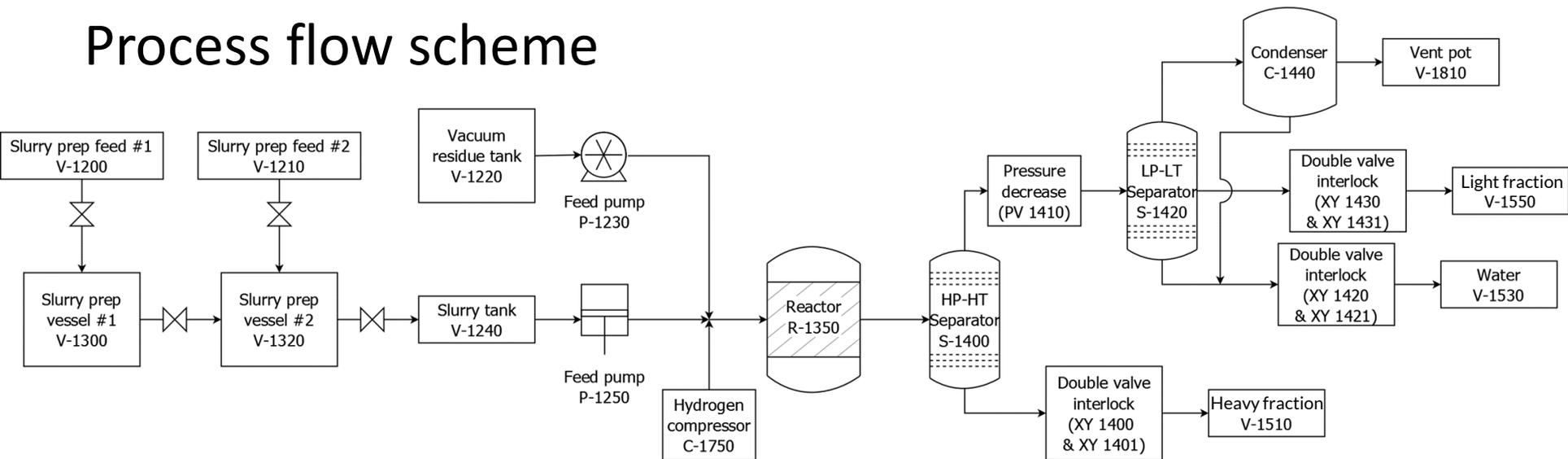
Image from: *Catal. Sci. Technol.*, 2013,3, 176-182

Slurry Hydrocracking Pilot Plant (SHC)

- Flexible and available open research infrastructure
- Financed by the Swedish Energy Agency, Preem, RISE and the Kempe foundations
- Temperature up to 500 °C and pressure up to 180 bar (hydrogen)
- 2 dm³ reactor volume (CSTR), LHSV 0.5 – 2 h⁻¹
- Liquid feed rate about 1 dm³/h
- Batch or continuous trials with continuous hydrogen flow
- In operation since March 2017



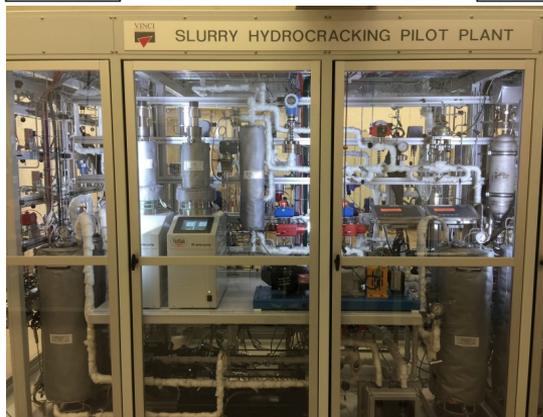
Process flow scheme



Slurry prep and reactor side



Gas feed side



Feeds and products side



Hydrogen compressor



Production of pyrolysis oil for co-refining tests

- Fast pyrolysis pilot plant (POC)
- Cyclone reactor with heated walls (ablative)
- About 30 kg feedstock/h
- Oil collected in two fractions
- Commissioned 2011
- 7 scientific publications (peer-reviewed)
- Willow and pine/spruce



Co-refining of pyrolysis oil and fossil feedstock in the SHC pilot

- Pyrolysis oil produced in the POC pilot plant was used as feedstock together with a low value fossil oil
- The pilot plant produced a heavy fraction, a light fraction and a water fraction as intended.
- Results evaluated by conventional research methods:
 - Mass balance
 - C, H, N, S, O balance
 - ^{14}C analysis of feed and products
 - 2D GC-MS, Simulated distillation



Co-refining of pyrolysis oil and fossil feedstock in the SHC pilot

- Continuous operation during 10+ hours.
- 100 +/- 5% closure of mass balance
- Detailed results to be published



Conclusions

- Successful co-refining of bio-based pyrolysis oil with fossil feedstock in continuous mode
- We believe that this pilot can be used to validate previous data obtained in batch experiments.



Thank you!



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