Heat to Fuel

Whole chain demonstration

Vienna, 27.04.2022

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BEST
Bioenergy and Sustainable Technologies

Scope

- Demonstrating the APR process on lab-scale
- Benchmarking the full-scale millistructured FT reactor
- Produce FT diesel complient with fuel standards
- Connecting the wet and dry route

APR process demonstration

Scale-up

Aqueous phase

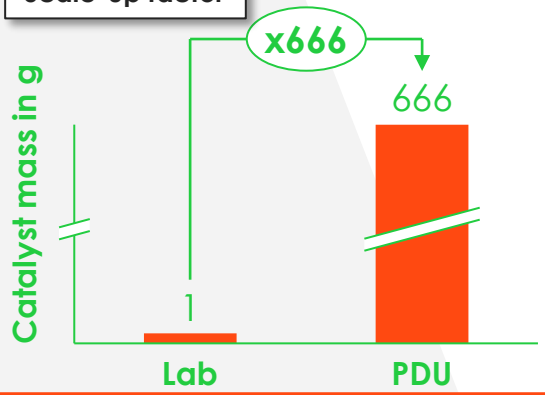
Carboxylic acids
Alcohols
Ketones
Polyalcohols
Aromatics
Aldehydes

APR

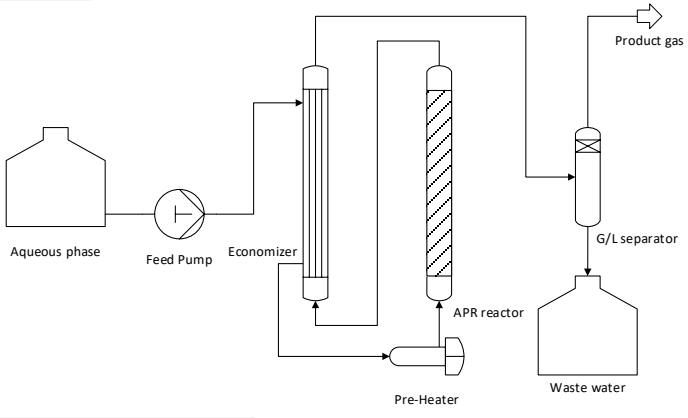
Product gas

Hydrogen
Carbon dioxide

Scale-up factor



APR process demonstration unit



APR reactor

Designed by **PoliTo/Khimod**
Manufactured by **Khimod**

Key facts

- Commissioned in Q2 2021
- Able to continously process up to 44 l/h of AP
- Max. allowable conditions: 70 barg and 290 °C
- Equipment made from 306/306L stainless steel
- Fully automated using an industrial PLC
- Certified by TÜV Austria

Summary

Key achievments

- Continous APR demonstrated in lab-scale for 250+ h
- Of that 100 h in one continouse test run (Mon 08:00 to Fri 12:00)
- Demonstrated operatorless operation overnight from 18:00 to 07:00
- Maximum of 500+ Nl/h gas produced

Conclusions

- Higher temperatures increase conversion
- Higher pressures decrease conversion
- Gas quality not significantly impacted by pressure and temperature
- Catalyst showed no signs of deactiverion over 229 days (250+ h net operating time)

Full-scale millistructured FT reactor

Fischer-Tropsch synthesis

Syngas

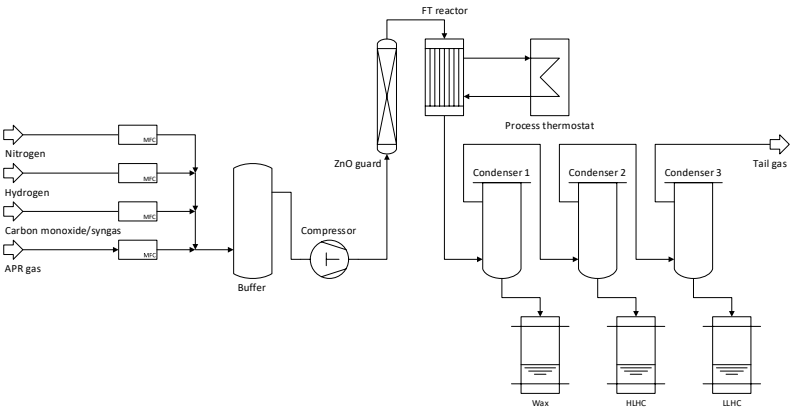
Hydrogen
Carbon monoxide

FTS

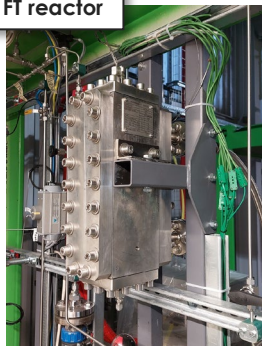
FT product

Alkanes
Alkenes
Alcohols

Lab-scale FT unit



FT reactor



Designed by **CEA**
Manufactured by **Khimod**

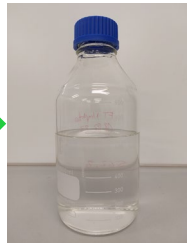
Key facts

- Originally designed for a SBCR (3.5 to 7.5 Nm³/h syngas)
- Rebuilt to accomidate the full-scale millistructured reactor
- Integrated APR gas supply
- Commissioned in Q4 2021
- Fully automated using an industrial PLC

FT product

Light liquid hydro carbons

- Condensed at ~5 °C and 20 barg
- Liquid at ambient temperature
- ~25 wt.% of total condensables

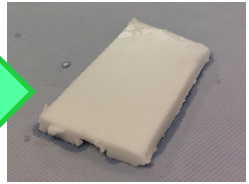


Heavy liquid hydro carbons

- Condensed at ~60 °C and 20 barg
- Liquid at ambient temperature
- ~15 wt.% of total condensables

Wax

- Condensed at ~150 °C and 20 barg
- Solid at ambient temperature
- ~60 wt.% of total condensables



Fuel analysis

Diesel was obtained through vacuum distillation from wax

Fuel analysis performed by CRF

Tested for compliance with EN 15940 Automotive fuels - Paraffinic diesel fuel from synthesis or hydrotreatment

Sample met all limits defined in EN 15940 Class A

Summary

Key achievements

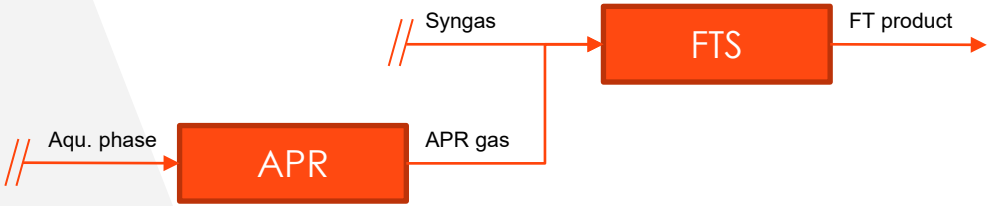
- 300+ h of operating time
- 6.4 kg of condensable FT product produced
- Diesel from FT experiments complied with the standard

Conclusions

- Similar CO conversion to intermediat scale
- Very long-chain product

Coupled APR/FT operation

Connecting wet and dry route



Summary

Key achievements

- 50 h of non-stop coupled operation
- 15 vol.% of syngas substituted by APR product gas
- Comparable CO conversion achieved for coupled operation

THANK YOU