

Scenarios <u>FOR</u> integration of bio-liquids in existing <u>REFINERY</u> processes

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Representative Feedstock

4Refinery in brief





High-level overview of HTL activities in 4Refinery

- HTL-biocrude production from AAU pilot unit
- Stand-alone hydrotreatment of bulk bio-crude
- Co-processing of biocrude distillates with straight run gas oil
- Co-processing of partially upgraded biocrude with rapeseed oil
- Hydrocracking of bulk bio-crude with vacuum gas oil



HTL and stand-alone biocrude upgrading

Carbon balance consideration:





Co-processing of HTL biocrude

- Bulk blending is a challenge
- Distillation decreases complexity and increases blendability
- >25 % of bulk biocrude is blendable in SRGO
- 75 % for hydrocracking?

	Aspen wood biocrude	Algae biocrude	Rapeseed oil	Pine wood biocrude	Heavy bunker fuel	SRGO
Aspen wood biocrude	\checkmark	\checkmark	×	\checkmark	×	×
Algae biocrude		\checkmark	×	×	\checkmark	×
Rapeseed oil			\checkmark	×	\checkmark	\checkmark
Pine wood biocrude				\checkmark	×	×
Heavy bunker fuel					\checkmark	\checkmark
SRGO						\checkmark



Miscibility and spot tests of woody biocrude and distillates in SRGO



Co-processing of HTL biocrude in SRGO

- Co-hydrotreatment of 5 % HTL distillates in straight run gas oil
- Objective: Guarantee diesel quality specs.
- Pros: Diesel quality specs were met
- Cons:



- Cat. Deactivation
- H₂ consumption nearly doubled
- Impurities in the H₂ loop

PROPERTIES	Unit	Target Values
Sulphur	ppmwt	<5
Density @ 15°C	kg/m ³	<845
PAH (Di+ Aromatics)	%wt	<7.0
Distillation ASTM D86 T95	°C	<361





Co-processing of partially upgraded biocrude

Integration into the *oleochemical pathway*



(Nearly) complete deoxygenation





Rapeseed oil

PUB-RO mixture (5-95 wt.%)







Thank you for your attention!



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