Continuous Co-Hydrothermal Liquefaction of Cow Manure and Wheat Straw Followed by Biocrude Hydrotreatment

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tcbiomass

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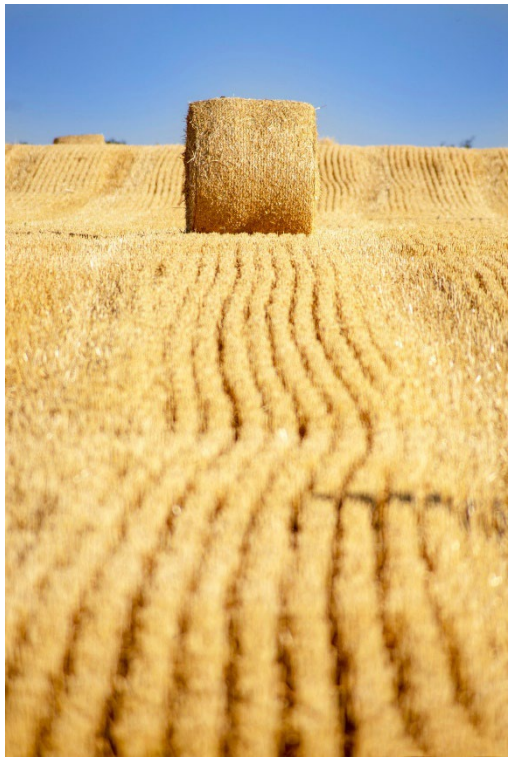
Agribusiness synergies

Wheat Straw



Dry stream
Low N

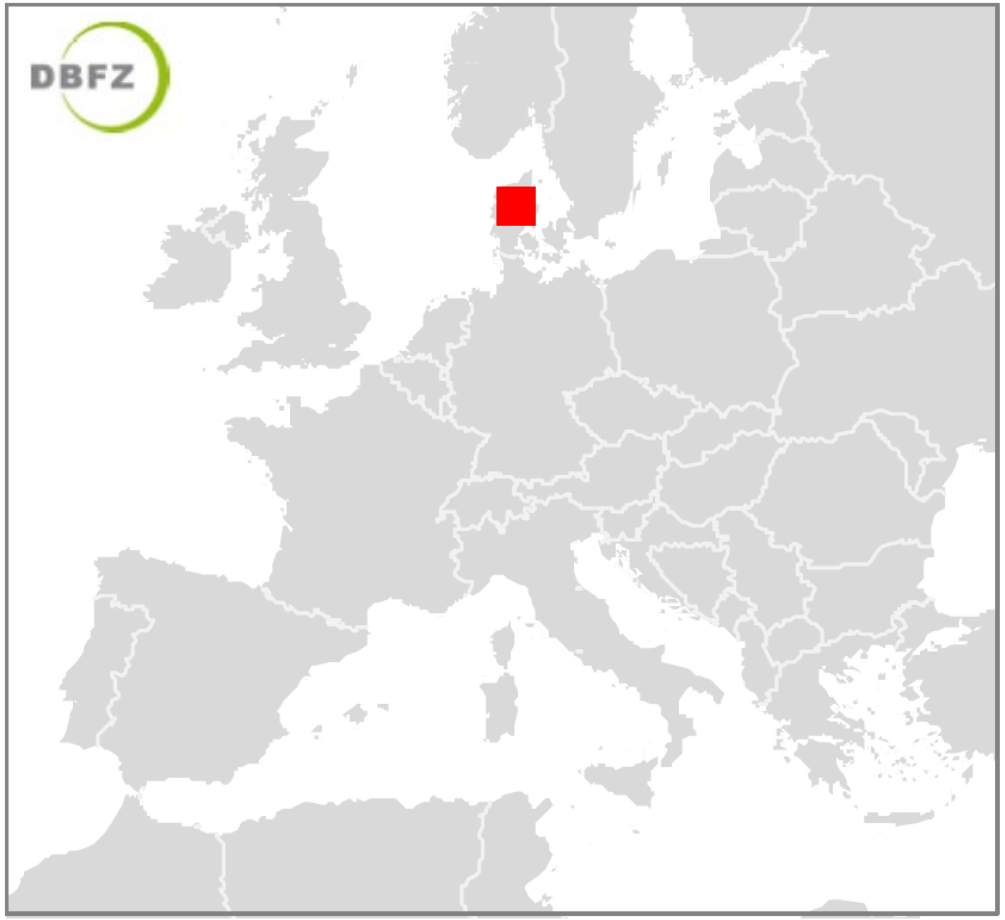
Wet stream
High N

HTL

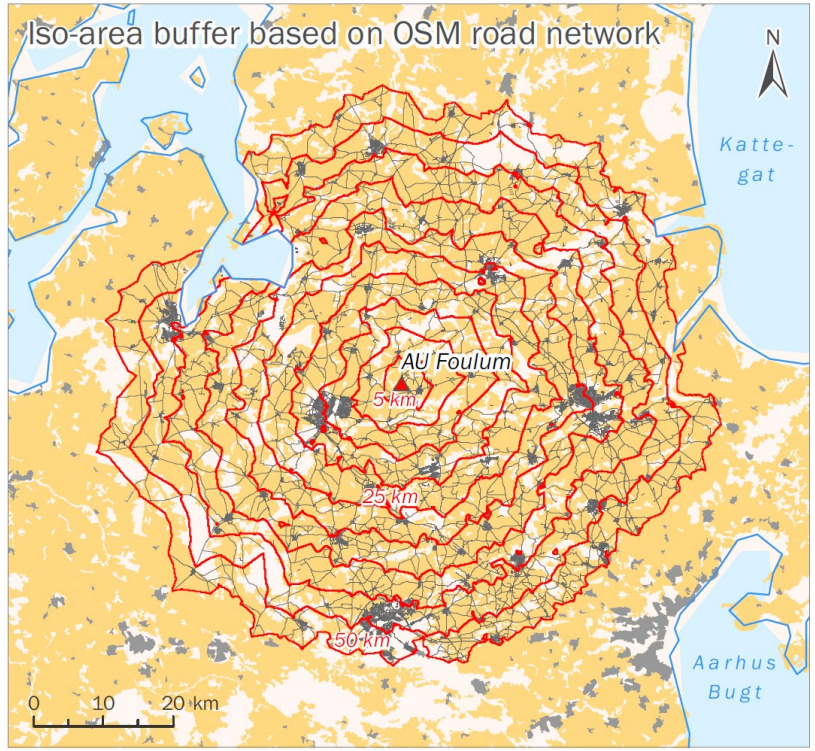
Cow manure

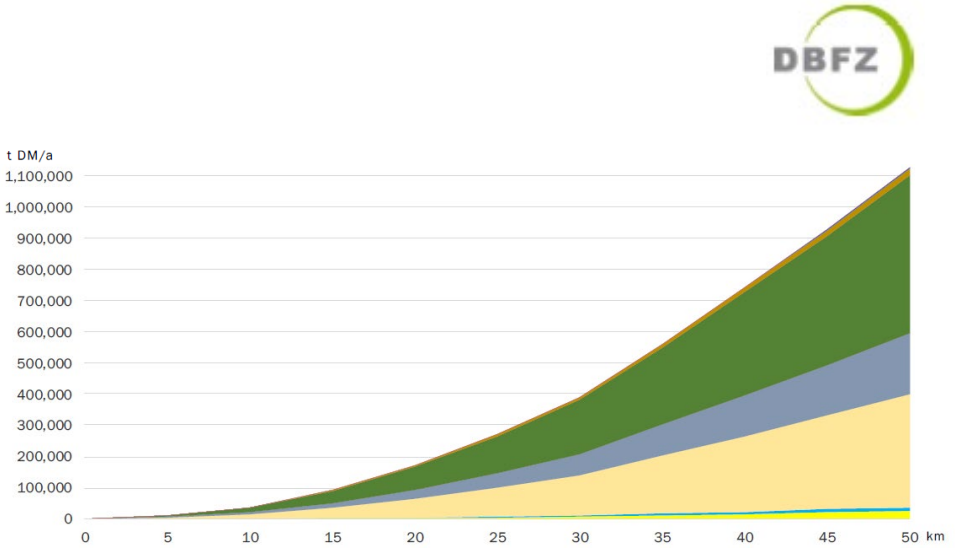
Juliano Souza dos Passos
Postdoctoral researcher

Agribusiness synergies



Agribusiness synergies

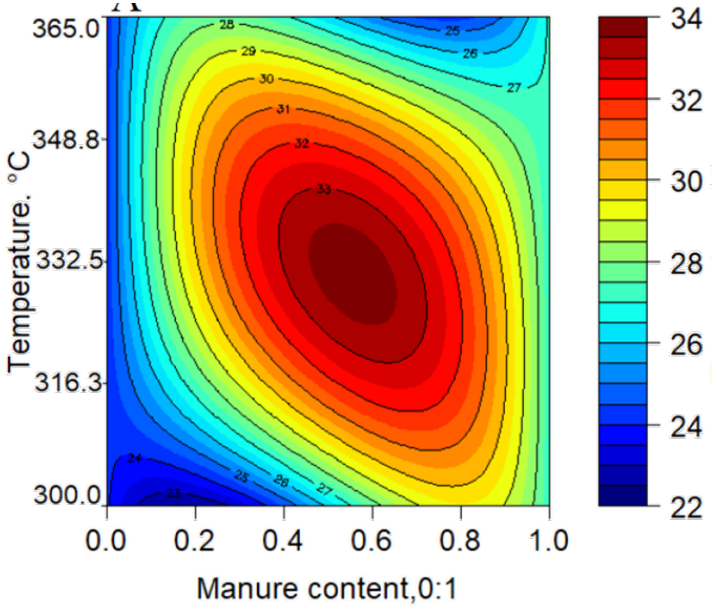




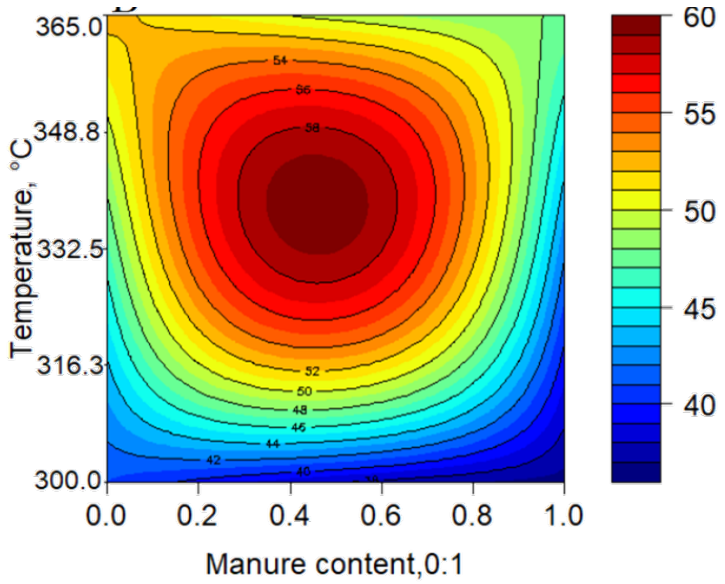
Feedstock	Available Biomass 0 - 50 km	Percent
Sugarbeet Leaves	7	0.00
Maize Stover	1,753	0.16
Oilseed Rape Straw	22,780	2.02
Sunflower Straw	0	0.00
Rice Straw	0	0.00
Cereal Straw	508,277	45.09
Poultry Excretions	116	0.01
Pig Excretions	193,469	17.16
Cattle Excretions	363,821	32.27
Sewage Sludge	12,147	1.08
Biogenic Municipal Waste	24,959	2.21
TOTAL	**1,127,329**	**100**
	t DM/a	**%**

HTL synergies – Batch optimization

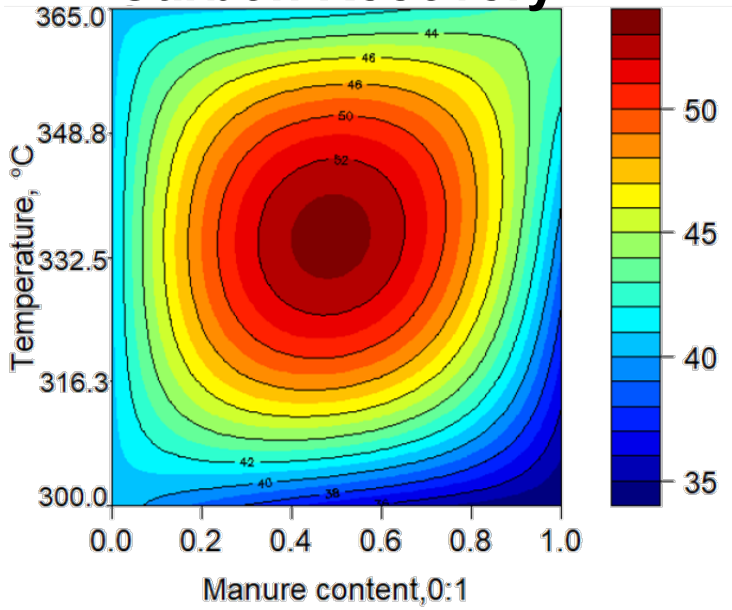
Oil yield



Energy Recovery



Carbon Recovery



Agribusiness synergies

Three different slurries

Wheat Straw

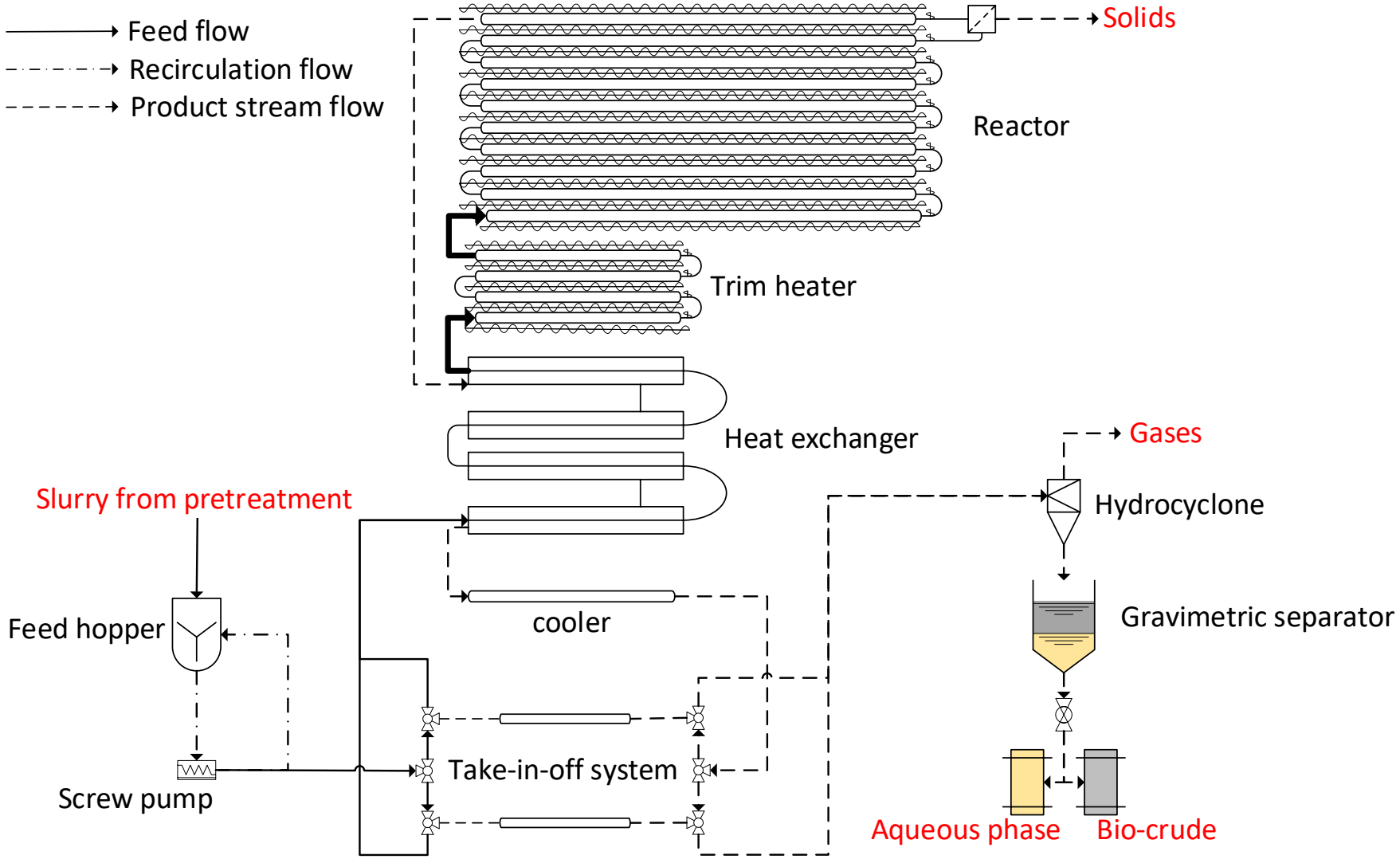
Cow Manure

Combined feedstock

HTL pilot plant

Anastasakis, K.; Biller, P.; Madsen, R. B.; Glasius, M.; Johannsen, I. Continuous Hydrothermal Liquefaction of Biomass in a Novel Pilot Plant with Heat Recovery and Hydraulic Oscillation. *Energies* 2018, *11* (10), 1–23. https://doi.org/10.3390/en11102695.

HTL pilot plant



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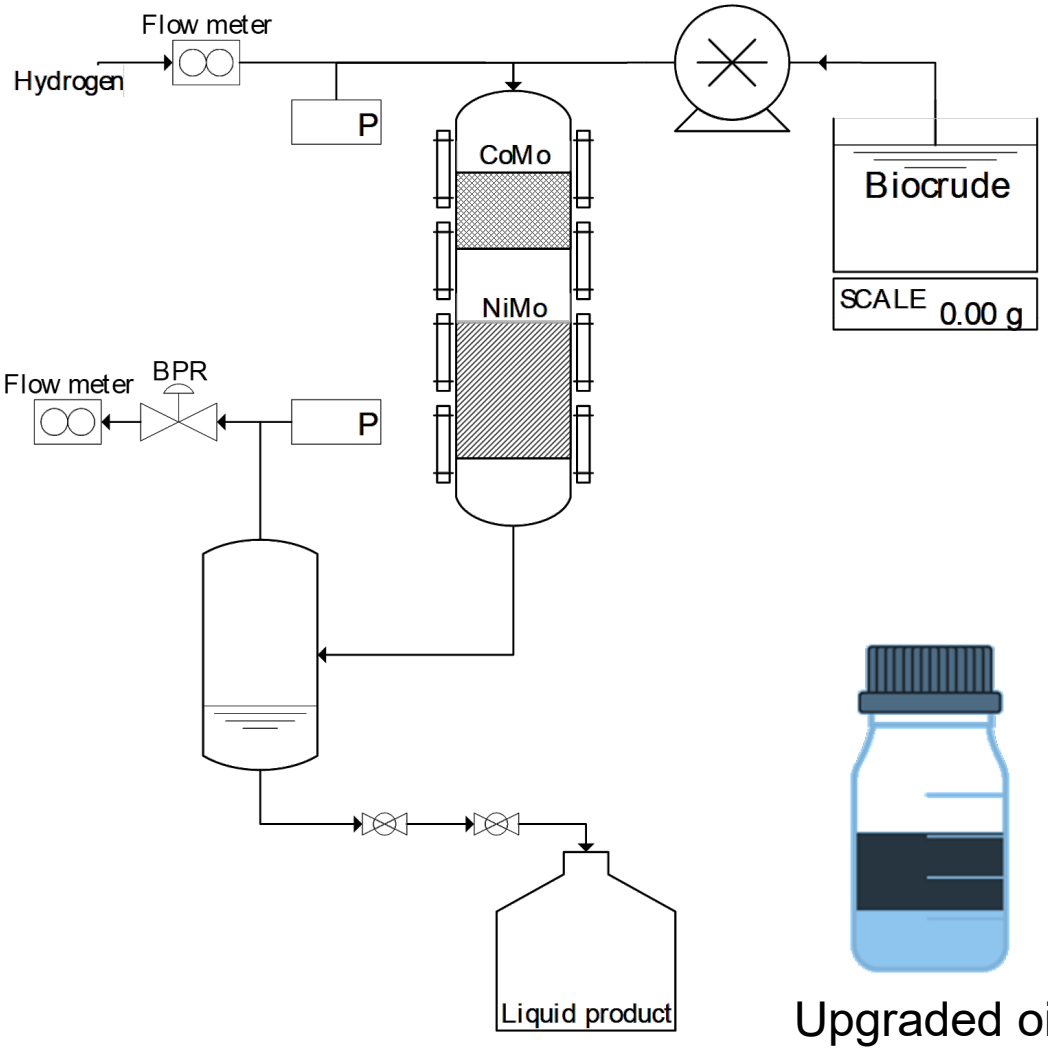
Continuous processing results

Table 2 – Continuous processing results

Property	Value	±	Value	±	Value	±	Unit
Feed slurry properties	Straw		Manure		Straw + manure		
Bio-crude							
Bio-crude yield (dry ash free)	26.9%	-	35.2%	-	38.5%	-	(kg_{oil} / kg_{input})
Bio-crude carbon yield (dry ash free)	39.7%	-	56.2%	-	60.2%	-	($kg_{C\ oil}$ / $kg_{C\ Input}$)
Bio-crude Nitrogen yield (dry ash free)	38.5%	-	36.4%	-	41.2%	-	($kg_{N\ oil}$ / $kg_{N\ Input}$)
HHV bio-crude (dry ash free)	28.7	0.4	30.6	0.4	30.4	0.3	(MJ/kg)
Energy in Bio-crude (dry ash free)	18.7	0.2	14.6	0.3	30.1	0.0	(kW, dry)
Energy Recovery (η_{th})	44.7%	-	59.8%	-	63.8%	-	(%)
Trim heater energy requirements	5.2	1.3	6.1	0.2	6.1	0.5	(kW)
Reactor energy requirement	4.0	0.0	4.8	0.0	4.8	0.0	(kW)
Main pump energy requirement	0.7	-	0.7	-	0.7	-	(kW)
Total efficiency (η_{tot})	36.1%	0.2	40.6%	0.0	51.2%	0.1	(%)

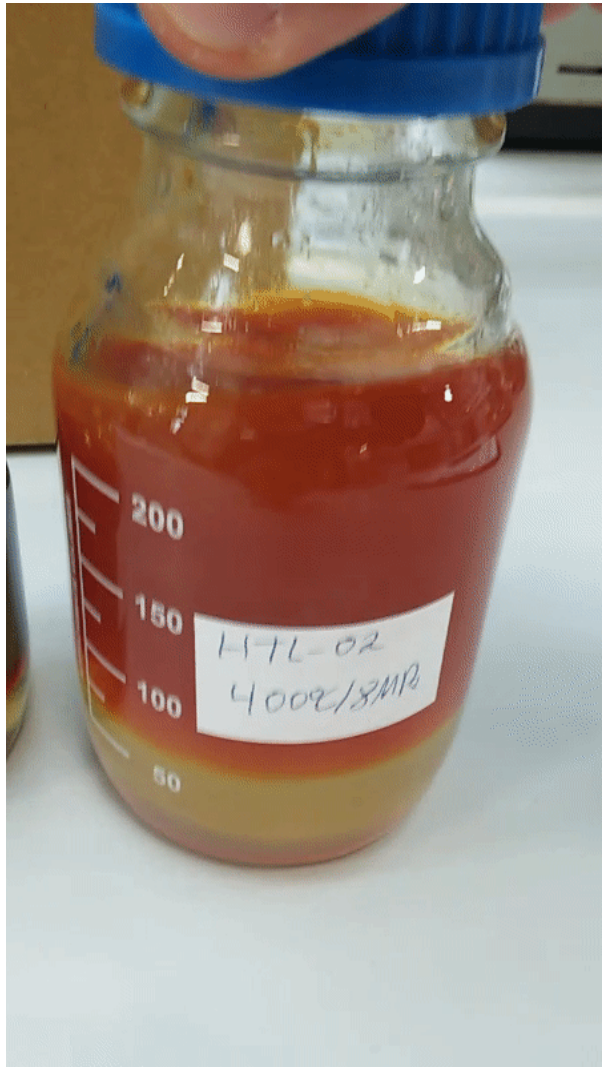
Continuous processing biocrude

Hydrotreatment CoMo / NiMo



Upgraded oil

Hydrotreatment CoMo / NiMo

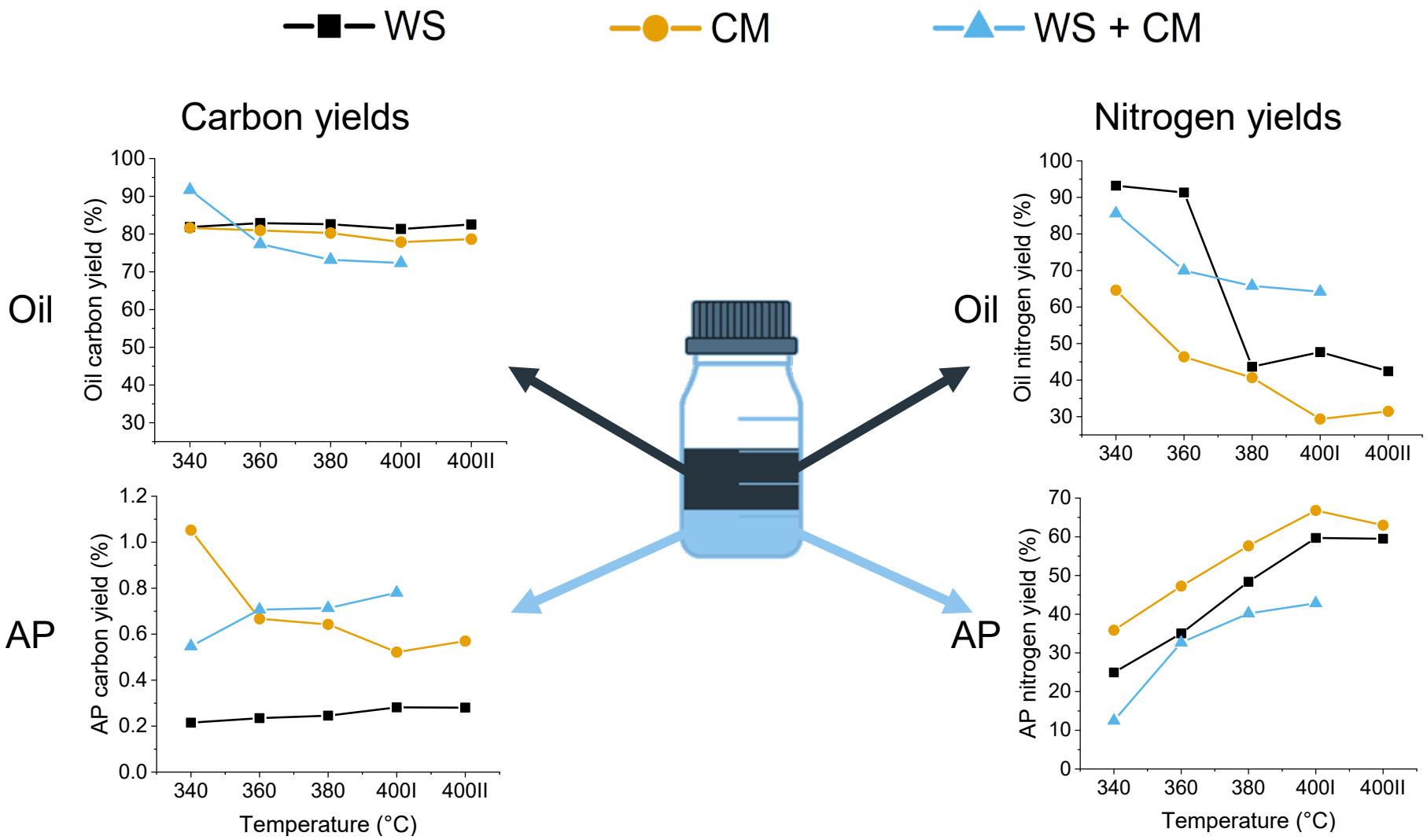


Biocrude labels:
WS = Wheat Straw
CM = Cow Manure
WS + CM = co-HTL

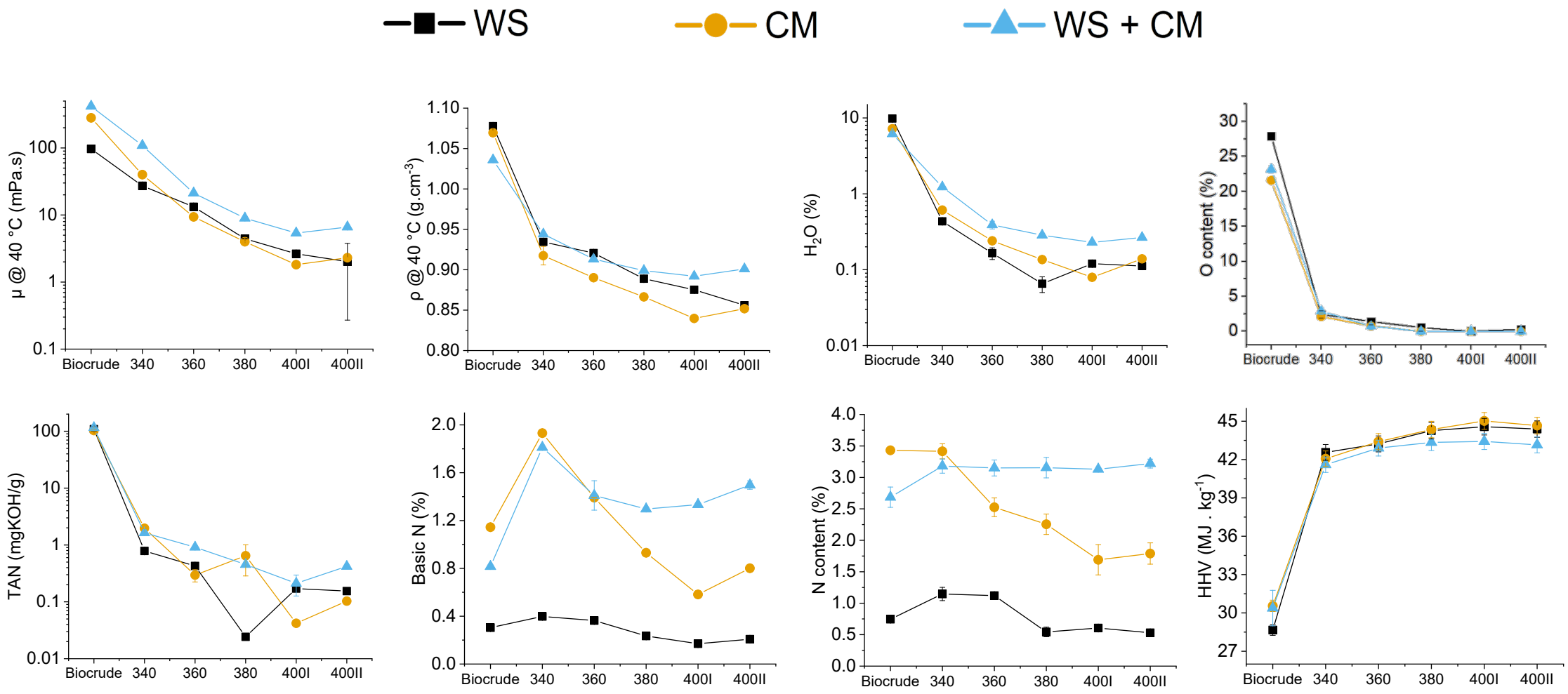
Hydrotreating conditions:

- 340 – 400 °C
- 80 bar
- 45 NL h^{-1} H_2
- 0.5 h^{-1} biocrude
- ~ 100 h OS each

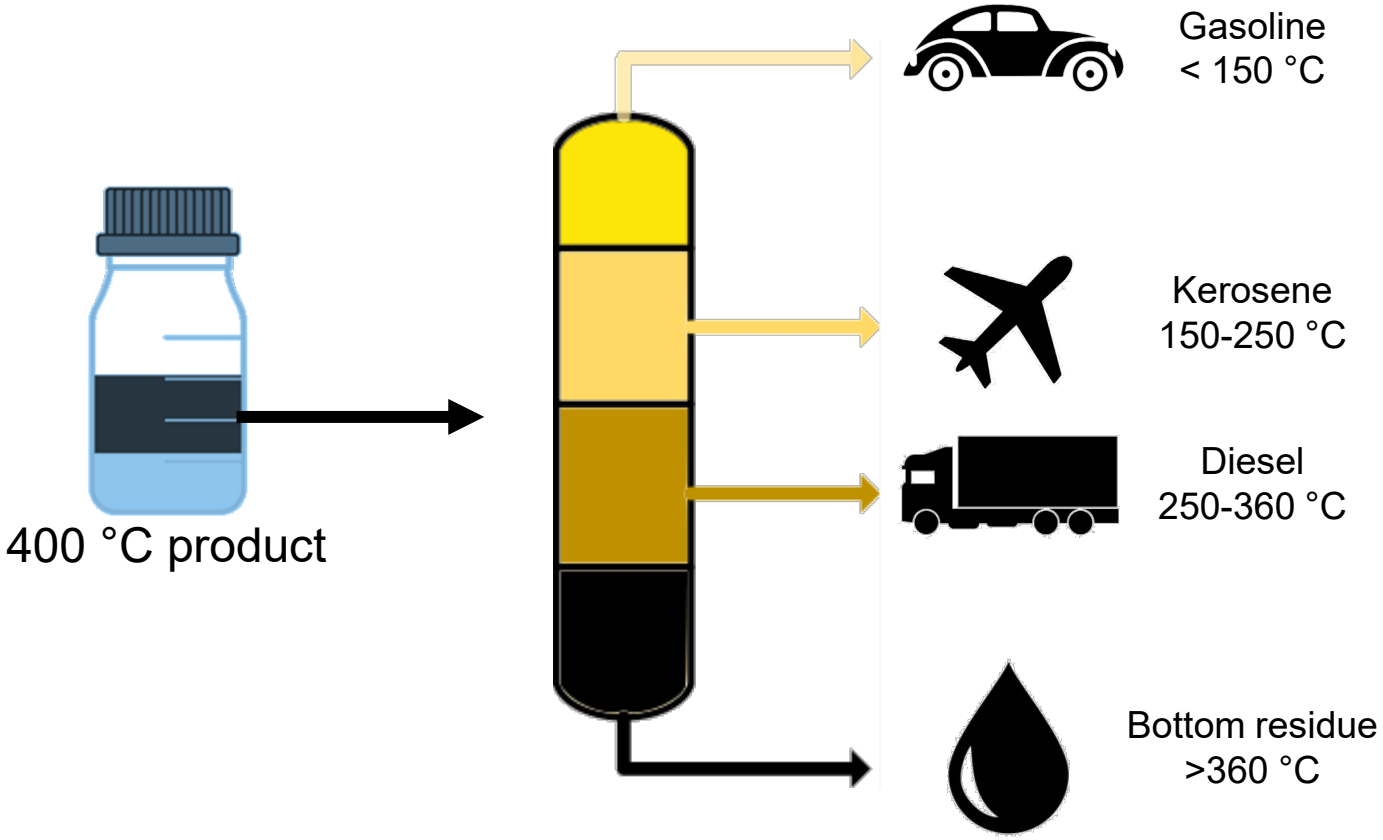
C and N yields

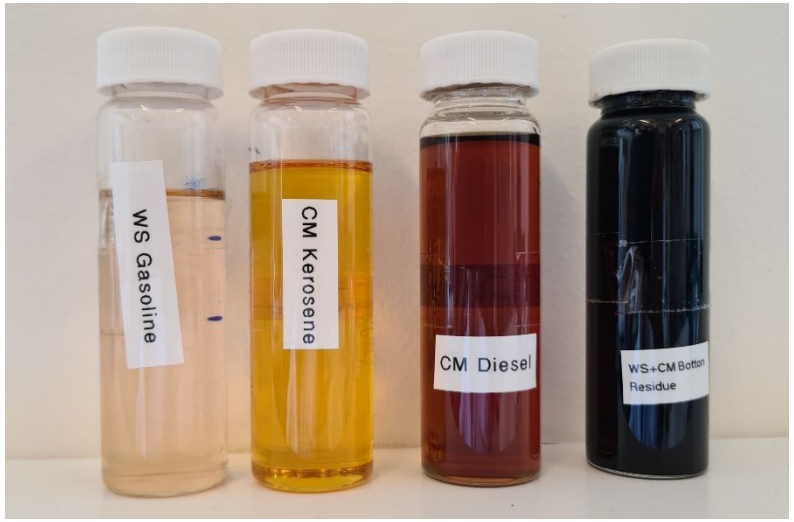


Upgraded products



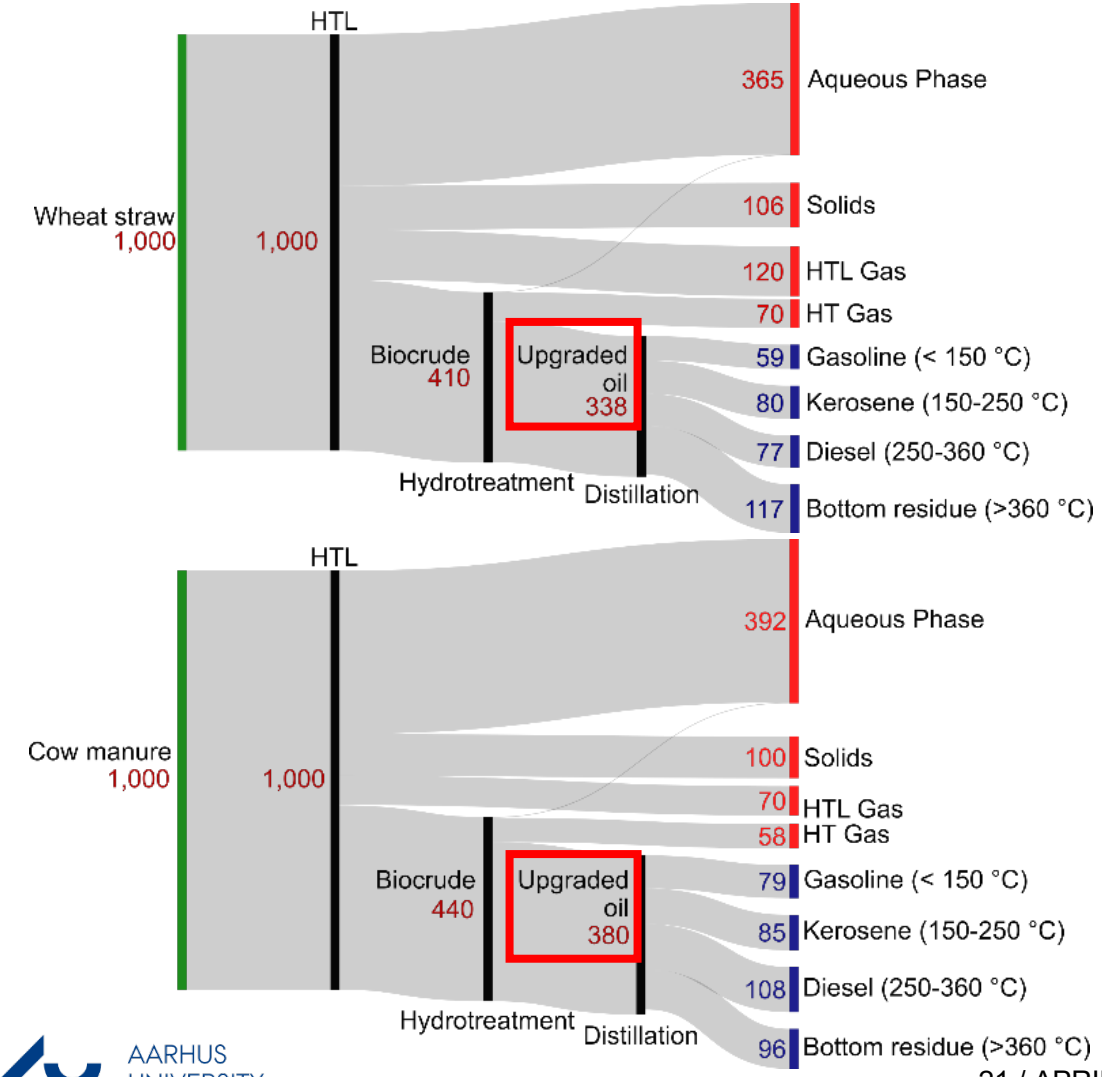
Distillation



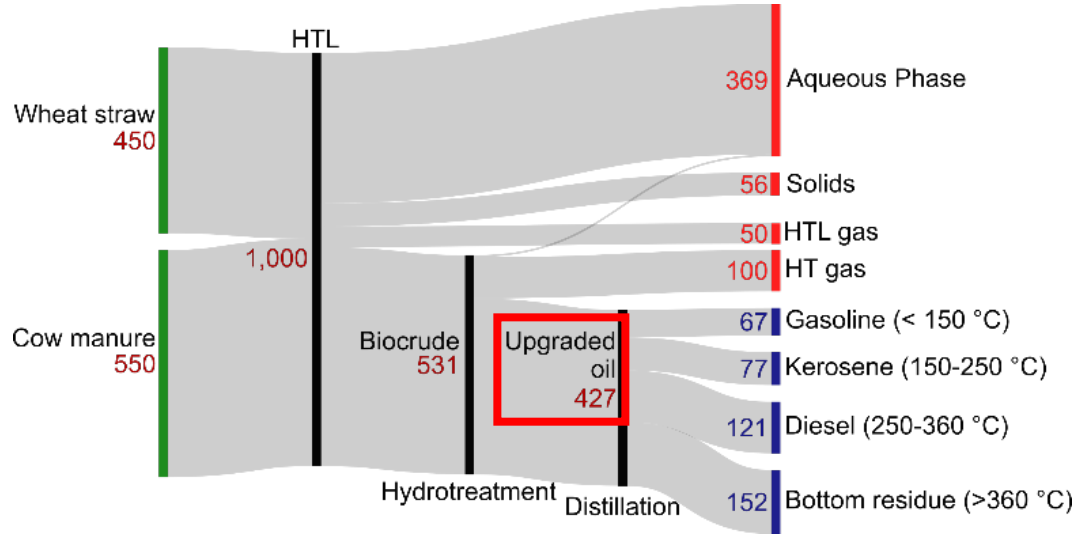


C balances from biomass to biofuel

Single feedstock HTL



Combined feedstock HTL



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Thank you!

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