FACULTY OF BIOSCIENCE ENGINEERING

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Carbon and nitrogen recovery by hydrothermal oxidation

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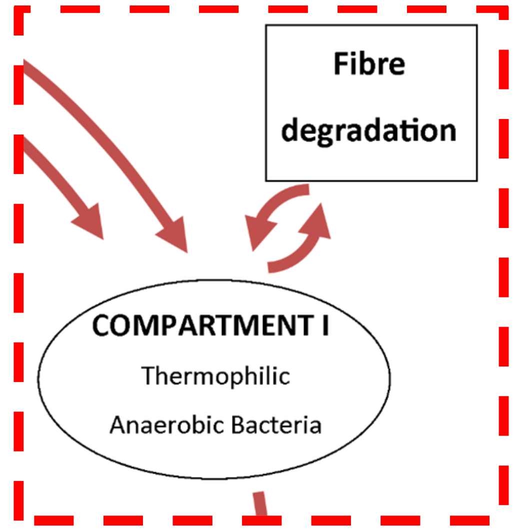
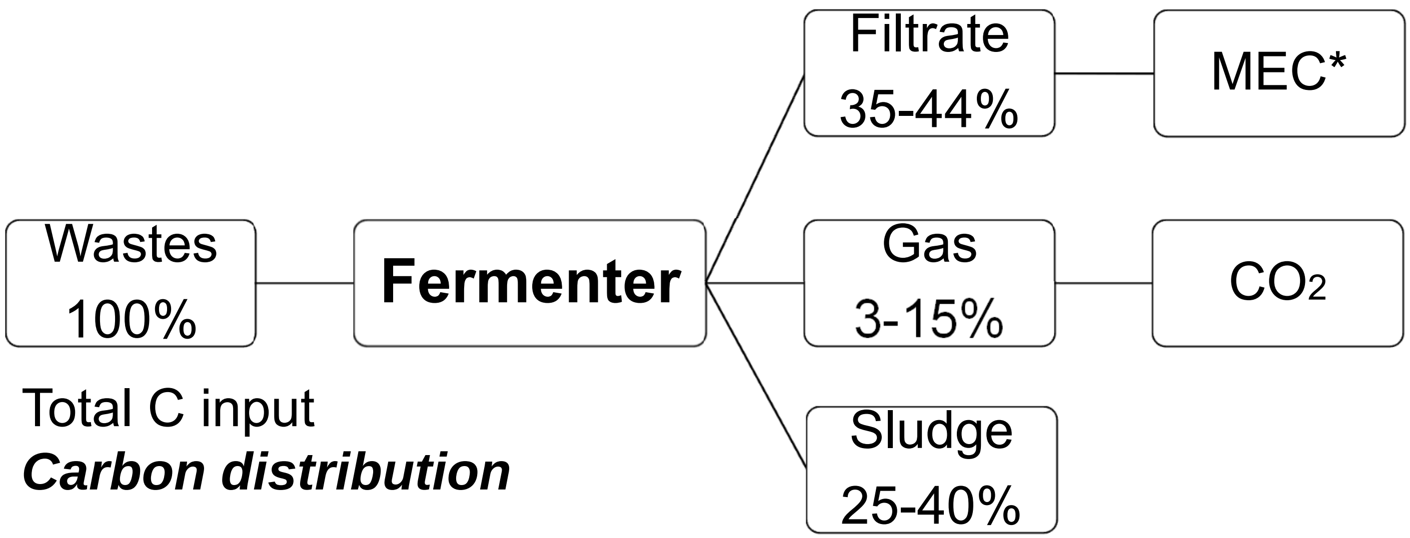
Hydrothermal oxidation

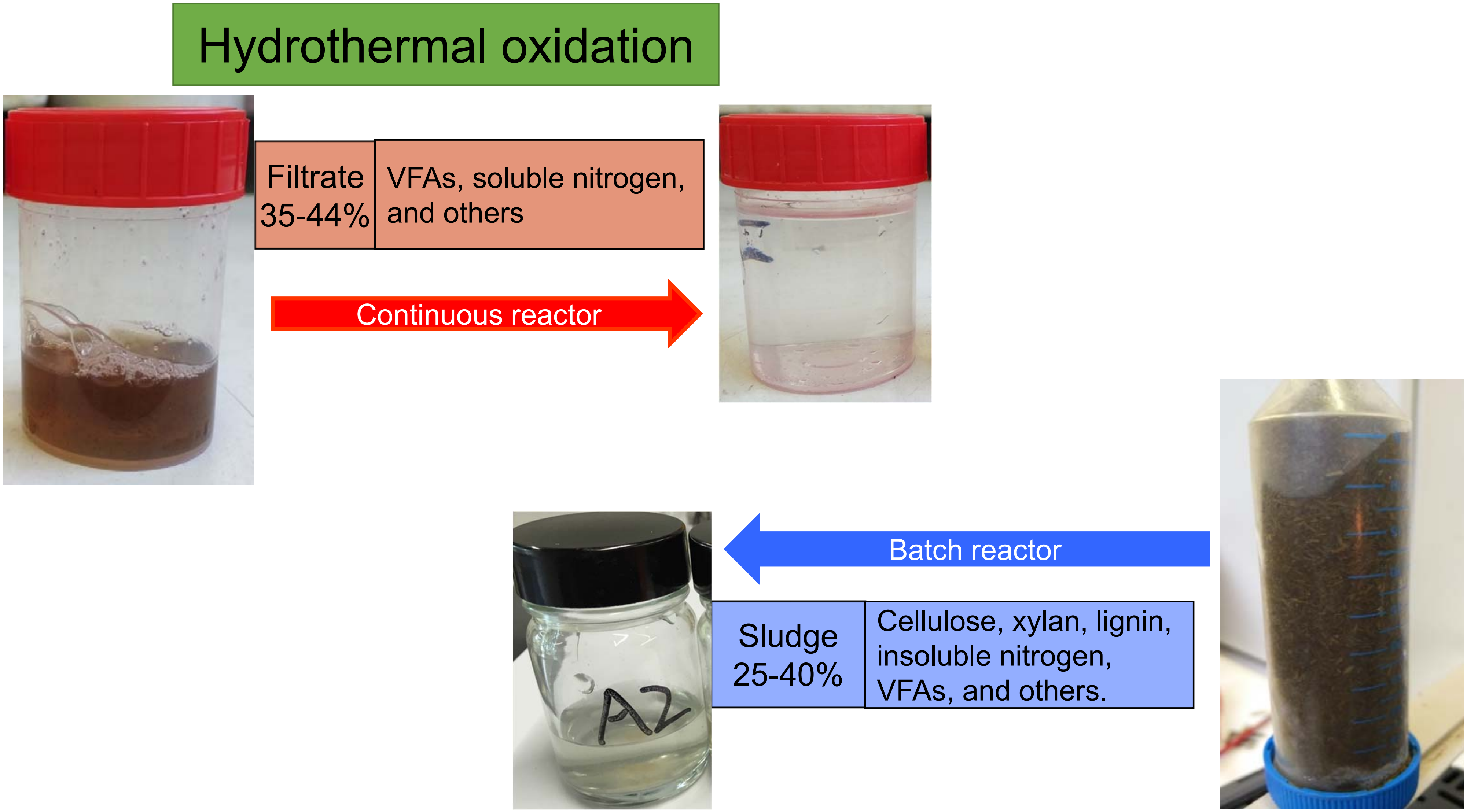


Biodegradation efficiency is low:
Proteolysis: 70%;
Fiber: 44%.



Total C input
Carbon distribution

*MEC: Microbial electrolysis cell


Hydrothermal oxidation
Filtrate 35-44%
VFAs, soluble nitrogen, and others
Continuous reactor
Batch reactor
Sludge 25-40%
Cellulose, xylan, lignin, insoluble nitrogen, VFAs, and others.
A2

Continuous reactor

Temperature (℃)	Residence time (s)	OER*
300	48, 58, 68	1 1.5 2 3 4
340	38, 48, 58	
360	38, 48, 58	
380	28, 38, 48	

*Oxygen equivalence ratio

Batch reactor

Temperature (℃)	Residence time (s)	OER*
300 400 450 500	60 300 600	0,5 1 1.5 2

Sample analysis:

Gas samples:

◊ Micro-GC

Liquid effluent:

◊ TOC analyzer

◊ Elemental analyzer

◊ NANOCOLOR® kits
(ammonia, nitrite, nitrate)

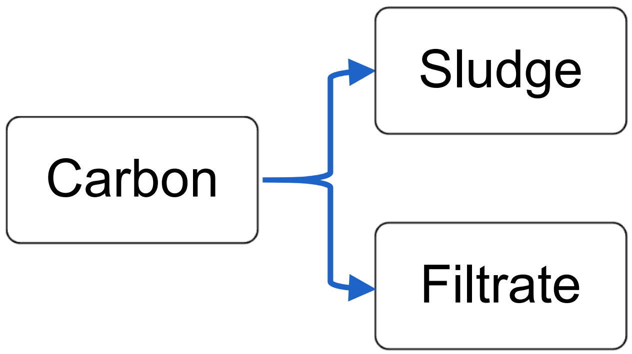
◊ GC-MS

◊ GC-FID
(VFAs)

RESULTS – CARBON DISTRIBUTION

Total C input

Carbon distribution



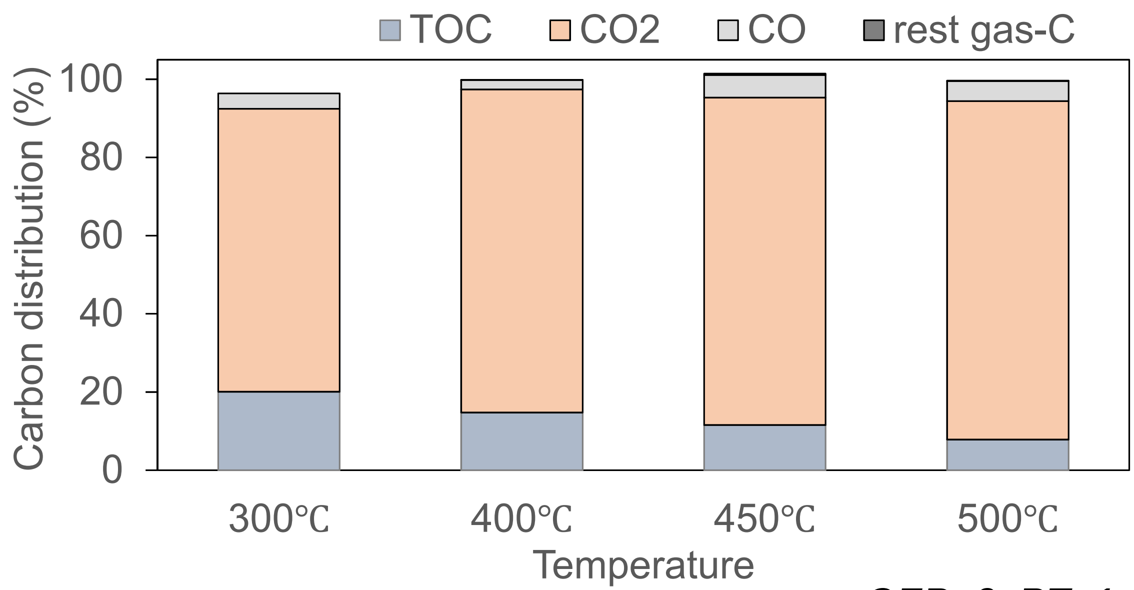
97,1% to CO_2

68,2% to CO_2

Acetic acid is the main residual for both feed.

GAS

Sludge



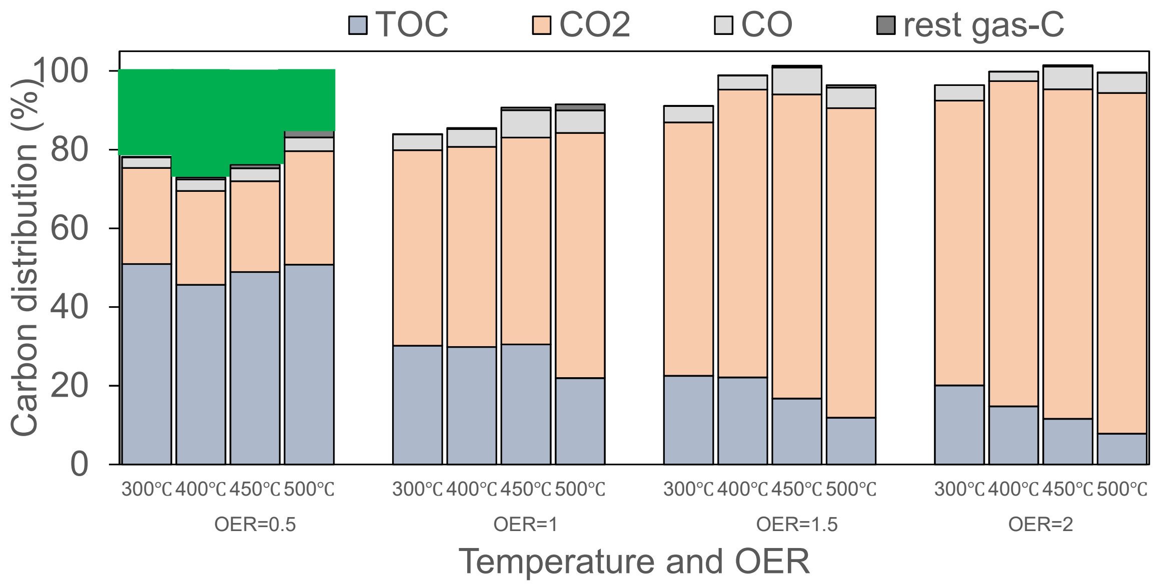
OER=2, RT=1min

Filtrate

Almost all converted into CO2, few cases with ethylene< 0,03 vol%

SOLID

Sludge

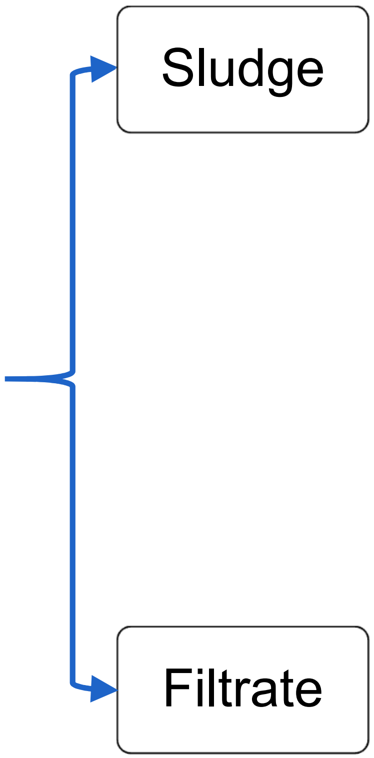


RT=1min

Filtrate

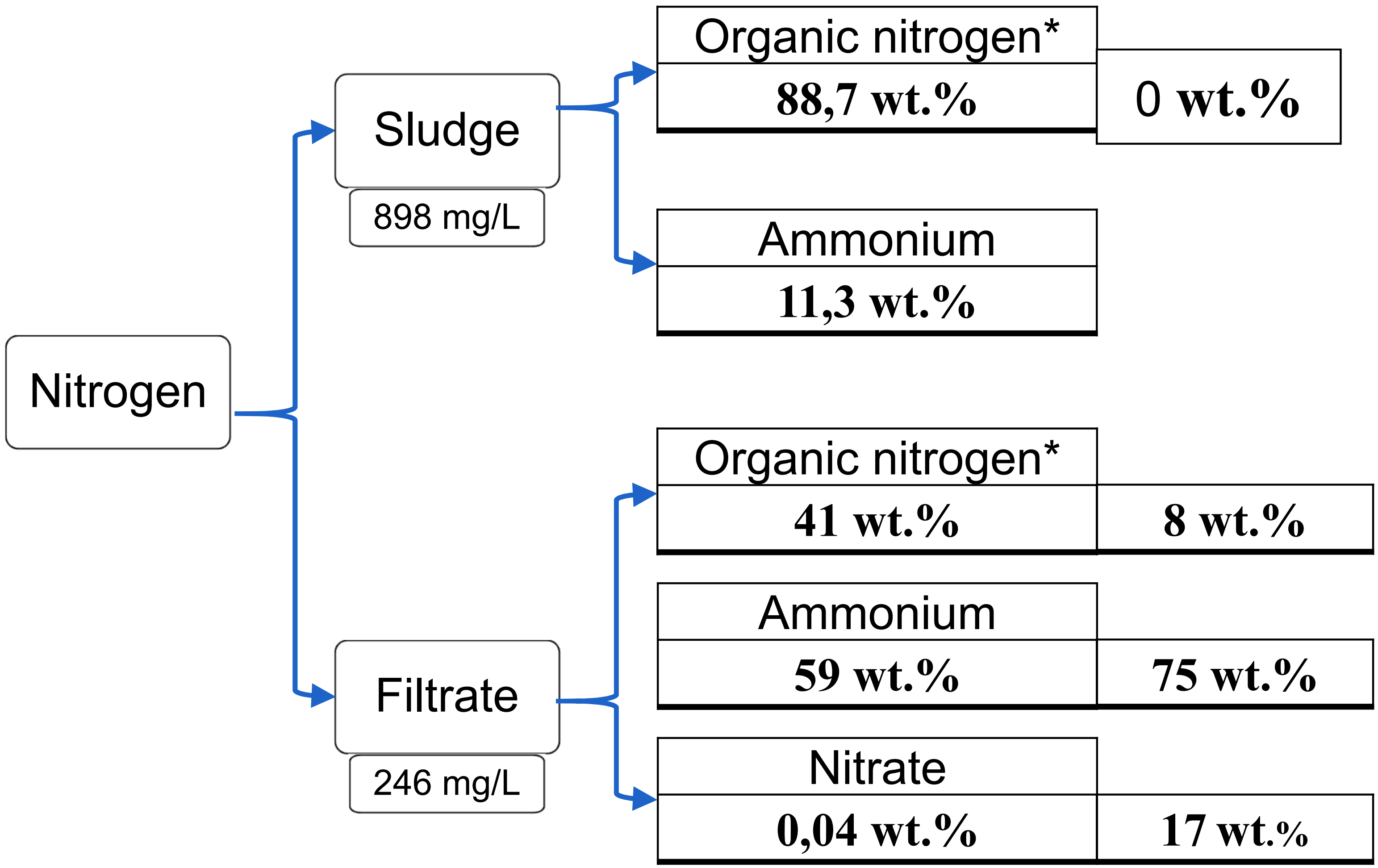
No solids produced.

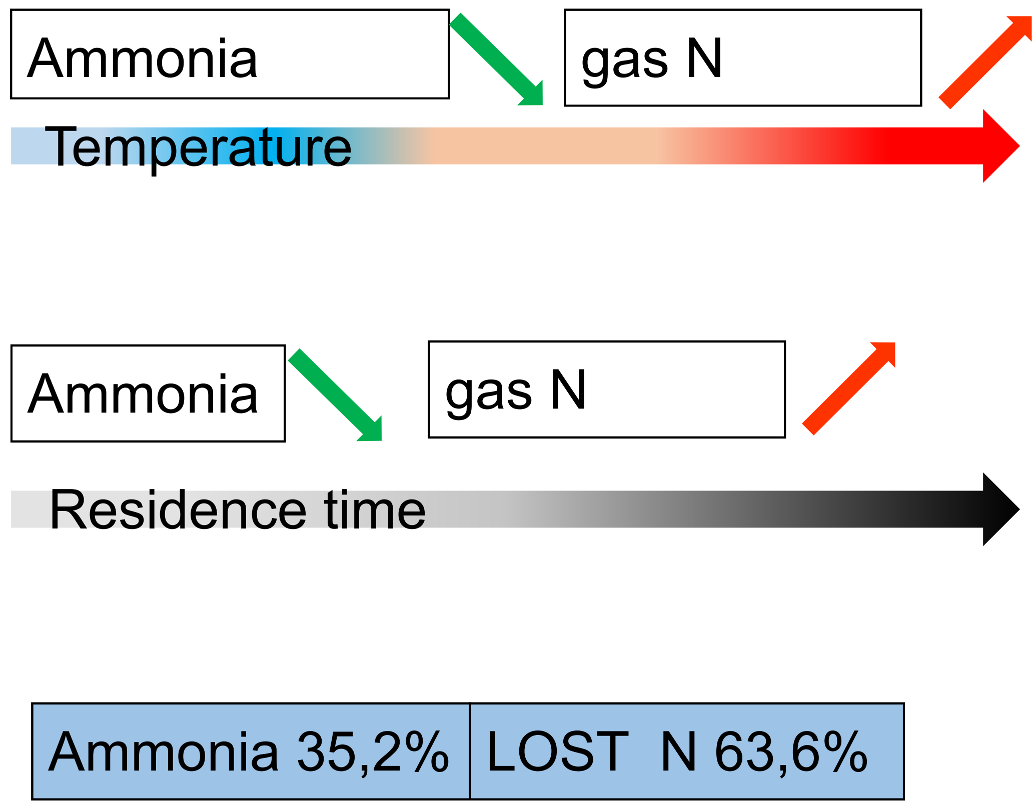
Liquid

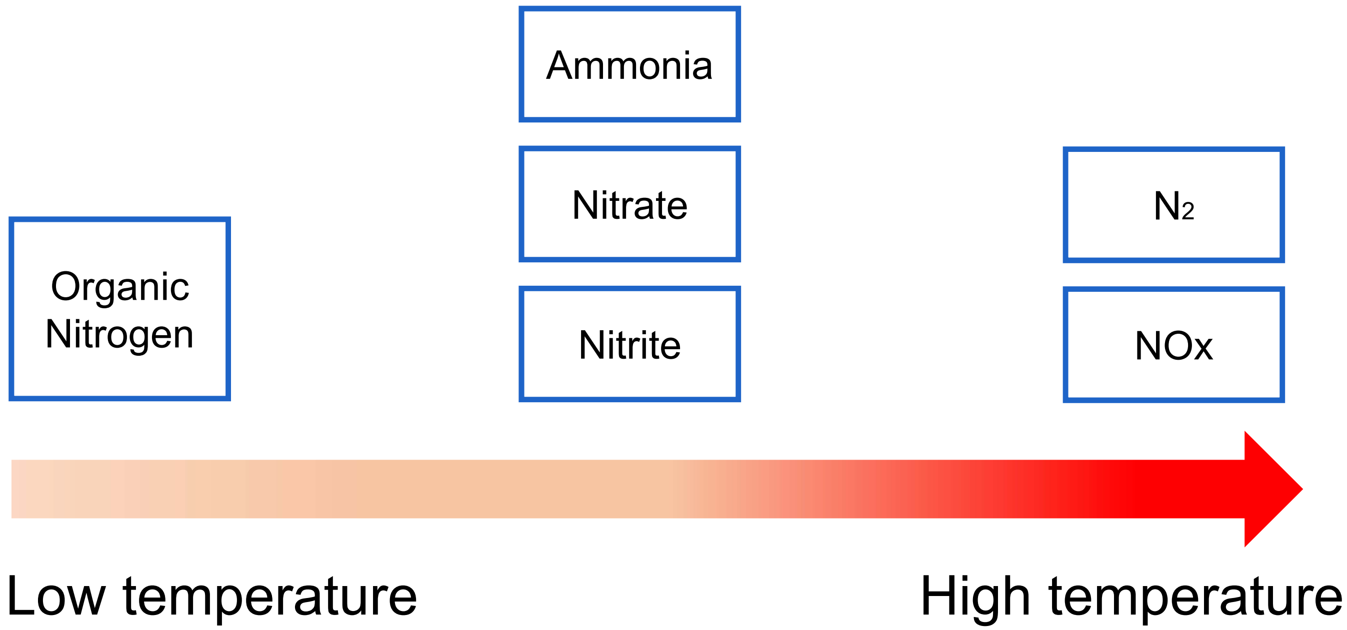


Volatile fatty acids are main residuals for both feed, and acetic acid is one of the main compound.

RESULTS – NITROGEN DISTRIBUTION




Ammonia
gas N
Temperature
Ammonia
gas N
Residence time
Ammonia 35,2%
LOST N 63,6%



Nitrogen distribution

CONCLUSION

- Temperature, residence time and OER all have positive correlation on carbon conversion.

- Nitrogen distribution varies with temperature. Temperature have to be preciously controlled to avoid conversion of nitrogen to gas phase.

- 400 ℃, OER=2, >1MIN could be one of the optimized conditions for carbon and nitrogen recovery.

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