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Wet oxidation of HTL aqueous phase:

Heat release and kinetics for process integration

C. Schuck[1], S. Chiaberge[2], K. Anastasakis[1], P. Biller[1]

([1] Aarhus University | [2] ENI S.p.A, Renewable, New Energies and Material Science Research Center)

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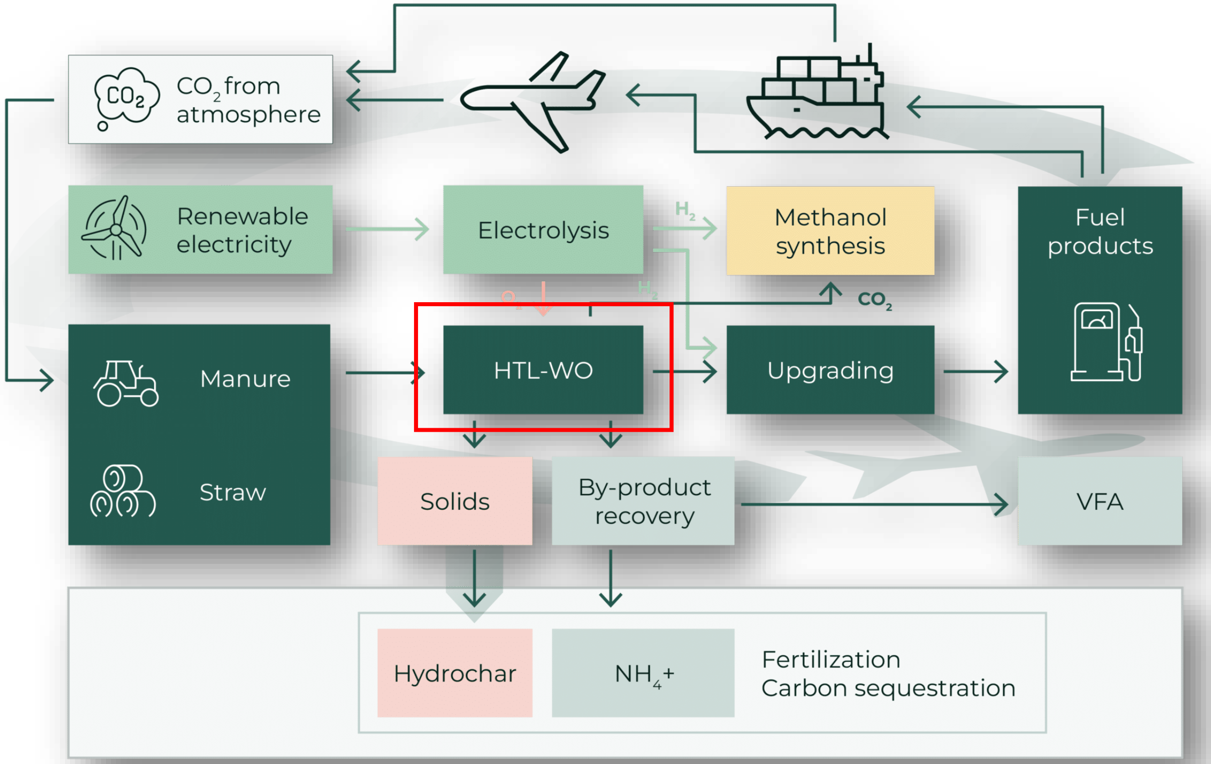
CIRCULAIR Project Overview

HORIZON Europe Project CIRCULAIR

- Valorization of all HTL product streams
- Wet oxidation treatment of HTL-AP
- Integrated HTL-WO for autothermal operation



Two key questions

Heat release

How much energy is released during WO?

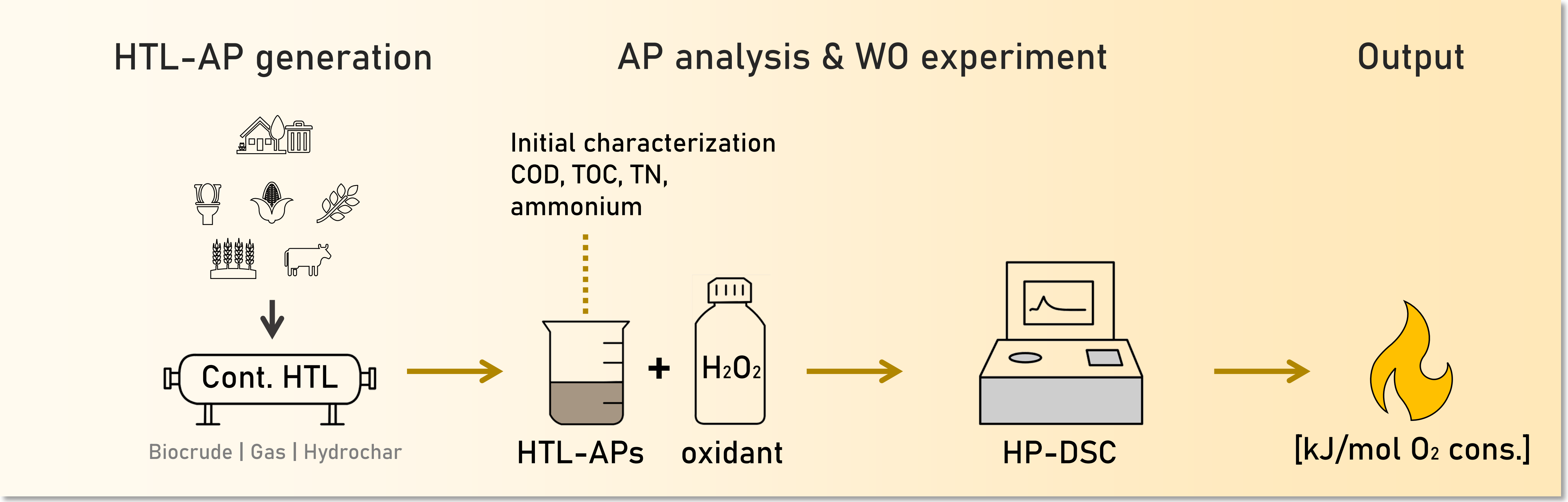
Heat integration potential

Kinetics

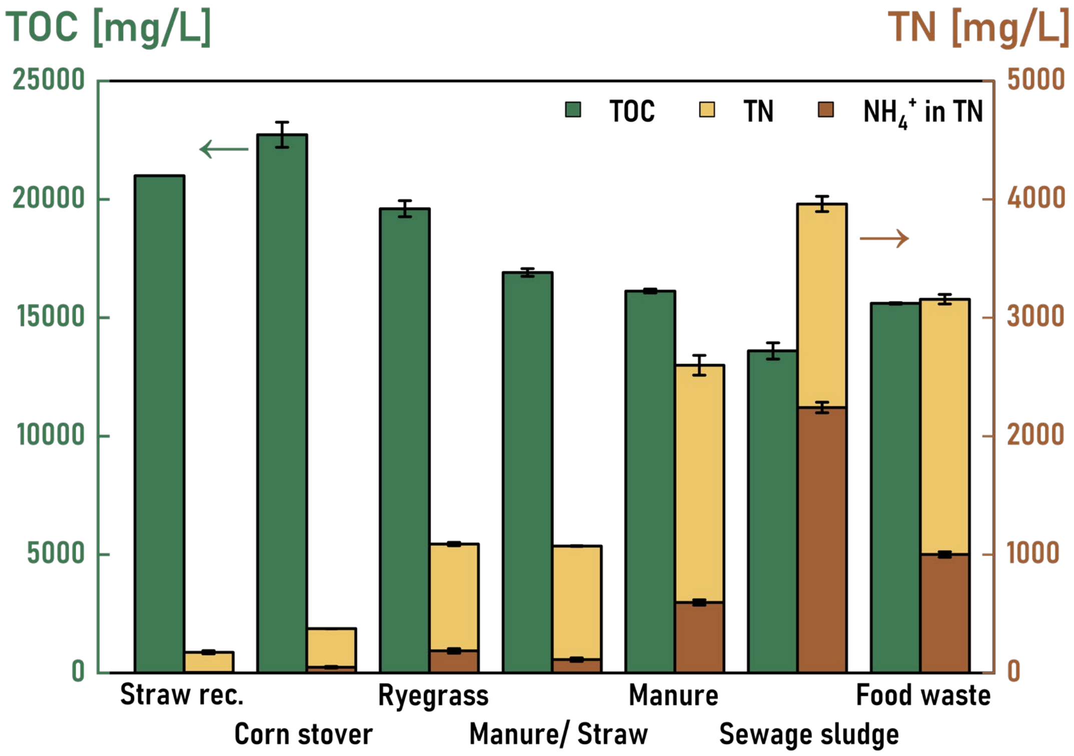
How fast do oxidation reactions proceed?

Reactor design and operating window

Experimental approach: Heat release



Feedstock governs HTL-AP composition



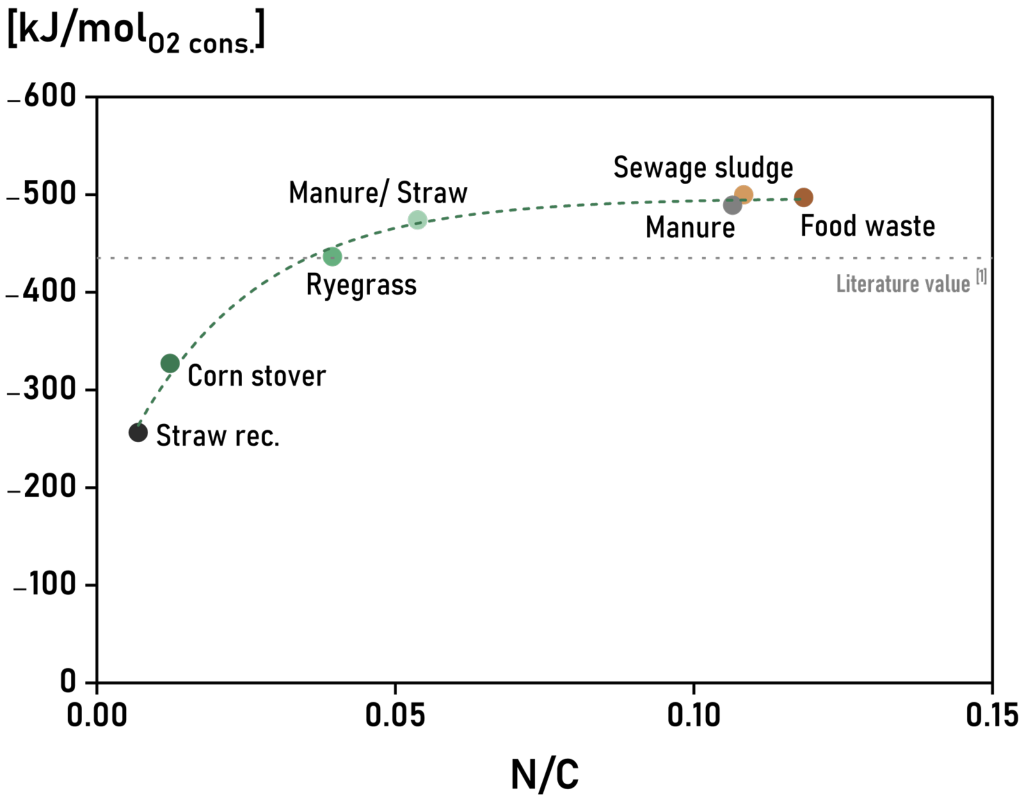
Heat release results adapted from: Schuck et al., *Carbon Resources Conversion (in press)*

Lignocellulosic feedstocks → low TN content

N-rich feedstocks (e.g. manure, municipal waste) → higher TN concentration

Large variation in organic load and N content among different HTL feedstocks

HTL-AP composition governs oxidation heat release

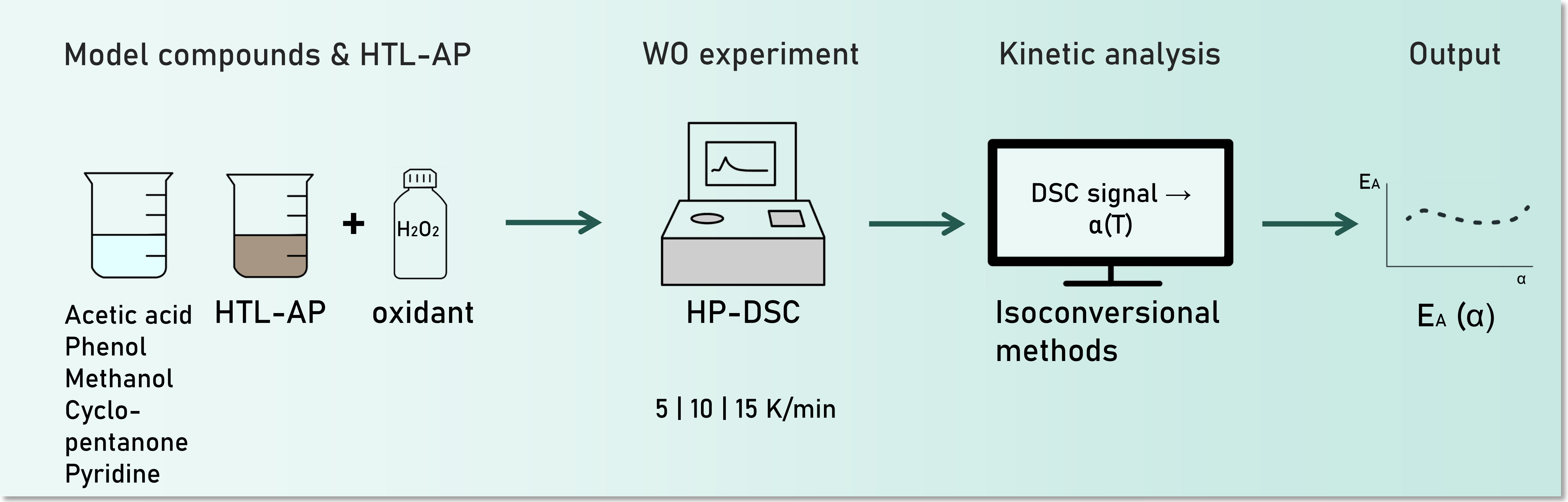


[1] H. Debellefontaine, J.N. Foussard, *Waste Management 20* (2000), 15-25
Heat release results adapted from: Schuck et al., *Carbon Resources Conversion (in press)*

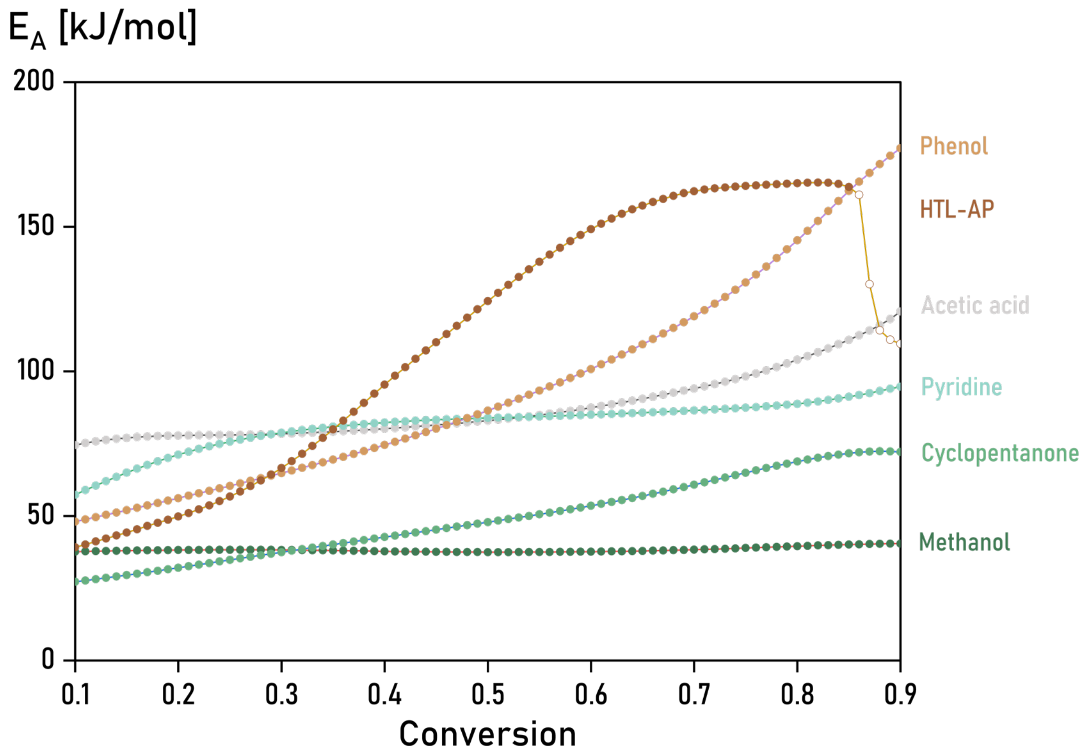
- Heat release increases with N/C ratio, plateau at high N/C
- N-containing compounds release more heat per mole oxygen → lower O_2 demand for oxidation

Heat release depends on HTL-AP composition

Experimental approach: Oxidation kinetics



Preliminary kinetic results



- Conversion-dependent E_A → differences in oxidation behaviour
- HTL-AP shows broader E_A evolution than model compounds

Ongoing work: complete parameterization beyond E_A

Reaction complexity increases from model components to HTL-AP

Take home messages

Heat release strongly depends on HTL-AP composition:

Higher N/C ratios —> higher exothermicity

Preliminary kinetic analysis emphasizes increasing reaction complexity: HTL-AP differs from simple model compounds

HTL-APs from different feedstocks vary widely in organic load and composition: Effect on integration potential

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