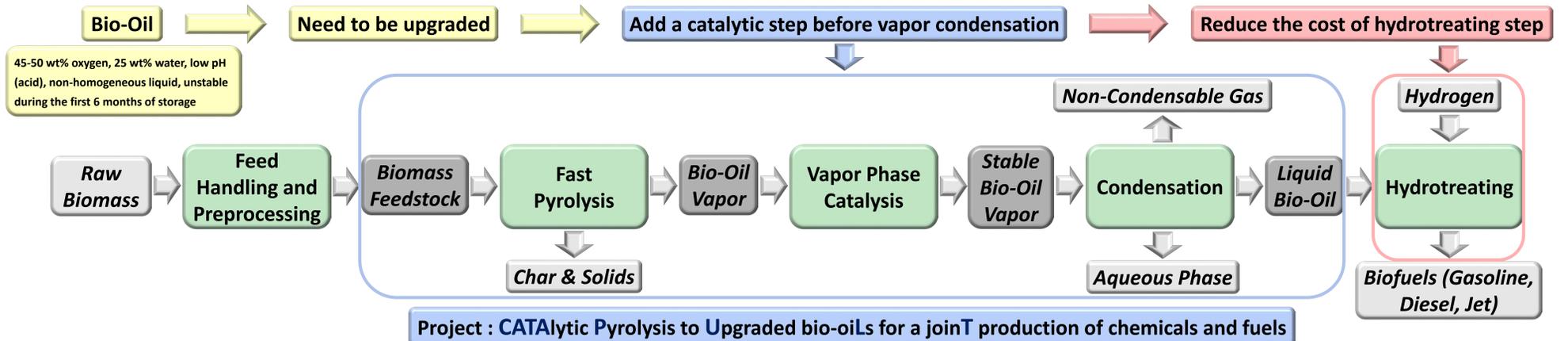


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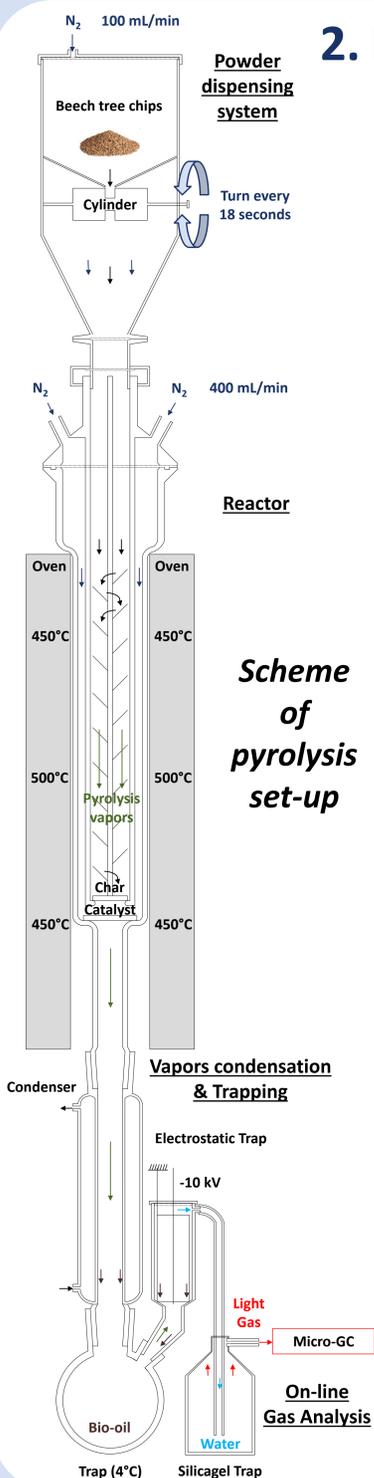
1. Context & Objectives

Fast pyrolysis¹ of biomass yields bio-oils with high levels of O-containing components and high acidity and low stability. Further upgrading of these oils is necessary before they can be used as liquid fuels. Several low-cost strategies have been proposed for reducing the oxygen and acid content. Catalytic pyrolysis consists in utilizing a catalyst during the pyrolysis² or in converting the pyrolytic vapors over a catalyst³.



Catalytic conversion of pyrolytic vapors is an approach that allows a partial deoxygenation before vapor condensation

2. Experimental

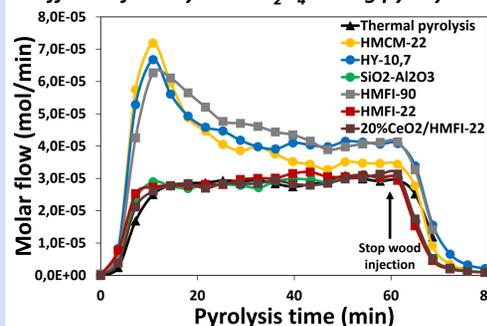


- A semi-continuous pyrolysis experiment on lab-scale was developed
- A powder dispensing system (*Parimix*) injects around 100 mg of beech tree chips every 18 seconds (pneumatic system)
- In total 20 grams of beech tree chips were dropped into the reactor (500°C) for 1 hour
- The reactor consists of a quartz tube (L=700 mm; \varnothing_{ext} =46mm) containing two porous frits
- A metallic insert reduces the fall of wood around 2-3 seconds
- A flow of nitrogen of 500 mL/min inerts the biomass injector and drives pyrolysis vapors
- The first frit stops char and protects the catalyst (catalyst-to-biomass ratio of 1:10)
- The second frit supports the catalyst at 450°C
- 2 grams of zeolite HMFI, HMCM, HY and silica-alumina were used
- A condensing system collects the bio-oil at 4°C
- An electrostatic trap captures very fine oil droplets (non-condensables)
- A last trap with silica gel protects the micro-GC used for on-line gas analysis
- Bio-oil were characterized by CHONS, SEC, GCxGC-MS, -FID, NMR

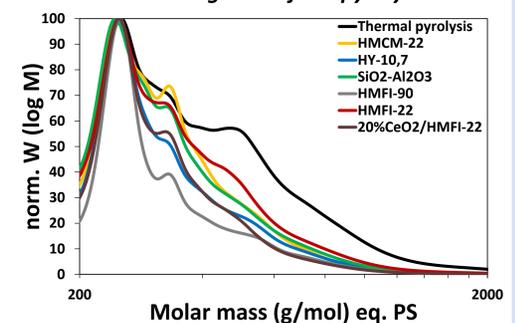
3. Results and Discussion

- Clear separation of two aqueous and organic phases obtained in the presence of the catalysts

Effects of catalysts on C_2H_4 during pyrolysis

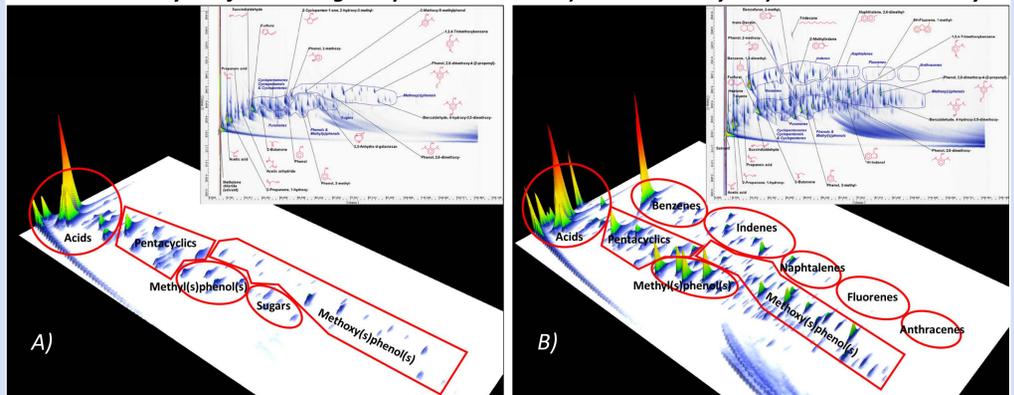


SEC chromatograms of the pyrolytic oil



- Online gas analysis shows an increase in the formation of ethylene with HMFI-90, HMCM-22 and HY-10,7
- The average molecular mass decreases in the presence of the catalyst, essentially with HMFI-90

GCxGC-MS analysis of bio-oil organic phase obtained A) without catalyst B) with HMFI-90 catalyst



- The catalyst has an effect on the nature of the liquid and gaseous products with the appearance of deoxygenated compounds

4. Conclusions

- ⚡ In conclusion, a series of solid acid catalysts were tested for the conversion of wood pyrolysis vapors, in house-designed lab-scale unit.
- ⚡ Whatever the catalyst, a clear phase separation (aqueous/organic) is obtained, while the reaction products (gas or liquid) depend on the nature of the catalyst.
- ⚡ Among the tested catalysts, HMFI-90 was found the most efficient in terms of degree of deoxygenation and depolymerization of the macromolecules present in the pyrolysis vapor.
- ⚡ As compared to the other catalysts (HMCM-22 and HY), HMFI-90 is also less prone to coking.

5. Acknowledgements

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