

**ICEBE**  
IMAGINEERING  
NATURE

# PROMETHEIA

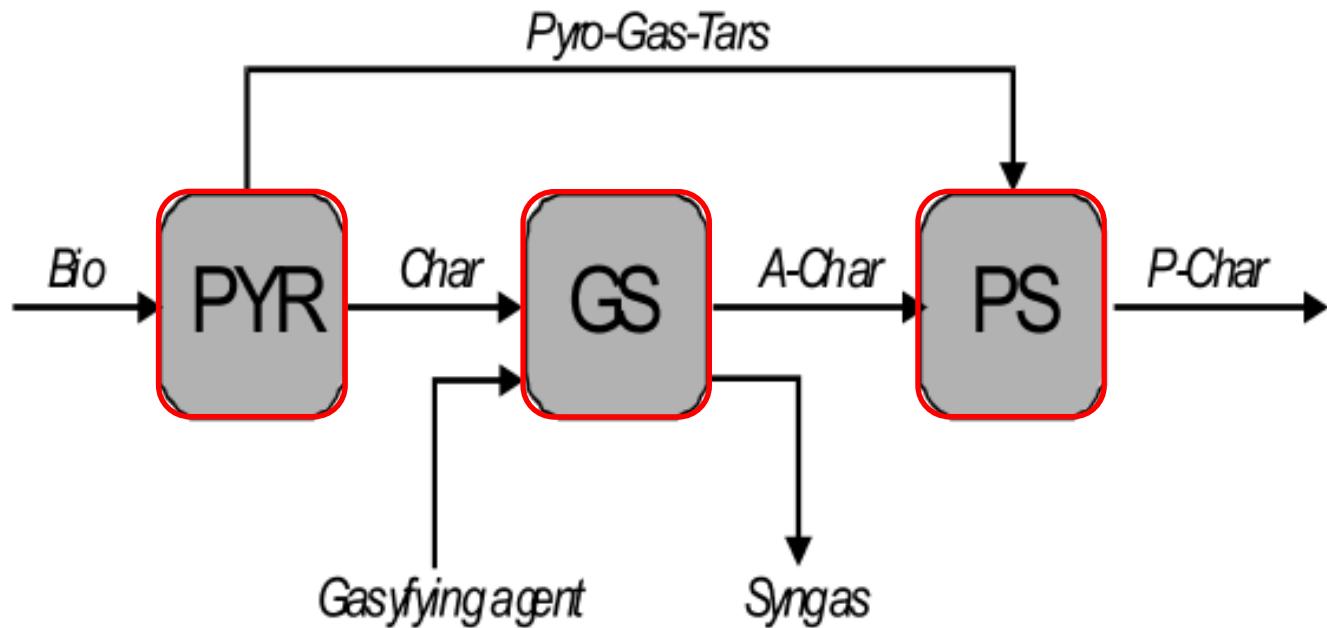
Processus for metal-to-char encapsulation

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## Main Phases of the Project

- Pyrolysis (PYR)
- Gasification (GS)
- Passivation (PS)



- + Life cycle assessment – carbon footprint

**Aim of the Project:** heavy metals retention in the solid phase and using biochar as valuable source



- Degradation of organic compounds
- Reduction of weight (80% → 20%)
- Tar production → high coking tendency
- Inert atmosphere

- Activation process. Removal of blockages on char Surface
- Gasification agent

- Coking of tar compounds at the Surface of the activated char
- Low reactive layer at the surface
- Use of tars with high carbon content

- plants (softwood, hardwood, herbaceous)

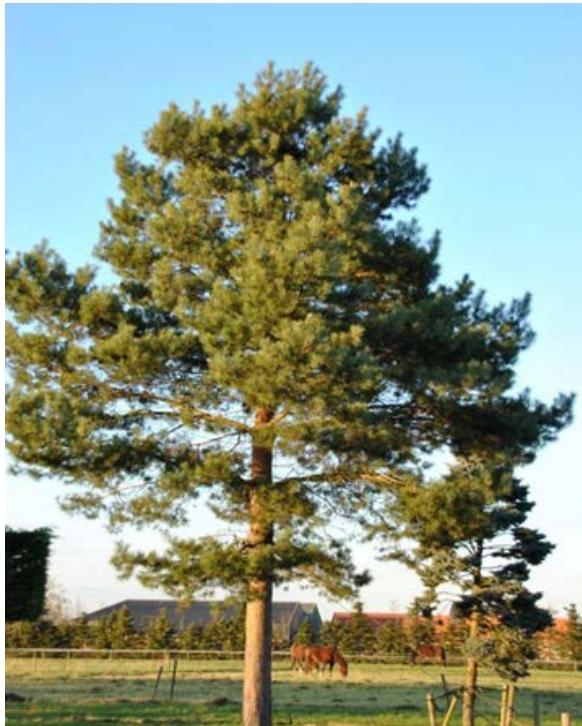
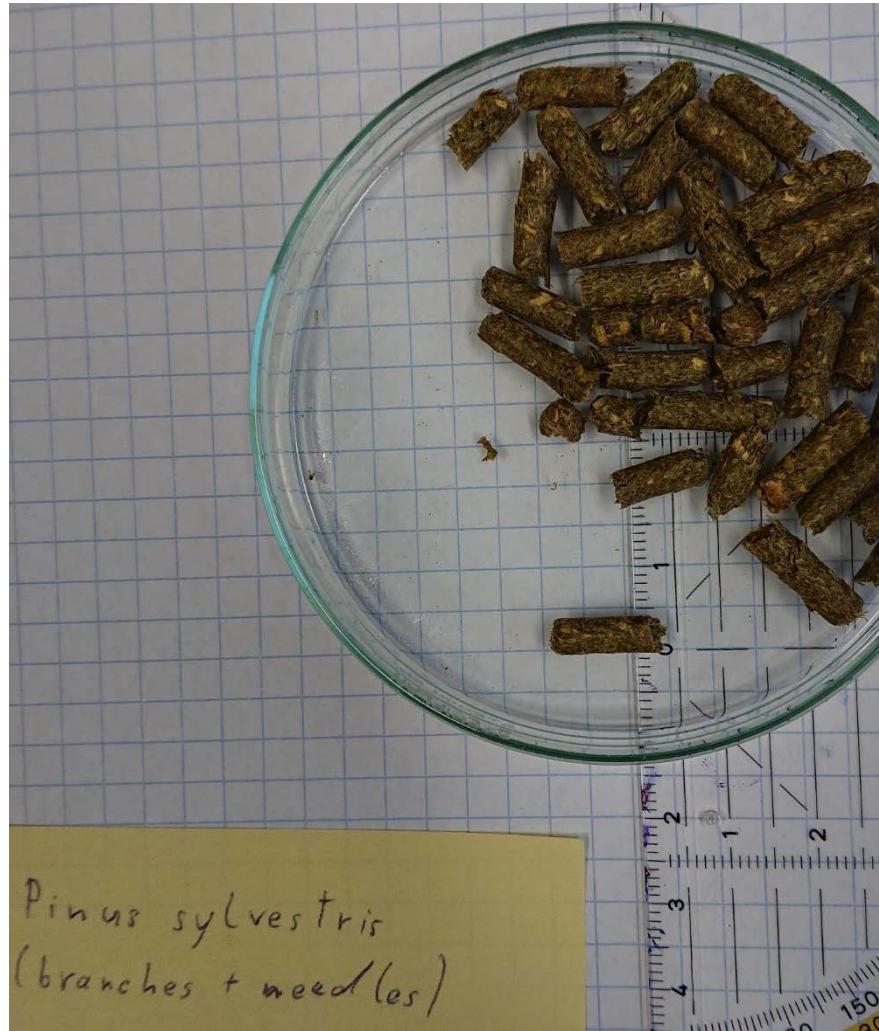


Fig. 1: *pinus sylvestris* (softwood) [1]



- Three type of plants (softwood, hardwood, herbaceous)



Fig. 2: *betula pendula* (hardwood) [2]



Fig. 3: *phragmites australis* (herbaceous) [3]

## Plant selection

- 3 plants (softwood, hardwood, herbaceous)
- HM-contaminated samples from a site in Poland (mainly Pb, Zn, Cd)

## Plant selection

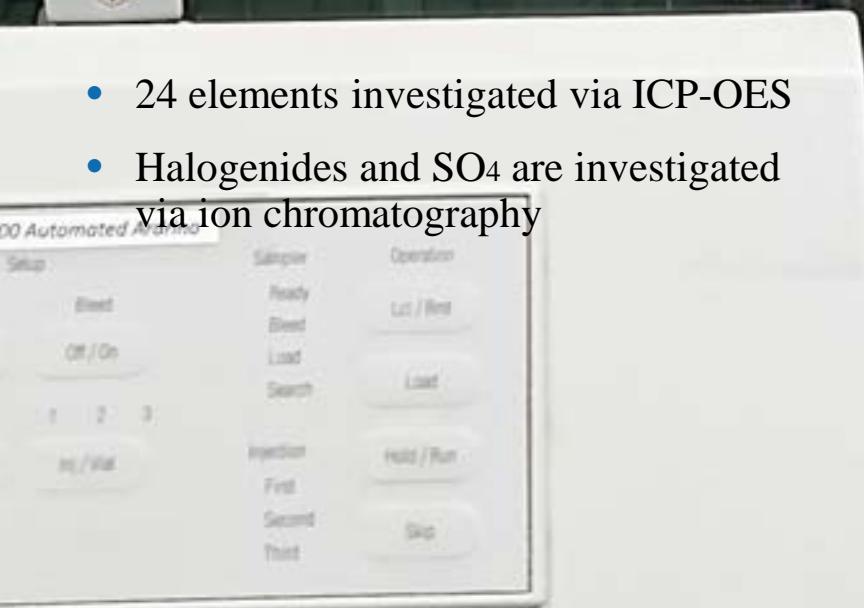
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## HM-Analysis

- 5 types of pellets have been chosen
- Pinus sylvestris (contaminated/uncontaminated)
- Betula pendula (contaminated/uncontaminated)
- Phragmites australis (contaminated)

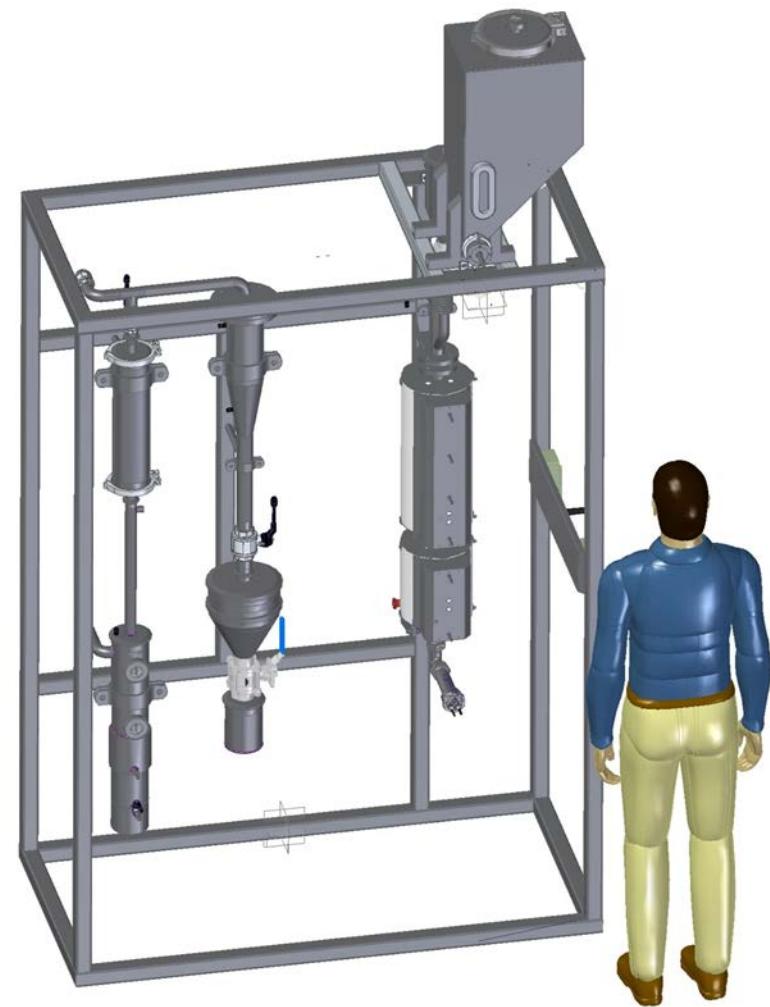
  

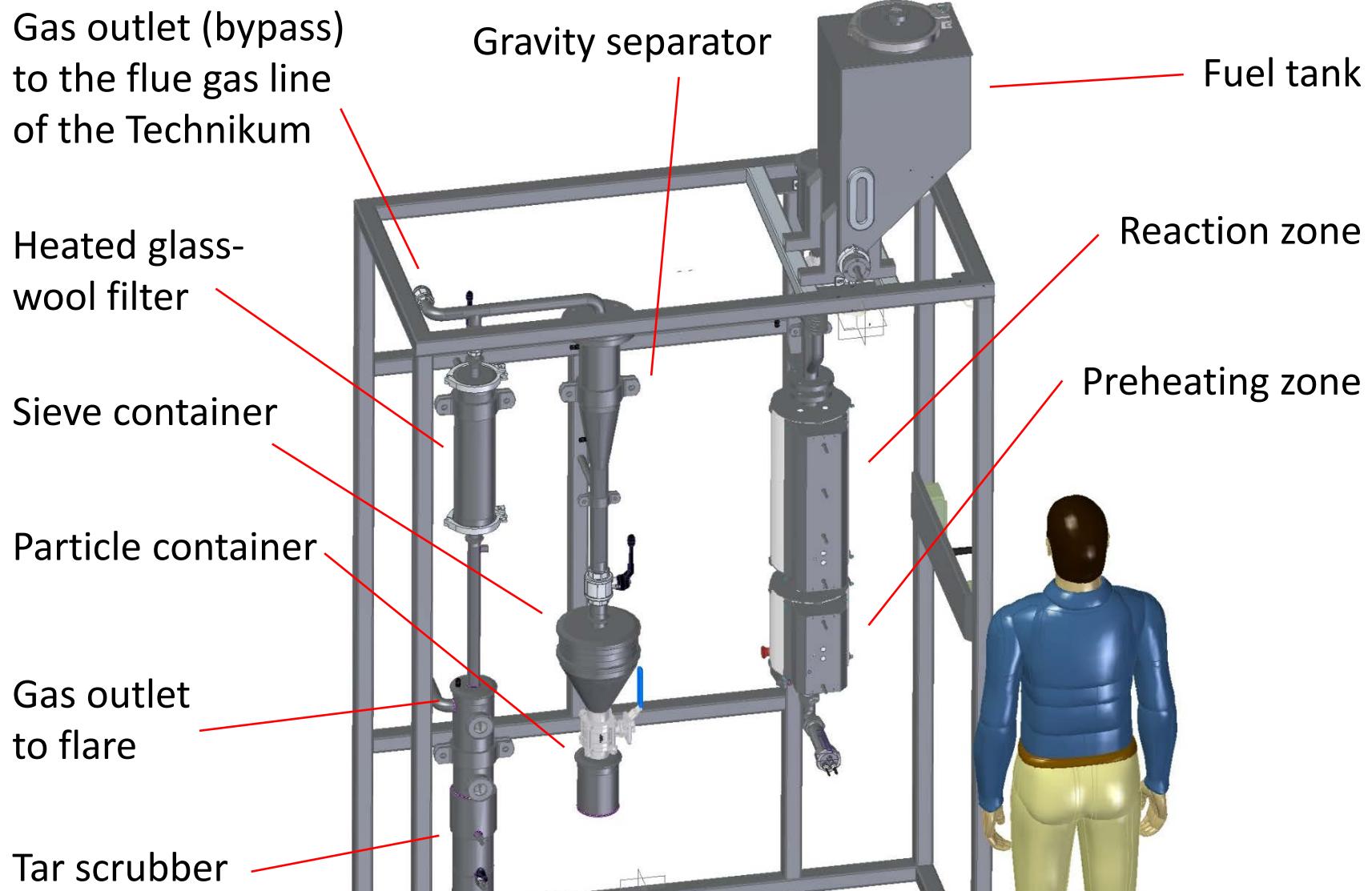
- 24 elements investigated via ICP-OES
- Halogenides and SO<sub>4</sub> are investigated via ion chromatography



## BIOTA – Biogenic, Innovative and Optimized Thermochemistry Apparatus

- Fixed bed/fluidized bed mode
- Elaborate flue gas treatment
  - Gravity separator for big particles and bed material
  - Heated glass wool filter
  - Scrubber for tars





- [1] *Pinus sylvestris*. Sint-Oedenrode: Van den Berk Baumschulen; [accessed 15 November 2021].  
<https://www.vdberk.de/baume/pinus-sylvestris/>.
- [2] *Betula pendula*. Sint-Oedenrode: Van den Berk Baumschulen; [accessed 15 November 2021].  
<https://www.vdberk.de/baume/betula-pendula/>.
- [3] Gemeines Schilfrohr (*Phragmites australis*). Saarbrücken: Neue Medien Dominik Hammerschmidt; [accessed 16 June 2023]. [https://www.gartenratgeber.net/pflanzen/gemeines-schilfrohr-phragmites-australis.html?utm\\_content=cmp-true](https://www.gartenratgeber.net/pflanzen/gemeines-schilfrohr-phragmites-australis.html?utm_content=cmp-true).
- [4] <https://www.technologynetworks.com/analysis/articles/icp-oes-icp-chemistry-icp-oes-analysis-strengths-and-limitations-342265>. [accessed 09 February 2022].