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Process technology development - Treating municipal waste streams

~15 min

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A brief history of HSY and chars

2014 – 2015: Reseach into biochar in biowaste management

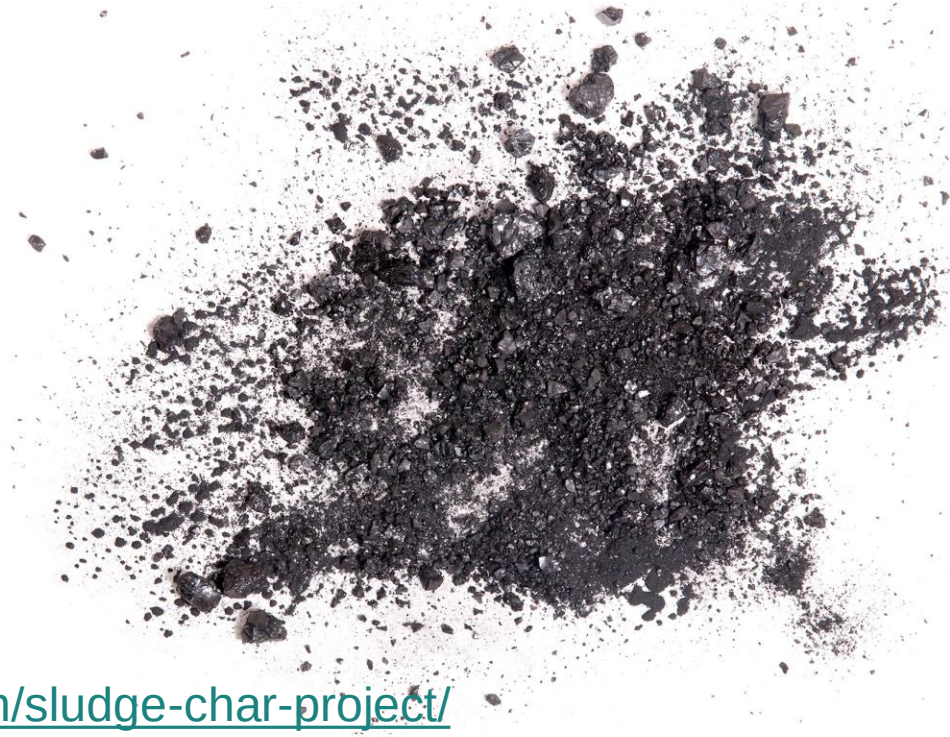
2015 – 2017: New sludge treatment technologies studied

2018 – 2020: Reseach into sludge char properties and potential uses with Luke and Gasum

2019 - 2020: Building sludge pyrolysis pilot plant

2021 – 2022: Piloting phase and research into promising sludge char applications

2023 – 2024: Possible construction of full-scale plant



Pictures © Luke and HSY

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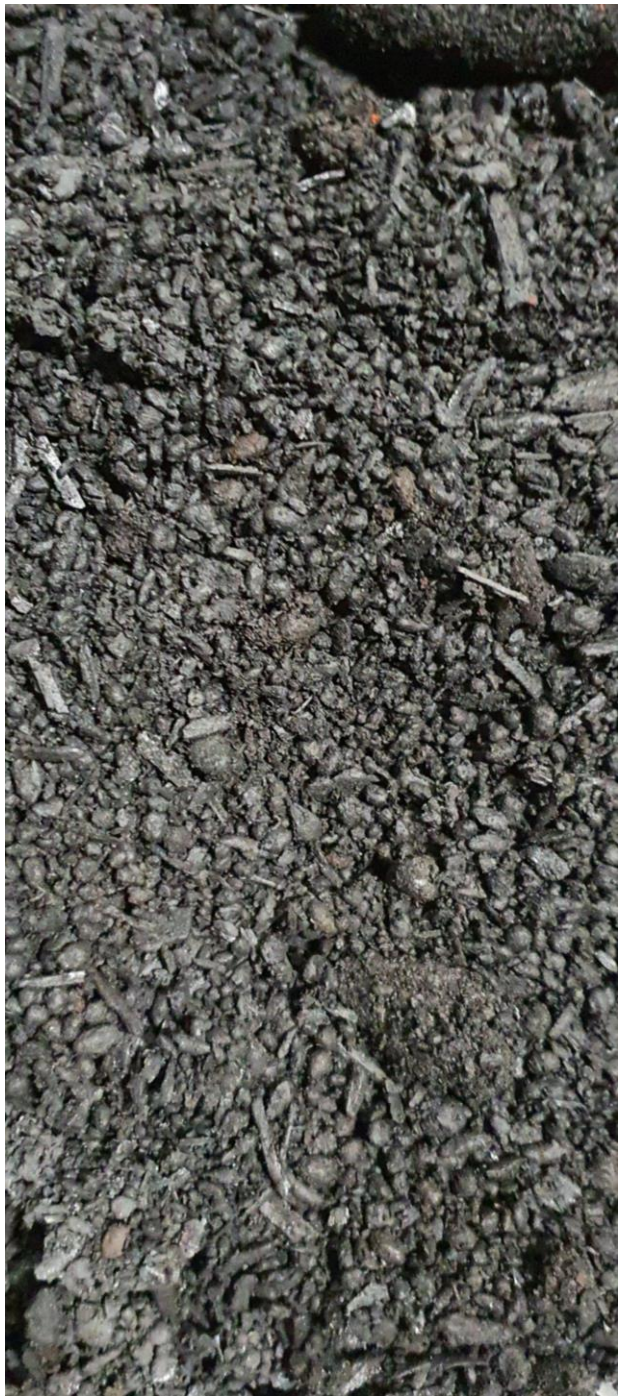
https://www.hsy.fi/en/sludge-char-project/

Pyrolysis in sludge management

- High teperatures ensure destruction of **pathogens** and **organic contaminants**. **Microplastics** are also expected to evaporate.
- The remaining char is composed mainly of carbon (25 %), iron (17 %), phosphorous (5 %) ja calsium (4 %) [with current sludge]
- There are still some **knowledge gaps** concerning the end product
- The goal of the project has been to study the properties of sludge char. Now we are moving into pilot-scale.
- Project partners:
  - 2018 – 2020: Luke and Gasum Oy
  - 2021 – 2022: HAMK
  - Research support from Aalto CHEM



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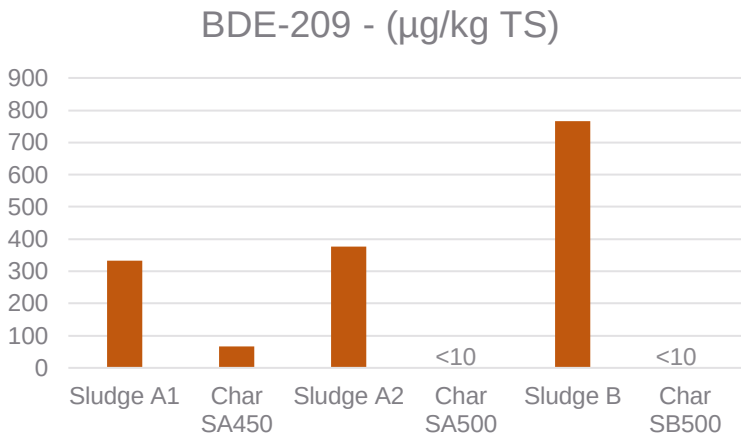
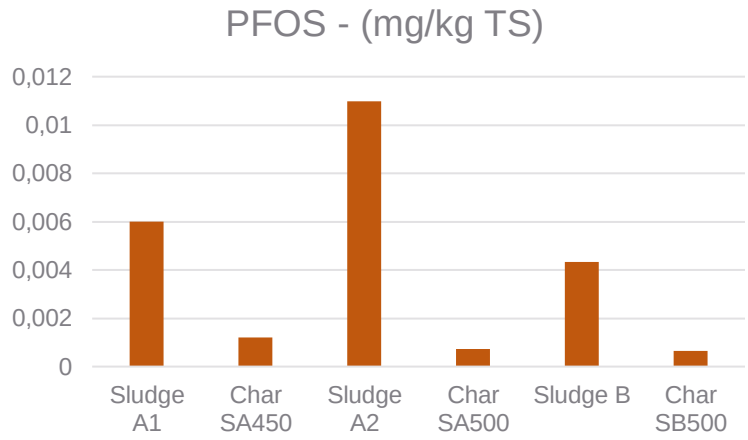
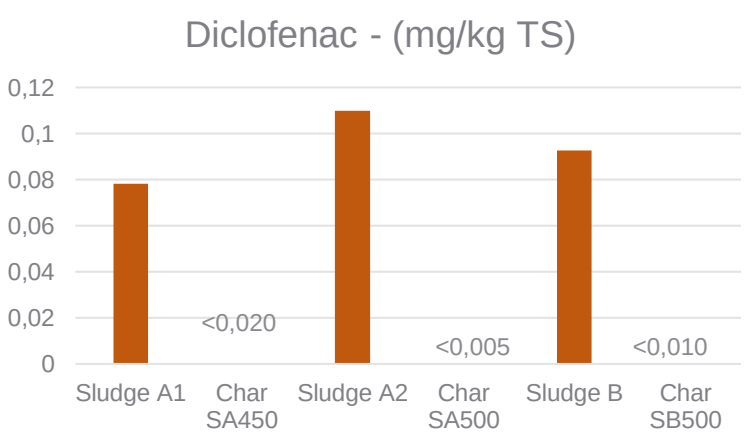
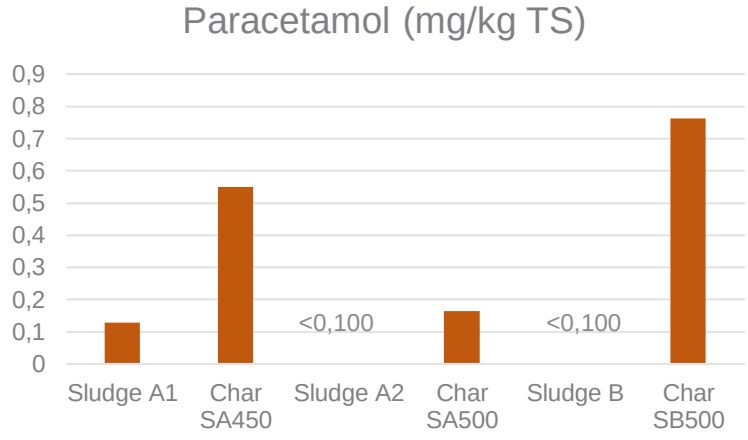
Organic contaminants

- 174 different organic contaminants were analyzed before and after pyrolysis
- Most organic contaminants were eliminated or reduced significantly in the process.
- Paracetamol was the only exception; the concentration increased in 2019 results, but not in more recent ones
- PAH16 as well as dioxins and furans were below guide values in all chars

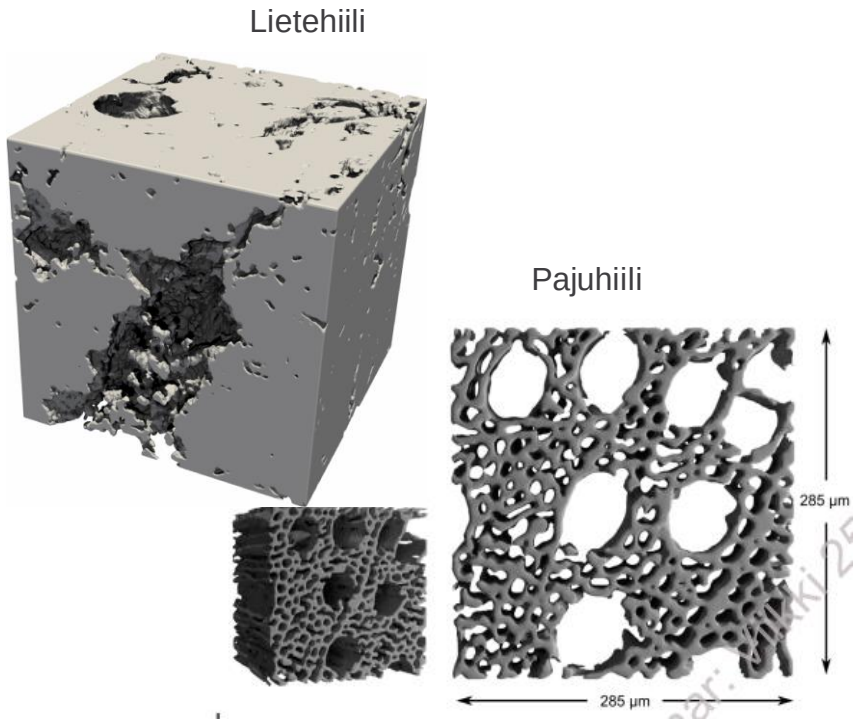






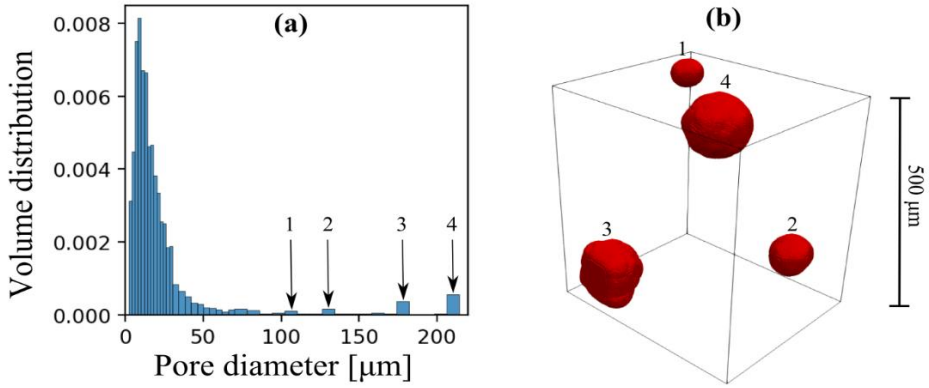


Char structure



Images: Markus Hannula, TAU and Jari Hyväluoma, HAMK

- Porousity is little compared to wood-derived biochars
- Surface area = 32 mm^2/mm^3 (in wood based chars 100-120 mm^2/mm^3)
- This is a crucial parameter to many conventional uses of biochar
  - → Small surface area lead to limited effects on water holding capasity or as a composting amendment



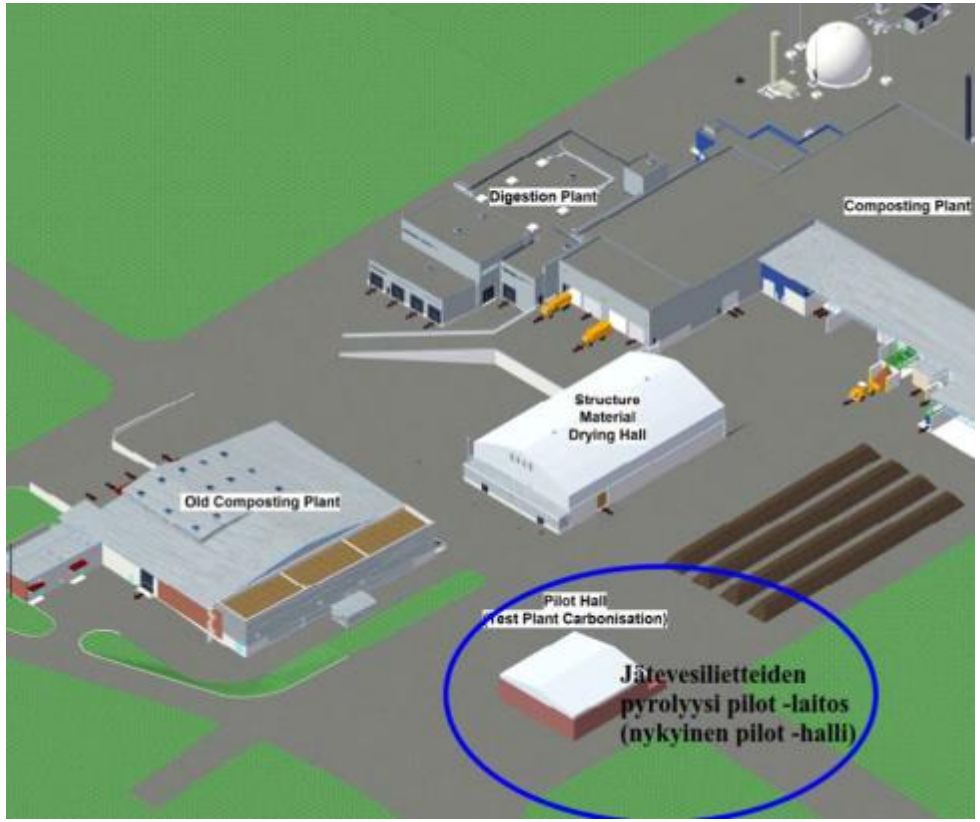
Promising applications currently studied with HAMK

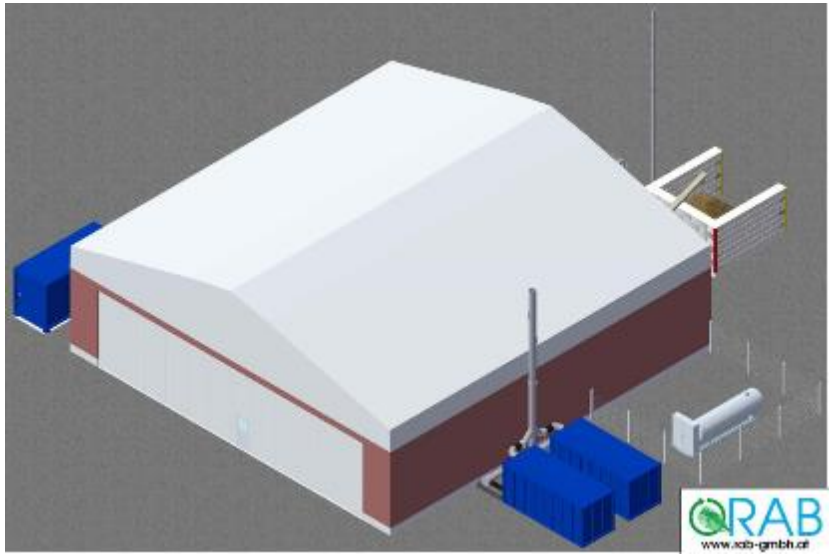
- Stormwater filtration
- Biowaste process amendment and subsequent use as fertilizer
- Direct use as fertilizer

Piloting sludge pyrolysis 2021-2022

Goals:

- To secure operation across the whole process and to gather user experience for full scale plant design
- Emission information for environmental permitting
- To determine actual operational costs
- To optimize the process through adjusting operational parameters such as temperature and retention time and feed mixing ratios
- To learn about the properties of flue gases in order to determine technology needs for emission control
- Process energy balance
- Waste streams and side products





Future plans:

- Decicions about the fill scale plant to be made in 2022
- Pilot plant to be used as a testing facility for other waste streams (green waste, horse manure etc.)

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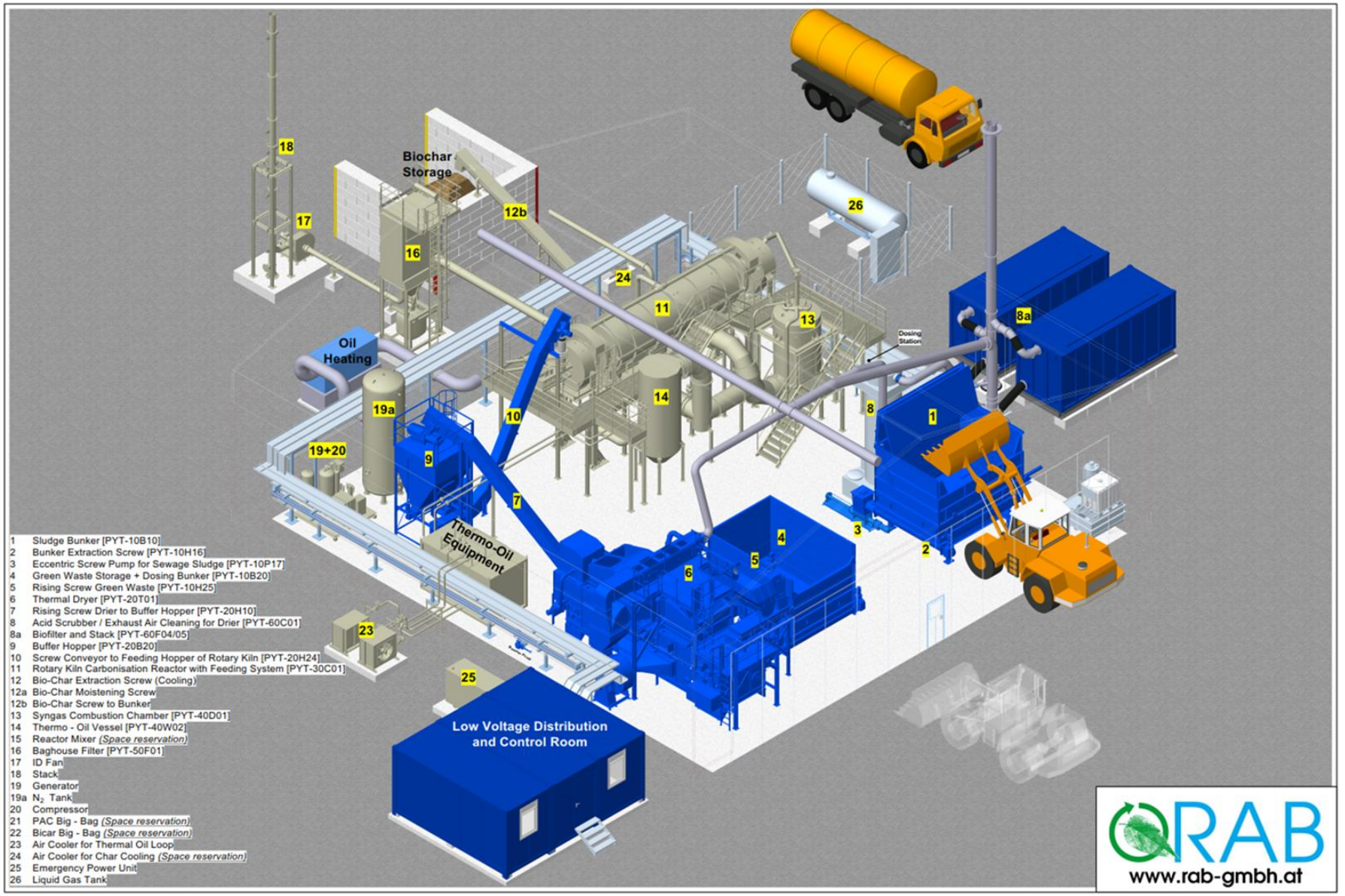
Pilot plant (Capasity 3 000 t/a sludge, 600 t/a green waste / wood chips)

[Link to video tour]



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Thank you!

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2.6.2021