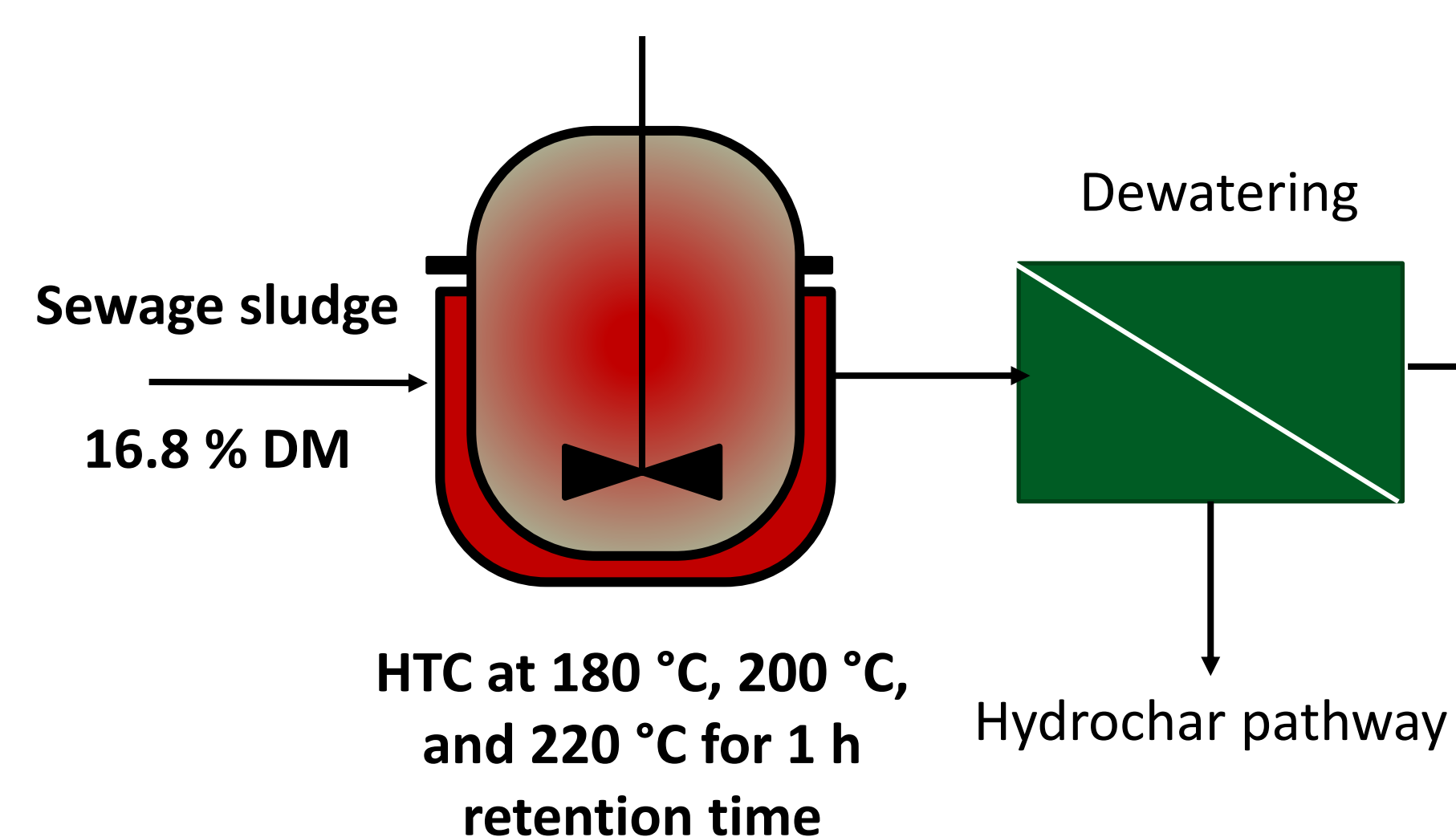


Development and testing of a mesophilic trickling filter for treating process water from HTC of sewage sludge

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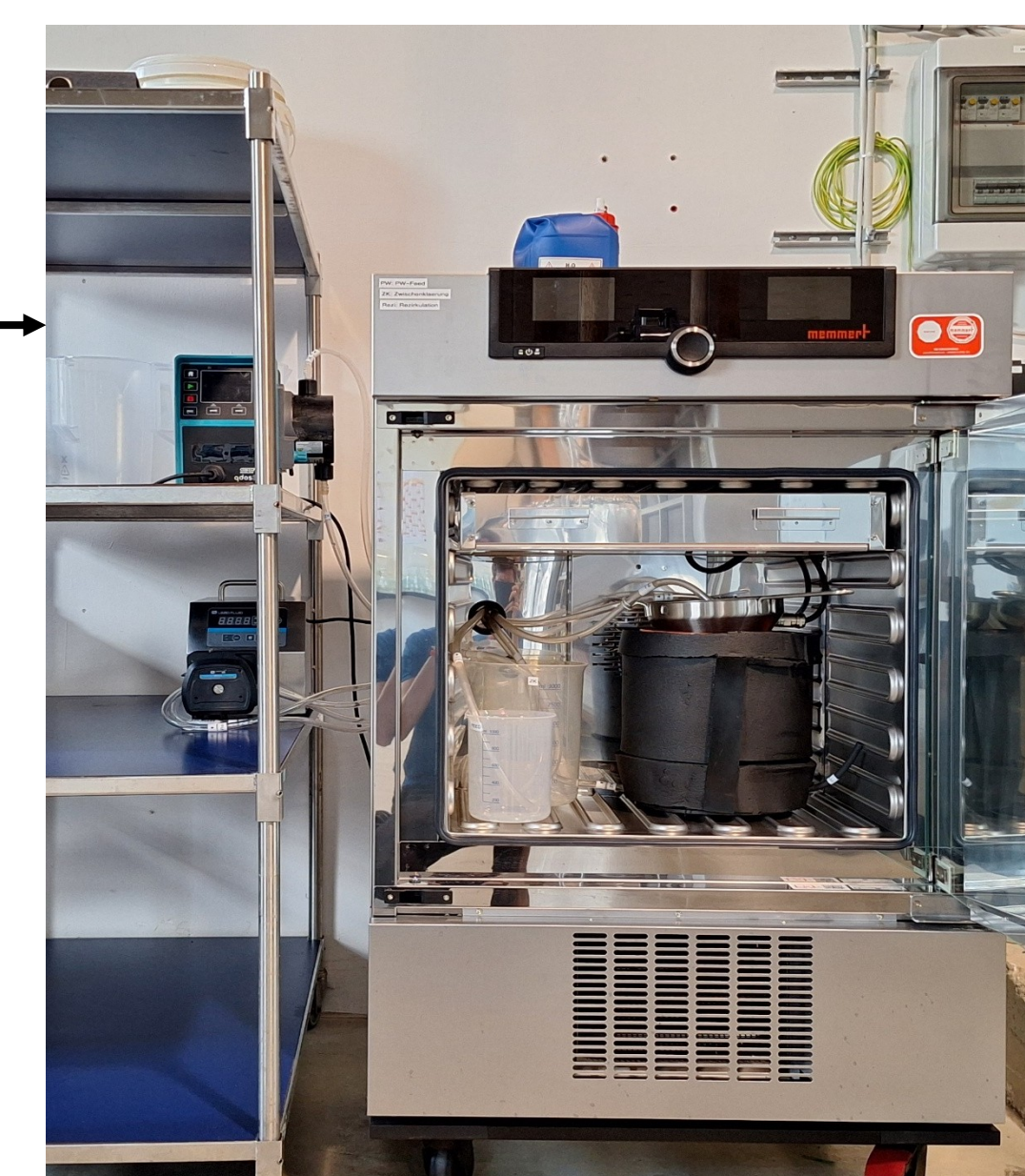
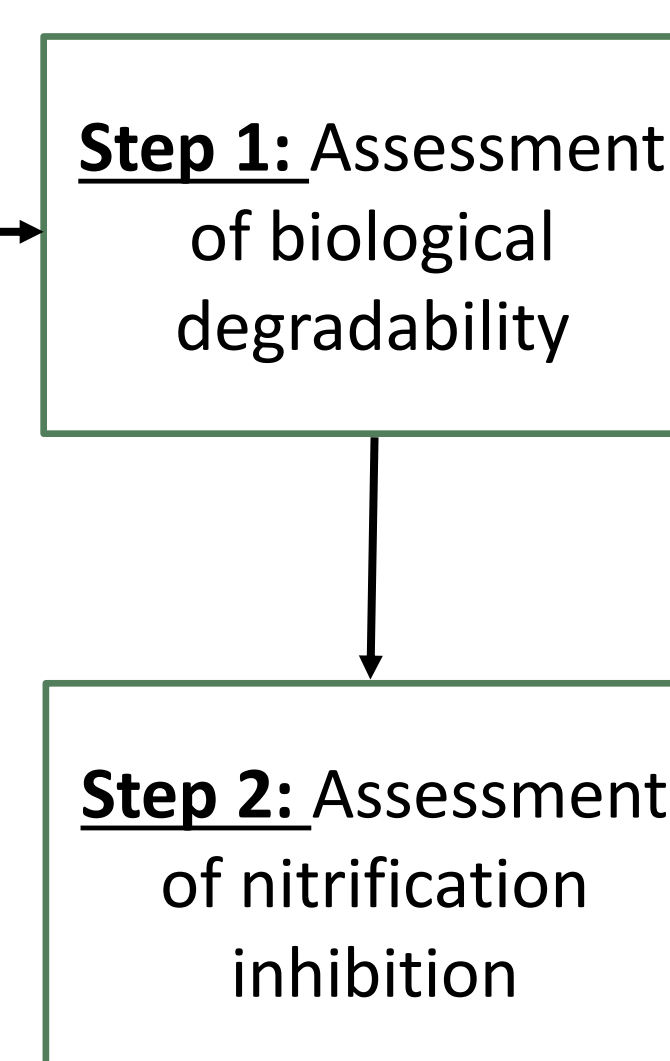
Hydrothermal carbonization (HTC)

- HTC is a promising alternative thermochemical process for the utilization of sewage sludge
- SS is converted at high temperatures (180–250 °C) and pressures (15–60 bar) into an hydrochar-sludge
- Water acts as solvent, catalyst and reactant
- After solid-liquid separation: hydrochar and process water (PW)



Aerobic biological treatment of PW

- Treatment of diluted PW from HTC of sewage sludge in a mesophilic operated aerobic trickling filter (30 °C)
- Stepwise increasing of organic loading rate (OLR)
- Dilution of PW up to 1:30



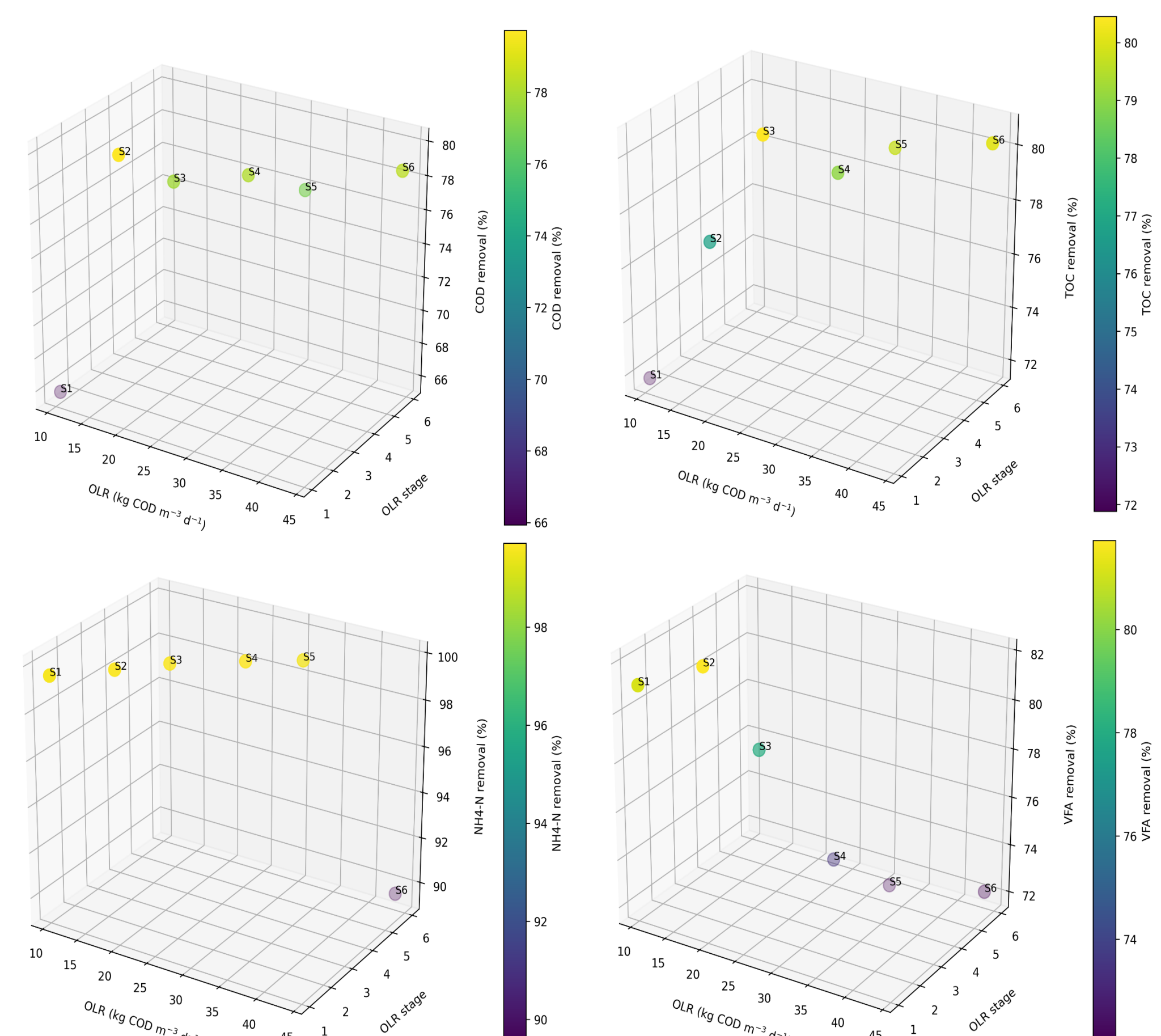
Step 3: Aerobic mesophilic biological treatment in a fixed-bed reactor

- Hydrochar is a solid lignite-like product that can be used in various applications
- The PW is produced in significant quantities due to the process's nature

Characterization and main challenges on PW

- High organic load: Very high COD values
 - COD: 53 – 57 g/l
- High nitrogen concentrations: PW is heavily loaded with nitrogen (TN) and ammonium (NH₄-N)
- PW is a complex mixture of substances
- GC-MS screening reveals a wide variety of low-molecular-weight dissolved organic compounds
- Phenolic compounds, pyrazine-like N-heterocycles, and diketopiperazines
- These may be potentially difficult to (bio)degrade or be toxic
- PW management and handling is important for the upscaling and commercialization of the HTC technology itself
- PW treatment possibilities include recirculation (re-use), anaerobic or aerobic biological treatment or chemico-physical or electro-chemical methods

Results



- The biofilm successfully adapted to diluted PW
- A stable COD removal rate of approximately 75–80% was achieved across a wide range of organic loading rates (OLR)
- NH₄-N removal remained very high even in the higher OLR range, reaching nearly 99% over long periods