Demo case Rotterdam

NEREUS start conference
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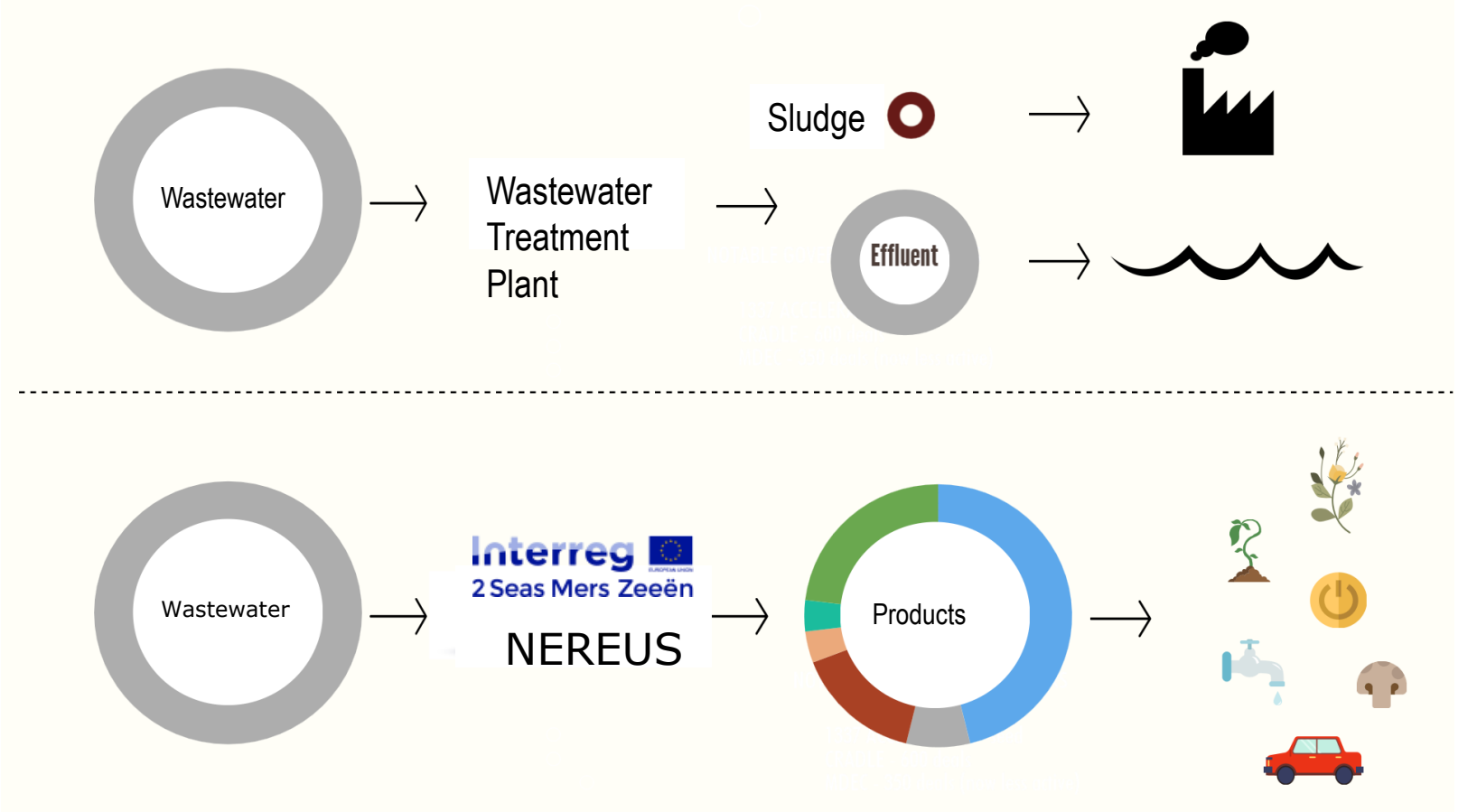
Contents

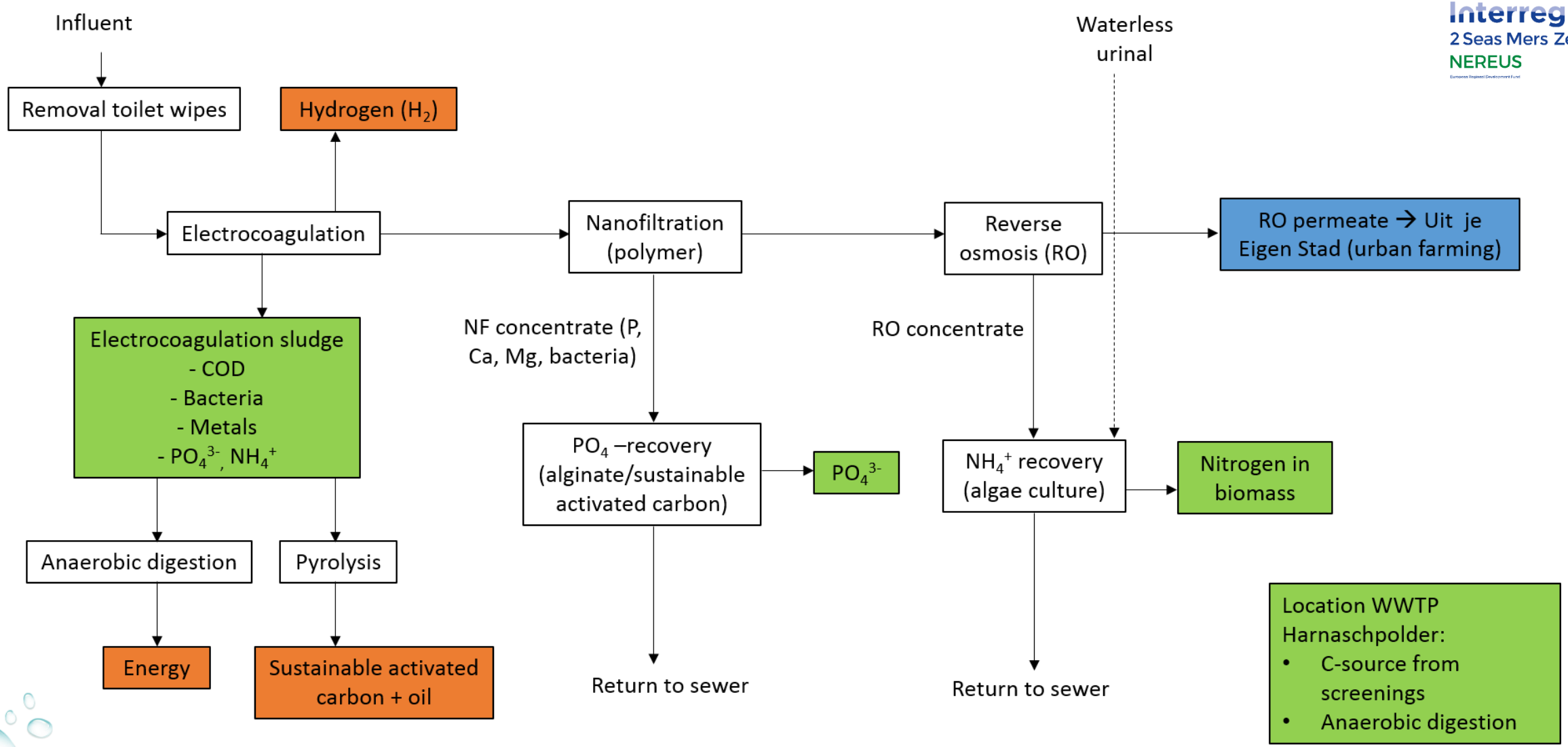
- Background
- Process
- Results
- Planning 2018
- Dissemination
- Conclusions

Why?



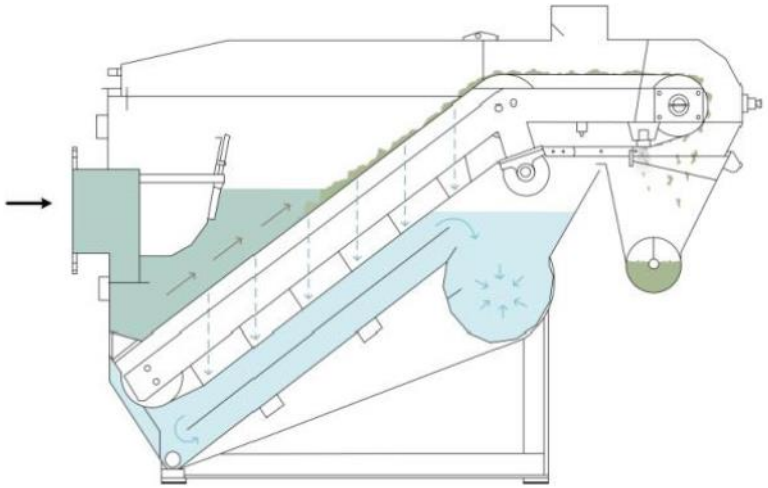
Pilot research (demonstration) recovery water, energy, nutrients in urban areas

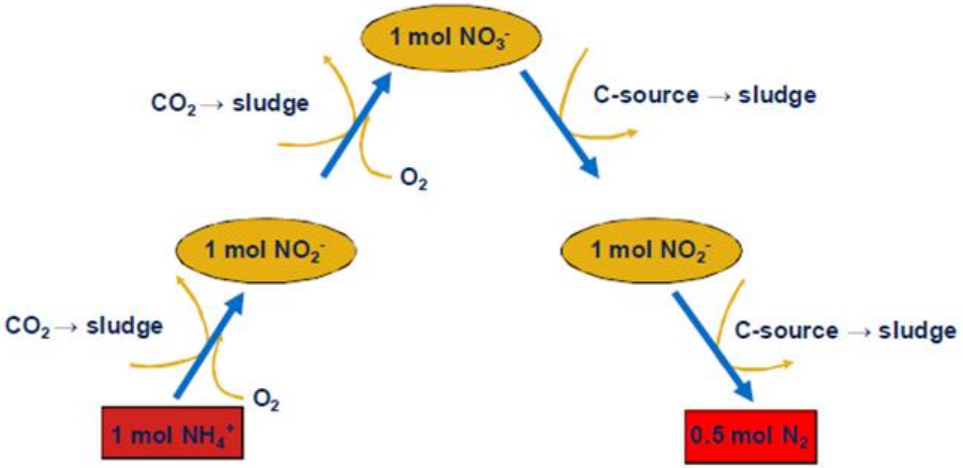
Process demo case Rotterdam



Results - Cellulose as C-source

- C-source is needed for denitrification
- Shortage in influent → purchasing methanol or glycerine
- Large impact on CO_2 footprint
- Possible to convert screenings from fine sieves into C-source?





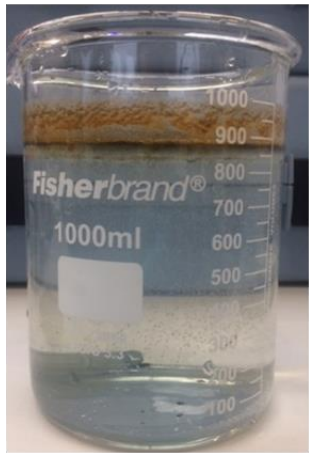
Results - Cellulose as C-source

- Proven on 1 liter scale, enzyme selection crucial
- Quality produced C-source ≥ purchased glycerine
- Business case positive for Schiphol WWTP
- Possible CO_2 footprint savings: 600 ton/year
- Scale-up to pilot scale in 2018; problem with availability enzyme

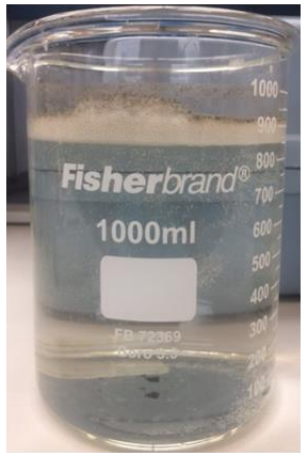
Results - Electrocoagulation

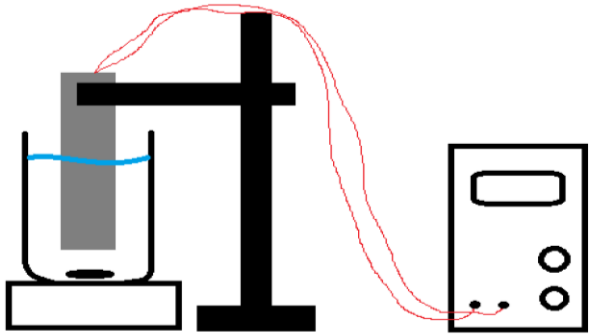
Influent

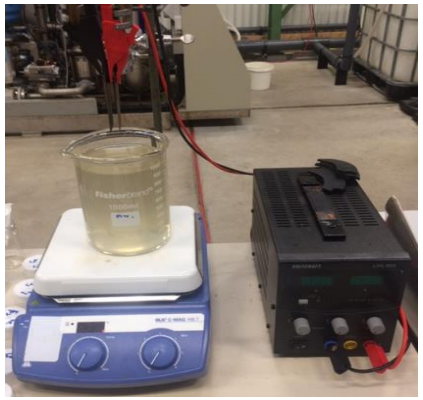
Effluent iron



Effluent aluminium

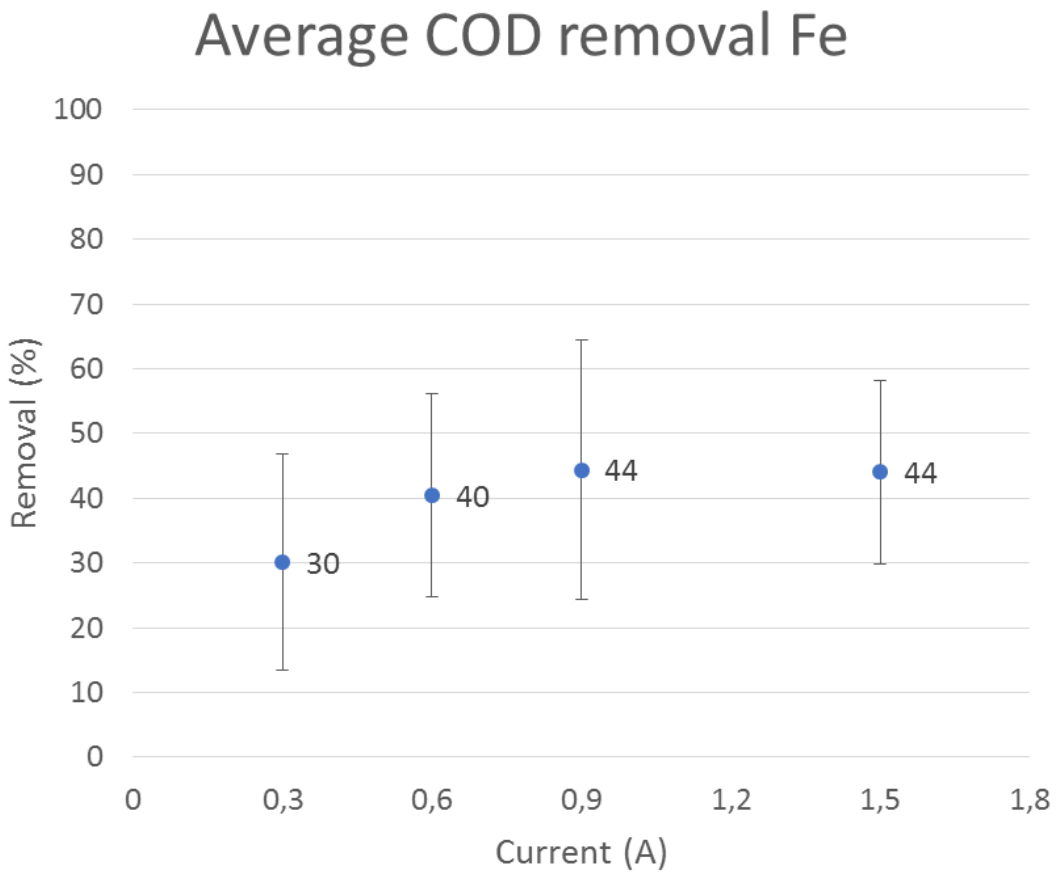


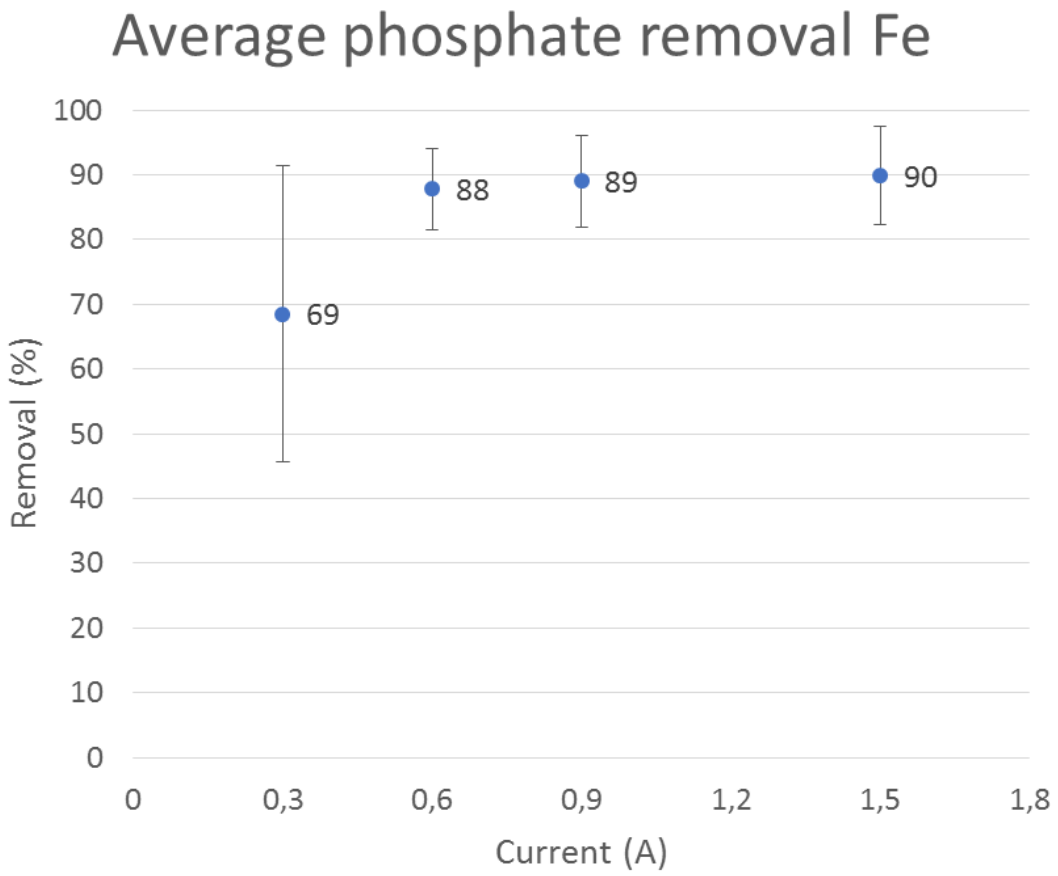




- Replacement $FeCl_3$ dosing
  - ✓ Less handling of chemicals (safety)
  - ✓ Using electricity should be renewable
  - ✓ Lowering CO_2 footprint
- Aluminium/iron electrode
- Optimal process conditions 1 liter scale known

Results - Electrocoagulation

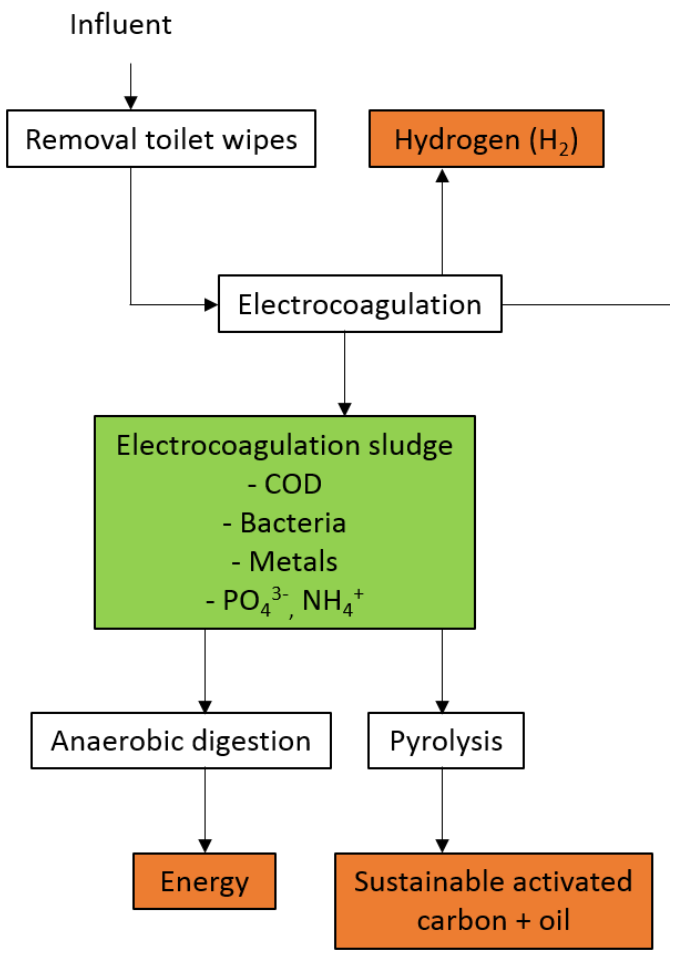




Results - Electrocoagulation

Electrocoagulation produces sludge, 2 treatment routes are explored:

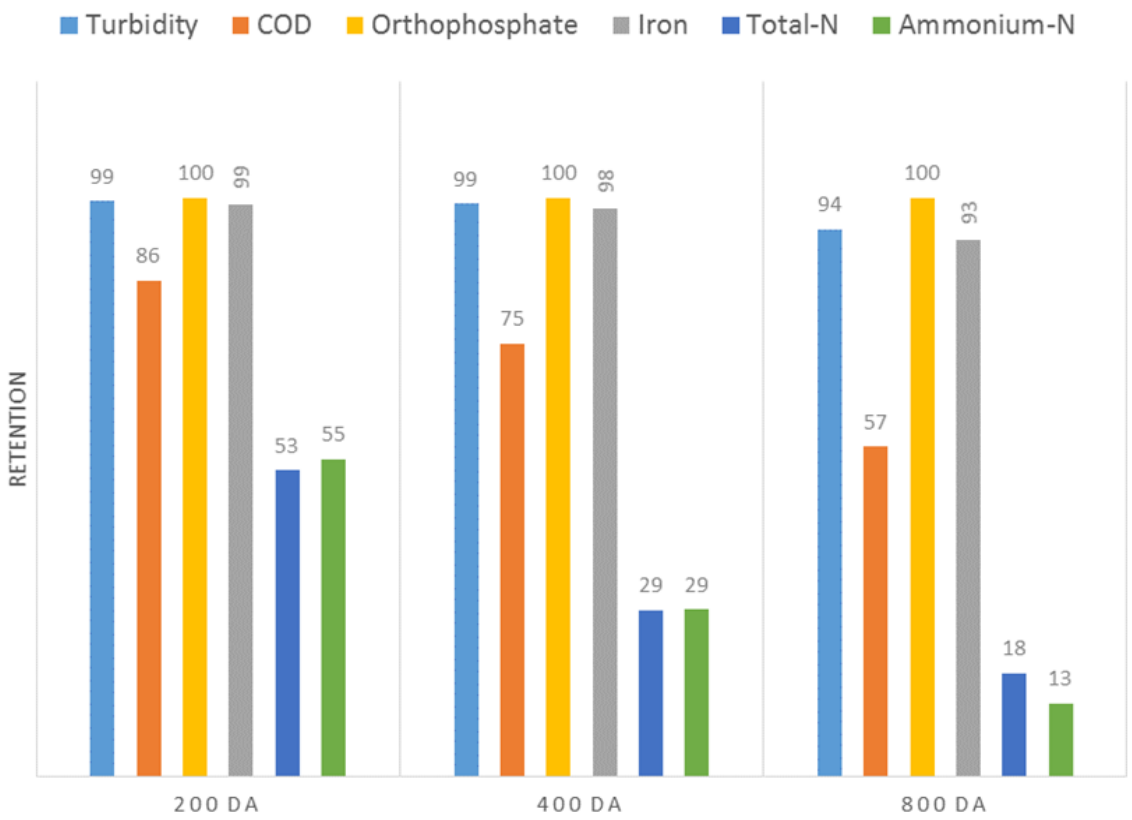
1. Anaerobic digestion tests
   - ✓ Methane production
   - ✓ Treatment digestate?
   - ✓ Nutrients and metals
2. Pyrolysis/TorWash
   - ✓ Sustainable activated carbon
   - ✓ Oil
   - ✓ Gas



Results - Nanofiltration

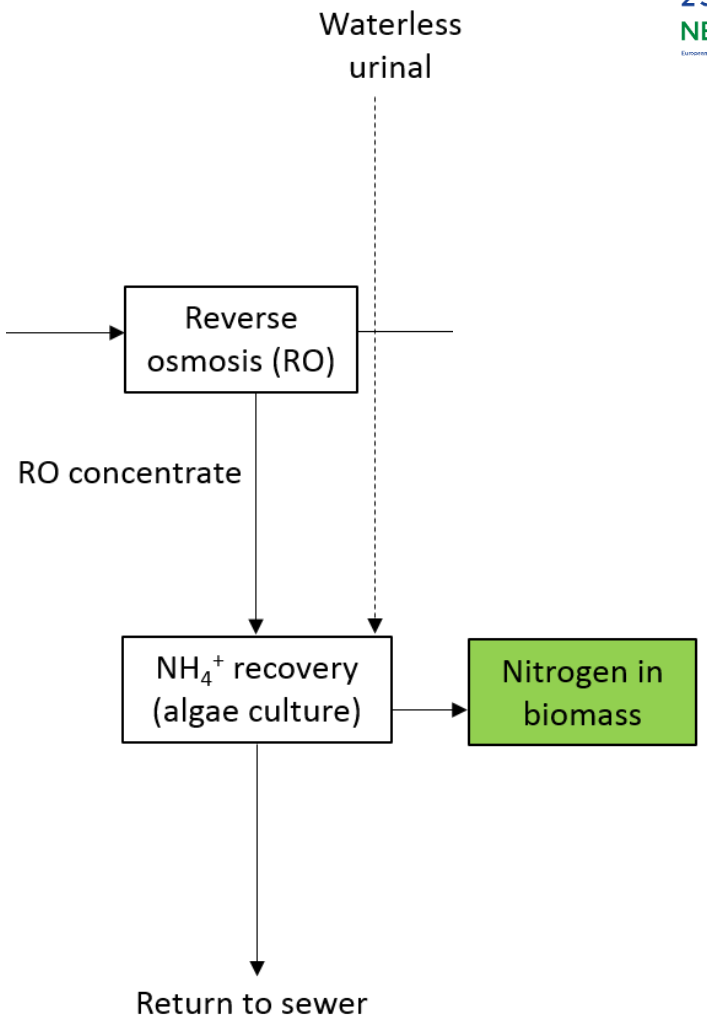
- Selection nanofiltration-membranes NXFiltration (production, selectivity) → MexPlorer
- Composition concentrate
- PO_4^{3-} recovery
  - ✓ Alginate beads

Electrocoagulation effluent FE 0,9A 10 L/H)



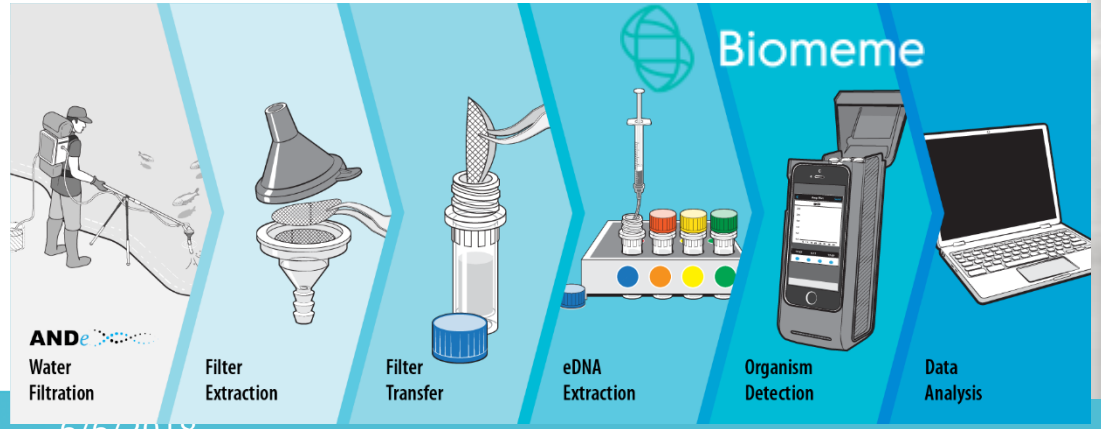
Results – Algae culture

- Recovery of nitrogen
- Waterless urinal is installed
- Selection algae (brackish water), extremophile
- Reactor system



Results – Reverse Osmosis

- Water
  - ✓ Irrigation water Uit je Eigen Stad
  - ✓ Cider production Vet & Lazy / Beer production students TU Delft
  - ✓ Monitoring microbiological quality



Planning 2018

1. Installation pilots
   - ✓ Electrocoagulation
   - ✓ Nanofiltration

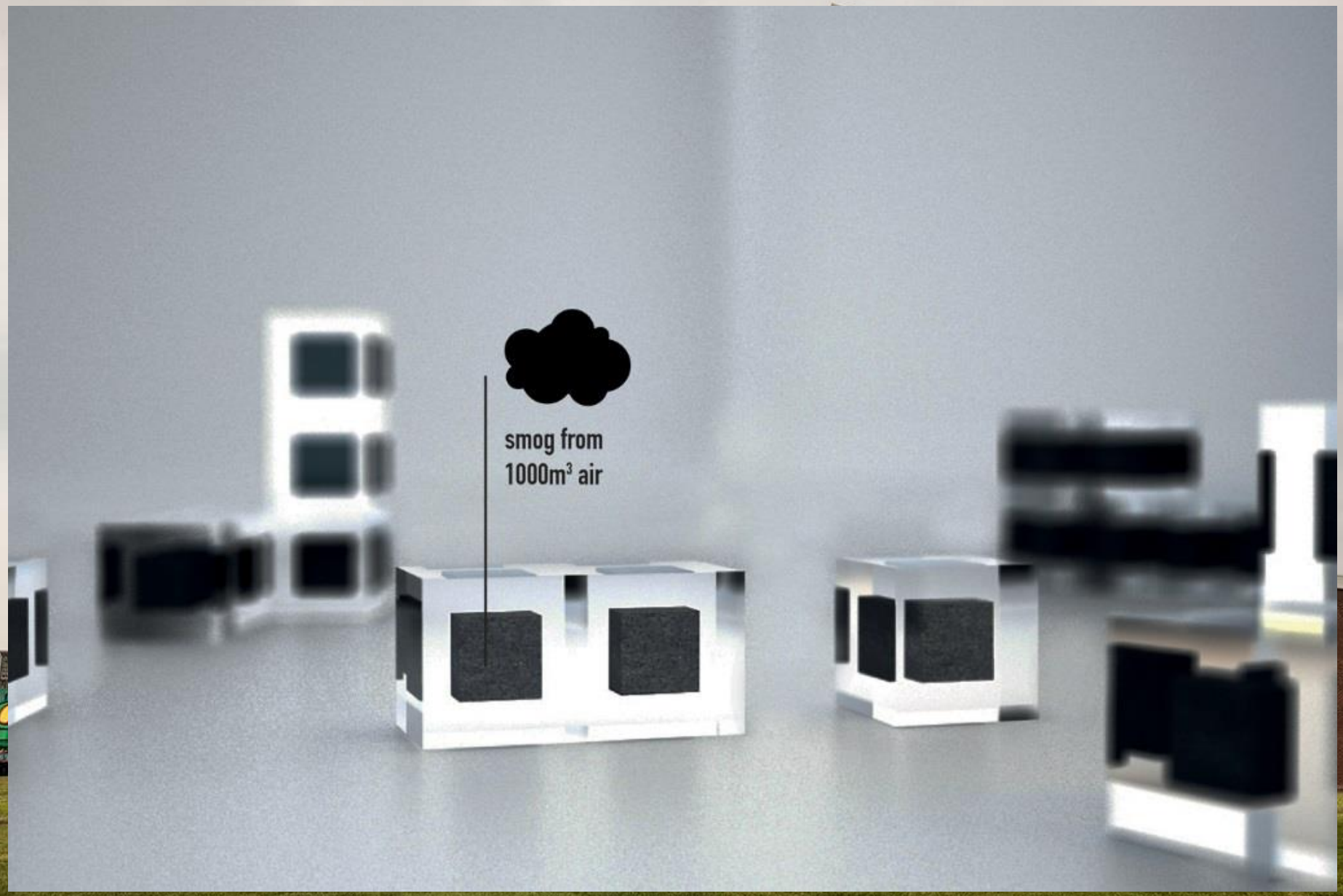
2. Official opening NEREUS pilot Rotterdam on 25 June 2018

3. Setting up critical performance indicators process steps:
   - ✓ Removal and recovery efficiency relevant compounds (e.g. COD, phosphate, ammonium)
   - ✓ Energy use
   - ✓ Use of chemicals
   - ✓ CO_2 footprint

Dissemination

- Abstracts (international congresses): Aachener Membran Kolloquium, …
- Articles: e.g. cellulose project
- Ups & Downs to observer partners &
- 4 x / year observer meeting
- Meetings international partners + o
- LinkedIn & Twitter
- Tours pilot Rotterdam

Coop



Conclusions

- Enzymatically produced C-source works at least as good as purchased glycerine

- Elektrocoagulation: >90% phosphate and 50% COD removal in lab scale reactor
  - ✓ Alternative for $FeCl_3$ (safety & CO_2 footprint)

- Nanofiltration can divide nutrients over separate streams
  - ✓ Possibility to recover phosphate and ammonium separately (instead of struvite)

Democase Rotterdam

Official opening NEREUS pilot Rotterdam on 25 June 2018!

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