

Biological Oxygen Dosed Activated Carbon

Removal of micropollutants from wastewater

BODAC @ WWTP Emmen

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Amsterdam, November 4th, 2021



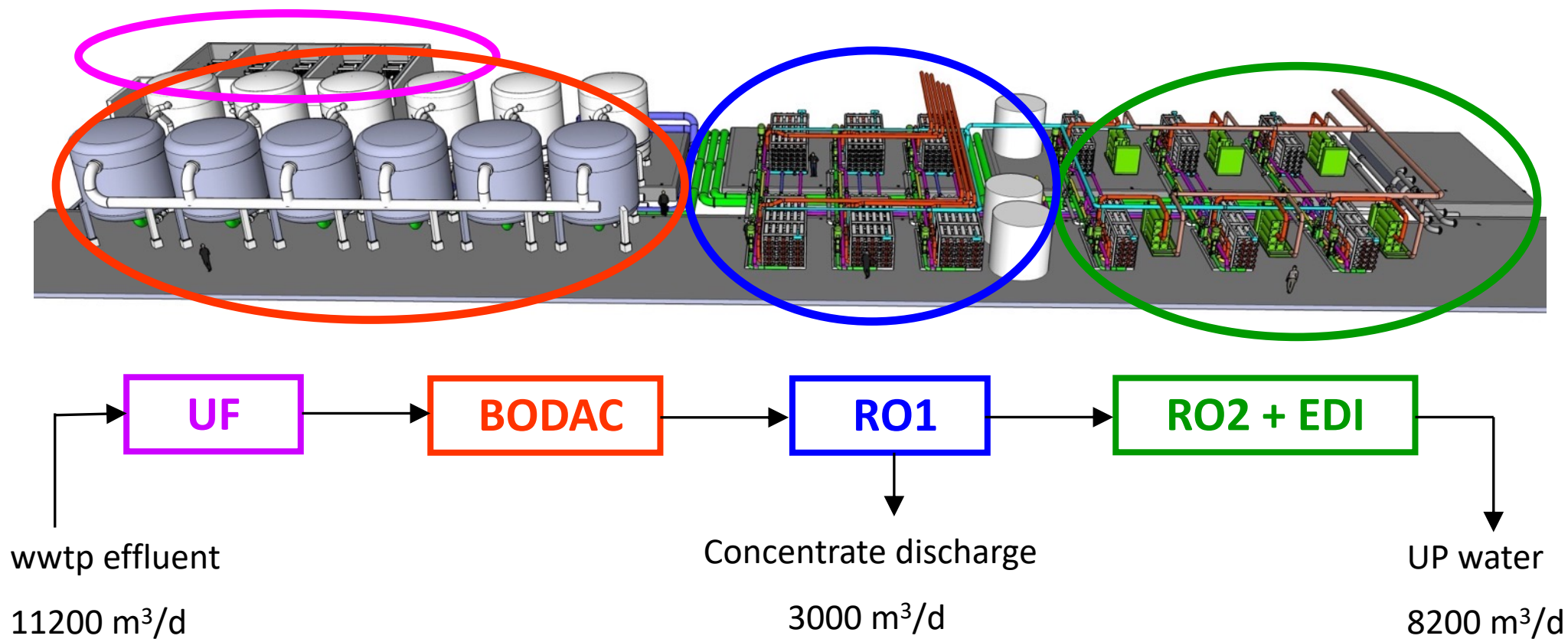
Ultra Pure Water production from WWTP effluent



BODAC, Aquatech Amsterdam



BODAC prevents biofouling on Reverse Osmosis membranes



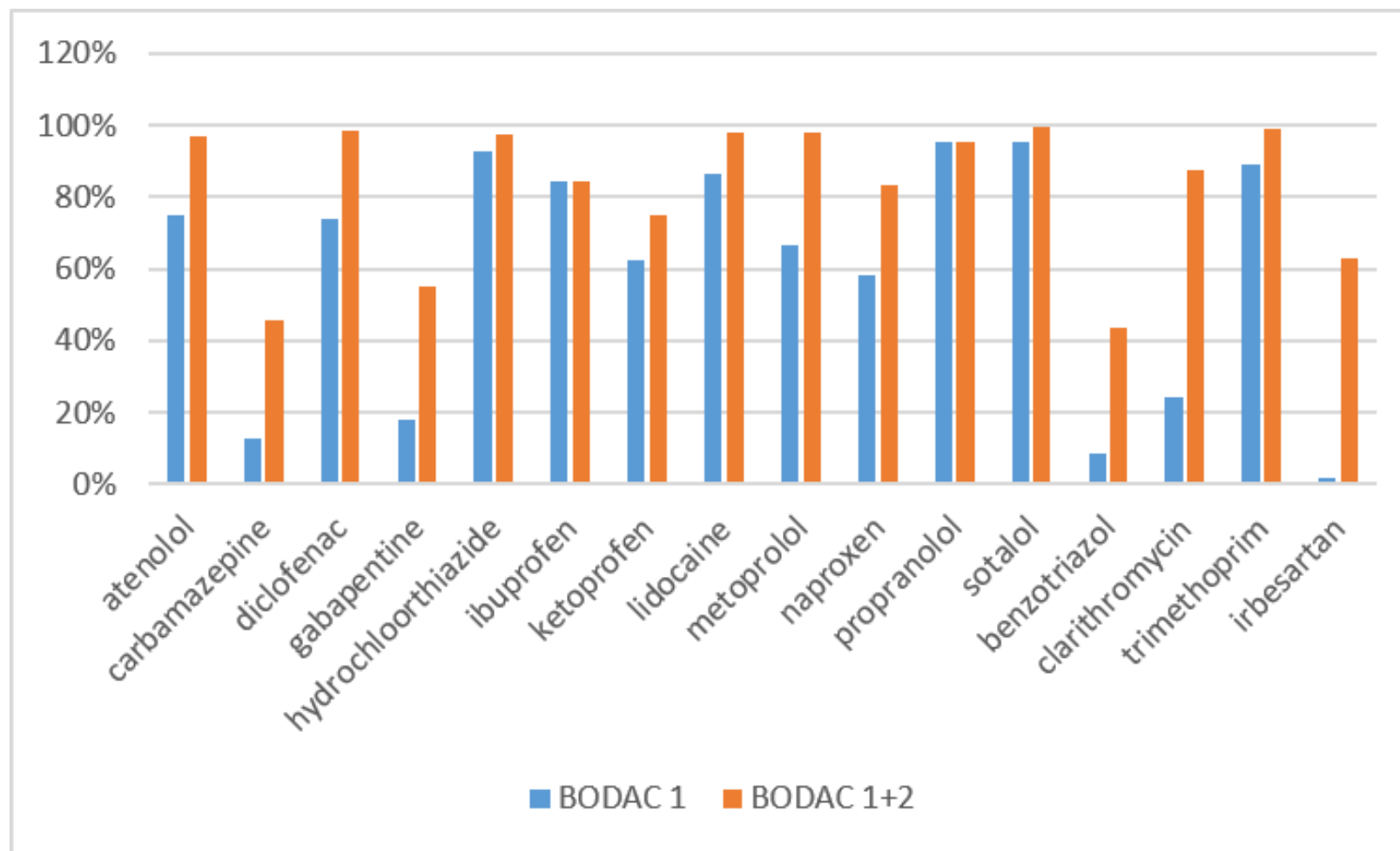
Biological Oxygen Dosed Activated Carbon for UPW



- Granular activated carbon filtration in 2 serial steps:

BODAC 1 = 16 min EBCT
BODAC 2 = 32 min EBCT
- Oxygen supply to keep aerobic conditions
- Degradation of biofouling precursors
- Nitrification
- Backflush 0.5 – 2 times/week
- In operation since 2010

Removal of pharmaceuticals from WWTP effluent



December 2018

N = 2

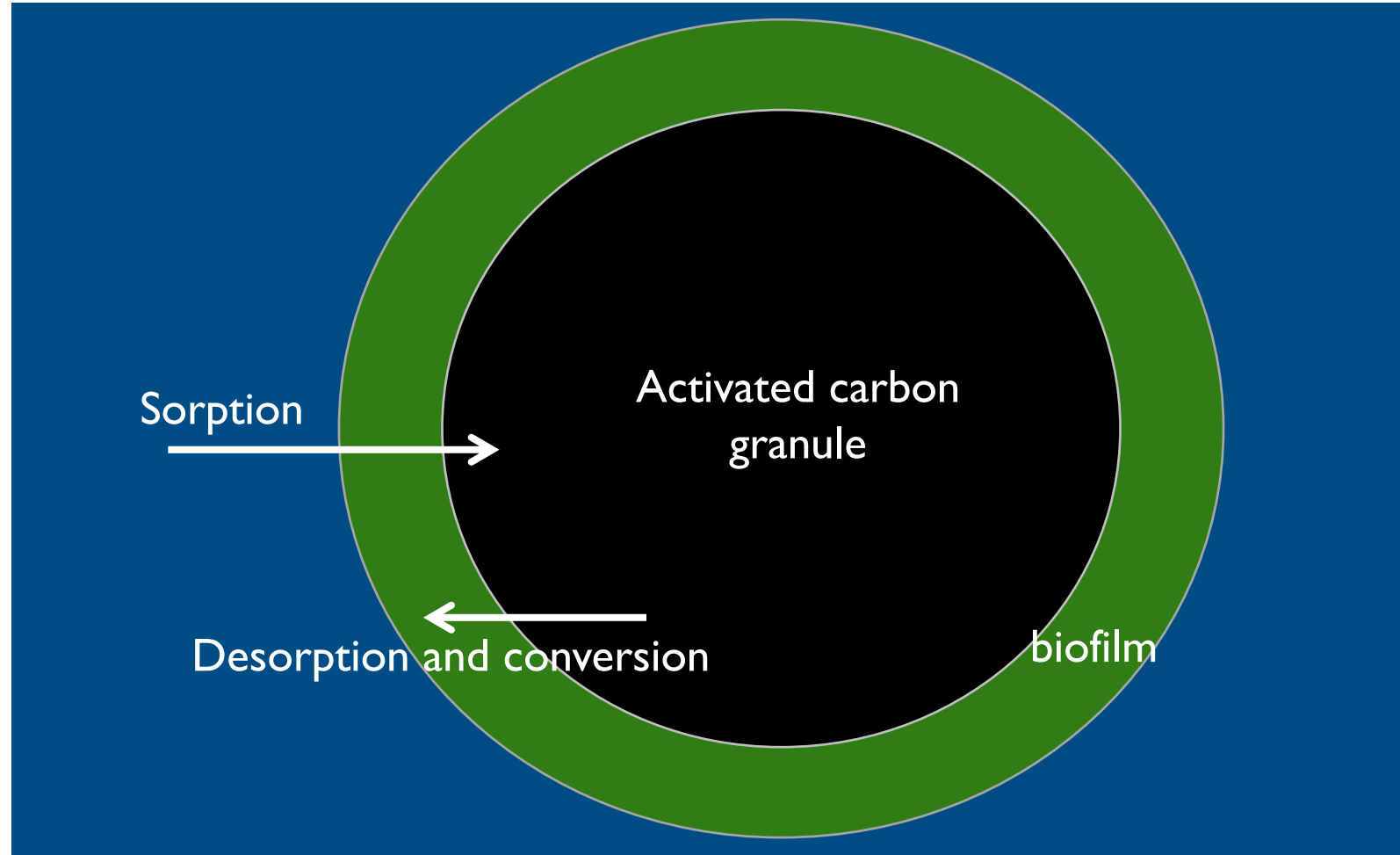
>200.000 bed volumina

EBCT

BODAC 1 = 16 min.

BODAC 2 = 32 min.

Principle supposed: continuous bioregeneration of AC



Feasibility study

May 2019 – May 2020

Full scale BODAC plant NWTR @ WWTP Emmen

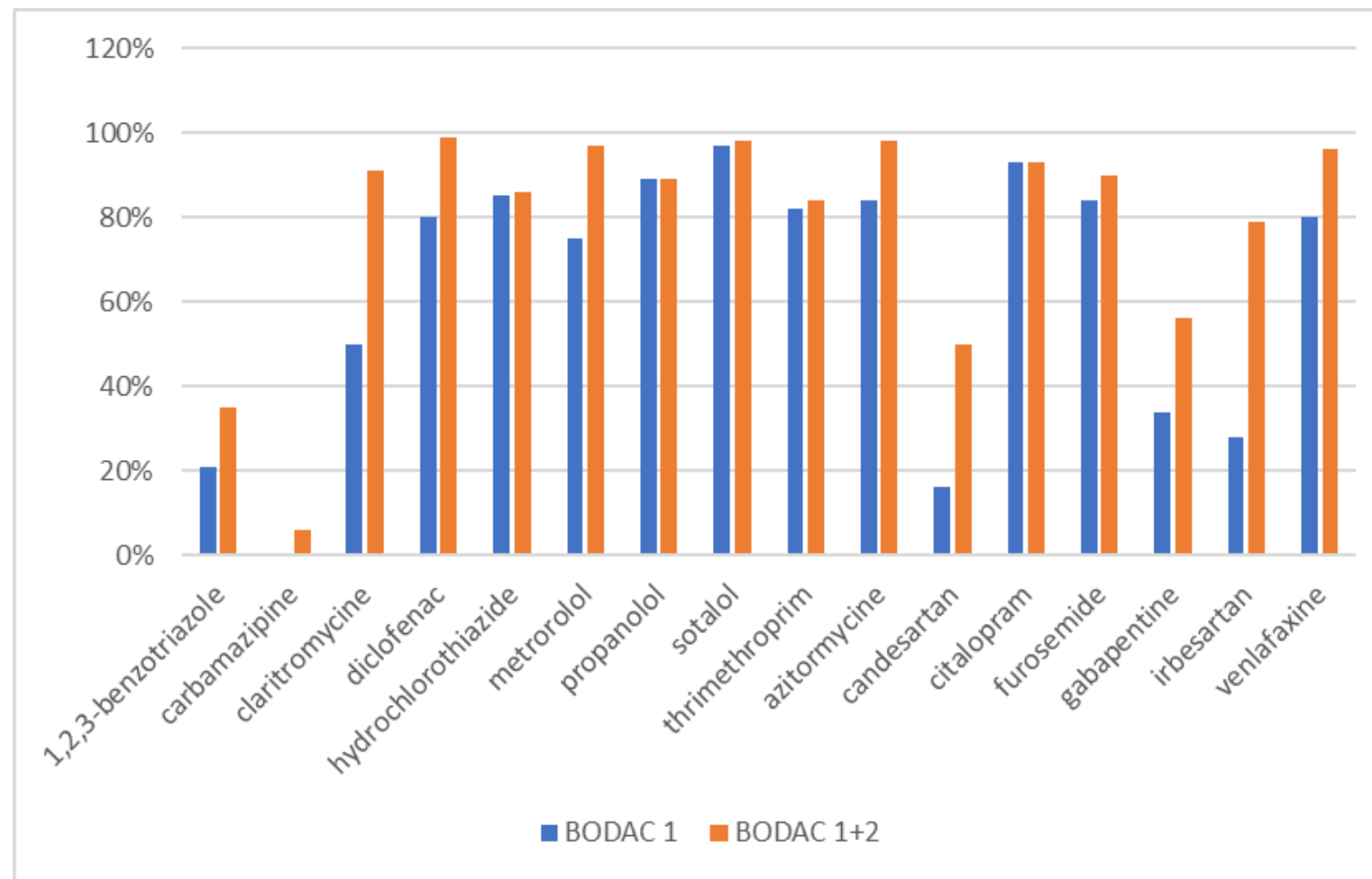
Goal

Assessment of performance indicators:

- Removal efficiency and mass balance pharmaceuticals
- Removal of other micropollutants
- Estimation of costs and CO2 footprint

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Removal of pharmaceuticals from WWTP effluent



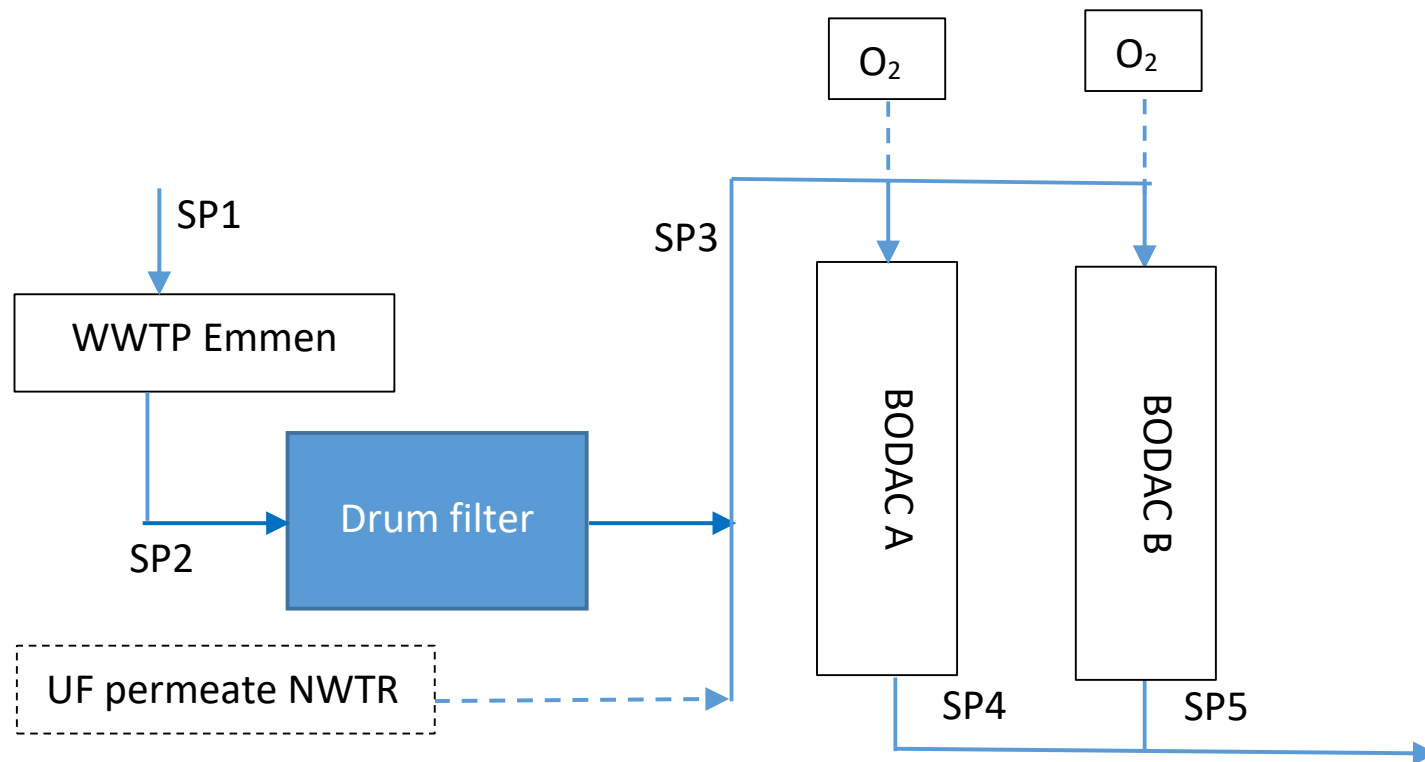
July 2019 – March 2020
N = 10

EBCT
BODAC 1 = 16 min.
BODAC 2 = 32 min.

BODAC performance indicators

1. High removal rates: 80% to 91% removal from WWTP effluent depending on EBCT.
(Average removal of 7 'guide substances': metoprolol, clarithromycin, diclofenac, hydrochlorothiazide, propranolol, sotalol and trimethprim).
1. >300 micropollutants are removed (LC-MS non target screening).
2. Energy consumption of 0.12 – 0.14 kWh/m³, CO₂ footprint amounts 95 g CO₂/m³
(assumption AC life time without regeneration: 12 years)
3. The costs are estimated to be approximately € 0.15 – 0.17 per m³ (WWTP 100.000 PE)
4. Relatively simple and widely applicable in current practice.

BODAC pilot research: pre-treatment and start-up



Simple pre-treatment:
Drum filter instead of Ultrafiltration

Start-up period:
Adsorption → Biodegradation

Pilot research 10 m³/h



Thank you for your attention!

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stowa



Rijkswaterstaat
*Ministry of Infrastructure
and Water Management*

Tackling Micropollutants in Wastewater
Approaches on Implementation and Innovation in Europe and The Netherlands

November 3 and 4 2021
Aquatech Amsterdam