



Removing OMP's with innovative adsorbens DEXSORB®
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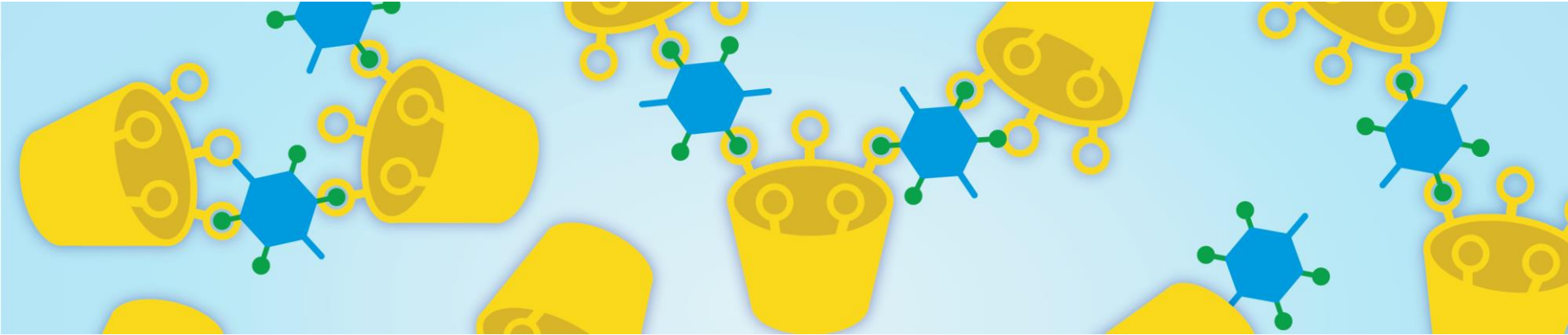
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Content

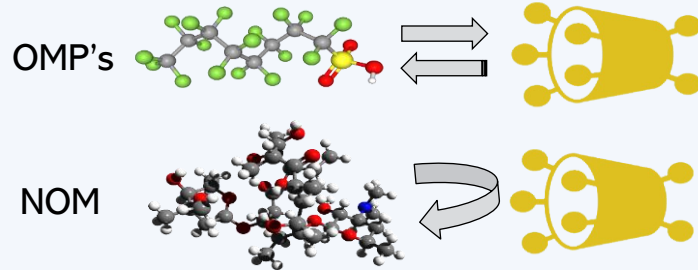
1. What is DEXSORB?
2. Pilot research at WWTP Lelystad
3. Evaluation of pilot performance
4. Future outlook
5. Questions & Answers



1. What is DEXSORB®?

What is DEXSORB?

- ✓ *Biobased, innovative adsorbents based on cyclodextrine*
- ✓ *Selective OMP removal by size-exclusivity*



- ✓ *Chemical regeneration with (m)ethanol*
- ✓ *Fast adsorption kinetics (equilibrium reached after 15 min.)*



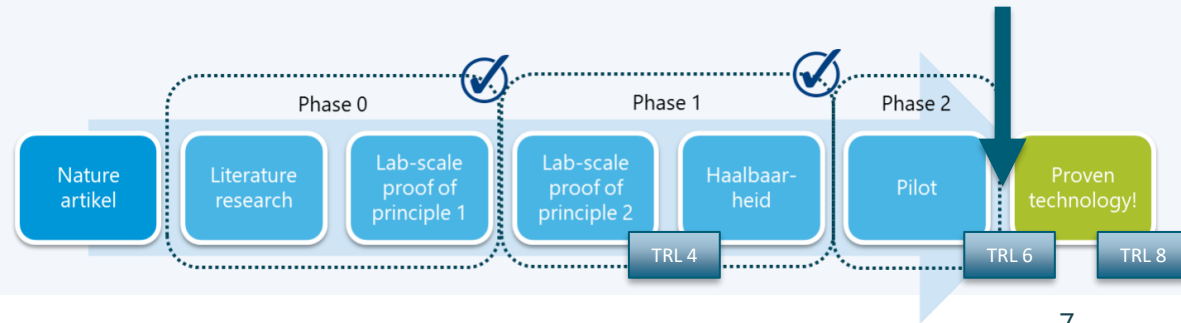


2. Pilot research at WWTP Lelystad



Goals of pilot research

- ✓ Development TRL 4 (lab) to 6 (pilot) *on Dutch WWTP effluent*;
- ✓ Evaluation of OMP-removal performance
- ✓ Evaluation of operational parameters of DEXfilter



Design *DEXfilter* in pilot

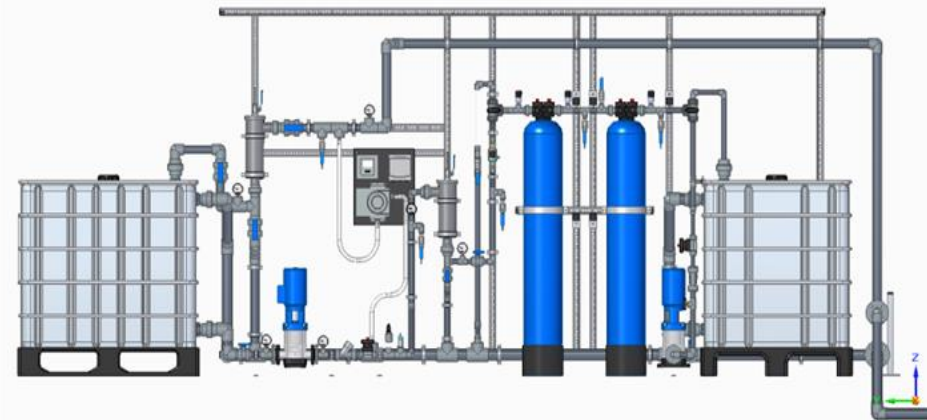
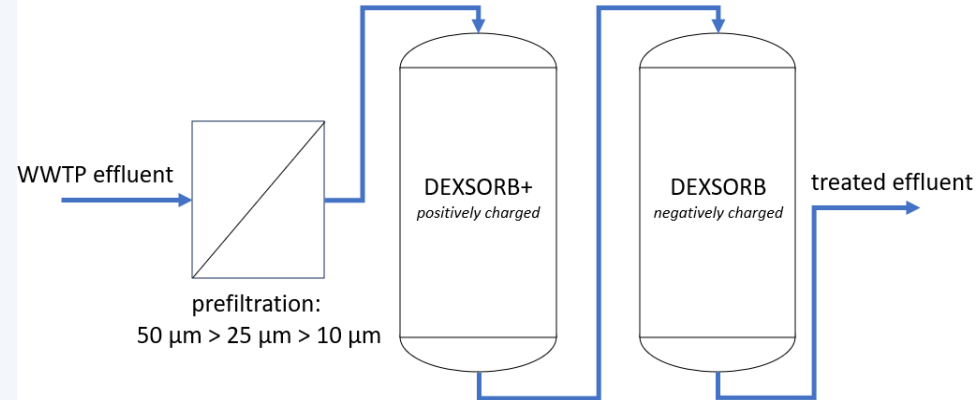
Location = WWTP Lelystad, NL

Configuration = Lead-lag

Flow rate = 0,5 m³/hr

EBCT = 5 min + 5 min

Filtration rate = ~ 10 m/hr



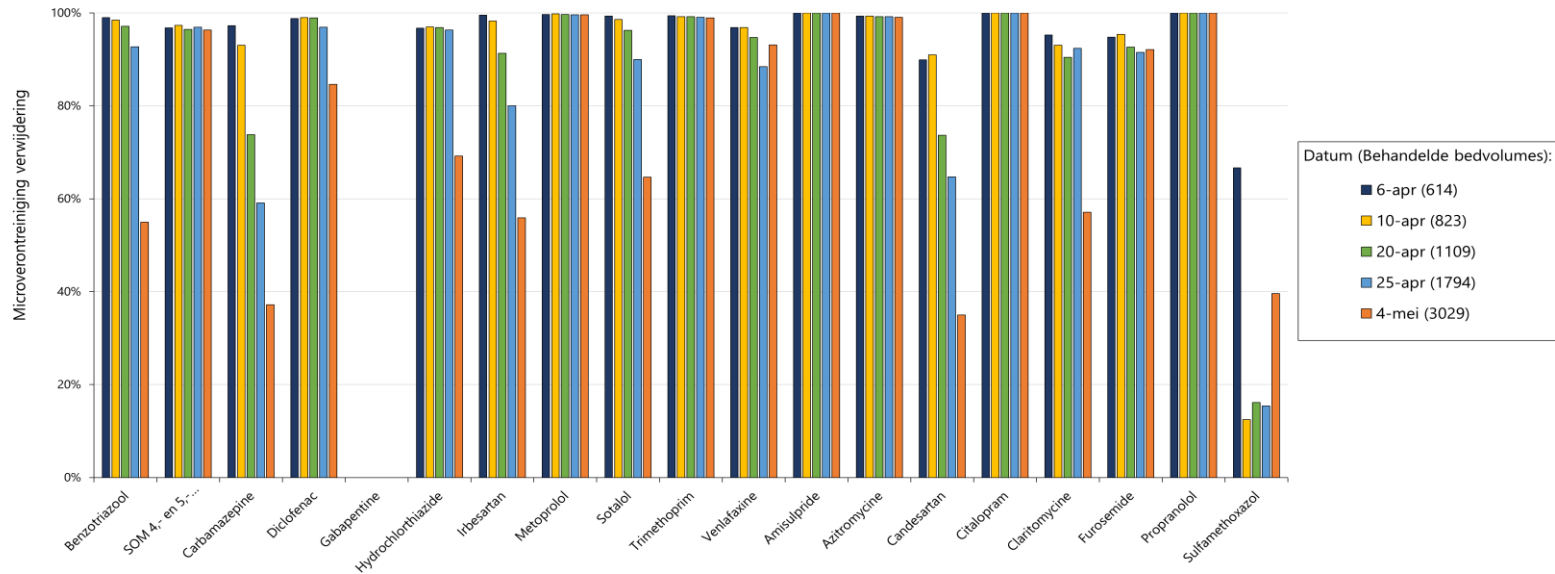
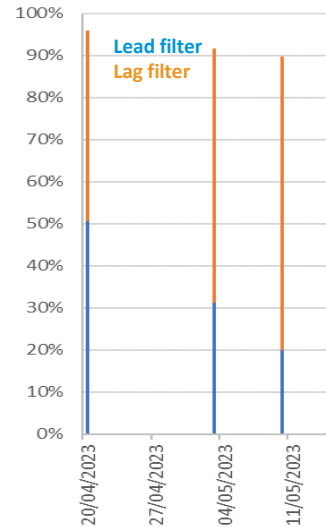


3. Evaluation of pilot performance

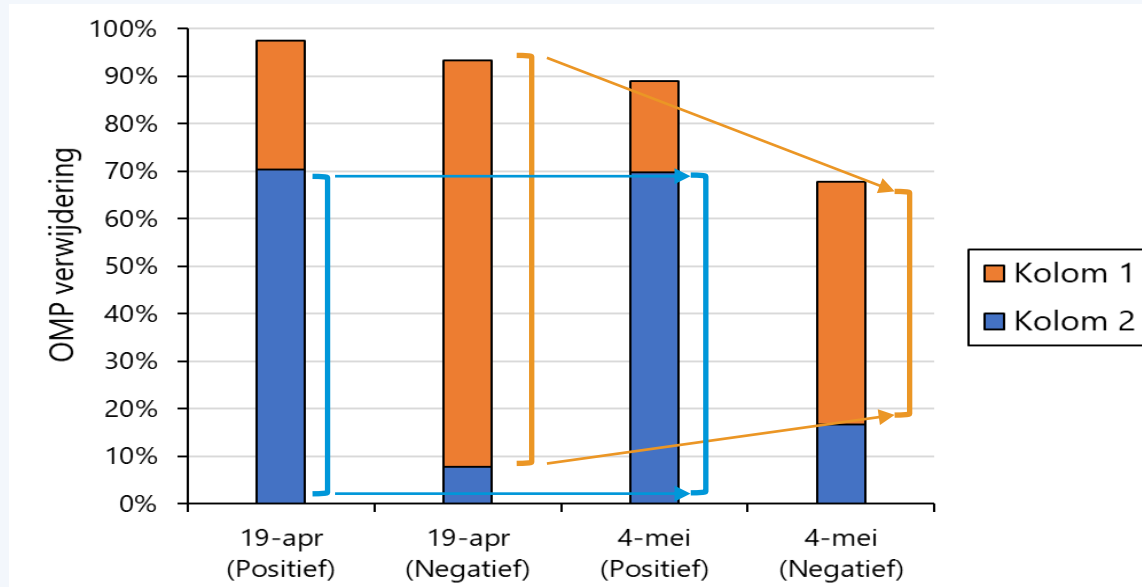
DEXfilter shows good removal of OMP's until 4.000 BV's

PFAS-removal

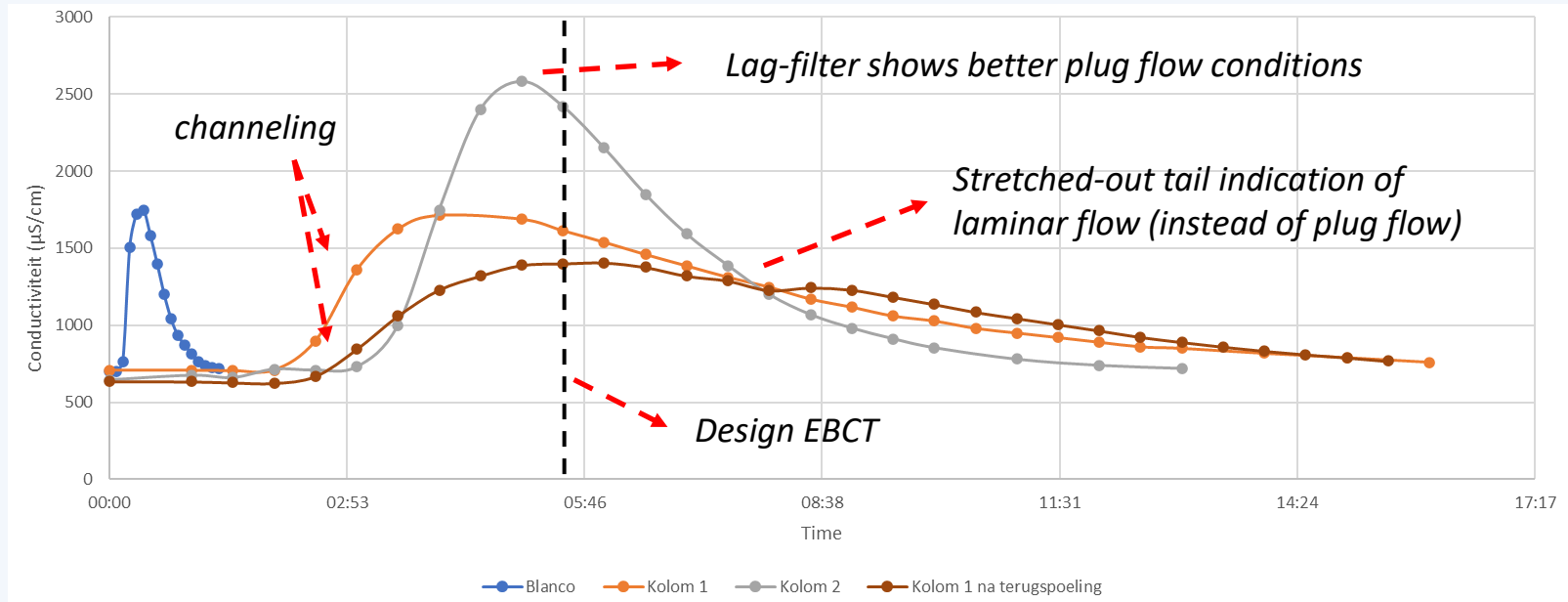
medicine-residues removal



Then, sudden reduction OMP-removal in lead-filter

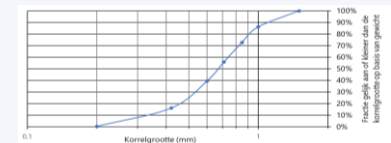
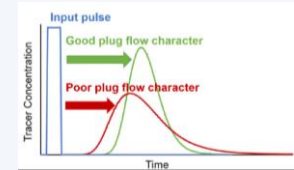


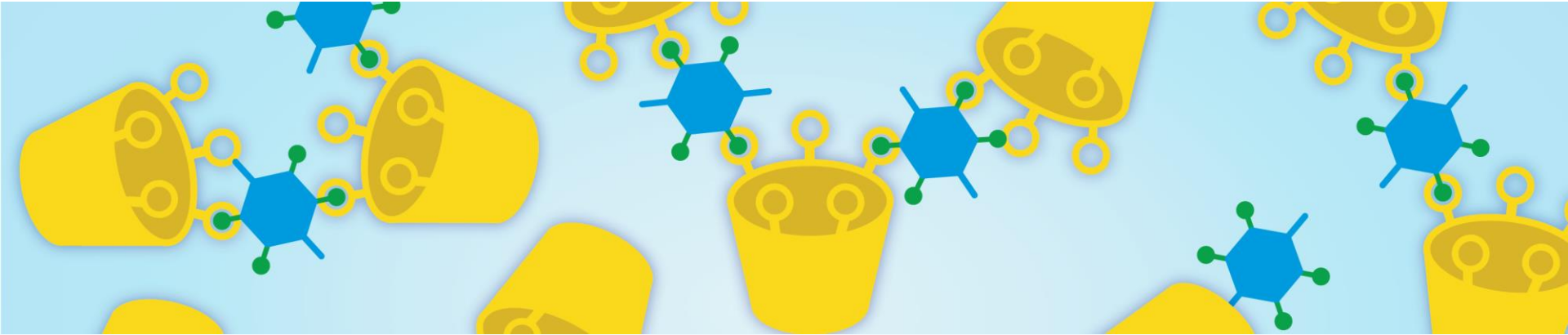
Channeling leads to significant reduction of EBCT



Solution: recommended optimization to filter design

1. Ensuring good, plug flow conditions by adequate filter design;
2. Effective backwash-regime by using water and air scouring;
3. Prevent stratification and washing out of granules during backwash





4. Future outlook

Scenario definition for cost & CO₂-footprint calculation

4.000 BV's not a realistic scenario after optimization of filter design, so:

Scenario 1: 20.000 BV's, or approximately 6 months of operation

Scenario 2: 40.000 BV's, or approximately 12 months of operation

Scenario's not confirmed with pilot, further research/validation needed!

	UNIT	PACAS	Ozone + Sand Filtration	DEXfilter ³
CO ₂ -footprint ¹	g CO ₂ /m ³	122	128	98-176
Costs ¹	€/m ³	0,05	0,17	0,11-0,29
Removal Efficiency Dutch guide substances ²	%	70-75%	80-85%	70-80%

¹ 1 Per treated m³ wastewater: peak dry weather flow must be treated. **Please note: standardized cost and CO₂ levels for 2018; recalibration of all CO₂- and cost levels will take place during the evaluation of the Innovation Program in 2024**

² Overall Removal Efficiency of effluent wwtp to influent wwtp (including bypass post treatment) for 7 of 11 guide substances: benzotriazol, carbamazepine, diclofenac, irbesartan, gabapentine, metropolol, hydrochloorthiazide, mixture of 4- en 5-methylbenzotriazol, sotalol, trimethoprim en venlafaxine in every 24h or 48h flow or time proportional sample. The sampling has to take the hydraulic retention time of the wwtp into account.

³ CO₂-footprint and costs are calculated for an estimated run time of the DEXfilter of 20.000 BV's (realistic) and 40.000 BV's (optimistic). These run times are not confirmed in the pilot research. These run times are estimated to be reachable after optimalization of the filter design.

Consequences stricter removal efficiencies Proposal EU Urban Wastewater Treatment Directive (80% in EU in stead of 70% in NL and different guide substances):

- PACAS will have a footprint of 160 g CO₂/m³ and a cost level of € 0,08/m³;
- no changes for ozone
- no changes for DEXfilter

Key take-aways of pilot research

- ✓ DEXfilter shows promising results on OMP (incl. PFAS) removal
- ✓ Optimizations in filter design needed to ensure good hydraulic conditions
- ✓ Good hydraulic conditions are expected to lengthen run time
- ✓ If optimizations are successfully implemented, DEXfilter is cost- and CO₂-competitive
- ✓ Primary target: WWTP's with both medicine-residue and PFAS contamination

Next steps:

2024:

Confirm effect **optimizations** on
DEXfilter in **pilot research**



Next pilot:

OMP-removal at WWTP
in West-Netherlands

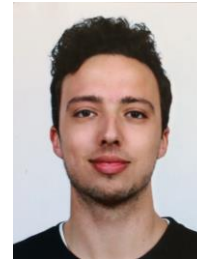
> 2025:

scale up to **full-scale** installations at
other **WWTP's** in NL



Thank you for your attention!

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stowa



Rijkswaterstaat
*Ministry of Infrastructure
and Water Management*

**Tackling Micropollutants in Wastewater
Results of the Dutch Innovation and Implementation Program**

**November 8 and 9 2023
Aquatech Amsterdam**