

# DEXfilter: Removing Organic Micropollutants with bio-based products

**Pilot Dexorb Filters WWTP Lelystad**

Associate-Prof. Dr.Ir. Arjen F. van Nieuwenhuijzen  
Witteveen+Bos Consulting Engineers

## Content

- Introducing DEXSORB® and DEXfilter
- Key takeaways feasibility R&D
- Pilot project
- Outlooks
- R&D questions



## Project consortium



consulting engineering, project management,  
piloting, validation and reporting



Pilot location, launching customers, technological  
expertise, TUDelft



Developer, supplier, leading-edge expert  
company, operational support



Research co-ordination, co-financing, expert team

## Introducing DEXSORB® and DEXfilter

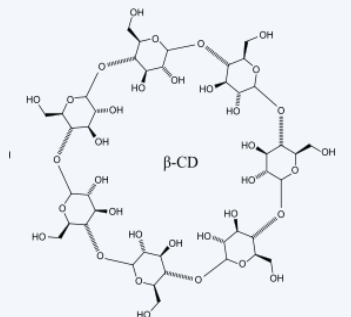
- DEXSORB® and DEXSORB+®: commercially available polymer adsorbents based on cyclodextrin
- Cyclodextrin: Cornstarch biobased product
- Cyclodextrin: Hydrophobic cyclic oligosaccharide molecule
- $\beta$ -cyclodextrin: cyclic oligosaccharide molecule
- DEXSORB® -> wide range organic micropollutants
- DEXSORB+® -> selective micropollutants + PFAS/PFOA

Regeneration of DEXORB with reusable methanol solvent

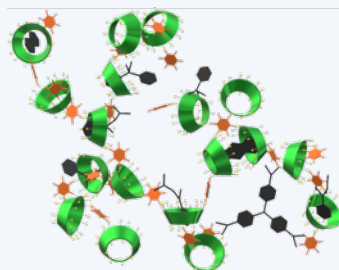


# Introducing DEXSORB® and DEXfilter

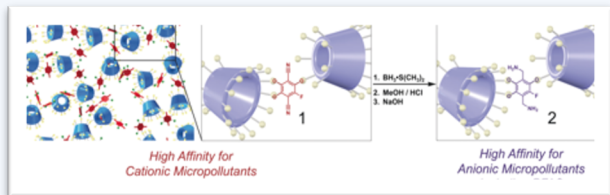
$\beta$ -cyclodextrin



Cyclodextrin + crosslinkers  
= DEXSORB®



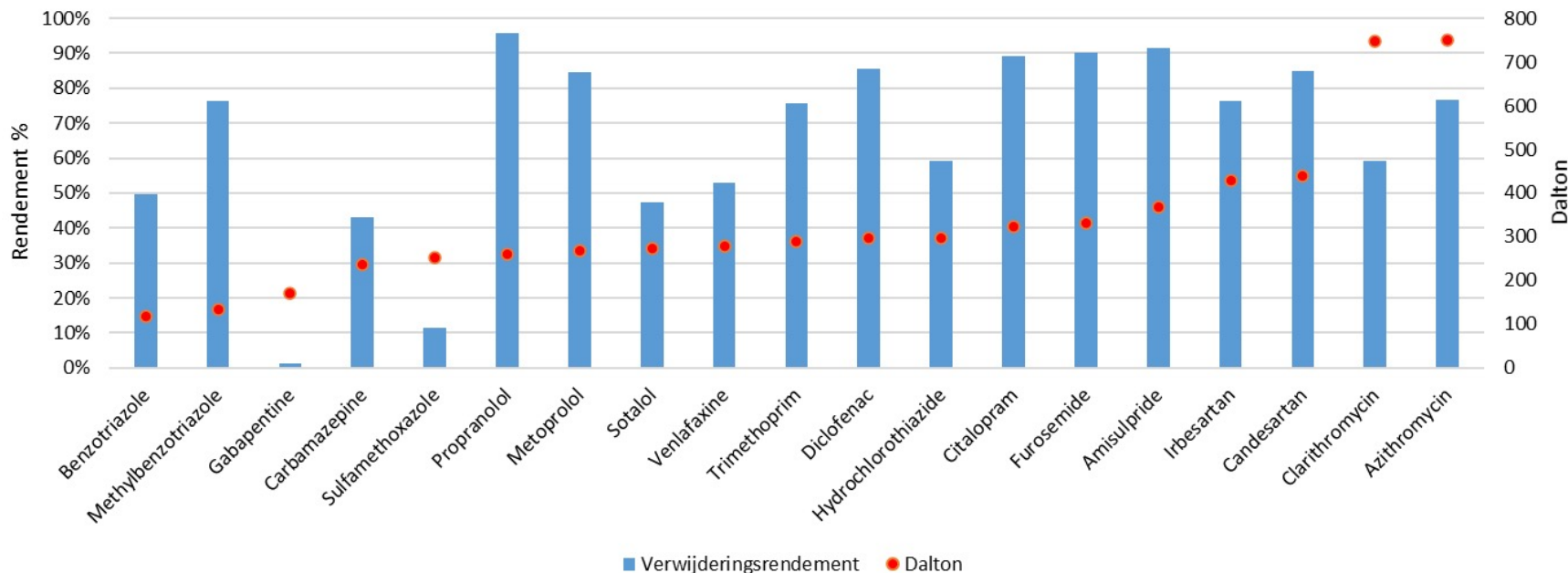
DEXSORB®  
in a filter column  
= DEXfilter



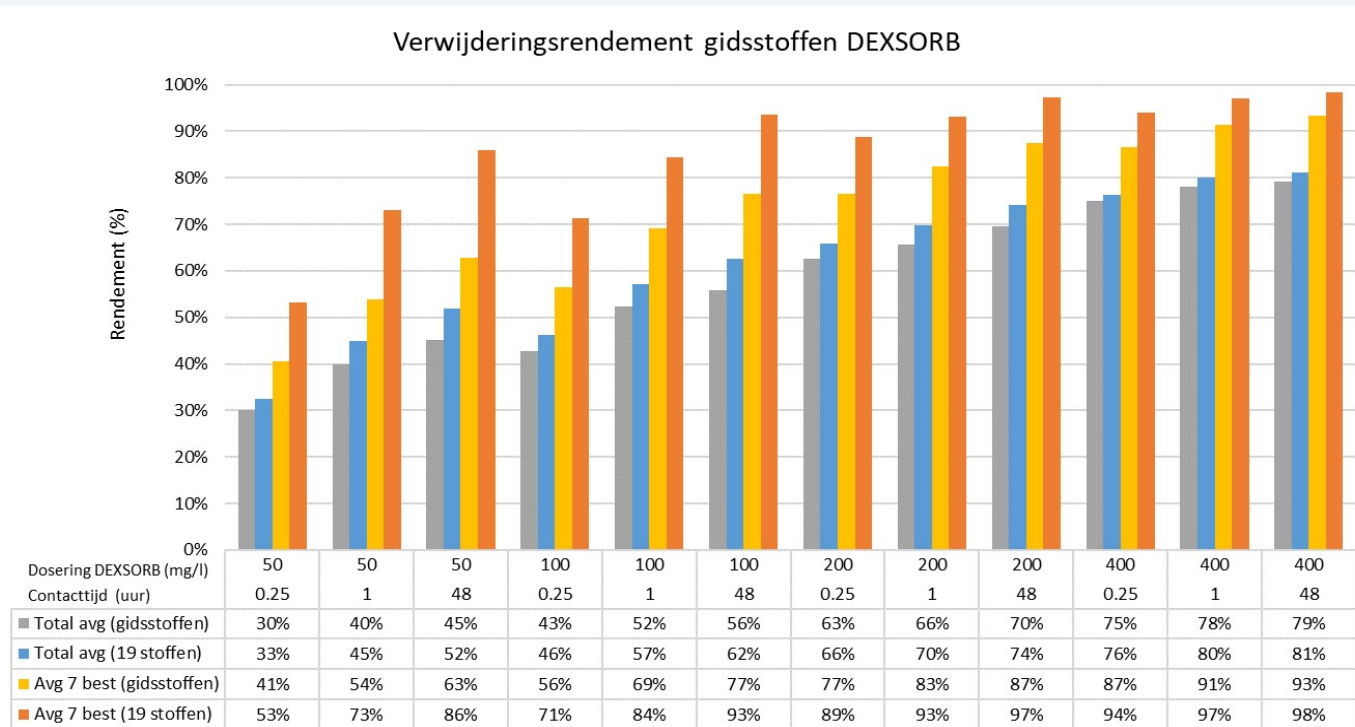


## Key takeaways feasibility R&D pilot: very effective and fast

Gem. verwijderingsrendement bij 200 mg/l DEXSORB en 15 min contacttijd, irt molecuulgrootte



## Key takeaways feasibility R&D pilot: very effective and fast



> 75 % removal

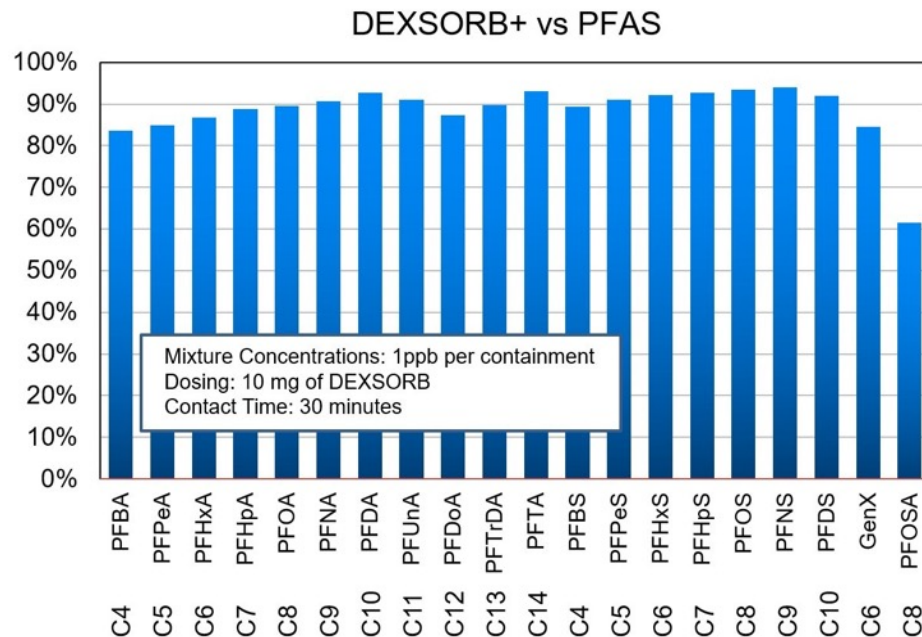
efficiency

< 5 minutes EBCT

## Key takeaways feasibility R&D pilot: effective for PFAS/PFOA

> 80% removal for PFAS/ PFOA en

GenX with DEXORB+ ®

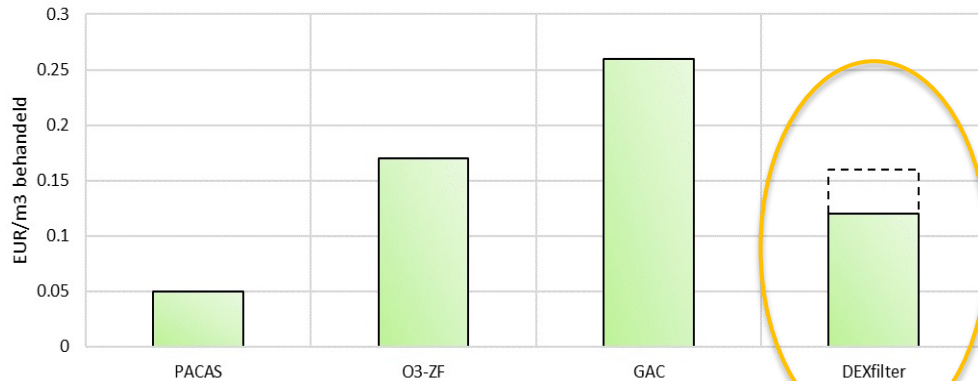




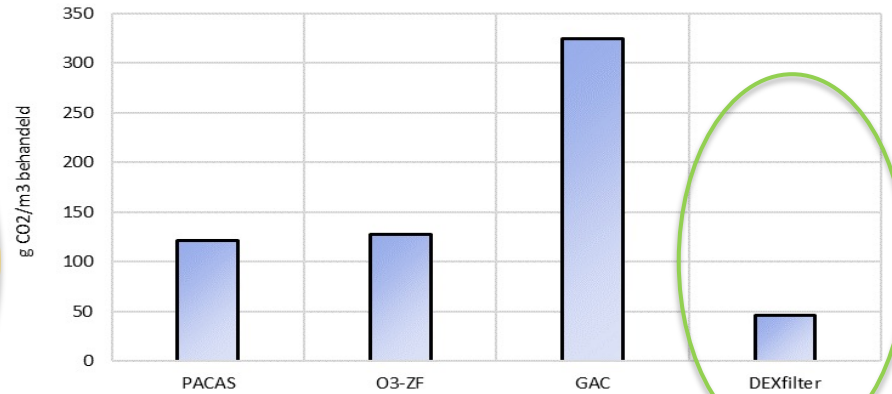
## Key takeaways feasibility R&D pilot: future-proof and applicable

- ✓ Cost effective and sustainable in reference to alternative technologies

Kosten DEXfilter

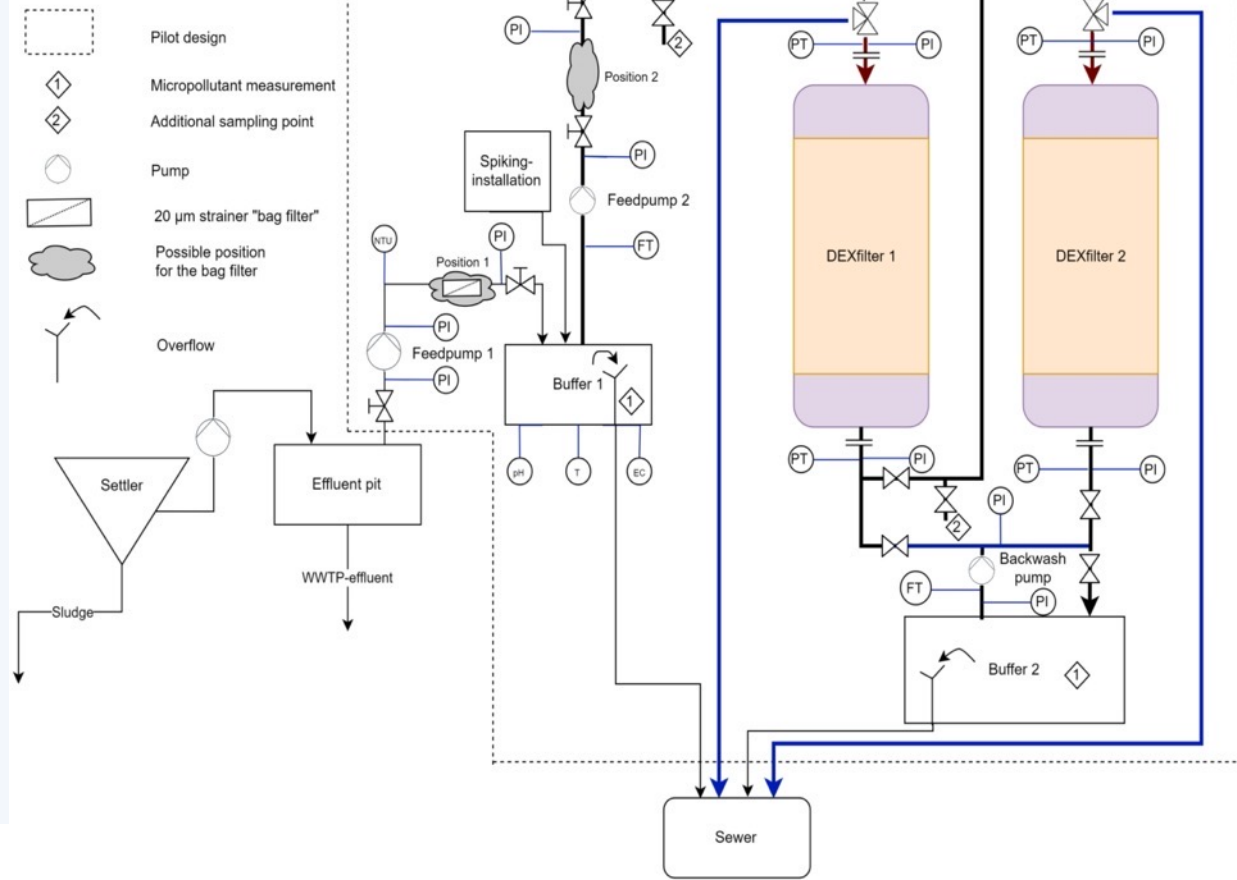
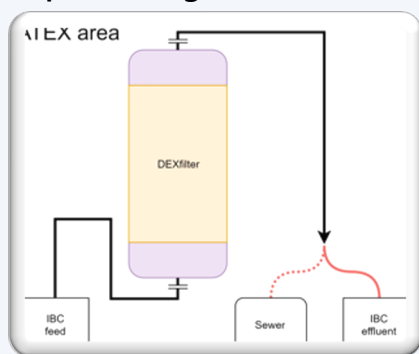


CO2-footprint DEXfilter



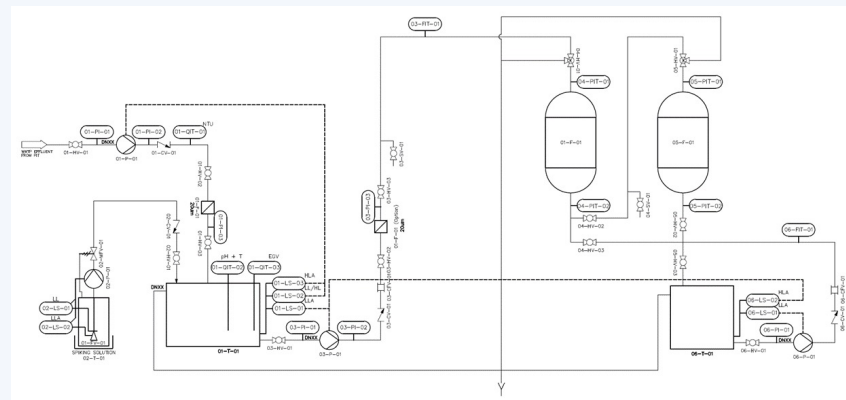
# DEXfilter Pilot Plant

## Separate Regeneration unit



## Pilot Plant 1 m<sup>3</sup>/h, EBCT 5 – 20 minutes

Parameter	Eenheid	Ontwerp	Min.	Max.	Opmerking
filtratie					
voedingsdebiet	m <sup>3</sup> /h	0,5	0,25	1	←
poriëngrootte strainer	µm	20			o.b.v. expert judgement <sup>1</sup>
bedvolume per ketel	m <sup>3</sup>	0,04			o.b.v. leveranciersinfo
bedvolume totaal	m <sup>3</sup>	0,08	←		o.b.v. leveranciersinfo
gewicht filterbed per ketel	kg	16,7			o.b.v. leveranciersinfo
gewicht filterbed totaal	kg	33,4			o.b.v. leveranciersinfo
oppervlakte filterbed per ketel	m <sup>2</sup>	0,05			o.b.v. leveranciersinfo
diameter filterbed	m	0,26			o.b.v. leveranciersinfo
hoogte filterbed	m	0,8			minimale hoogte o.b.v. leveranciersinfo
hoogte ketel	m	1,5			incl. hoogte voor terugspoelexpansie
oppervlaktebelasting	m/h	10	5	20	o.b.v. leveranciersinfo
Empty Bed Contact Time per ketel	min	5	2,5	10	o.b.v. leveranciersinfo
Empty Bed Contact Time Totaal	min	10	5	20	← o.b.v. leveranciersinfo
bedvolumes tot verzadiging	BV	50.000			o.b.v. leveranciersinfo
standtijd filterbed	dagen	170	330	85	
drukval filtratie totaal	bar	0,5	← 0,3	2,1	o.b.v. leveranciersinfo



## Containerized pilot at WWTP Lelystad (Zuiderzeeland)



## R&D questions



Min EBCT to achieve > 80 % removal of 7/19 guidance micropollutants



Full operational experience; including regeneration efficiency



Ecotoxicity of effluent DEXfilter



Product and Leaching tests of DEXSORB™ in DEXfilter



Sustainability analysis of DEXfilter (CO<sub>2</sub>/ GHG emissions)



PFAS/PFOA removal efficiency



Thank you for your attention!



Rijkswaterstaat  
Ministry of Infrastructure  
and Water Management

Arjen van Nieuwenhuijzen  
Witteveen+Bos  
[arjen.van.nieuwenhuijzen@witteveenbos.com](mailto:arjen.van.nieuwenhuijzen@witteveenbos.com)  
[www.witteveenbos.com](http://www.witteveenbos.com) / [cyclopure.com](http://cyclopure.com)

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

November 3 and 4 2021  
Aquatech Amsterdam

