

BODAC

Biological oxygen
dosed activated
carbon



Why?

- increase in micro organic pollutants due to more use and better analytical methods
- limited removal in conventional WWTP's

Fullscale BODAC proven technology, but in set up not yet competitive.

Pilot testing on;

- Pretreatment with drumfilter i.o. UF
- Optimizing EBCT
- Verifying start up of a virgin filter



Located at WWTP Emmen – UPW

BODAC principle

- Fixed bed filtration
- Dosing pure oxygen in the influent (to avoid/limit oxygen limitation)
- Filtration process under pressure
- Pressure needed to dissolve oxygen above atm. saturation in water
- Backwash every 2-3 days

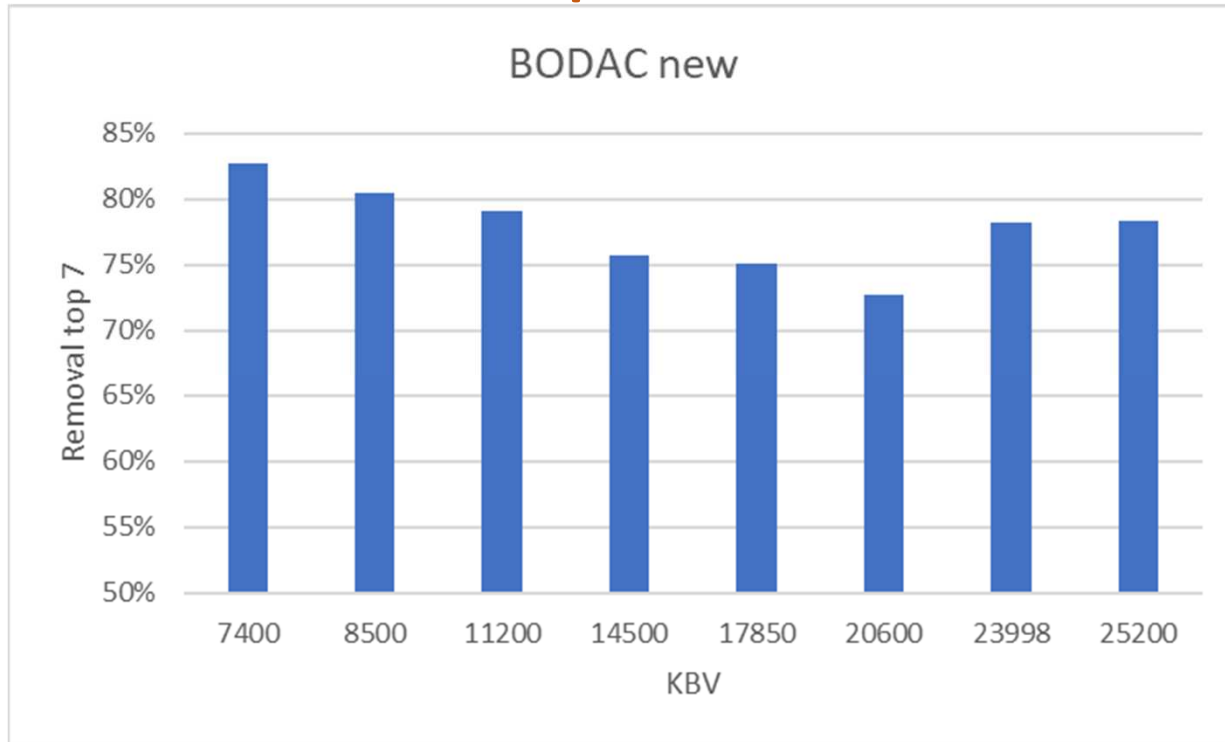
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Removal principle:

- Biodegradation by biology on the activated carbon
- Adsorption is limited
- Reactivation of carbon not needed for 13 years and is still performing good. No wear of the carbon is signaled and expected to last until 20-25 years.

Pilot set up & results



BODAC old		%
EBCT (min)	15	51-65
	17	67-75
	20	77-85
	<u>23</u>	<u>75-84</u>
	30	82-86
BODAC new		
EBCT	15	75-83
	<u>23</u>	<u>83-84</u>

Summary Performances

	UNIT	PACAS	Ozone + Sand Filtration	BODAC
CO ₂ -footprint ¹	g CO ₂ /m ³	122	128	103
Costs ¹	€/m ³	0,05	0,17	0,25
Removal Efficiency Dutch guide substances ²	%	70-75%	80-85%	75-84%

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.

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
- BODAC will have a slightly higher CO₂ footprint and costs

Wrap up

- Pilots perform comparable to the full scale
- Ultrafiltration is not needed as pretreatment
- After 20.000 KBV biodegradation is starting
- In startup biodegradation and adsorption are performed simultaneously

BODAC proven technology for the removal of organic micropollutants, with a relative low CO₂ footprint.



Thank you for your attention!

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

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