BO3-technology

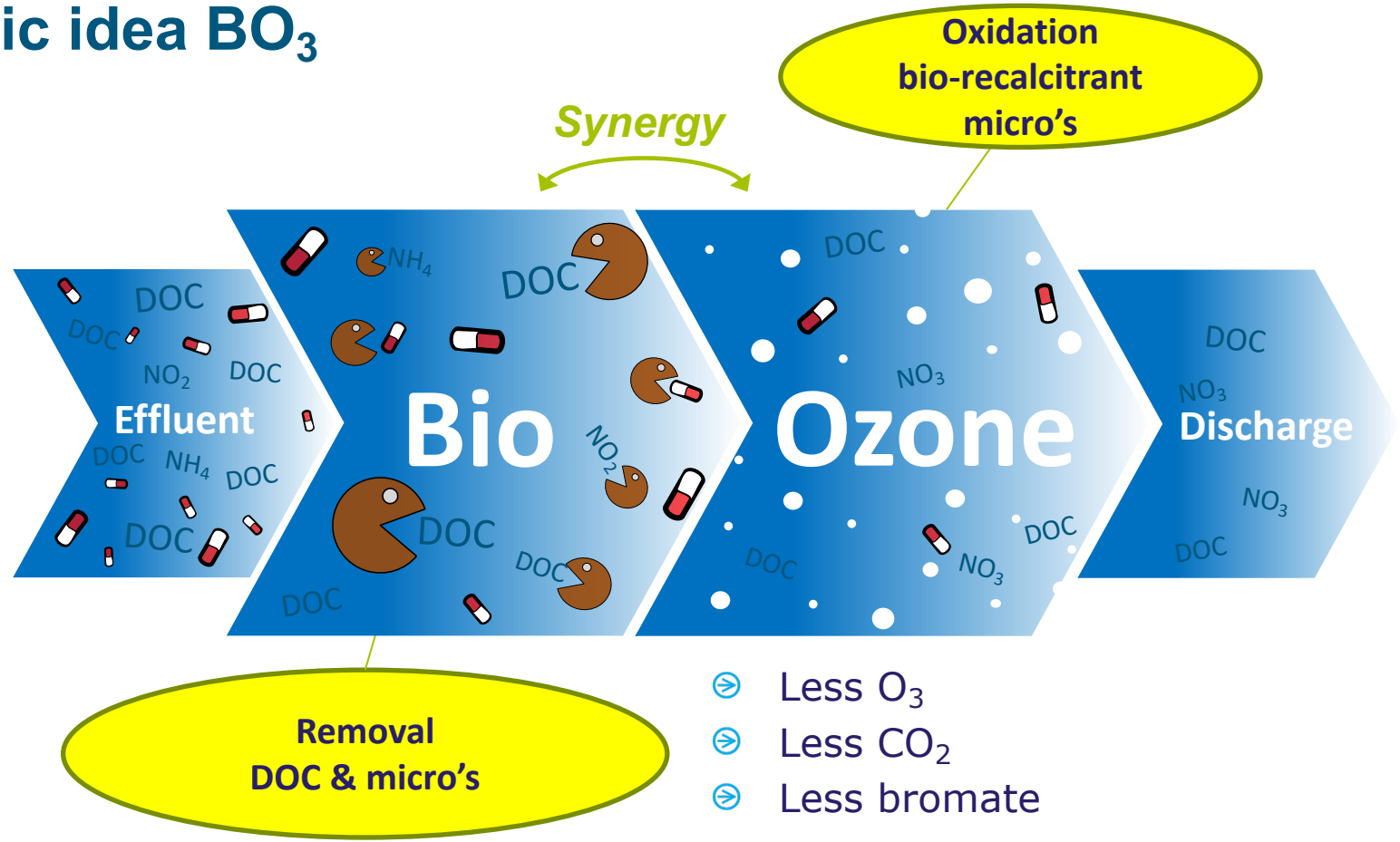
Biology Chemistry Synergy

Arnoud de Wilt

WAGENINGEN
UNIVERSITY & RESEARCH

Royal HaskoningDHV
Enhancing Society Together

Basic idea BO_3



- Less O_3
- Less CO_2
- Less bromate

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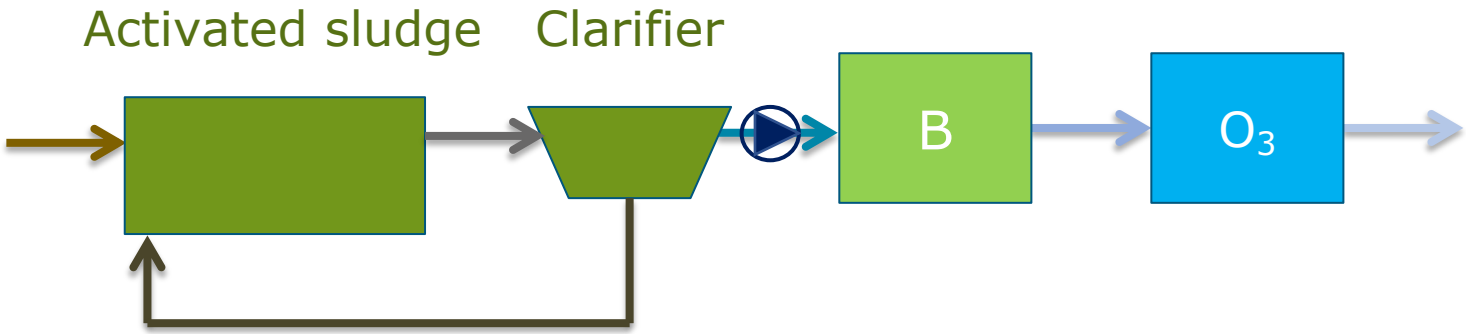
Process scheme BO_3



Development BO_3(B)

- 2016 1st lab-tests Wageningen University
- 2018 Publication proof-of-principle BO_3B
- 2018-2022 follow up PhD-research
  - TKI collaboration Wageningen University and Royal HaskoningDHV
  - Lab-tests BO_3
    - Continues operation >3 years
    - Direct WWTP-effluent (Bennekom)
      - DOC ≈ 10 mg/l
      - COD ≈ 25 mg/l
  - Stable removal of DOC and micropollutants
  - Expected reduced ozone consumption 50-75%
  - Outflow BO_3 not toxic (Daphniatox, Microtox and Algaetox)

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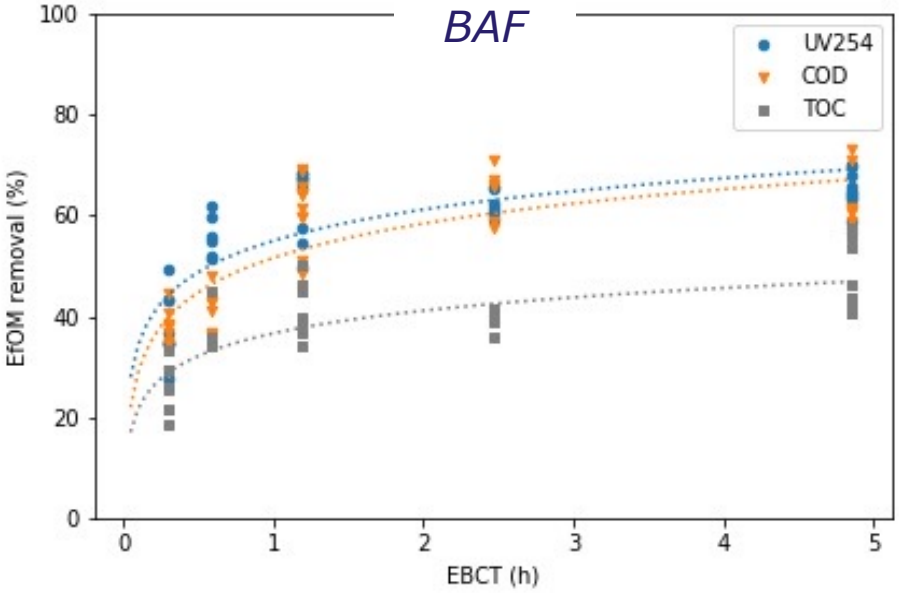
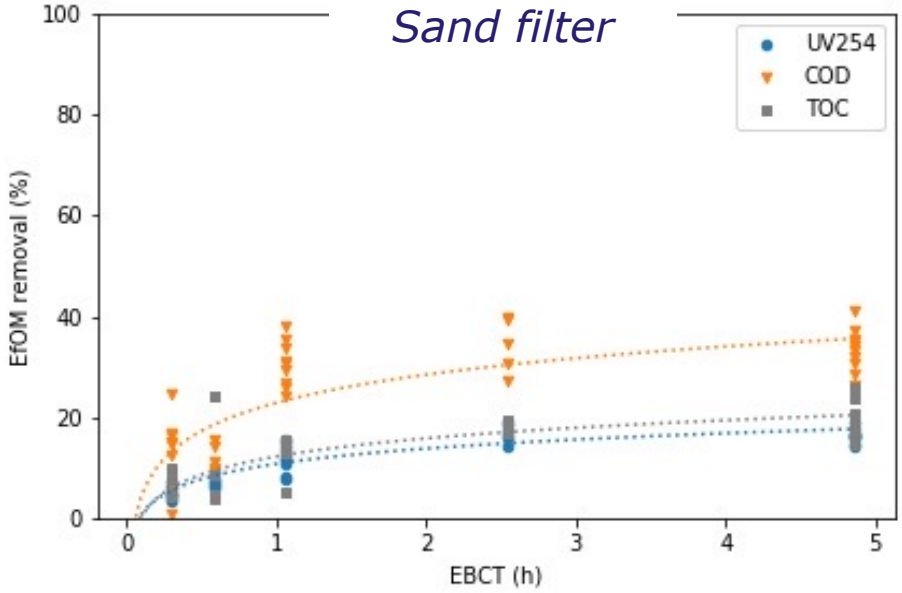
Results lab-study – ‘B’ reactor





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Results lab-study - BAF + Ozone

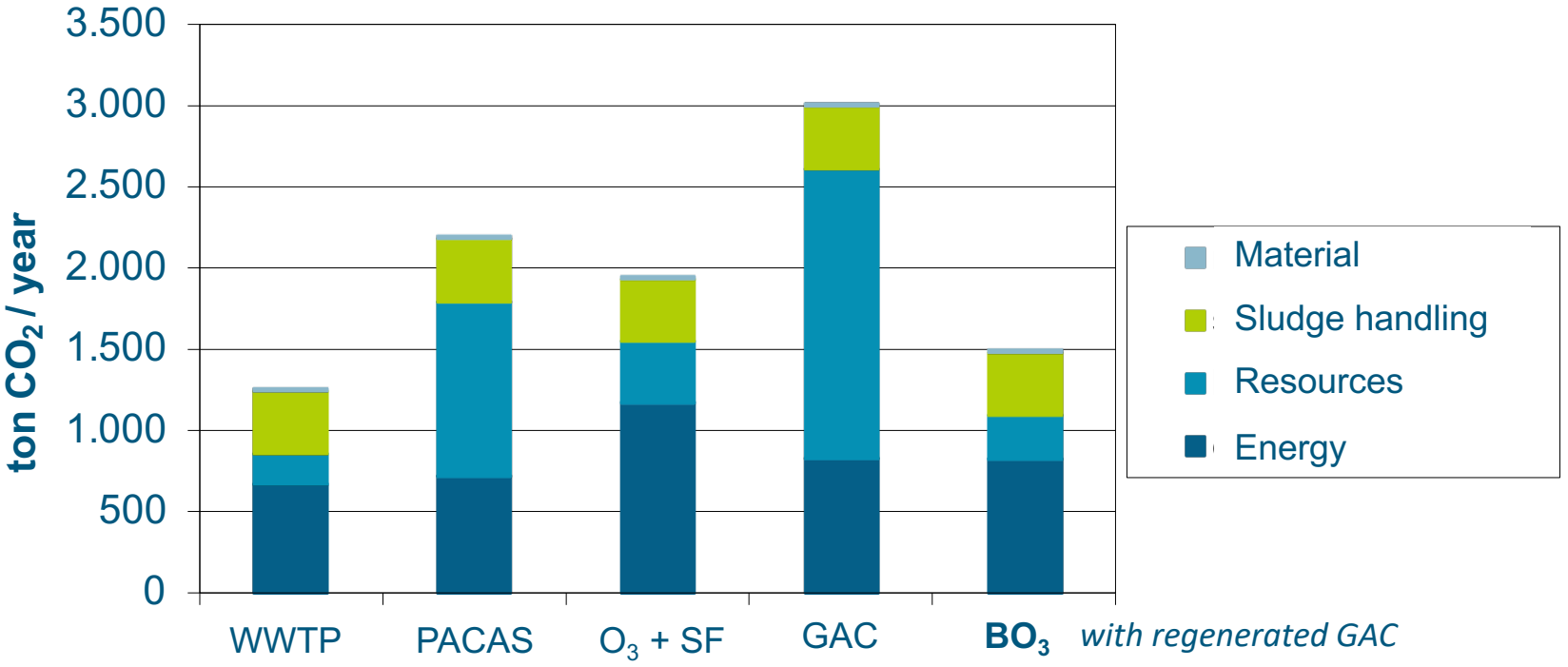
To be published

Specific ozone dose (g O_3/g DOC)	-	0,2	0,4	0,6
Average removal 11 “gidsstoffen”	59	95	97	99
7 best removed “gidsstoffen”	78	98	99	99

Impact on WWTP – *100.000 p.e. WWTP*

- Energy consumption
  - 241.000 kWh/year
  - 0,045 kWh/m^3 treated water
- Resource consumption
  - 2,5 - 5% GAC replenishment
- Wash water and sludge production
  - 5% of flow, back to AT
- Space requirement
  - 700 - 900 m^2
- Oxidation products
  - Limited formation expected, not yet determined

CO_2-footprint



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Comparison

	Unit	PACAS	Ozone + ZF	GAC	BO_3 *virgin GAK*	BO_3 *regenerated GAC*
CO_2-footprint[1]	kg CO_2/m^3	122	128	325	63	44
CO_2-footprint	ton CO_2/jaar	2.198	1.953	3.009	1.608	1.502
Costs[1]	€/m^3	0,05	0,17	0,26	0,12	0,11
Removal "gidsstoffen"[2]	%	70-75%	80-85%	80-85%	>95%	>95%

[1] Per m^3 treated water
[2] Removal efficiency of 7 out of 11 "gidsstoffen": benzotriazole, claritromycine, carbamazepine, diclofenac, metoprolol, hydrochloorthiazide, mixture of 4- and 5-methylbenzotriazole, propranolol, sotalol, sulfamethoxazol, trimethoprim.
The removal is calculated as effluent (after additional treatment) over influent of the WWTP

Thank you for your attention!

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Arnoud de Wilt
Arnoud.de.wilt@rhdhv.com

stowa

Rijkswaterstaat
Ministry of Infrastructure and Water Management

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

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