



# Implementation of Activated Carbon: Lessons Learned, Knowledge Gaps and Future Research

Ad de Man

Tackling Micropollutants in Wastewater

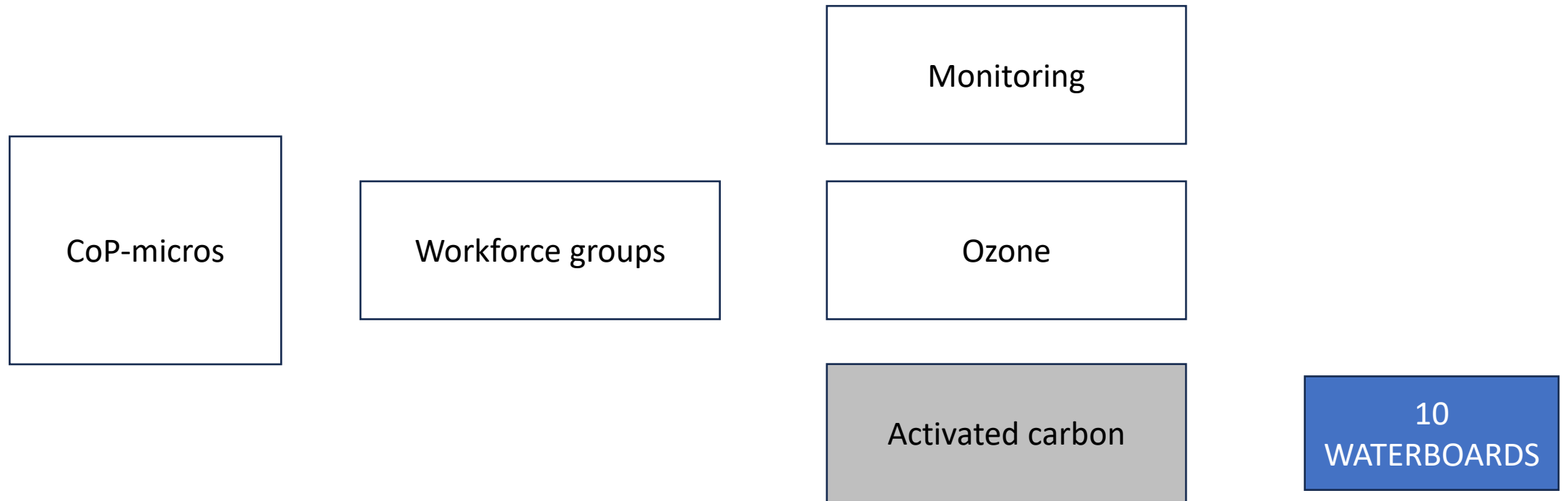
Workforce activated carbon



November 8 and 9 2023  
Aquatech Amsterdam

1. Workforce
2. Activated carbon
3. Exchange information
4. Pacas in NL
5. Quick market scan
6. CO<sub>2</sub>-footprint
7. Quality
8. Other issues
9. Future research and development

# Workforce implementation activated Carbon



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# Powdered activated carbon

- in activated sludge proces

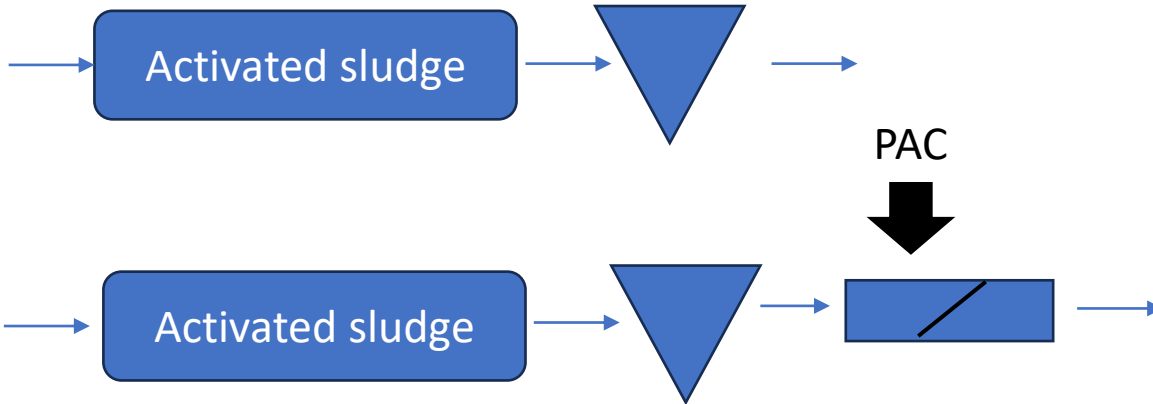
*PACAS*

- post treatment

*PAC+Cloth filtration*

+/- 30  $\mu\text{m}$

PAC



# Micro granular activated carbon

*Upflow GAC*

+/- 500  $\mu\text{m}$

Activated sludge

Fluid bed

# Granular activated carbon

*1 STEP*

+/- 2.000  $\mu\text{m}$

Activated sludge

Static bed

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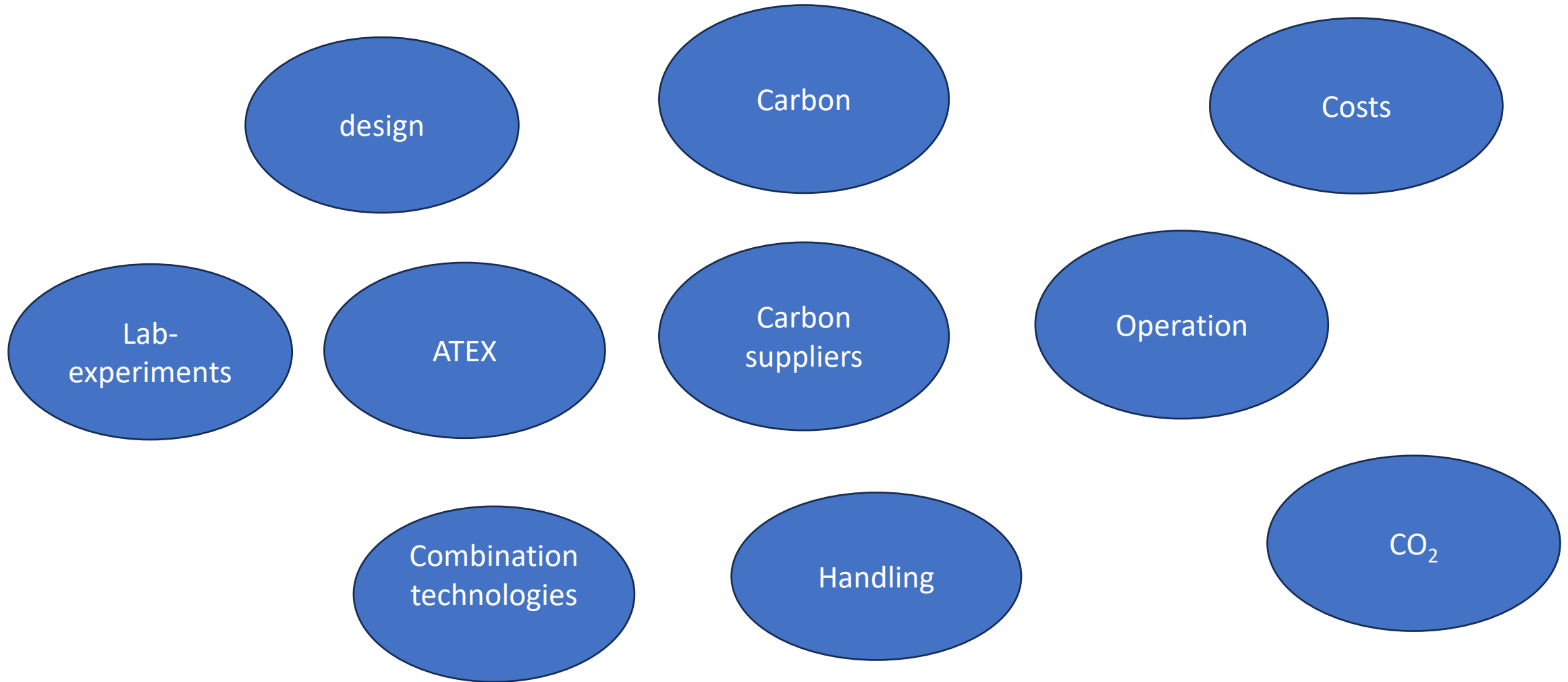
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# Exchange information



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2016

2021

2022

2023



Almere

Simpelveld

Nieuwe Waterweg

Gouda

Vinkel  
(PAC + Cloth filtration)

Non fossil  
PAC



# Pacas-WWTP's in NL

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# PACAS – experiences

- PACAS : fits well into the usual operation of the WWTP
- Dosage of the 10 – 15 g/m<sup>3</sup> - removal efficiency : 70 – 80%
- Dosage of powdered activated carbon is very accurate
- (Effluent)water supply : quality and quantity

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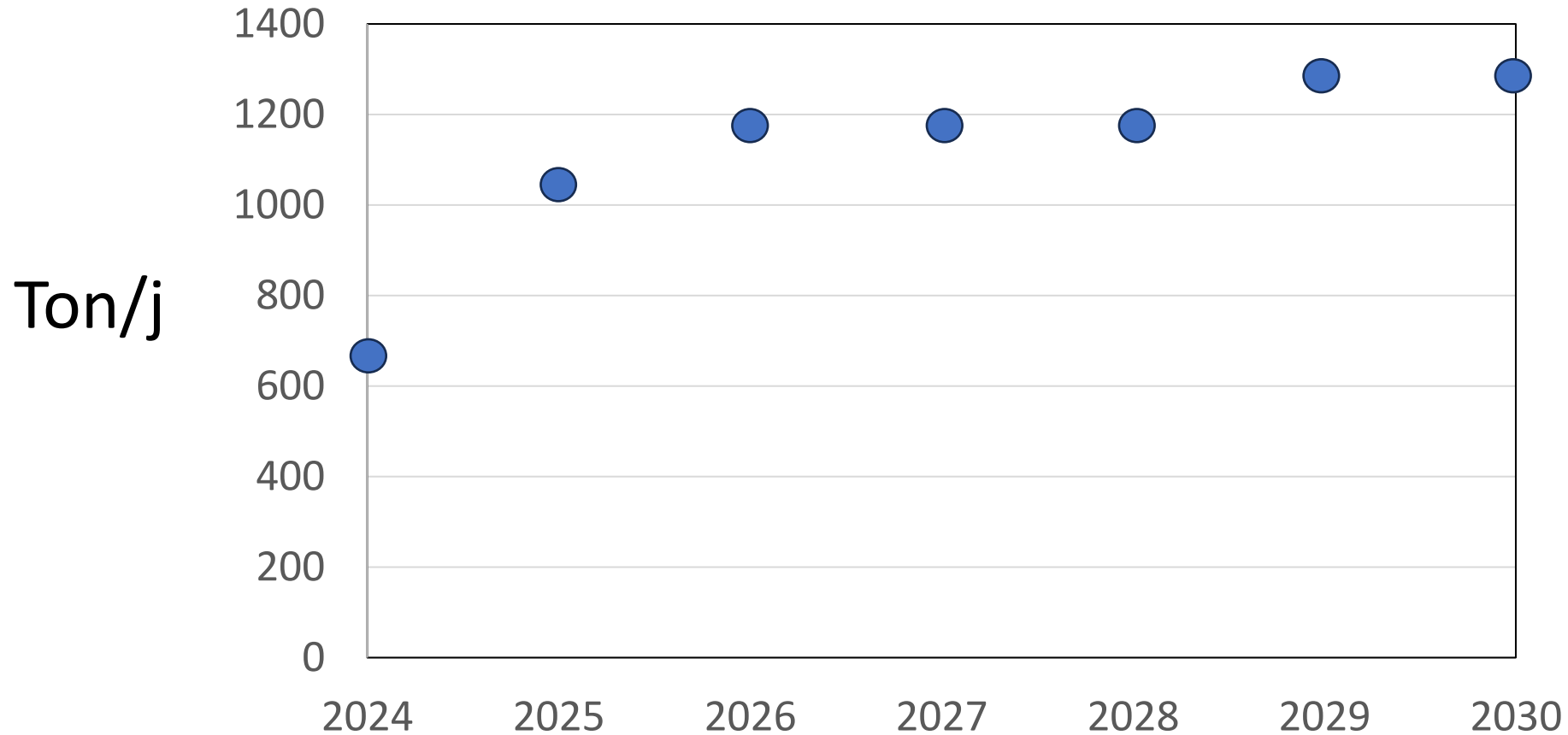
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# Demand powdered activated carbon in the NL



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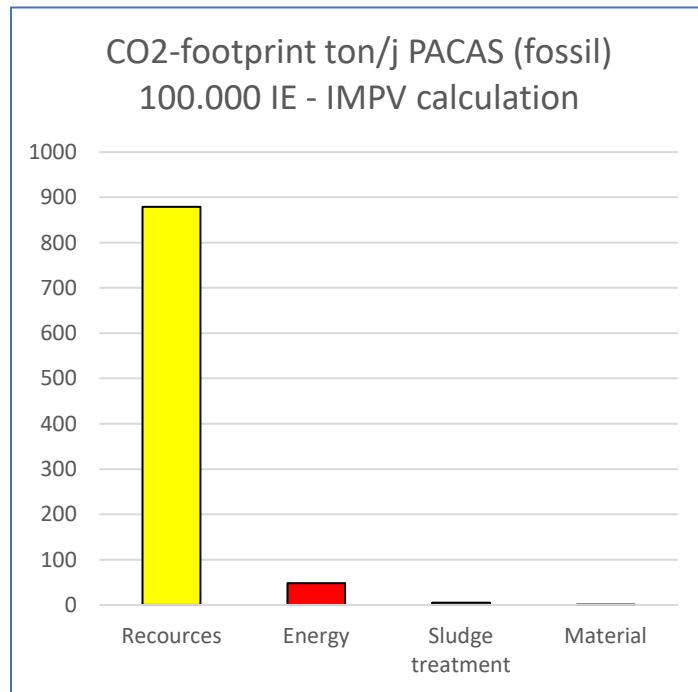
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# CO<sub>2</sub>-footprint

- Footprint PACAS - fossiel carbon : appr. 122 g CO<sub>2</sub>/m<sup>3</sup>



Conclusion (2021-24) : It is possible to enhance the sustainability of the PACAS proces by using non fossil activated carbon in a cost-effective way

# Quick market scan

5 suppliers

- Enough fossil and non-fossil activated carbon available
- Price non-fossil carbon higher
- CO<sub>2</sub>-footprint calculation : needs to be standardised
- Non fossil resources:
  - Pine tree
  - MDF
  - Waste wood
  - (Local) wood production
  - Used activated powdered carbon from Drinking Water Company

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# Quality

*Waterboards: what is the desired carbon quality and how can it be checked ?*

- Iodine, methyleen blue, molasse number etc.
- Particle size
- CO<sub>2</sub>-footprint
- Adsoption capacity – effluent/standard solution 11 micros
- Moisture %
- Ash-content
- Density
- Other components (heavy metals)
- Leaching properties

Supplier

WWTP

External lab

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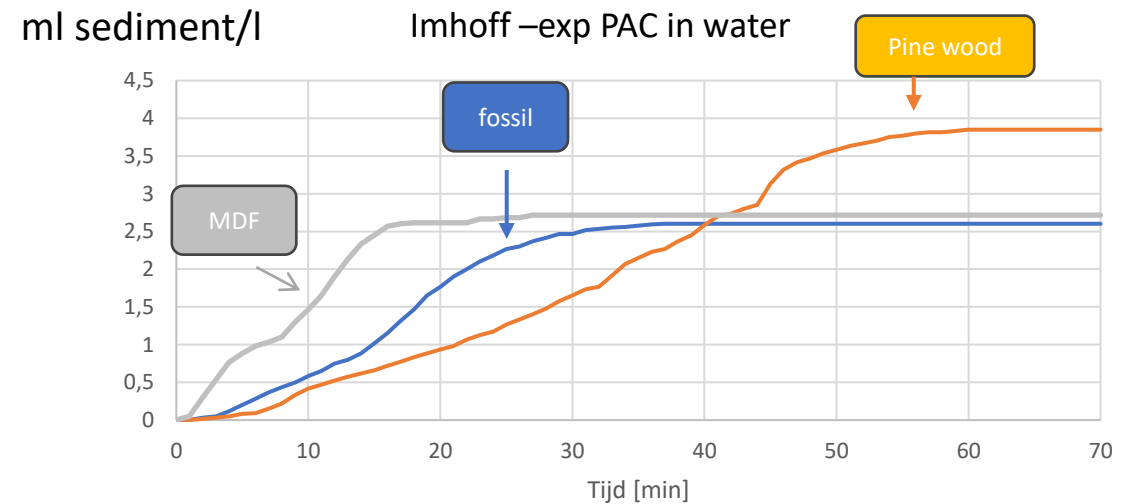
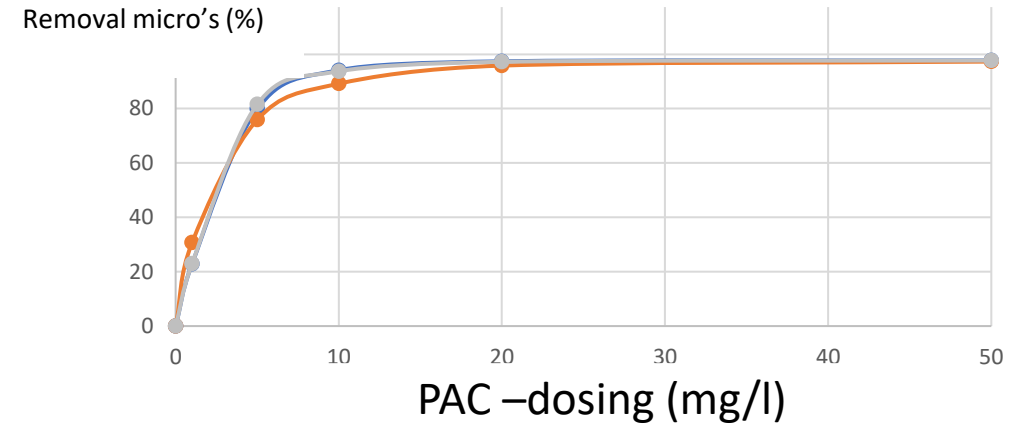
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# Analyses at the WWTP



	Fossil carbon	Carbon (pine wood)	Carbon (MDF)
Efficiency micros (lab test)	+	+	+
Moisture (%)	4	5	5
Density (kg/m <sup>3</sup> )	360	230	280
Ash-% 550°C	73	25	14
Ash-% 1000°C	14	2	4



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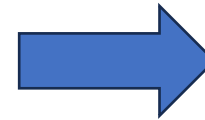
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# Other issues

- Necessary ATEX measures for different type of carbon (steam/chemical activated/fossil/non-fossil)
- Handling different types of carbon (density)
- Is there a max dosing level ?



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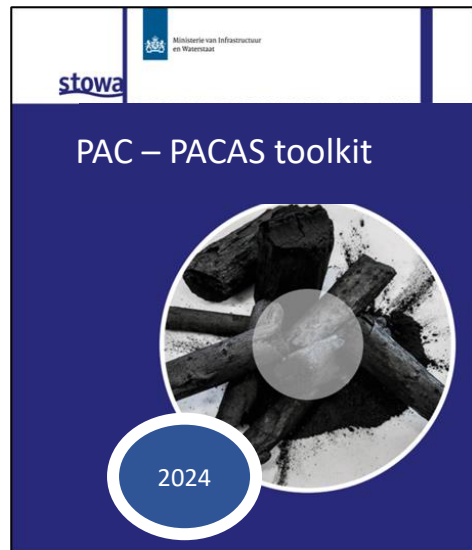
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# Future Research – development (1)

- Continuation gathering and exchange knowlegde/experiences



- Standard CO<sub>2</sub> calculation
- Quality demands
- Quality check
- ATEX-issues
- Decision tool : efficiency, price, quality, CO<sub>2</sub>
- Learn from :
  - drinking water compagnies
  - carbon suppliers
  - users abroad
  - other tenders : PE

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# Future Research – suggestions (2)

- Stimulating local production of non-fossil activated carbon
- Joint purchase/tender non-fossil activated carbon
- More accurate measurement of PAC-concentration in effluent
- Development of an adsorbent (10 – 15 mg/l) : micros and PFAS
- Also focus on GAC and GAC applications

• Interaction :

Monitoring

Ozone

Activated  
carbon

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**Thank you for your attention!**

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

**stowa**



**Rijkswaterstaat**  
*Ministry of Infrastructure  
and Water Management*

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