



Using non-fossil commercially available PAC

Laboratory tests, costs and sustainability

Joost van den Bulk

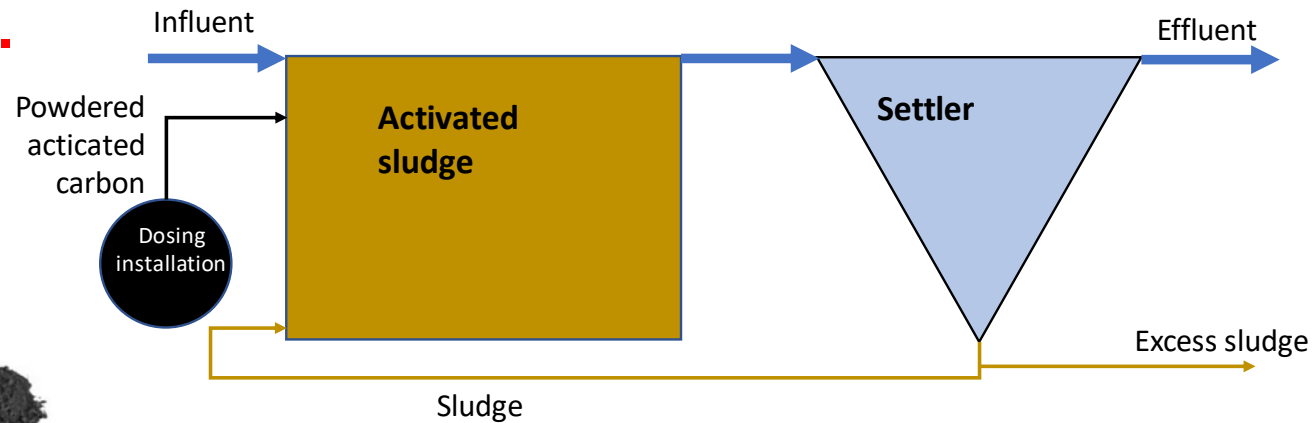


Back to 2018

STOWA 2018-02

- Powdered Activated Carbon in Activated Sludge (PACAS)
- Easy to implement
- Cost efficient

But....

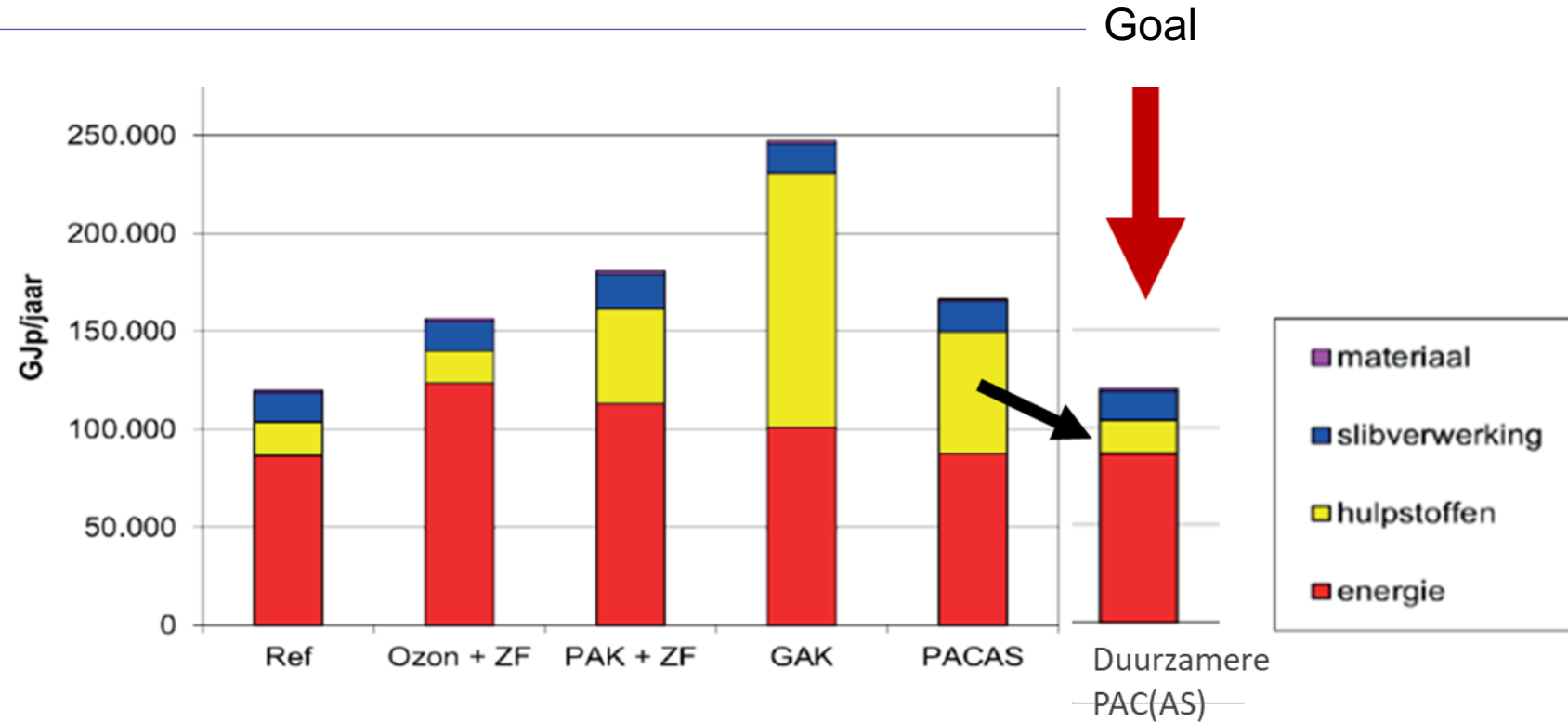


CO₂ footprint...

**No recovery of PAC;
High CO₂ footprint**



**Feasibility study on
sustainable alternatives
(non-fossil PAC)**



Feasibility Study

Tabel 4.1: Longlist: commercieel beschikbare PAK's gemaakt uit hernieuwbaar materiaal en de referentiekool

Naam kool	Leverancier	Indicatieve kosten euro/ton	Grondstof kool	Verwijderingsrendementen micro-verontreinigingen getest?	Activatie methode
Referentie: Pulsorb WP 235	Chemviron	1.950*	Steenkool blend		stoom
Act & sorb product**	Act& sorb	>2.000	MDF afvalhout	√	stoom
PAK C 1000 C	Carbotech	1.410	kokosnoot schillen	√	stoom
MAR-300	Carbon Activated Europe	8.000	hernieuwbaar, onbekend	√	stoom
WOS-PL1000	Carbon Activated Europe	7.750	hout		stoom
WHP-11	Carbon Activated Europe	11.750	hout		chemisch
Acticarbhone 2SW	Chemviron	5.100	marine dennen hout		stoom
Acticarbhone ENO H	Chemviron	7.250	marine dennen hout		chemisch
C-PURE®	Desotec	4.250	hout		chemisch
C-pure 200-7	Desotec		hout		chemisch
Organosorb 200-1 WB	Desotec	1.940	hout		stoom
Aquasorb G9	Jacobi carbon	2.500	hout	√	?
AquaSorb TM XP-W	Jacobi carbon	Niet bekend	gereactiveerde steenkool (deels)		?
Oxpure 325W-10	Oxbow	vertrouwelijk	hout		stoom
Oxpure 325W-12	Oxbow	vertrouwelijk	hout		stoom
Oxpure 325W-9	Oxbow	vertrouwelijk	hout		stoom
Pyreg kool	Pyreg	Niet bekend			stoom

Reference



Possible sustainable alternatives



stowa

Ministerie van Infrastructuur en Waterstaat

HAALBAARHEIDSSSTUDIE
DUURZAME ALTERNATIEVEN
POEDER ACTIEFKOOL
VOOR PACAS



RAPPORT

2020
19

STOWA
2020-19

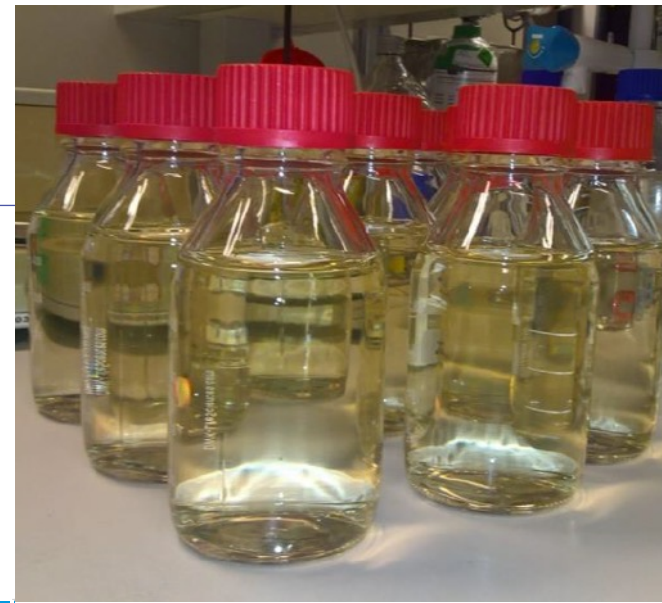
STOWA 2021-24

- Laboratory tests; removal efficiency
- Sustainability
- Costs
- Availability organic waste streams



Laboratory tests

- Removal efficiency for indicator substances
- Both fossil as non fossil PAC



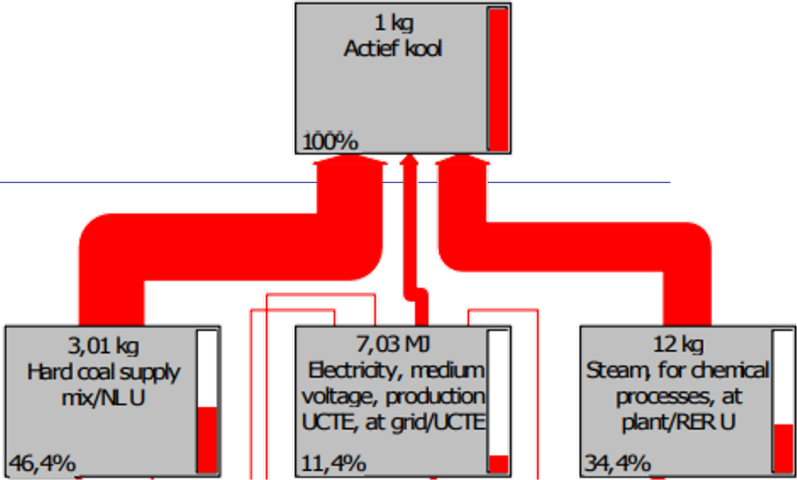
Average removal of indicator substances, dosage 20 mg PAC/l

Poederkool	Gemiddelde rendement over alle 19 stoffen (gidsstoffen en	Gemiddelde rendement over de 11 gidsstoffen	Aantal stoffen dat meer of minder presteert dan referentie (meer / minder)
Referentie (Pulsorb wp235)	86%	93%	-
Puragen OxPure	90%	96%	4 / 0
Chemviron Acticarbon 2SW	87%	94%	2 / 0
Jacobi Aquasorb G9	84%	90%	0 / 2
Carbon Activated Europe SMP 1436 MAR 300	82%	89%	0 / 4
CarboTech PAK C 1000 C	77%	84%	0 / 6
Pyreg	75%	83%	0 / 8
Desotec Organosorb 200-1 WB	63%	72%	0 / 12
geactiveerd zeefgoed Wilp	50%	57%	0 / 18

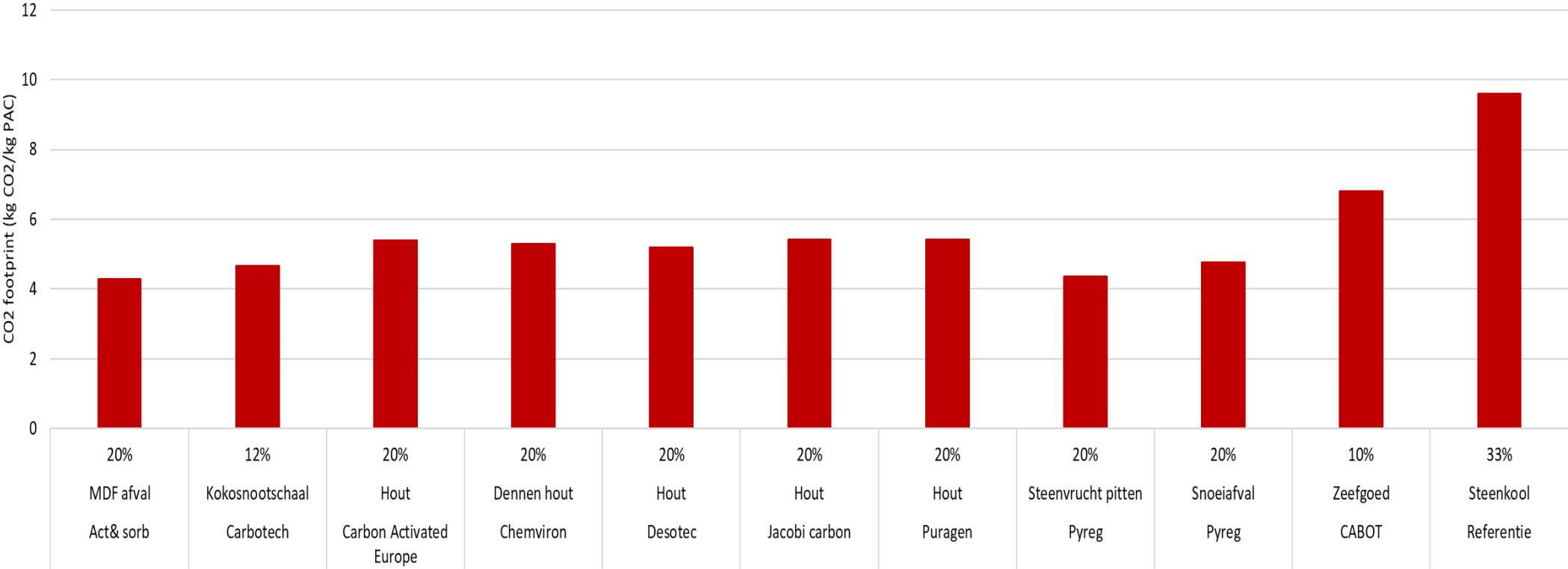
11 guiding substances: benzotriazol, claritromycine, carbamazepine, diclofenac, metoprolol, hydrochloorthiazide, mengsel van 4- en 5-methylbenzotriazool, propranolol, sotalol, sulfamethoxazol, trimethoprim.



Sustainability



CO₂-footprint



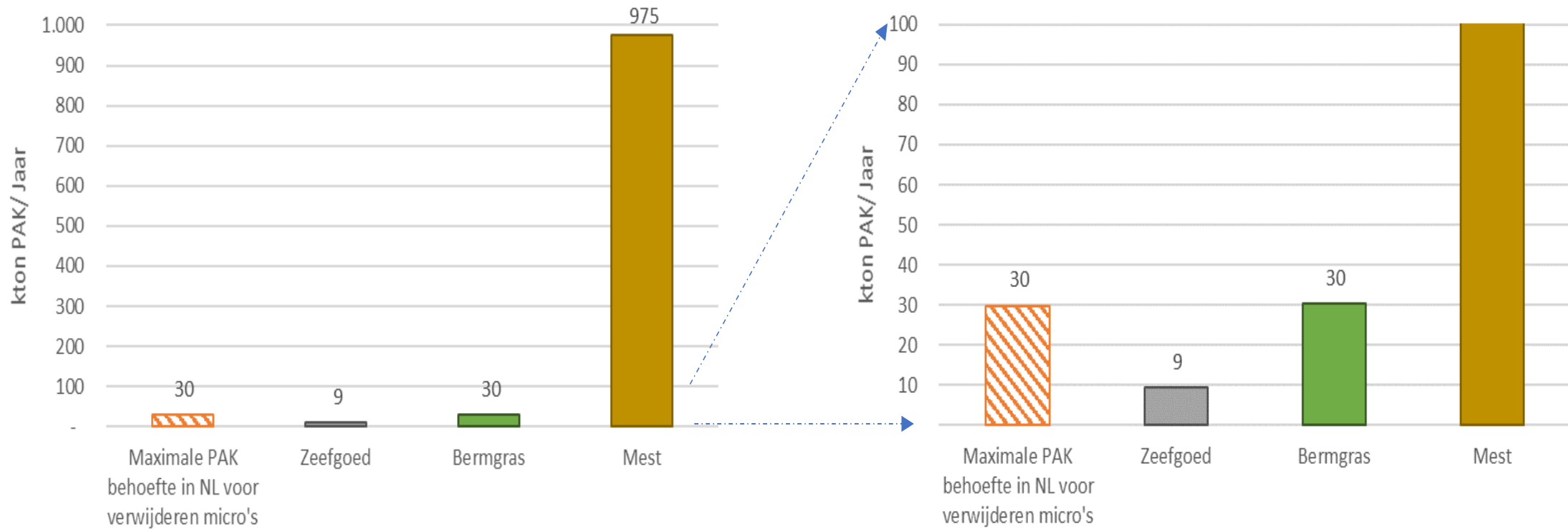
Costs

PAK	PAC prijs	Dosering	Kosten
	€/ton*	g/m ³	€/m ³
Referentiekool (<u>Pulsorb</u> WP235)	€ 1.950	15	4,6
<u>Act&Sorb</u>	>€ 2.000	15	>5,8
PAK C 1000 C (<u>Carbotech</u>)	€1.410	20	4,6
Jacobi	€ 2.500	15	5,3
MAR-300	€ 1.600	15	4,2

* bron: STOWA 2020-19



Organic waste



Summary

	Unit	PACAS reference (fossil)	PACAS non-fossil
CO ₂ -footprint	g CO ₂ /m	115	64 – 127 ¹
Costs	€/m ³	0,05	0,04 – 0,06
Removal of indicator substances	% ²	70 - 75	70 - 75

¹ CO₂ footprint of commercial available non-fossil PAC ranges from 64 – 103 gram CO₂ / m³. PAC from finesieve material results in a CO₂ emission of 127 gram because this PAC has a low removal efficiency



Voettekst





Thank you for your attention!

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**Tackling Micropollutants in Wastewater - Approaches on
Implementation and Innovation in Europe and the Netherlands**

**November 3rd and 4th 2021
Aquatech Amsterdam**

