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USE OF BIOCHAR IN FILTRATION SUBSTRATE MIXTURES FOR SOIL AND WATER CONSERVATION

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OVERVIEW

- Infiltration and filtering of precipitation
- Biochar as a sustainable filtering material
- Results from experiments with new green roof substrates
- Conclusions

INFILTRATION AND FILTERING OF PRECIPITATION

- Changing climate leads to more and more intense precipitation
- Urbanization leads to more impermeable surfaces
- To avoid flood, permeable surfaces and drainage retardation is key

GREEN ROOFS

- Delay rain water reaching sewers
- Insulate roofs
- Enhance wellbeing
- Increase real estate value

But:

- Current materials are imported
- Have poor filtering capacities
- Only support succulent plants

BIOCHAR

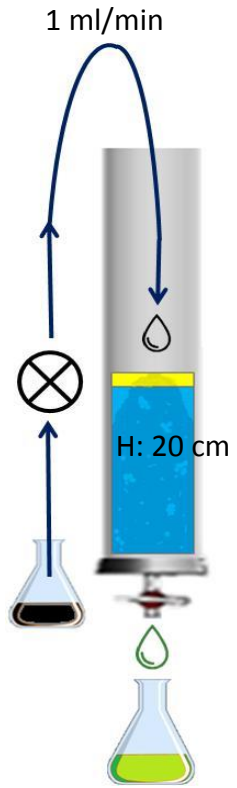
- Biochar is charcoal: Not made for BBQ, but for soil
- Biochar in soil is a low tech Carbon Capture and Storage (CCS) and a great soil improver
- High porosity, water holding capacity, cation exchange capacity, etc.
- But not microbially degradable (Half-life >100 yr)
- Is it also a good filter material?

PROPERTIES FOR INFILTRATION

- ✓ High infiltration capacity
- ✓ Pressure stable
- ✓ Retains some water for plants
- ✓ Adsorb metals and organics

REMOVAL OF METALS AND PAH

- Column experiment with BC from wood or olive pomace
- BC 30 % (v) mixed with 70 % (v) peat or volcanic rock
- Overlayed with sand spiked with phenanthrene
- Percolated with water containing 5 mg/L Cd, Cr, Cu, Ni, Pb and Zn
- Weekly percolation events
- Leaching water collected and analysed



PHENANTHRENE RETENTION

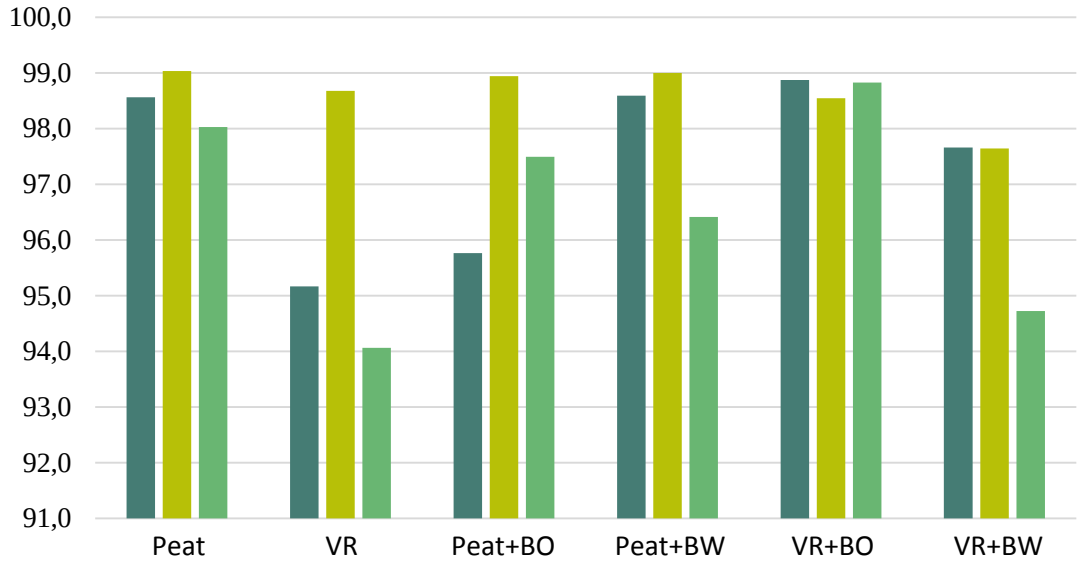
– Volcanic rock retained the least during 3 weekly percolation events

Abbreviations:

VR – Volcanic rock

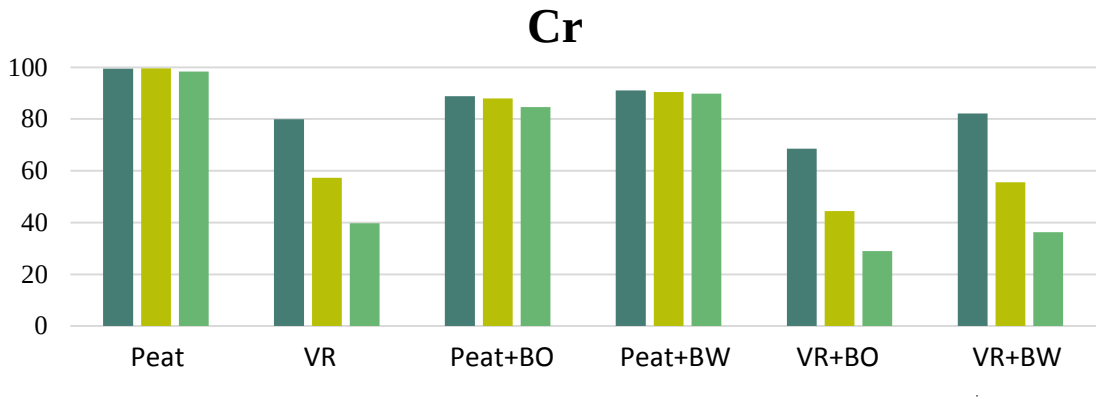
BO – Biochar from olive pomace

BW – Biochar from wood



METAL RETENTION

- All Cd was retained by all materials
- 97-100 % Cu, Ni, Pb and Zn was retained,
- Volcanic rock retained least Cu and Ni
- Peat retained least Pb and Zn
- Otherwise, no differences between the materials were observed
- Cr differed most:



	Time (days)	VR		VR/BP		VR/BO		Peat		Peat/BP		Peat/BO	
Phe	7	95±1.1	d	98±1.0	abc	99±0.8	a	99±0.6	ab	99±0.5	b	96±2.0	c
	14	99±0.1	k	98±0.5	l	98±0.7	l	99±0.4	k	99±0.2	k	99±0.3	k
	21	94±1.6	y	95±1.5	xy	99±0.0	w	98±1.1	w	96±1.3	x	98±0.9	wx
Cd	7	100±0.0		100±0.0		100±0.0		100±0.0		100±0.0		100±0.0	
	14	100±0.2		100±0.0		100±0.0		100±0.0		100±0.0		100±0.0	
	21	100±0.2		100±0.1		100±0.0		100±0.1		100±0.0		100±0.0	
Cr	7	80±4.1	c	82±2.8	c	69±5.2	d	99±0.5	a	91±2.8	b	89±3.9	b
	14	57±6.7	m	56±0.5	m	44±5.1	n	100±0.5	k	90±3.3	l	88±5.9	l
	21	40±3.0	y	36±2.4	y	29±6.6	z	98±1.5	w	90±3.2	x	85±5.2	x
Cu	7	97±0.1	c	98±0.2	b	99±0.3	a	99±0.6	a	99±0.3	a	99±0.1	a
	14	98±0.4	l	99±0.2	k	100±0.1	k	99±0.3	k	99±0.2	k	99±0.1	k
	21	99±0.1	x	100±0.1	w	98±0.5	y	99±0.1	x	100±0.1	w	100±0.1	w
Ni	7	98±0.1	c	97±0.2	c	98±0.7	b	99±0.2	a	99±0.4	ab	99±0.8	ab
	14	98±0.6	m	98±0.5	m	99±0.3	l	100±0.1	k	99±0.8	l	99±0.1	l
	21	98±0.5	x	99±0.3	w	99±0.2	w	99±0.3	w	99±0.2	w	100±0.0	w
Pb	7	100±0.1	a	99±0.1	b	100±0.2	a	98±0.5	c	99±0.1	b	98±0.5	c
	14	100±0.0	k	99±0.2	l	100±0.1	k	98±0.5	m	99±0.2	l	99±0.2	l
	21	100±0.2	w	100±0.2	w	100±0.1	w	98±0.5	y	99±0.1	x	99±0.1	x
Zn	7	99±0.1	b	99±0.1	b	100±0.1	a	96±0.5	d	98±0.2	c	98±0.6	c
	14	100±0.1	k	99±0.2	l	100±0.1	k	98±0.5	n	99±0.2	m	99±0.2	m
	21	100±0.1	w	100±0.2	w	100±0.1	w	98±0.5	y	99±0.1	x	99±0.1	x

CONCLUSIONS

- Biochar slightly enhance retention of Cu, Ni, Pb and Zn compared to traditional green roof materials
- Biochar slightly enhance retention of phenanthrene
- Reasons to use BC in green roof materials and constructed soils for water infiltration should mainly rely on other beneficial properties than pollutant retention

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