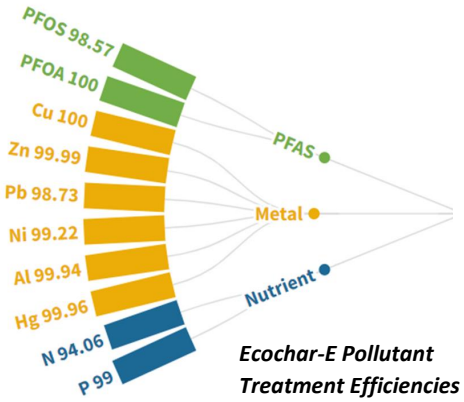
ECOCHAR-E

"GREEN CARBON" MULTI-POLLUTANT HIGH PERFORMANCE ADSORPTION MEDIA FOR SOIL & WATER



Ecochar-E Pollutant Treatment Efficiencies

Contact:

https://www.ecocharenvironmentalsolutions.net/

Description:

Ecochar® is a trademarked biochar produced through a patented gasification technology process at temperatures ranging from 1200 degrees F to 1800 F. Ecochar® is a solid carbonaceous adsorbent material obtained from the thermochemical conversion of biomass in an oxygen-limited environment.

Ecochar®E is a predominantly stable, recalcitrant organic carbon (C) compound safely processed from a variety of biomass feedstocks – manure (M), plant (P), wood (W), bone (B), biosolids (BS) and can be used as soil amendments, conditioners and nature-based water and soil pollutant treatments. When mixed with soil, it increases soil health, porosity, and water filtration and holding capacity, while treating pollutants, with the additional bioremediation benefits of healthy biofilm microorganisms that further break down unwanted constituents. It enhances healthy plant growth naturally through non-leachable bioavailable phosphorus and minerals. Plants and crops prosper and stay healthy. This product will permanently add carbon to your soil. It also enables beneficial reuse of organic waste streams, thereby better protecting water quality and public health.

Ecochar®E can be used alone, in combination with other Ecochars or as an ingredient within a blended product, with a range of applications as an agent for soil improvement, improved resource use efficiency, remediation and/or protection against particular environmental pollution, and as an avenue for greenhouse gas (GHG) mitigation. (International Biochar Initiative (IBI) Definition & Standard). It can also be used for storm water treatment or liquid phase filtration to remove organic and inorganic species, including heavy metals. Can be used in numerous water filtration and infiltration designs and in combination with a variety of structural or non-structural low impact stormwater best management practices.

Benefits:

- Ecochar-E Trademarked biochar is a safely processed (carbon negative sequestration patented gasification technology) biomass-based soil conditioner and green infrastructure amendment for enhanced water filtration, retention and holding capacity, treatment of TSS, nutrients, heavy metals, and other toxics, with net zero GHG impacts.
- When mixed with soil and/or compost, it improves overall soil and beneficial microbial community health, thus enhancing plant/crop growth.
- High Carbon Content; Long Half-Life >200 yrs.; High Cation Exchange Capacity (CEC) for non-leachable adsorption of pollutants.
- This product will permanently add carbon to your soil and its production has resulted in reduced Greenhouse Gases (GHGs) – CO2, CH4. N2O. It also reduces and sequesters GHGs when added to soil. It also enables beneficial reuse of organic waste streams, thereby better protecting water quality and public health.

APPLICATIONS:

Ecochar-E is an excellent media for enhanced stormwater filtration, retention and bio- adsorption treatment of toxics and other pollutants. As a soil treatment and conditioner, it also improves performance of green infrastructure – expediting healthy green growth, improving soil porosity, water retention and microbial activity. It is available in a coarse to fine grained particle size, all of which can be pre-screened for a variety of applications, including but not limited to the following:

- ✓ Reduce nutrient runoff and leaching in a variety of stormwater and water treatment applications.
- ✓ Bind heavy metals and other pollutants in treating soil and water.
- ✓ Expedite vegetative growth and cover, while reducing soil erosion and degradation.
- ✓ Provide a home for beneficial soil microbes including mycorrhizal fungi.
- ✓ Enhance phytoremediation and microbial degradation for further pollution treatment.
- ✓ Return and store soil carbon – locking up atmospheric carbon and sequestering it in the soil also making it a viable solution to reduce and offset GHG emissions.
- ✓ Increase soil cation exchange capacity and soil pH.
- ✓ Add to compost and mulches to stimulate microbial activity and eliminate harmful leachates.
- ✓ Blend with other natural fertilizers to improve availability and reduce loss.

SPECIFICATIONS:

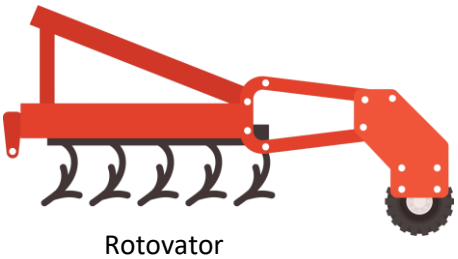
Property/Parameter	**Info/Units/Value**
Product Name:	EcocharE
Feedstock:	Various -Ag-based materials
Production Process:	Gasification – Coaltec/Earthcare Energy-Patented Technology – Temperatures – 1200 Fahrenheit -1800 Fahrenheit
Particle Size Distribution ASTM granular:	<.4-2.0 mm ASTM distribution -Various mesh sizes available
Composition:	Natural charcoal
Chemicals and binding agents:	There are no added chemicals or binding agents
Inherent Moisture (%)	~10-20% (wood <5%)
Average Ash (%)	~35-75% (wood <14%)
Organic Carbon (%)	~25-45% (wood = 80+%)
Organic Nitrogen (%)	~.57-2.4
Fe	<.82%
Mg	<4%
Average Surface Area (m^2/g)	~150 – 263 (wood ~490)
pH	9-11 (wood ~8)
Cation Exchange Capacity (CEC)	40++ cmol/kg (wood ~3-4 cmol/kg)
Infiltration Rate or Hydraulic Loading Capacity	110-118 in/hr. (wood – 169 in/hr)
Densities	550 lbs. – 800 lbs./CY depending upon feedstock
Molar Ratio (H:C)	.25-.7
Types	EcocharE; EcocharEA; EcocharESA

ECOCHAR
ENVIRONMENTAL SOLUTIONS

Ecochar-E Soil Amendment Application for Improved Health & Filtration Performance

Research indicates that to secure the evident, long-term soil health improvement benefits, wood- and crop residue-derived biochars may be applied cumulatively at 2–5 mass% soil and manure-derived biochars be applied at 1–3 mass% soil to cropland. The practical biochar amendment rates should be further confirmed by soil pH and EC prescreening tests.

Ecochar (biochar) can be added by mixing homogeneously into the upper soil layer at a depth of 15-20 cm (~6-8 in) at a rate of 1-3% mass volume of soil (~10 tons per acre) for achieving optimum soil health. First, scatter the pre-determined quantity of Ecochar on the soil surface by hand or machine. It is preferable to wet down the Ecochar prior to or immediately after spreading. A rotovator or disc harrow can be used for mixing Ecochar evenly into the upper soil layer (Figure 1). The soil physical properties such as bulk density, porosity, water holding capacity and infiltration are improved. However, the important issue in this stage is that the Ecochar does not remain above the soil surface. Ecochar dust that is not mixed into the soil is released into the atmosphere through wind erosion and can threaten air quality as particulates. In addition, Ecochar is washed away during irrigation (especially in traditional irrigation method) and the expected impact on the soil cannot be observed. When it is desired to mix Ecochar into the deeper soil layer, the plows utilized in the conventional tillage method are used. The Ecochar laid on the ground can be mixed easily 30-35 cm (~12-14 in) soil depth with help of a plow.



Rotovator

Disc Harrow

Figure 1.

Ecochar can also be premixed with compost in a 1:3 or 2:2 ratio – Ecochar/Compost for improved vegetative growth then applied with a compost spreader followed by a tiller. (Figure 2)

Premixing with compost

Figure 2. Compost spreader

References:
Guo M. The 3R Principles for Applying Biochar to Improve Soil Health. Soil Systems. 2020; 4(1):9. https://doi.org/10.3390/soilsystems4010009

Mehmet Hakkı Alma. Methods of Application and Incorporation of the Biochar into Soil. World Journal of Agriculture and Soil Science. 2021; ISSN: 2641-6379

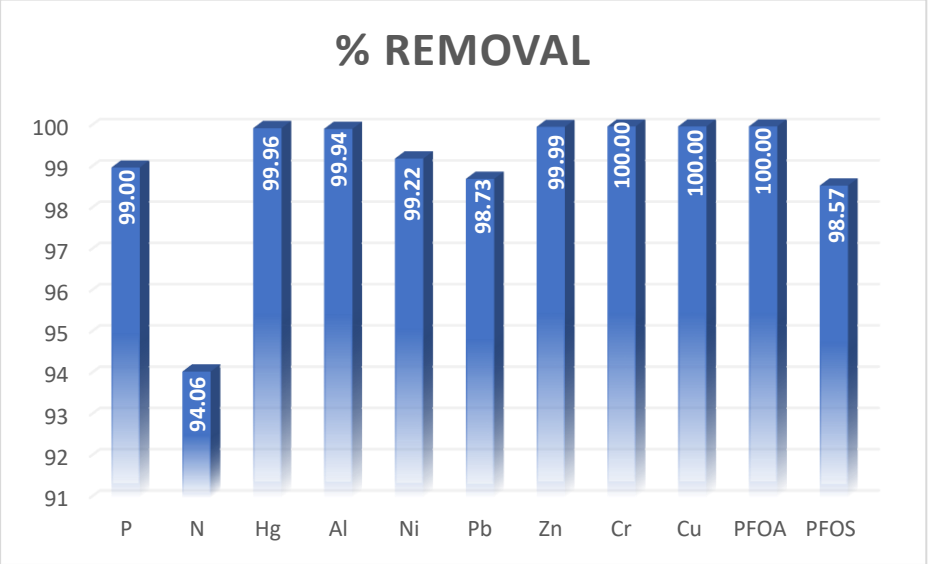
Metals & Organics Removal*

Ecochar(E)A & Ecochar(E)SA

Adsorption Efficiency for various contaminants:

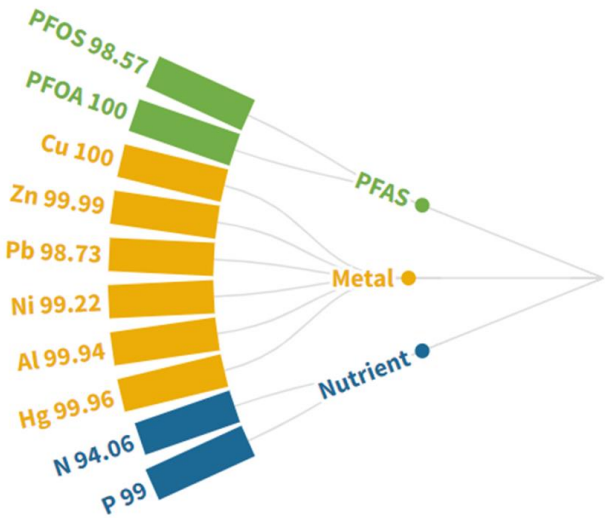
Contact time ~ 2 mins

Contaminant	% Removal
P	99.0041
N	94.059
Hg	99.957
Al	99.939
Ni	99.2203
Pb	98.7283
Zn	99.9897
Cu	100
Cr(VI)	100
PFOA	100
PFOS	98.5651



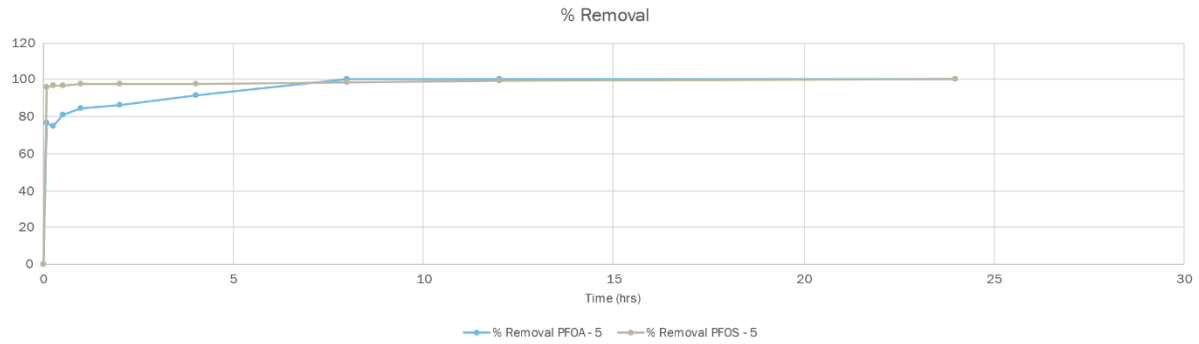
Adsorption Capacity

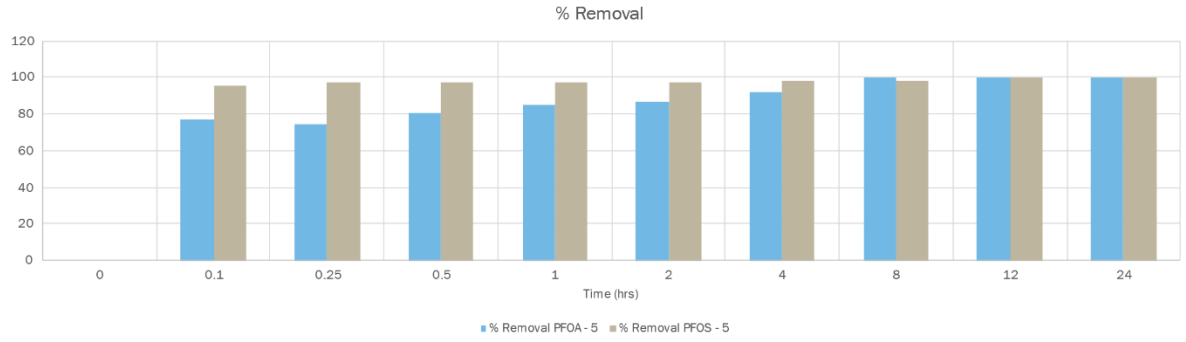
Contaminant	Adsorption (mg/g)
P	50
N	5.63
Hg	47.5
Al	49
Fe	672.4
Ni	50
Pb	50
Zn	25.31
Cu	9.14
Cr(VI)	4.27
PFOA	0.86
PFOS	33.33



PFAS Removal*
Ecochar(E)SA5

PFOA & PFOS = 10,000 ppb; 5% Ecochar(E) SA5 Adsorption Testing Results (below)





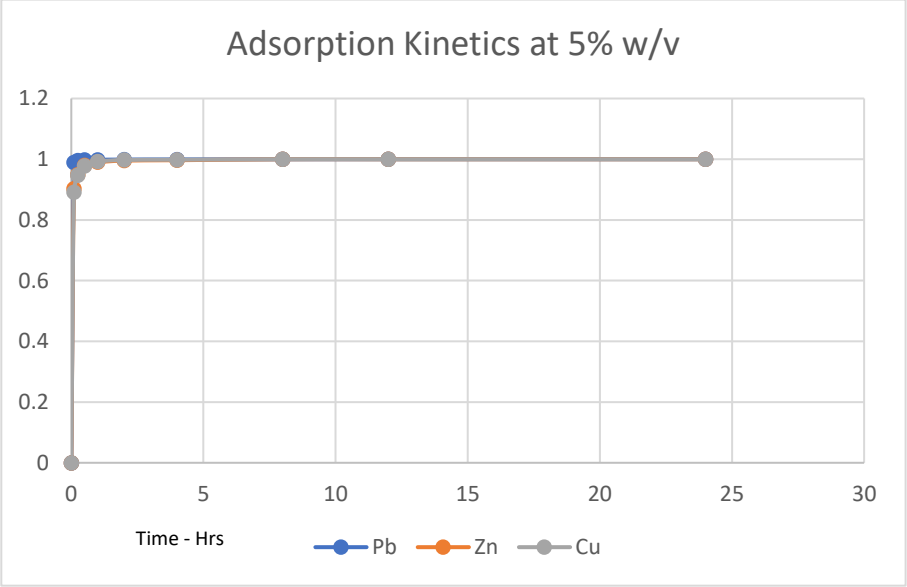
Heavy Metals Removal*
Ecochar(E)M

Heavy Metals Adsorption Capacities – *Copper, Zinc, Lead*

Metals Adsorption Capacities for Ecochar*M at **5% Ecochar** (Weight/Volume) – *Cu; Zn;Pb*

Constituent	Constituent Concentration (mg/L)	Ecochar-M* Adsorption Capacity (mg metal/g media)	Ecochar-M* (% Adsorbed)	Ecochar-M* (Adsorption or Contact Time)
Copper	98.37	49.19	89%	6 min or less
Zinc	98.83	49.41	90%	6 min or less
Lead	492.5	246.0	99%	6 min or less

**Ecochar-M hydraulic loading rate = 100-118 in/hr; 8x24 mesh; pH = 10.6*



Adsorption Kinetics at 5% w/v Ecochar								
Sample	Pb	Zn	Cu		Sample	Pb	Zn	Cu
0 hr	492.55	98.83	98.374		0	0	0	0
0.1	4.952	9.63	10.69		0.1	98.99%	90.26%	89.13%
0.25	1.959	4.99	5.18		0.25	99.60%	94.95%	94.73%
0.5	1.172	1.97	2.23		0.5	99.76%	98.01%	97.73%
1	0.86	0.99	0.767		1	99.83%	99.00%	99.22%
2	0.54	0.45	0.25		2	99.89%	99.54%	99.75%
4	0.29	0.32	0.17		4	99.94%	99.68%	99.83%
8	0.11	0	0		8	99.98%	100.00%	100.00%
12	0	0	0		12	100.00%	100.00%	100.00%
24	0	0	0		24	100.00%	100.00%	100.00%
Max Ads (mg/gm)	246.275	49.415	49.187					

* *Testing and Analyses performed at the Environmental Engineering Laboratory, Department of Civil, Environmental and Ocean Engineering, Stevens Institute of Technology, Hoboken, NJ*

For additional information, please contact Dominique Lueckenhoff: dominique@ ecocharenvironentalsolutions.com