



**OurCarbon**<sup>®</sup>

**BIOFORCETECH**

**CRADLE-TO-GATE ENVIRONMENTAL  
PRODUCT DECLARATION OF  
OURCARBON BIOCHAR**



ASTM INTERNATIONAL

**OurCarbon**<sup>®</sup>

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## General information

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<b>Manufacturer Name:</b>	Bioforcetech Corporation USA Headquarters: 938 Linden Ave, South San Francisco 94122 CA
<b>Program Operator:</b>	ASTM International 100 Barr Harbor Drive West Conshohocken, PA 19428-2959, USA
<b>Declaration Number:</b>	EPD 742
<b>Reference PCR:</b>	ISO 21930: 2017
<b>Date of Issuance:</b>	July 19, 2024
<b>End of Validity:</b>	July 19, 2029
<b>Product Name:</b>	OurCarbon Biochar
<b>EPD Owner:</b>	Bioforcetech
<b>Declared Unit:</b>	1000 kg of OurCarbon (Dry Weight Basis)
<b>EPD Scope:</b>	Cradle-to-gate (A1, A2, and A3)
<b>Prepared By:</b>	WAP Sustainability Consulting
<b>Verification:</b>	ISO 21930 serves as the core PCR. Independent verification of the declaration according to ISO 14025 and ISO 21930.  <input type="checkbox"/> internal <input checked="" type="checkbox"/> external
<b>LCA Reviewer and EPD Verifier:</b>	Lindita Bushi, Athena Sustainability Materials Institute

## Company information

Bioforcetech is a California-based company specializing in the biological drying and advanced pyrolysis of organics. Their first scaled feedstock, municipal biosolids, is diverted from emissive practices like landfilling, transformed through their advanced pyrolysis process into a carbon negative material called OurCarbon, and then utilized in industry. OurCarbon's porosity and absorptive qualities, tinting strength as a black colorant, and mineral content can all be leveraged in differing ways depending on the application. When added to structural concrete, OurCarbon's fixed carbon content is stored in the built environment in its entirety, utilizing the built environment as a carbon store.

## Product information

OurCarbon is a material that is produced by heating organic material in a limited oxygen environment, a process known as pyrolysis. The feedstock used to make OurCarbon as well as the temperature at which the pyrolysis occurs and the handling of the pyrolytic gases formed during the process, and the duration of the time the material is processed for determine the quality and characteristics of the product. Bioforcetech Corporation's OurCarbon is made using a biosolid feedstock from a municipal wastewater resource recovery facility. The resulting material has had key contaminants destroyed and a large fraction of the carbon in the original feedstock is newly fixed in place depending on the application, and effectively removed from the carbon cycle. The pyrolysis process produces energy through the creation and oxidizing of pyrolytic gases which keeps the entire system at temperature without the requirement of outside thermal energy sources.

Parameter	Value	Unit
O:C Ratio (Molar)	<0.4	N/A
H:C Ratio (Molar)	<0.7	N/A
Carbon Content	28-32	%
Elemental Ash Content	60-70	%

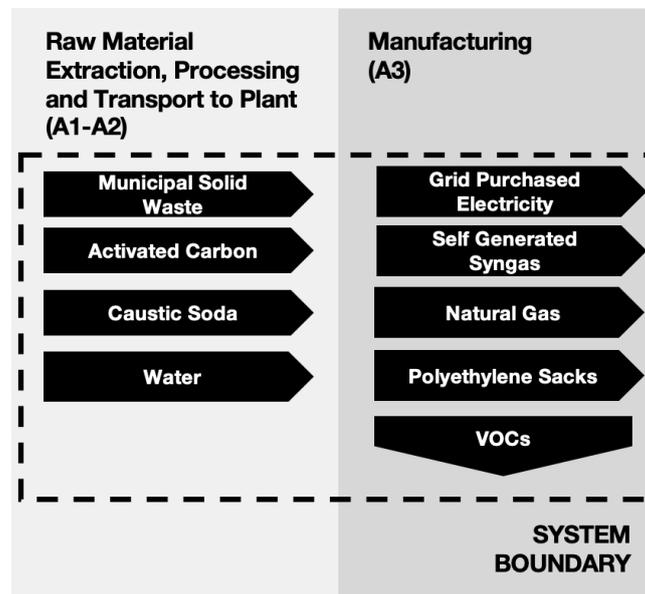
Bioforcetech Corporation's OurCarbon is intended to be used as a material additive and black pigment that can be applied to a range of products including textiles, inks and coatings, polymers and more. The application considered in this study is as a concrete additive, with the assumption that 100% of the carbon content is contained and stored in the concrete mix.



## LCA information

<b>Declared unit</b>	1000 kg of OurCarbon Biochar (Dry Weight)
<b>Reference service life</b>	Not declared as use phase is not included in the study
<b>Description of the system boundaries</b>	Cradle to Gate
<b>Geographical representativeness</b>	A1-A3: United States
<b>Time representativeness</b>	Primary data collected for calendar year 2022
<b>Cut-off rules</b>	All flows for which data were provided are included in the assessment, accounting for at least 99% of the energy or mass flows and at least 99% of the environmental impacts from the product system. Production of capital equipment is excluded from this assessment.
<b>Allocation rules</b>	General principles of allocation were based on ISO 14040/44. The manufacturing process produces heat that is used internally. Because this energy product is used internally and not sold to the market and occurs completely within the system boundary, there is no allocation applied. Beyond this, there are no other products other than the product under study that are produced as part of the manufacturing processes. To derive a per-unit value for manufacturing inputs such as electricity and thermal energy, allocation based on total production by mass was adopted. As a default, secondary datasets in ecoinvent use an economic basis for allocation.
<b>Database and LCA software used</b>	SimaPro 3.9.1 Ecoinvent V9.1
<b>LCA Report</b>	LCA of OurCarbon, May 2024
<b>Scenario Description: A2</b>	Assumed transportation from suppliers: 800 km by truck
<b>Scenario Description: A3</b>	Electricity Source: WECC region specific grid mix

### System diagram:



EPDs are comparable only if they comply with this document, use the same sub-category PCR where applicable, include all relevant information modules and are based on equivalent scenarios with respect to the context of construction works

Modules declared and geographical scope:

	Product stage			Construction process stage		Use stage							End of life stage				Resource recovery stage
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
Module	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Modules declared	X	X	X	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Geography	US			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Content information

Product components	Percent Composition %
Biosolids biochar from recovered municipal wastewater (Dry Weight)	100%

No substances in the product are on the Candidate List of Substances of Very High Concern (SVHC) which exceed the limits for registration with the European Chemicals Agency

## Results of the environmental performance indicators

The results presented here are for 1 declared unit, which is 1000 kg of OurCarbon Biochar (Dry Weight)

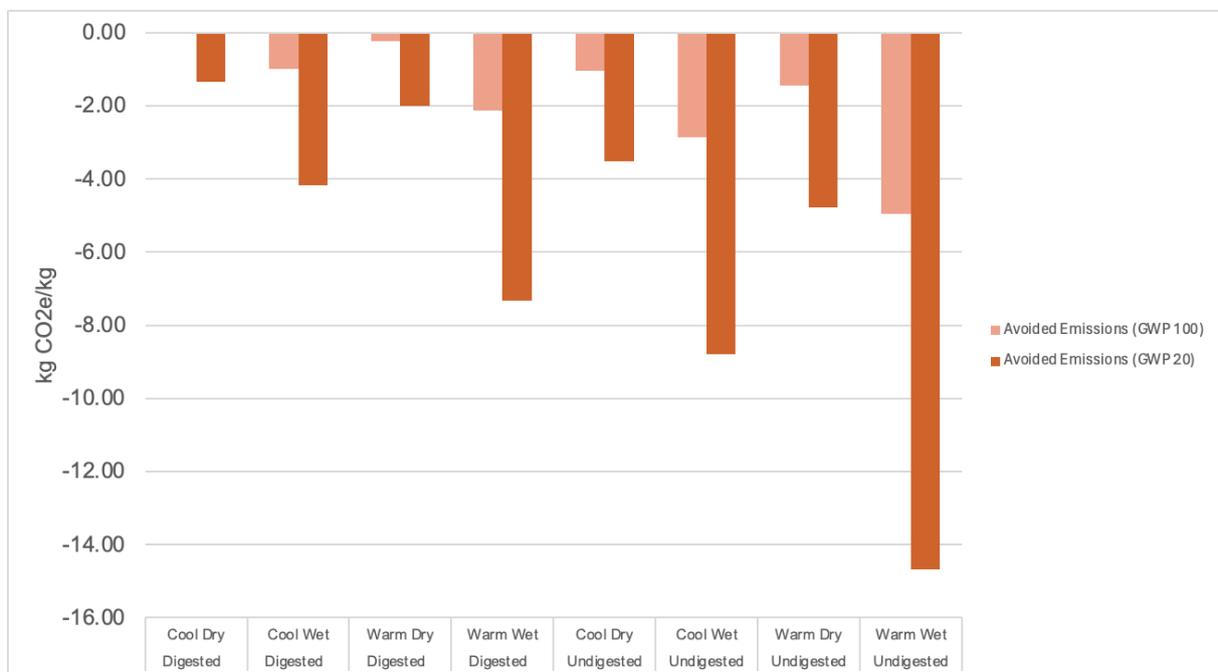
Impact Category	A1-A3	A1	A2	A3
<b>IPCC AR5</b>				
GWP excl. bio [kg CO <sub>2</sub> eq]	1.29E+02	3.69E+01	3.26E+00	8.89E+01
GWP incl. bio [kg CO <sub>2</sub> eq]	-1.02E+03	3.78E+03	3.26E+00	-4.80E+03
<b>TRACI LCIA Impacts (North America)</b>				
AP [kg SO <sub>2</sub> eq]	3.90E-01	1.81E-01	1.93E-02	1.90E-01
EP [kg N eq]	3.34E+00	1.35E-01	9.90E-04	5.49E-01
ODP [kg CFC 11 eq]	3.59E-05	1.94E-05	1.24E-10	5.57E-07
SFP [kg O <sub>3</sub> eq]	1.51E+02	2.39E+00	5.30E-01	2.84E+00
<b>CML LCIA Impacts (Europe, Rest of World)</b>				
ADPF [MJ]	8.43E+04	3.93E+02	4.17E+01	1.18E+03
<b>Resource Use Indicators</b>				
RPR <sub>E</sub> [MJ]	3.99E+02	5.32E+01	0.00E+00	3.46E+02
RPR <sub>M</sub> [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRPR <sub>E</sub> [MJ]	2.09E+03	4.95E+02	4.43E+01	1.55E+03
NRPR <sub>M</sub> [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SM [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RE [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW [m <sup>3</sup> ]	5.29E+03	2.45E+02	0.00E+00	5.04E+03
<b>Output Flows and Waste Categories</b>				
HWD [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NHWD [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
HLRW [kg]	4.11E-07	5.73E-08	0.00E+00	3.53E-07
ILLRW [kg]	3.47E-06	3.54E-07	0.00E+00	3.12E-06
CRU [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEE [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
<b>Carbon Emissions and Uptake</b>				
BCRP [kg CO <sub>2</sub> ]	-4.89E+03	-4.89E+03	0.00E+00	0.00E+00
BCEP [kg CO <sub>2</sub> ]	3.74E+03	0.00E+00	0.00E+00	3.74E+03
BCRK [kg CO <sub>2</sub> ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEK [kg CO <sub>2</sub> ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEW [kg CO <sub>2</sub> ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CCE [kg CO <sub>2</sub> ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CCR [kg CO <sub>2</sub> ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CWNR [kg CO <sub>2</sub> ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00

The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins and/or risks. The results of modules A1-A3 shouldn't be used without considering the results of module C. A1-A3 results include the "balancing-out reporting" of biogenic CO<sub>2</sub> of packaging, traditionally released in A5.

## Additional environmental information

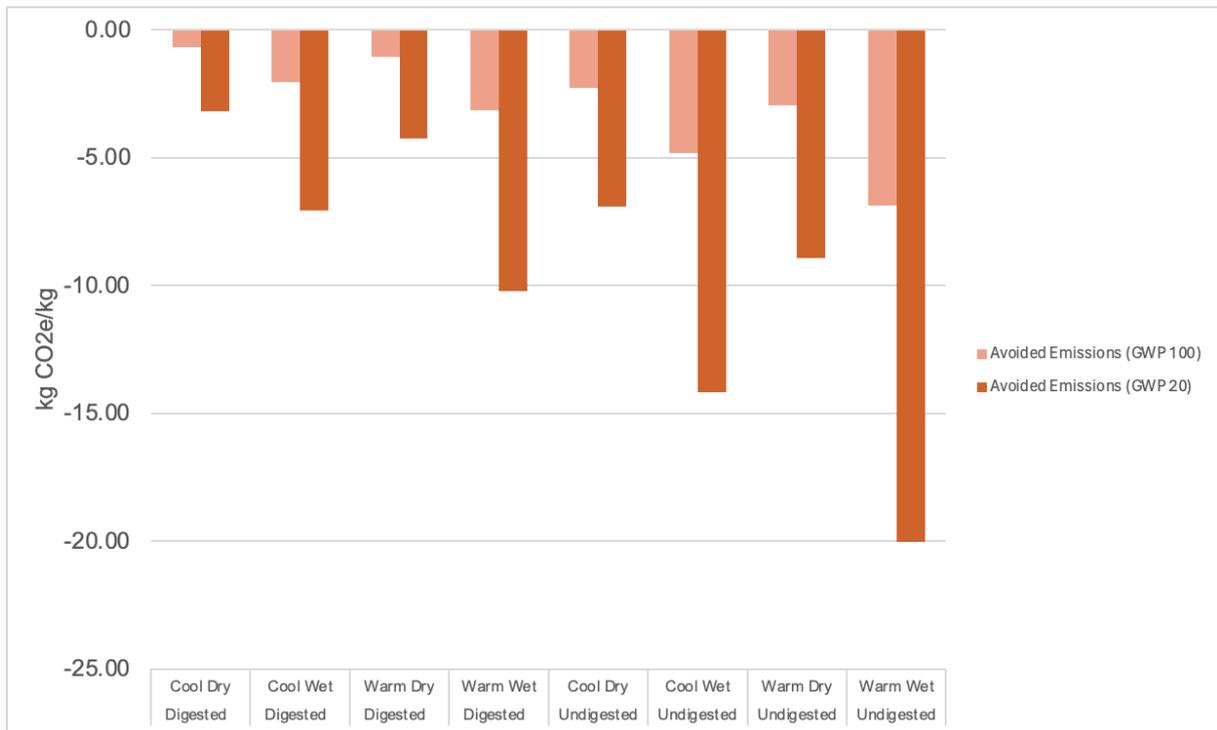
A key motivation of Bioforcetech Corporation to produce OurCarbon using their technology is the avoided emissions that are incurred from biosolid on its typical waste management pathway. Although the avoided emissions are not included within the calculated modules of the LCA per the relevant standards, an additional analysis on the expected avoided emissions that could occur from this pathway is calculated here.

Bioforcetech Corporation provided WAP Consulting with the estimated emission values that would occur if the biosolids followed a typical pathway to landfill. The values were calculated using the BEAM (Biosolids Emission Assessment Model) v.2 developed in September 2022. This model can be accessed via the North East Biosolids and Residuals Association (NEBRA) on their website: <https://www.biosolidsglghs.org/>. The scenario analysis looks at an undigested or digested feedstock and four different landfill parameters: worst-case landfill, typical landfill, aggressive landfill, and CA regulatory landfill. For each of these landfill and feedstock scenarios, four climates were analyzed - cool dry, cool wet, warm dry, and warm wet. The most conservative assumption, California landfill is shown below.



The manufacturing facility studied in this LCA is installed in Redwood City, California. This is right on the edge of a cool wet and cool dry climate. For the conservative case of California regulatory landfill, looking at the undigested feedstock in a cool wet climate, the avoided emissions incurred are -0.99 kg CO<sub>2</sub>e/kg OurCarbon for GWP 100 and -1.52 kg CO<sub>2</sub>e/kg OurCarbon for GWP 20. For the same scenario in the cool dry case, the avoided emissions are -0.01 kg CO<sub>2</sub>e/kg OurCarbon for GWP 100 and -1.34 kg CO<sub>2</sub>e/kg OurCarbon for GWP 20.

The most realistic assumption, typical landfill is shown below.



The more realistic scenario of a typical landfill for the undigested feedstock, cool wet climate incurs avoided emissions of -4.82 kg CO<sub>2</sub>e/kg OurCarbon for GWP 100 and -14.1 kg CO<sub>2</sub>e/kg OurCarbon for GWP 20. Finally, the typical landfill for the undigested feedstock, cool dry climate incurs avoided emissions of -2.29 kg CO<sub>2</sub>e/kg OurCarbon for GWP 100 and -6.92 kg CO<sub>2</sub>e/kg OurCarbon for GWP 20.

## References

- ASTM 2020 - ASTM Program Operator for Product Category Rules (PCR) and Environmental Product Declarations (EPDs) General Program Instructions v8, April 29<sup>th</sup>.
- WAP Sustainability Consulting: 2024 – A Cradle-to-Gate Life Cycle Assessment of OurCarbon Biochar
- ISO 21930: 2017 Sustainability in building and civil engineering works – Core rules for environmental product declarations of construction products and services
- ISO 14025: 2006 Environmental labeling and declarations - Type III environmental declarations - Principles and procedures.
- ISO 14044:2006/AMD 1:2017/ AMD 2:2020 - Environmental management - Life cycle assessment - Requirements and guidelines.
- ISO 14040:2006/AMD 1:2020 - Environmental management - Life cycle assessment - Principles and framework.

