Environmental Product Declaration

THE INTERNATIONAL EPD® SYSTEM

In accordance with ISO 14025:2006 and PCR biochar 2021:07 for:

Biochar

from

Carbuna AG

Programme:	The International EPD® System, www.environdec.com
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Programme information

Programme:	The International EPD® System
Address:	EPD International AB Box 210 60 SE-100 31 Stockholm Sweden
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Accountabilities for PCR, LCA and independent, third-party verification
Product Category Rules (PCR)
PCR: *Biochar PCR 2021:07 v 1.0, UN CPC 345*
PCR review was conducted by*: Francesca Falconi, LCA-lab srl, francesca.falconi@lca-lab.com*
Life Cycle Assessment (LCA)
LCA accountability: *Amy Stockwell, CarbonZero AB, Amy.Stockwell@eando.se*
Third-party verification
Independent third-party verification of the declaration and data, according to ISO 14025:2006, via: ☒ EPD verification by individual verifier Third-party verifier: *Vladimir Koci, LCA Studio, Vladimir.Koci@lcastudio.cz* Approved by: The International EPD® System
Procedure for follow-up of data during EPD validity involves third-party verifier: ☐ Yes ☒ No

The EPD owner has the sole ownership, liability, and responsibility for the EPD.

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Updated 2024-03-25: further explanation of allocation method and biogenic carbon content.

Company information

Owner of the EPD: Carbuna AG

Contact: Benedikt Zimmermann, +49 8331 99 497-12, b.zimmermann@carbuna.com, Mendelssohnstr. 2, DE-87700 Memmingen, Germany

Description of the organisation: Carbuna is focusing on manufacturing and wholesale of biochar-based products for agricultural, urban and industrial application. The company is certified under ISO 9001:2015, GMP+ and EBC (European Biochar Certificate). Carbuna sources biochar from pyrolysis units within the EBC ecosystem, based on long-term contracts and strict product quality specifications.

Name and location of production site: Germany, Austria, Switzerland. The most recently installed plant in Switzerland was chosen as most representative.

Product information

Product name: Biochar

Product identification: Biochar from wood chips, EBC-certified. It has approximately 80-90% carbon content.

Product description: Biochar is produced from the pyrolysis of wood chips. The pyrolysis plant is a highly efficient biomass-fired CHP power plant that also produces biochar. Biochar is used in several different fields of application. Biochar is used as a soil additive in agriculture or as an additive in structural (urban) soils (e.g. in tree planting substrate), where it stores additional water and nutrients. Biochar can be also be used as an additive in concrete, where it improves the concrete's physical properties and can add electric conductivity as a material property.

Biochar is a cheap alternative or a precursor to activated carbon, as it can filter out a wide range of organic and inorganic contaminants from water.

In most applications biochar remains in a matrix that is not oxidized at the end of use and since biochar is mostly biochemically inert, it will not degrade over time, which makes biochar a potent carbon sink.

Outside of carbon sequestration, biochar can be used as a biogenic alternative to fossil coal in metallurgic processes, such as metal ore reduction or steel carburization.

This biochar is sold to a variety of customers in agriculture, substrate production, concrete production, industry and metallurgy. The final destination is depending on these application, but especially in soil and concrete application, a permanent carbon sink is created.

UN CPC code: 345

Geographical scope: Europe

LCA information

Functional unit / declared unit: 1 ton biochar and its packaging.

Reference service life: not applicable

Time representativeness: 2022-2023

Database(s) and LCA software used: LCA for Experts v10.7.1.28 (GaBi), Ecoinvent 3.8

Description of system boundaries: cradle to gate with options. Delivery to customer and disposal of packaging is included.

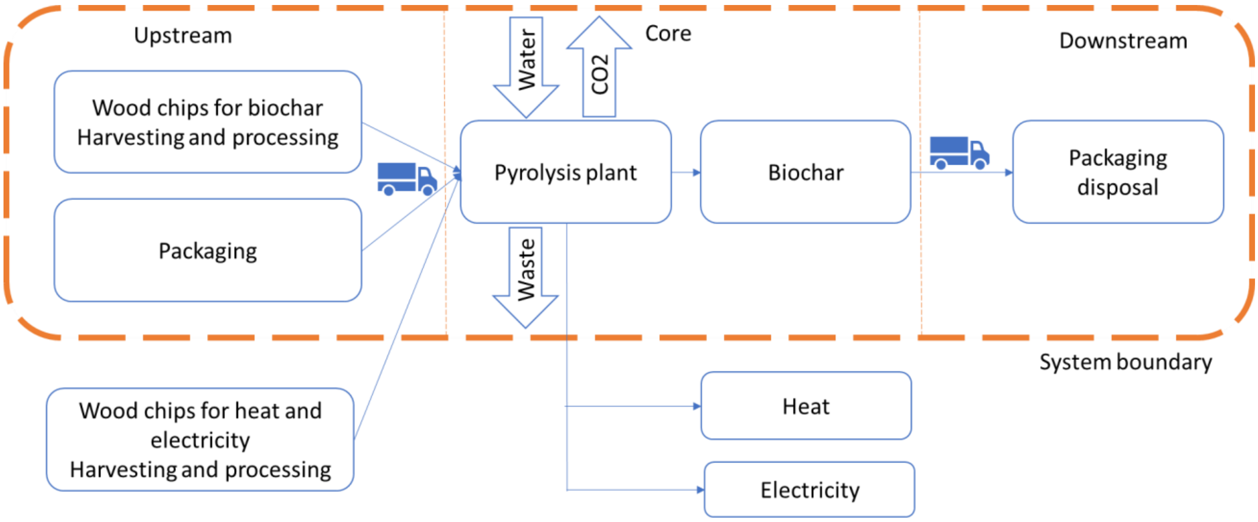
Excluded lifecycle stages: none.

More information: The product is assumed to be transported 500 km to customers, and the packaging is reused.

Allocation: Allocation was based upon system expansion.

Biochar is produced in a combined heat and power unit. The efficiency of this power plant is within the range of most combined heat and power units of the same size. Two combined heat and power units with identical usable energy output were compared for system expansion, one producing biochar and one that does not. Biochar-producing powerplants require more wood input to reach the same energy output because a part of the carbon is turned into biochar, and thus, not all wood is burned to produce energy. There are two paths to system expansion, which lead to similar results: Either the additional wood input that turns into biochar is disregarded in the energy view (outside the boundaries), or it is assumed that the biochar is burned as well to produce more energy. In the biochar-producing plant, a part of the input wood is turned into usable energy and another part of the input wood is turned into biochar through pyrolysis. Pyrolysis is an endothermic process, but the energy required to power the pyrolysis is within the range of energy efficiency losses in comparable heat and power units. Overall, no additional energy is lost in this biochar-producing combined heat and power unit compared to any non-biochar-producing combined heat and power unit. Therefore, the energy-producing part can be split from the biochar-producing part through system expansion. Biochar is the part of this system that is not burned, so CO_2 generation is only associated with energy production, and energy production is left out of the scope by system expansion. Therefore, in the biochar-producing segment all carbon from wood is theoretically turned into biochar.

System diagram:



Content declaration

Product

Product components	[Unit]	%	Environmental / hazardous properties
Biochar	1 ton	100 %	none
TOTAL	1 ton		

The contaminants are all within the legal thresholds of their respective applications. No substances that appear in the REACH candidate list of SVHC (Candidate List of Substances of Very High Concern) are present or used in the product concerning this EPD.

Packaging

Packaging is sent to customers in big bags on pallets.

Packaging materials	Weight kg/ton	Weight % vs product	Weight biogenic carbon kg C/ton
Polypropylene	2.7 E+00	0.3 %	0
Pallet	2.7 E+01	2.7 %	1.11E-02
Total	2.9 E+01	3.0 %	1.11E-02

Recycled material

Provenience of recycled materials (pre-consumer or post-consumer) in the product:
No recycled materials are included.

Results of the environmental performance indicators

Impact category indicators

PARAMETER		UNIT	Upstream	Core	Downstream	TOTAL
Global warming potential (GWP)	Fossil	kg CO_2 eq.	4.25E+02	1.23E+02	7.18E+00	5.55E+02
	Biogenic	kg CO_2 eq.	-3.67E+03	2.81E+01	4.05E+01	-3.60E+03
	Land use and land transformation	kg CO_2 eq.	1.43E+00	1.10E+00	6.63E-02	2.60E+00
	TOTAL	kg CO_2 eq.	-3.25E+03	1.53E+02	4.78E+01	-3.05E+03
Ozone layer depletion (ODP)		kg CFC 11 eq.	1.49E-06	1.55E-11	6.27E-13	1.49E-06
Acidification potential (AP)		mol H^+ eq.	1.86E+00	2.35E-01	1.35E-02	2.11E+00
Eutrophication potential (EP)	Aquatic freshwater	kg P eq.	4.87E-03	1.32E-03	2.61E-05	6.22E-03
	Aquatic marine	kg N eq.	8.41E-01	1.02E-01	5.60E-03	9.49E-01
	Aquatic terrestrial	mol N eq.	9.20E+00	1.10E+00	6.39E-02	1.04E+01
Photochemical oxidant creation potential (POCP)		kg NMVOC eq.	2.65E+00	2.21E-01	1.21E-02	2.88E+00
Abiotic depletion potential (ADP)*	Metals and minerals	kg Sb eq.	1.27E-04	7.78E-06	4.65E-07	1.35E-04
	Fossil resources	MJ, net calorific value	5.98E+03	1.65E+03	9.74E+01	7.73E+03
Water deprivation potential (WDP)*		m^3 world eq. deprived	1.53E+01	3.91E+00	8.25E-02	1.93E+01

** Disclaimer: The results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator.*

Resource use indicators

PARAMETER		UNIT	Upstream	Core	Downstream	TOTAL
Primary energy resources – Renewable	Use as energy carrier	MJ, net calorific value	-2.17E+04	1.18E+02	6.89E+00	-2.16E+04
	Used as raw materials	MJ, net calorific value	6.65E+04	0	0	6.65E+04
	TOTAL	MJ, net calorific value	4.48E+04	1.18E+02	6.89E+00	4.49E+04
Primary energy resources – Non-renewable	Use as energy carrier	MJ, net calorific value	5.86E+03	1.65E+03	9.76E+01	7.61E+03
	Used as raw materials	MJ, net calorific value	1.25E+02	0	0	1.25E+02
	TOTAL	MJ, net calorific value	5.98E+03	1.65E+03	9.76E+01	7.73E+03
Secondary material (optional)		kg	0	0	0	0
Renewable secondary fuels (optional)		MJ, net calorific value	0	0	0	0
Non-renewable secondary fuels (optional)		MJ, net calorific value	0	0	0	0
Net use of fresh water (optional)		m^3	1.20E+00	1.88E+00	7.59E-03	3.09E+00

Waste indicators (optional)

PARAMETER	UNIT	Upstream	Core	Downstream	TOTAL
Hazardous waste disposed	kg	-4.10E-07	8.40E-09	3.61E-10	-4.01E-07
Non-hazardous waste disposed	kg	2.86E+00	3.04E+01	1.41E-02	3.33E+01
Radioactive waste disposed	kg	2.34E-01	2.53E-03	1.26E-04	2.37E-01

Output flow indicators (optional)

PARAMETER	UNIT	Upstream	Core	Downstream	TOTAL
Components for reuse	kg	0	0	2.94E+01	2.94E+01
Material for recycling	kg	0	0	0	0
Materials for energy recovery	kg	0	0	0	0
Exported energy, electricity	MJ per energy carrier	0	0	0	0
Exported energy, thermal	MJ per energy carrier	0	0	0	0

Other environmental performance indicators

PARAMETER	UNIT	Upstream	Core	Downstream	TOTAL
GWP-GHG[1]	kg CO_2 eq.	4.20E+02	1.51E+02	1.07E+01	5.82E+02
GWP[2]	kg CO_2 eq.	-3.25E+03	1.47E+02	4.77E+01	-3.06E+03

[1]This indicator accounts for all greenhouse gases except biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. As such, the indicator is identical to GWP-total except that the CF for biogenic CO_2 is set to zero.

[2]This indicator supports comparability with EPDs based on the previous version of EN 15804 (EN 15804:2012+A1:2013).

Additional environmental information

The biogenic carbon content of the biochar is 854 kg C per ton. Based on stoichiometry, this is equivalent to 3130 kg CO_2e per ton of biochar. So if the biochar is used in an application that prevents oxidation into CO_2 indefinitely, 1 ton of this biochar has prevented 3130 kg CO_2e emissions. However, EPD's impact assessment is based on upstream data from LCI-databases rather than on stoichiometry. As explained in the allocation segment, based on a system expansion approach, 100% of carbon from wood becomes biochar. We calculated using generic data, which states that 1 kg of wood chips contain 0.444 kg pure carbon. Although a conservative LCI-dataset was chosen, the database-derived calculations state that -3670 kg biogenic CO_2e were taken from the atmosphere in the upstream process of wood growth and timber production, which is sightly more than stoichiometry can explain. We assume that the database accounts for other positive impacts of sustainable forestry, but it is aggregated, so we are not able to see where these impacts come from.

According to the IPCC, biochar has the potential to be a carbon sink. In order to achieve a permanent carbon sink, the final product must not be used or disposed of in a way that allows the carbon to be emitted (such as through incineration). It is essential to know exactly where the biochar comes from and to be able to digitally track the biochar from production to end use in a carbon-preserving application. Therefore, all units of biochar traded by Carbuna AG are monitored, reported and verified via Carbonfuture GmbH, a certified MRV-company.

References

EPD International (2021)	General Programme Instructions of the International EPD® System, version 4.0
ISO 14020:2022	International Standard ISO 14020 – Environmental statements and programmes for products – Principles and general requirements
ISO 14025:2006	International Standard ISO 14025 – Environmental labels and declarations — Type III environmental declarations — Principles and procedures
ISO 14040:2006	International Standard ISO 14040: Environmental Management – Life cycle assessment – Principles and framework. Second edition 2006-07-01.
ISO 14044:2006	International Standard ISO 14044: Environmental Management – Life cycle assessment – Requirements and Guidelines.
PCR 2021:07	PCR 2021:07 v 1.0 Biochar

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