


Arbaz, 2<sup>nd</sup> June 2021

## EBC carbon sink certificate

General Data	ID of C-sink certificate = C-sink register ID EBC ID EBC Batch ID Production periode QR-Code of Biochar Batch Analysis	12DE00520102 co-de-52 ba-de-52-1-2 1.2.2021 - 1.2.2022	
Producer	Abfallwirtschaft und Stadtreinigung Freiburg GmbH 79108 Freiburg Hermann-Miltsch-Str. 26 Germany		
Google maps location	<a href="https://goo.gl/maps/EQD6GGatPy732UoZ9">https://goo.gl/maps/EQD6GGatPy732UoZ9</a> <a href="http://www.abfallwirtschaft-freiburg.de">www.abfallwirtschaft-freiburg.de</a> <a href="mailto:buerger@abfallwirtschaft-freiburg.de">buerger@abfallwirtschaft-freiburg.de</a>		
Biomass	Type of biomass (EBC-class) Total amount of biomass (dry matter) used for the certified batch Emissions due to fertilization Transportation of biomass to pyrolysis site Preparation of feedstock Emissions for drying of feedstock Feedstock storage emissions <b>Total biomass related GHG emissions without CH<sub>4</sub> per batch</b>	Wood residues (F-02) 300 t 0 t CO <sub>2</sub> eq 0.13 t CO <sub>2</sub> eq 3.84 t CO <sub>2</sub> eq 0 t CO <sub>2</sub> eq 0.50 t CH <sub>4</sub> <b>4.0 t CO<sub>2</sub>eq</b>	
Pyrolysis	Source of electric energy used on site Emissions due to electricity consumption for entire pyrolysis plant incl. post pyrolysis treatment Emissions due to LPG and other external fuel for reactor heating Emissions due to carrier gas CH <sub>4</sub> -emissions of pyrolysis unit <b>Total pyrolysis related GHG emissions without CH<sub>4</sub> per batch</b>	renewable 0 t CO <sub>2</sub> eq 3.00 t CO <sub>2</sub> eq 0 t CO <sub>2</sub> eq 0.03 t CH <sub>4</sub> <b>3.0 t CO<sub>2</sub>eq</b>	
Methane	Total methane emissions Amount of compensated methane emissions Type of methane compensation Total non compensated CH <sub>4</sub> emissions per batch <b>Total non compensated CH<sub>4</sub> emissions in CO<sub>2</sub>eq per batch (@ GWP20 of 86)</b>	0.53 t CH <sub>4</sub> 0 t CH <sub>4</sub> - 0.53 t CH <sub>4</sub> <b>45.30 t CO<sub>2</sub>eq</b>	
Margin of security	<b>10% of total GHG emissions (incl. GWP20 of CH<sub>4</sub>) per batch</b>	<b>5.2 t CO<sub>2</sub>eq</b>	
<b>Total emissions</b>	<b>Total GHG emissions in CO<sub>2</sub>eq per batch</b> Total GHG emissions in C per ton of biochar (dry matter)	<b>57.5 t CO<sub>2</sub>eq</b> 0.131 t C	
Energy	Carbon neutral thermal energy per batch Carbon neutral electricity per batch	0 MWh 0 MWh	
Biochar	Amount of biochar (DM) produced per certified batch H/Corg ratio C-content <b>C-sink potential</b>	120 t 0.1 85.2% <b>72.1% of DM</b>	
Data per ton of biochar	Total GHG emissions per t biochar (dry matter)  CO <sub>2</sub> eq-content per t of biochar (dry matter) [gross C-sink]  C-sink potential in tCO <sub>2</sub> eq per t of biochar (dry matter) [net C-sink]  <b>Csink<sub>100</sub> in tCO<sub>2</sub>eq per t of biochar (dry matter) [persistent C of the sink after 100 years when applied to soil @ P<sub>100</sub>=74%]</b>	0.48 t CO <sub>2</sub> eq  3.12 t CO <sub>2</sub> eq  2.64 t CO <sub>2</sub> eq  <b>1.96 t CO<sub>2</sub>eq</b>	

# EBC Carbon Sink Certificate

Issued for Abfallwirtschaft und Stadtreinigung Freiburg GmbH

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**The biochar batch ba-de-52-1-2 produced by Abfallwirtschaft und Stadtreinigung GmbH has carbon sink potential of 72.1 %. Each ton of biochar from the certified batch has a carbon sink potential of 2.64 t CO<sub>2</sub>eq. When applied to soil, the accountable fraction of carbon persistent after 100 years (C<sub>sink100</sub>) is 1.96 t CO<sub>2</sub>eq.**

The carbon sink value of 72.1% provides the percentage of a mass unit of biochar that, on a dry matter base, can be considered as a temporal carbon sink. For example, a big bag containing 131 kg biochar (dry matter) has a carbon sink potential of (131 kg \* 72.1 % C<sub>s</sub>) = 94.5 kg C which is the equivalent of 346 kg CO<sub>2</sub>eq per bigbag.

The 94.5 kg carbon of a 1m<sup>3</sup> big bag of biochar is the amount of carbon that can be considered a carbon sink once the biochar is applied to soil, to compost, to digestate, to animal feed or to any other durable product or protective matrix.

The production of 1 t of biochar (dry matter) caused emissions of 480 kg CO<sub>2</sub>eq due to feedstock production, transportation, storage, preparation and operation of the pyrolysis plant and methane emissions during both biomass storage and the combustion of the pyrolysis gases. These emissions were deduced from the carbon sink value of the biochar.

The CO<sub>2</sub> emissions of the combustions of the pyrolysis gases used for energy production are considered as carbon neutral as the feedstock for the pyrolysis originated from forest management residues.

The CH<sub>4</sub> emissions were measured repeatedly during regular operation on at least three pyrolysis plants of the same type. The methane values are thus subject to some uncertainty in regard to start-up and shut down of the process or possible problems during regular operation. For this reason, a margin of 50% was added to the measured CH<sub>4</sub> emissions. It was guaranteed that the chipped feedstock is never stored longer than 30 days before drying to below 20% water content, therefore no CH<sub>4</sub>-emissions due to self-heating were considered. All electricity used for the production was provided as renewable, carbon neutral energy.

Neither the carbon expenditures necessary to transport the biochar from the production site to the location of the final C-sink (via a merchant and/or processor) nor the carbon expenditures when manufacturing or blending the biochar into a carbon sink product are considered so far. These emissions must be deducted as soon as a C-sink certificate or an offset service is generated for an end customer based on this C-sink potential certificate. Equally, when applied to soil, only the carbon fraction that is persistent after 100 years (C<sub>sink100</sub>) or any other EBC-defined sequestration period should be traded as C-sink certificate.

During the biochar production, an estimated 0 MWh thermal energy will be produced. As all GHG emissions of the entire process were deduced from the biochar carbon sink potential, this thermal energy is completely carbon neutral. The total certified amount of carbon neutral heat will be provided at the end of the batch.

The present ***EBC carbon sink potential certification*** is valid for the entire biochar batch produced between 2/1/2021 and 2/1/2022 and can be used for carbon sink certification and trade procedures.

The present EBC carbon sink potential certification was issued by the Ithaka Institute (Switzerland) on 2<sup>nd</sup> June 2021.



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Hans-Peter Schmidt  
Head of Ithaka Institute