Global Artisan Carbon Sink Certification

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GLOBAL C-SINK

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Global Artisan C-Sink

Methodology for the certification of biochar-based C-Sinks, where the biochar is produced with artisanal, non-industrial, methods of flame-cap (Kon-Tiki) pyrolysis.

The geographical scope of the Global Artisan C-Sink is limited to low-income, lower middle income and higher middle-income countries as defined by the World Bank classification of countries

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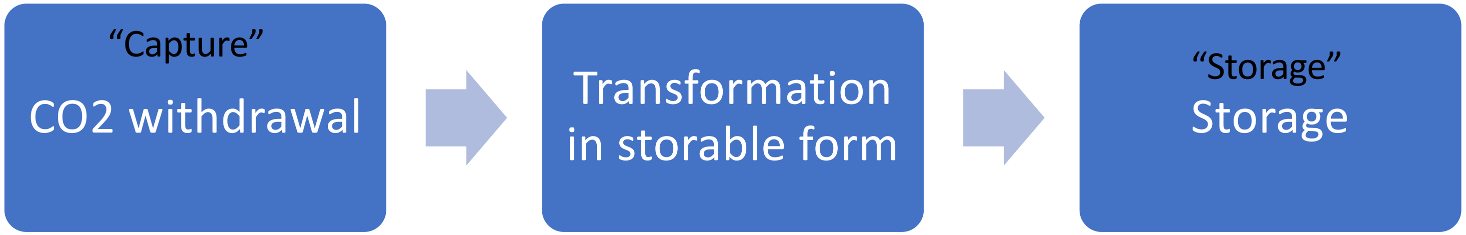
What is a C-sink?

A carbon sink is the result of

(1)carbon dioxide removal (CDR) from the atmosphere,
(2)the transformation of the CO_2 into a storable form, and
(3)storage of the carbon for verifiably duration in a non-atmospheric carbon pool.

Depending on the duration of storage, a C-sink may be described as short term <100 years or long term > 100 years.



C-Sink vs. Certified Emission Reduction (CER/VER)

Carbon Sink (VCR)

- Reduced the CO_2 – concentration in the atmosphere

- Is materially traceable, localizable and measurable

Carbon Credits - CER

- Prevents the further increase of the atmospheric CO_2 concentration but does not actively reduce it

- Cannot be measured directly & needs a reference scenario: e.g., coal fired power plant vs. renewable energy

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Pyrogenic Carbon Capture and Storage (PyCCS)

CO_2 is **captured** by plants through photosynthesis,
their biomass is **transformed** into stable carbon
through the technical process of pyrolysis
and **stored** by the use of Biochar

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C-SINK GUIDELINES & DOCUMENTS

Find here the guidelines for EBC Carbon Sink Certification and the documentation of updates

The Guidelines

EBC Carbon Sink Certification (Guidelines Version 2.1 from 1st February 2021)

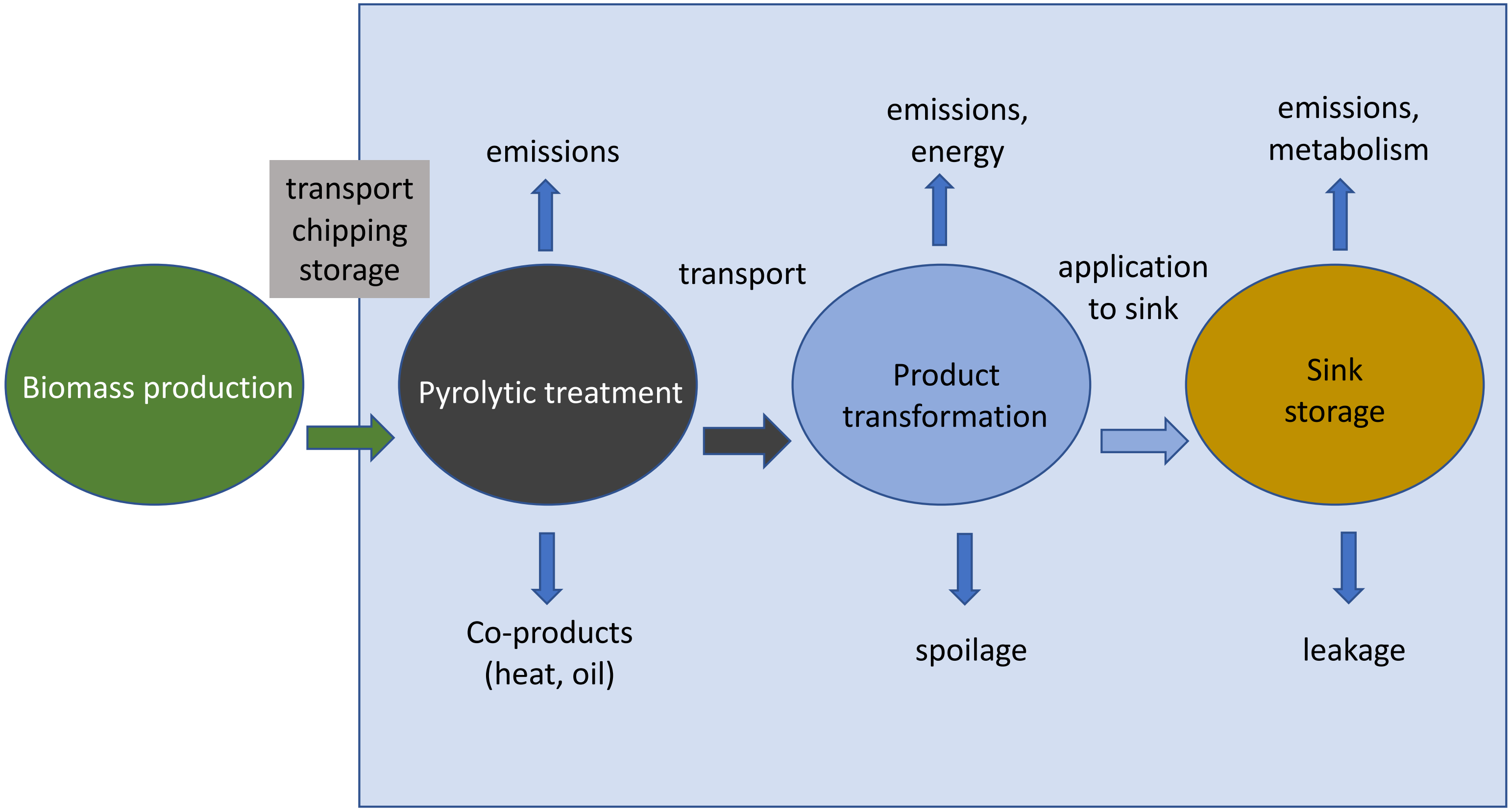
Global Artisan C-Sink (Guidelines Version 1.0 from 5th October 2022)

Global Rock C-Sink (Guidelines Version 0.9 from 31st October 2022)

Updates

Modifications from Version 2.0 to Version 2.1 with track changes

Assessment of PyCCS based Carbon-Sinks



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Biomass Feedstock

→ Do not consider only the biochar as such but start the carbon accounting with the production of the biomass feedstock

If harvesting the biomass interrupts and reduces the carbon uptake from the atmosphere it has to be accounted for

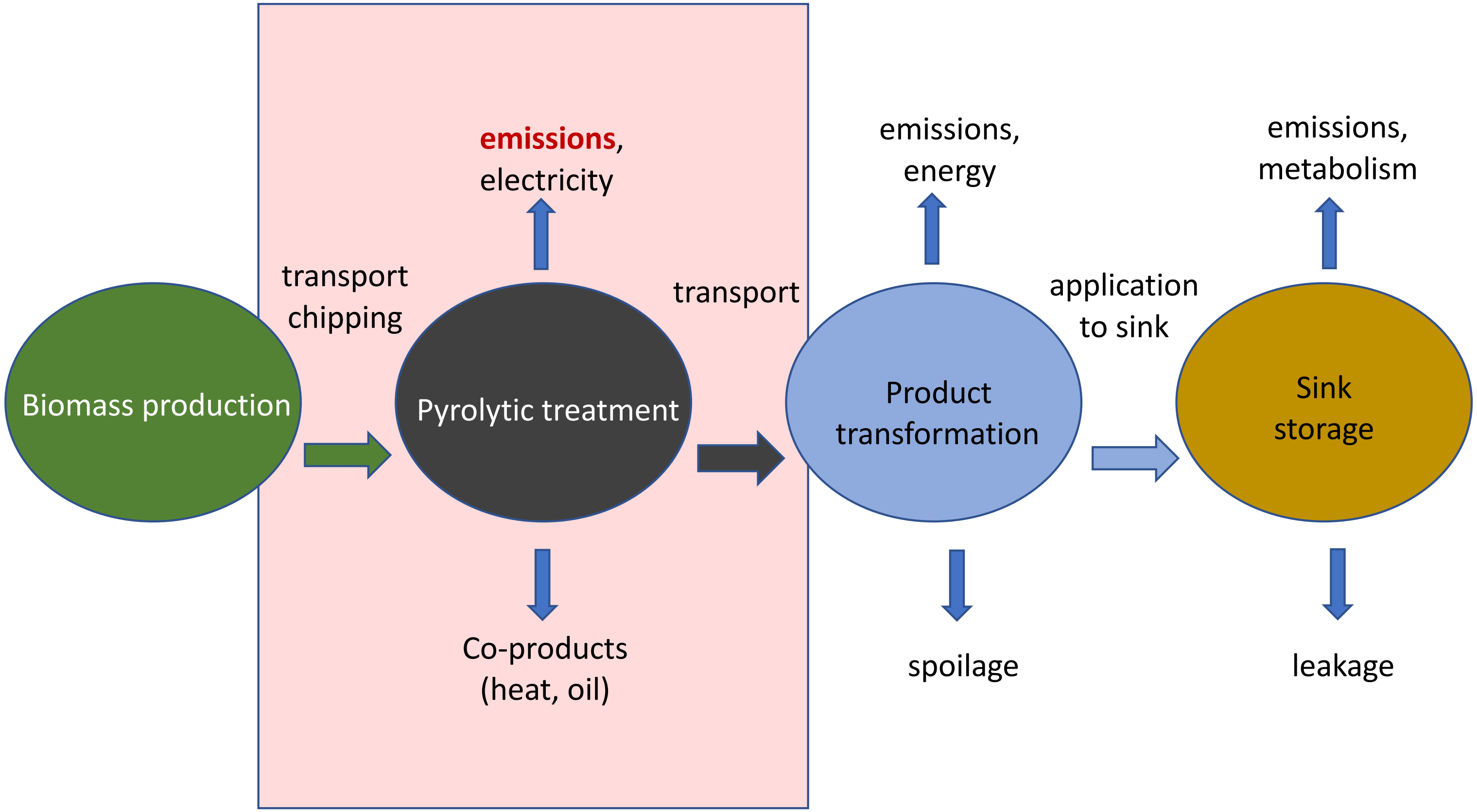
Eligible feedstock

6. Biomass feedstock

The present certification standard assumes that the biochar is made from biomass feedstock that originated from the artisan's farm or from biomass processing such as cocoa mills, coffee pealing, rice thrashing, sawmills, and comparable industries. The biomass may also come from disaster debris, maintenance of fallow fields, or dedicated biomass production like bamboo or switch grass plantations.

Under the present Global Artisan Artisan guidelines, it is not permitted to use primary forest biomass. The only exceptions are residues from sustainable and, as such certified forest management. Still, use of the latter needs written permission from the Certifier.

PyCCS - parameters



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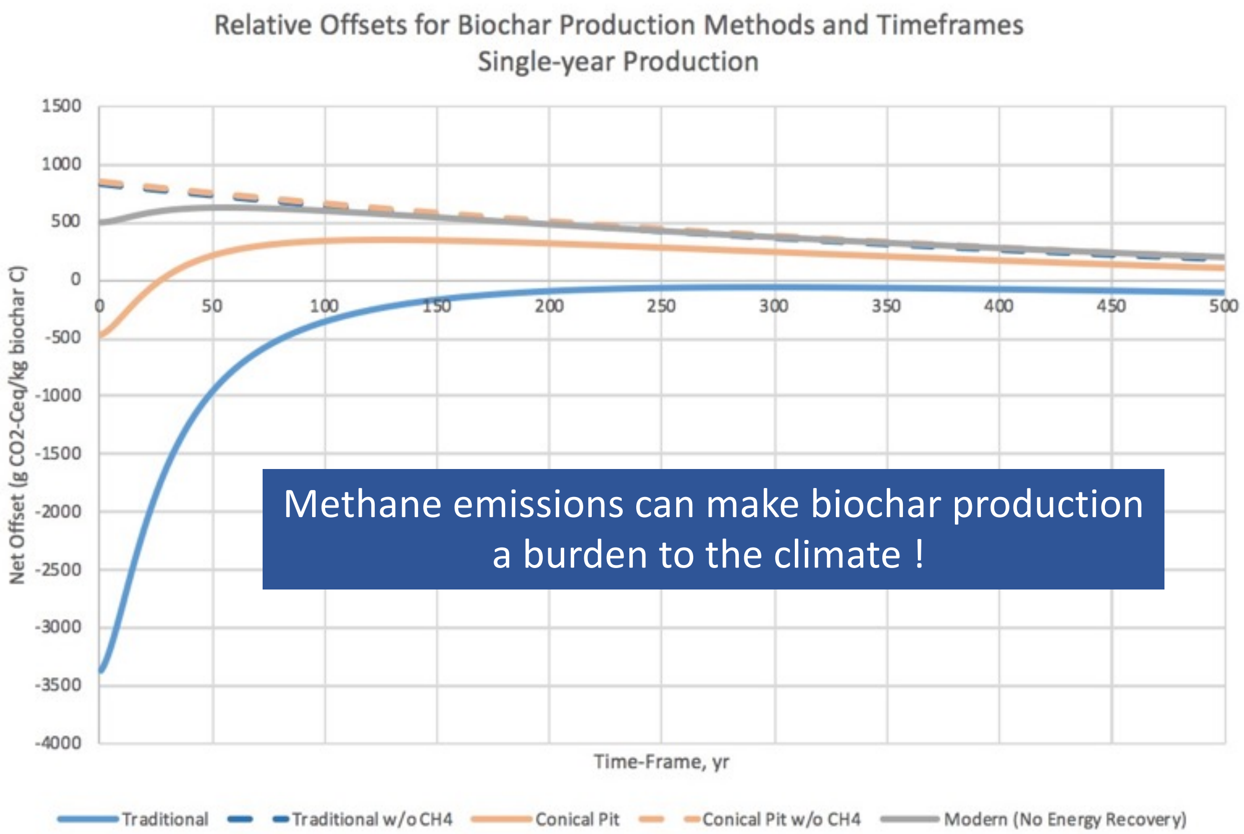
Pyrolysis Emissions



Based on Cornelissen et al. 2015

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Emission of Kon-Tiki and TLUDs

Table 3. Emission factors (g/kg charcoal) of CO_2, CO, CH_4, TSP [aerosols, from particulate matter < 10 µm (PM_{10})], non-methane volatile organic carbon (NMVOC), and the sum of nitrogen oxide and nitrogen dioxide (NO_x), as well as the sum of all products of incomplete combustion, PIC (all gases except CO_2). Average values per flame curtain kiln type and per feedstock, and kiln literature values (traditional non-improved kilns, retort kilns with syngas circulation and combustion, TLUDs).

		n[a]	CO_2	CO	NMVOC	CH_4	TSP	PIC	NO
Per flame curtain kiln type									
All-Steel deep octagonal	this study	n = 3	5600 ± 700	38 ± 20	6 ± 2	57 ± 52	22 ± 28	123 ± 82	0.3 ± 0.1
Steel-shield Soil pit	this study	n = 3	2300 ± 800	23 ± 28	5 ± 5	14 ± 20	9 ± 7	51 ± 31	0.3 ± 0.2
Soil pit	this study	n = 3	3800 ± 1300	36 ± 40	8 ± 1	32 ± 44	20 ± 24	97 ± 108	0.8 ± 0.7
shallow steel pyramidal and octagonal	this study	n = 10	4700 ± 800	73 ± 31	5 ± 3	26 ± 75[b]	5 ± 4	108 ± 93	0.32 ± 0.12
Per feedstock type									
100% Eupatorium	this study	n = 9	4600 ± 2100	74 ± 34	6 ± 3	60 ± 90[b]	11 ± 16	151 ± 109	0.4 ± 0.2
80% Eup, 20% wood	this study	n = 3	3400 ± 2300	23 ± 26	5 ± 3	28 ± 34	23 ± 27	79 ± 89	0.1 ± 0.2
50% Eup, 50% wood	this study	n = 3	3900 ± 2000	13 ± 4	9 ± 1	13 ± 21[c]	9 ± 7	43 ± 25	0.7 ± 0.6
50% Eup, 50% Rice husk	this study	n = 2	3810 ± 50	47 ± 16	3.0 ± 0.2	0	3 ± 2	52 ± 19	0.260 ± 0.002
Kiln literature									
Traditional kiln	Ref. [10, 12][d]	n = 8[e]	2375	351	53	49	19	472	2.2
Retort kiln	Ref. [10, 12][d]	n = 5[e]	2602	148	7	35	11	202	1.7
TLUD	Ref. [20]	n = 5[e]	n.r.	94	274	40	7	415	0.0
High-tech large-scale reactor	Ref. [44]		3010	$3 \cdot 10^{-7}$	0	0	0.05	0.05	0.7

[a] n is number of datasets (time series during one kiln run). Each dataset consists of 10–15 measurements. Thus, the total number of measurements is 20 to 150.

[b] large std since value is dominated by one large value of 238 g/kg char.

[c] large std since value is dominated by one large value of 37 g/kg char.

[d] average of two literature datasets where each data set was given equal weight.

[e] one dataset per kiln type.

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Methane compensation

At an average 30 kg CH_4 / t biochar and a GWP20 of 86 t CO_2, the production of 1 t biochar causes 2.6 t CO_2eq.

The 30 kg CH_4 (2.6 t CO_2eq) will be decayed after 20 years.

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To compensate the CH_4-emissions of the biochar production:

By tree plantation

2.6 t CO_2 needs to be extracted from the atmosphere for 20 years. This corresponds to

- the plantation of 7 Michelia trees (20 y average of 380 kg CO_2/y) or
- the plantation of 30 Cinnamon (20 y average of 88 kg CO_2/y)

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The 30 kg CH_4 (2.6 t CO_2eq) will be decomposed after 20 years.

To compensate the CH_4-emissions of the biochar production:

By cessation of crop waste burning or uncontrolled decomposition

*The cessation of open field burning of crop waste can be accounted for as CH_4-compensation for 10 years (**time horizon**).*
After these 10 years, the new method of producing and using biochar will be considered the new standard and, therefore, no emission avoidance from crop waste burning can be account for anymore.

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PHOTOGRAPHY
http://www.norbertwoehnl.com

Rice straw and leaf pyrolysis in Bangladesh

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Mixing biochar-based liquid fertilizers (Ghana)

Root zone application mixed with fertilizer

Furrow application

Root zone injection

Canopy circumference application

Training of the Artisan

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“It is not the Kon-Tiki technology as such that can be certified but only the combination of the technology and the executing artisan – the artisan biochar producer”

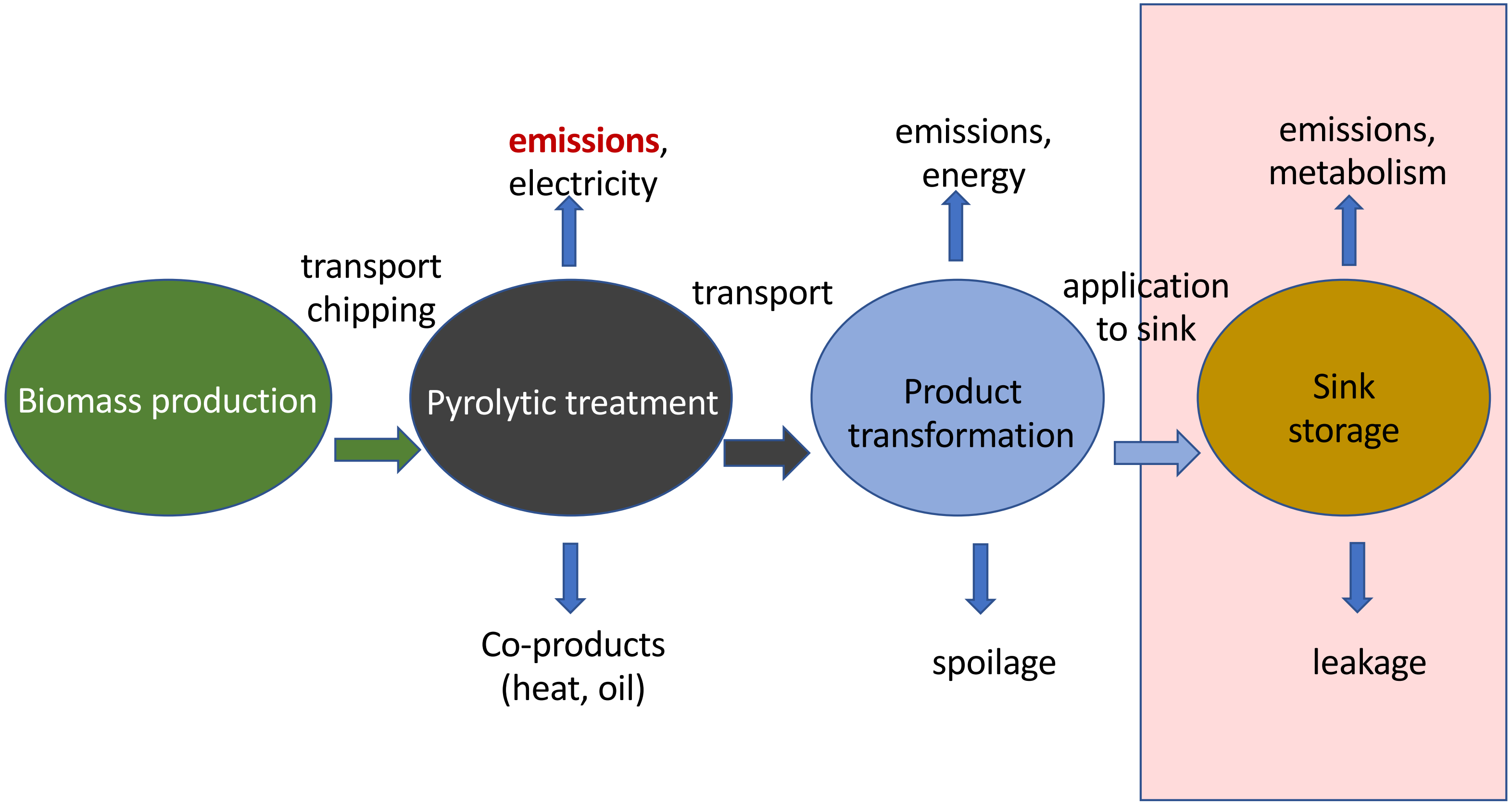
Training must cover:

- Principles of feedstock selection
- Biomass drying
- Kon-Tiki operation
- Volume measurements
- Use of the Artisan App (Participatory MRV)
- Post-pyrolytic treatment
- Agronomic use of biochar

Training must be completed by a successful examen

Picture: M. Bier, Solidaridad

PyCCS - parameters



Admissible biochar pathways to sink

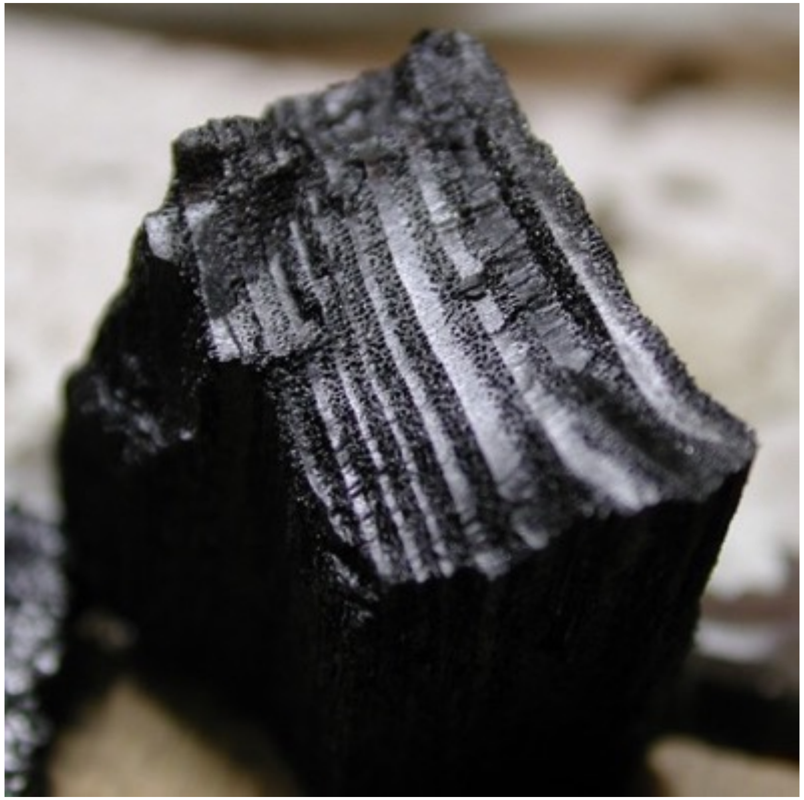
a. Direct soil application
b. Compost
c. Liquid manure treatment
d. Bedding for cows, sheep, goats, pigs (no chicken, no horses if manure is not used as soil amendment)
e. Feeding cows, sheep, goats, pigs (no chicken, no horses if manure is not used as soil amendment)
f. Sillage additive
g. Additive for anaerobic digestion (if digestate is not pyrolysed)
h. Organic biochar based fertilizer

Agriculture

i. Road construction
j. Building construction

Materials

Persistence of biochar



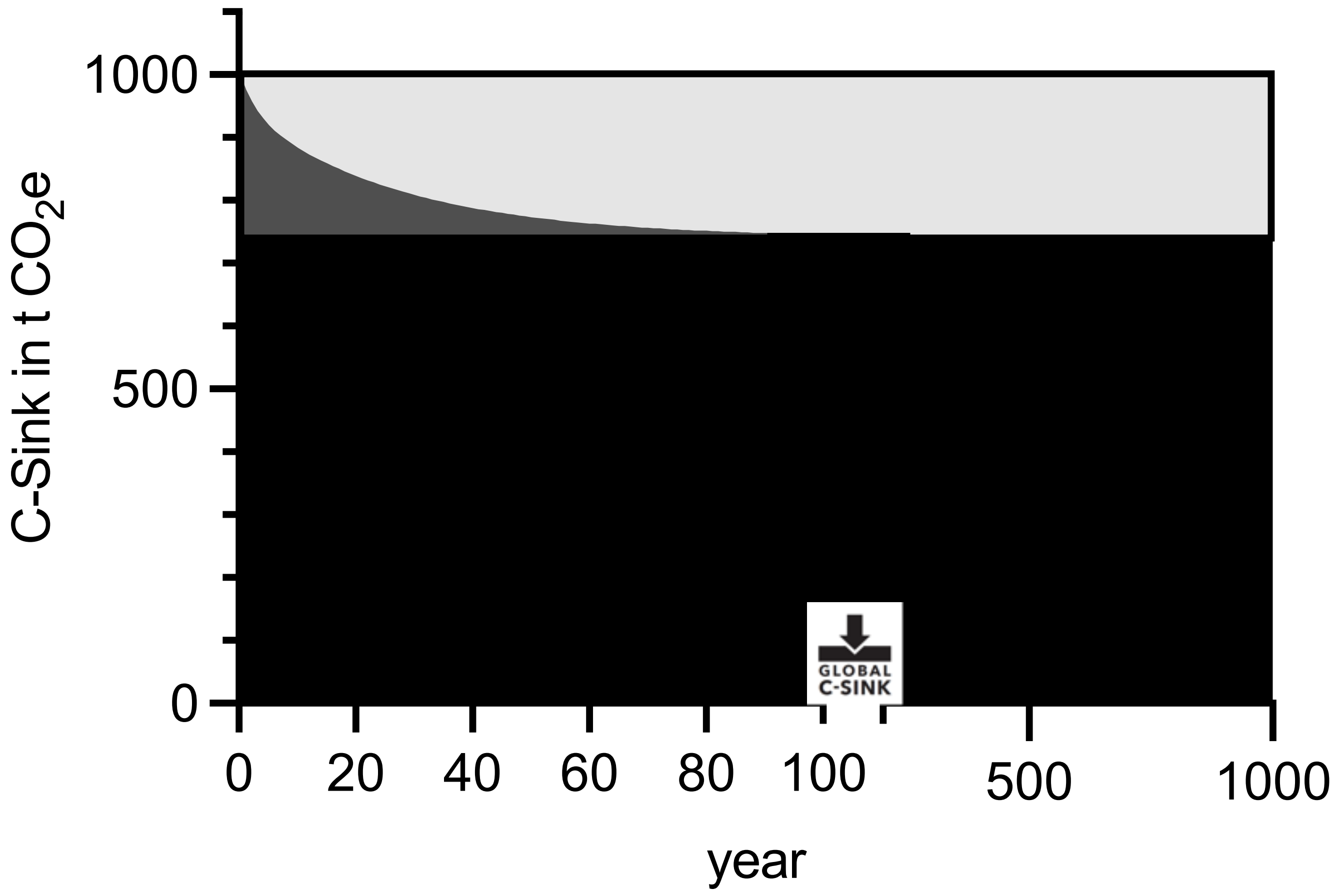
Biochar is composed of about 75% persistent Carbon with an average residence time in soil of over 1000 years.

The more unstable pool largely degrades in the soil within the first 100 years.

75% of the C in biochar can be considered a long-term C sink.

More exact analytical methods are currently developped which will lead to higher persistent pools depending on biochar quality.

Biochar persistence



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EBC-quality of Kon-Tiki biochar

Bridge Technology

eurofins | Umwelt

Prüfberichtsnummer: AR-21-FR-034269-0

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Parameter	Lab.	Akkr.	Methode	EBC-Feed Klasse I	EBC-AgroBio Klasse II	EBC-Agro Klasse III	EBC-Material Klasse IV	BG	Einheit	anl	wf	anl	wf
								Probenbezeichnung		**biochar, cocoa pods+branches, sample indonesia**		**biochar, cocoa pods, sample indonesia**	
				Vergleichswerte				**Probennummer**		**121113385**		**121113386**	
Eigenschaften der Pflanzenkohle													
Schüttdichte < 3 mm	FR		in Anlehnung an VDLUFA-Methode A 13.2.1						kg/m³	-	157	-	160
spezifische Oberfläche (BET)	SND2/f		DIN ISO 9277: 2010						m²/g	-	195.02	-	201.07
Wasserhaltekapazität (WHC)	FR		DIN EN ISO 14238, A: 2014-03						%	-	254.1	-	248.5
Gesamtwassergehalt	FR	RE000 FY	DIN 51718: 2002-06					0.1	Ma.-%	25.5	-	28.2	-
Aschegehalt (550°C)	FR	RE000 FY	DIN 51719: 1997-07					0.1	Ma.-%	16.4	22.1	15.5	21.6
Kohlenstoff	FR	RE000 FY	DIN 51732: 2014-07					0.2	Ma.-%	51.4	68.9	50.8	70.7
Kohlenstoff, organisch	FR	RE000 FY	berechnet						Ma.-%	50.3	67.4	49.6	69.0
Wasserstoff	FR	RE000 FY	DIN 51732: 2014-07					0.1	Ma.-%	1.1	1.5	0.9	1.2
Stickstoff, gesamt	FR	RE000 FY	DIN 51732: 2014-07					0.5	g/kg	7.1	9.6	8.4	11.7
Schwefel, gesamt	FR	RE000 FY	DIN 51724-3: 2012-07					0.03	Ma.-%	0.16	0.22	0.21	0.29
Sauerstoff	FR	RE000 FY	DIN 51733: 2016-04						Ma.-%	7.6	10.2	6.5	9.1
TIC	FR	RE000 FY	DIN 51726: 2004-06					0.1	Ma.-%	1.1	1.5	1.2	1.7
Carbonate-CO2	FR	RE000 FY	DIN 51726: 2004-06					0.4	Ma.-%	4.2	5.6	4.6	6.4
H/C Verhältnis (molar)	FR	RE000 FY	berechnet							0.26	0.26	0.20	0.20
H/Corg Verhältnis (molar)	FR	RE000 FY	berechnet	< 0.7	< 0.7	< 0.7	< 0.7			0.27	0.27	0.21	0.21
O/C Verhältnis (molar)	FR	RE000 FY	berechnet	< 0.4	< 0.4	< 0.4	< 0.4			0.111	0.111	0.096	0.097

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This biochar could be certified as a carbon sink if:

1. The biomass was procured sustainably.
2. Was dried or aerated to avoid emissions during storage.
3. The pyrolysis was done with care to prevent non-CO_2-greenhouse gas emissions.
4. The biochar was applied to the soil and not burnt or sold as charcoal.

Main parameters for Artisan C-sink certification

- Eligible pyrolysis technology
- Sustainable biochar feedstock
- Training of the biochar artisan
- Smartphone based monitoring
- Methane compensation
- Measuring of production and analysis of quality
- C-Sink calculation
- Transparent benefit sharing
- Accreditation and control of C-sink managers

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Carbon Sink & Climate Balance per tropical hectare

- An average 4 t (dry matter) of residual biomass per ha can be harvested
- Methane emission from uncontrolled decomposition avoided
- Production of at least 1 t biochar (DM) per ha
- C-sink potential of 70% of biochar weight = 700 kg C
- Minimum expected C-sink per farm: 2 t CO2eq
- Farmer income at 75 Eur / t CO2eq = 150 Eur per farm as C-sink benefit

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Contact

Imprint

Data protection

European Biochar Certificat (EBC)

Developed by the Ithaka Institute

Ensured by Carbon Standard International

CARBON STANDARDS international

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