



# Biochar Carbon Removal

How converting organic waste into stable charcoal permanently removes CO<sub>2</sub> from the atmosphere — and what makes it different from other carbon removal pathways

PROJECT TYPE GUIDE | Puro.earth / Verra VM0044 / EBC | SDG 13, 15, 2, 9

<b>Standard</b>	Puro.earth / Verra VM0044 / EBC
<b>SDG alignment</b>	SDG 13, 15, 2, 9
<b>Typical credit yield</b>	2.0 – 3.0 tCO <sub>2</sub> e per tonne of biochar produced
<b>Project life</b>	100 – 1,000+ years (high stability)
<b>Indicative price</b>	GBP 70 – 100 per tCO <sub>2</sub> e (Puro.earth, 2024)

## What is Biochar?

Biochar is a stable, carbon-rich material produced by heating organic matter (biomass) in a low-oxygen environment — a process called pyrolysis. Unlike burning, which releases carbon as CO<sub>2</sub>, pyrolysis converts the carbon in biomass into a highly stable aromatic structure that resists decomposition in soil for hundreds to thousands of years.

Plants absorb CO<sub>2</sub> from the atmosphere through photosynthesis. Normally, when organic matter decomposes or burns, that carbon returns to the atmosphere within years to decades. Biochar intercepts this cycle — the carbon that would have been released stays locked in the ground, constituting a genuine carbon dioxide removal (CDR) rather than merely an emission reduction or offset.

- Produces a genuine, durable carbon dioxide removal — not just an offset
- Can use waste biomass feedstocks (agricultural residues, wood waste)
- Improves soil fertility, water retention and agricultural productivity
- Commands premium prices due to high permanence and durability
- Verified under Puro.earth, Verra VM0044 and European Biochar Certificate (EBC)

## The Carbon Calculation Chain

Understanding how biochar generates carbon credits requires following the full calculation chain from raw biomass input through to verified net CO<sub>2</sub>e. Each step involves measurable parameters with defined uncertainty ranges.

Step	Formula	Typical Value (woody biomass)
Dry biomass	Wet input x (1 - moisture)	850 kg per tonne wet input
Biochar produced	Dry biomass x yield %	230 - 300 kg (27 - 35%)
Carbon in biochar	Biochar x carbon content %	160 - 240 kg (65 - 80%)
Gross CO <sub>2</sub> e	Carbon kg x 3.667	0.59 - 0.88 tCO <sub>2</sub> e
Less process emissions	Gross x process %	-0.09 to -0.18 tCO <sub>2</sub> e
Less permanence discount	Net x permanence %	-0.05 to -0.15 tCO <sub>2</sub> e
Net verified CO <sub>2</sub> e	Final result	0.45 - 0.70 tCO <sub>2</sub> e per tonne wet biomass

Use the [Biochar Calculator](#) at [thecarbonworkbench.com](#) to model specific feedstocks and pyrolysis conditions.

## Feedstocks and Pyrolysis

### Suitable Feedstocks

- Woody biomass (forestry residues, wood chips, sawdust) — highest carbon content, most stable biochar
- Agricultural residues (straw, husks, bagasse) — widely available, lower carbon content
- Manure and sewage sludge — lower yield and stability but avoids methane emissions from decomposition
- Hard shells (coconut, nut shells) — very high carbon content, premium biochar

### Pyrolysis Temperature and Stability

Higher pyrolysis temperatures (above 600 degrees C) produce more stable, carbon-rich biochar with lower H:C molar ratios, but at the cost of lower yield. The H:C molar ratio is the primary indicator of biochar permanence accepted by carbon standards — a ratio below 0.4 indicates very high stability; below 0.7 is the minimum required by most standards.

Temperature Range	Biochar Yield	Carbon Content	H:C Ratio	Permanence
350 - 450 C	35 - 45%	55 - 65%	0.5 - 0.7	Moderate
450 - 550 C	27 - 35%	65 - 75%	0.35 - 0.5	High
550 - 700 C	20 - 28%	75 - 85%	0.2 - 0.35	Very High
Above 700 C	15 - 22%	80 - 90%	Below 0.2	Exceptional

## Carbon Standards and Verification

### Puro.earth

Puro.earth is the leading marketplace for engineered carbon removal including biochar. Their methodology requires H:C molar ratio below 0.7, documented feedstock sourcing, and third-party verification of production records. Credits typically issued at 2.5 - 3.0 tCO<sub>2</sub>e per tonne of biochar.

### Verra VM0044

Verras VM0044 methodology for biochar was published in 2023 and is aligned with the broader Verra VCS framework. It applies permanence discounting based on biochar stability class and requires comprehensive monitoring of production, feedstock and application.

### European Biochar Certificate (EBC)

The EBC provides quality certification for biochar rather than carbon credits per se, but EBC-certified biochar is increasingly required by carbon credit buyers as evidence of quality and traceability.

## Why Biochar Commands Premium Prices

Biochar credits typically trade at GBP 70 - 100 per tonne — five to ten times the price of nature-based offsets — for several reasons:

- **Permanence:** 100 - 1,000+ year carbon storage compared to decades for nature-based projects
- **Measurability:** Carbon content can be directly measured and verified, reducing uncertainty
- **Additionality:** Without the project, the biomass would decompose and release its carbon — the removal is clearly additional
- **Co-benefits:** Biochar improves soil fertility, reducing the need for synthetic fertilisers
- **Growing demand:** Corporate net zero commitments increasingly require high-quality CDR rather than avoidance credits

**Use The Carbon Workbench to model this project type**  
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