

# Biochar Industry Overview

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## A. What is Biochar

Biochar is a charcoal-like substance that's made by burning organic material from agricultural and forestry wastes (also called biomass) in a controlled process called pyrolysis.

Biochar is by far more efficient at converting carbon into a stable form and is cleaner than other forms of charcoal.

Biochar's chemical composition varies depending on the feedstocks used to make it and methods used to heat it.

## B. Different Biochar sources and Nutrient characteristics

Initial Plant Source Used to Create Biochar	Macronutrient Source*
Biosolids and green waste	P*
Corn straw and rice straw	P and K
Gasified rice hulls	P and K
Hardwood	K
Pelleted agricultural or forestry residues	P and K
Switchgrass	P and K
Timber harvest residues	P and Mg

\*The abbreviations stand for magnesium (Mg), phosphorus (P) and potassium (K).

## C. Bio Char Production conditions influence its properties

**Table 2. Fast and slow biochar production processes and resulting biochar characteristics.**

Heating Process	Temperature	Exposure Time	Biochar Particles Size	Physical Properties (Surface Area and CEC)	pH
Fast	High (> 650 C/1,200 F)	Short (seconds)	Fine and porous	Greater	Higher
Slow	Low (450-650 C/ 850-1,200 F)	Long (minutes or hours)	Large	Smaller	Lower

## D. Benefits of Biochar

Primarily used to modify soil physical and chemical properties

- Increasing cation exchange capacity (CEC).
- Increasing surface area.
- Increasing pH.
- Increasing plant nutrient availability.

- Enhancing water-holding capacity.

#### E. Effects of Bio Char on Plant growth and crop yield

- A four-season field trial in Philippines and Thailand (tropical climate) using rice-husk biochar on dry, poor, non-acidic soil, improved yields ranging from 16–35% due to the enhanced water retention and increased availability of K and P (Haefele et al., 2011).
- A field study in Ghana found significant increase in the maize yield along with improved soil pH, SOC and the available N, P and K on application of Sorghum and rice-husk biochar (2 t ha<sup>-1</sup>) (Calys-Tagoe et al., 2019). Similarly, upto 30% increase in crop yield was observed on durum wheat in the Mediterranean region with application of coppiced woodlands biochar at 30 and 60 t ha<sup>-1</sup> (Vaccari et al., 2011)

#### F. Technology Insights

- Pyrolysis segment dominated the market for biochar in the U.S. and accounted for a share of 83.0% in 2020. This high share is attributable to the manufacturing of biochar by using pyrolysis owing to its high-quality product and large production quantity. The convenience factor and easy availability of equipment play a major role in the adoption of the pyrolysis method for manufacturing biochar. In addition, small manufacturing facilities majorly prefer pyrolysis technology for biochar production as the setup is less costly with low complexity compared to its counterparts.
- The gasification segment is expected to witness a CAGR of 16.9% in terms of revenue over the forecast period. This high share is attributed to the technological superiority of this process. Gasification is similar to pyrolysis, wherein the biomass is heated in the presence of limited oxygen, which helps break down the woody biomass yielding synthetic gas in the process. This technology has witnessed a rise in demand on account of the growing need for electricity in distributed energy system

#### G. Bio Char Certification

##### 1. [European Biochar Certificate \(EBC\)](#)

In 2019 the EBC developed the first methodology and standard to specifically certify biochar as a carbon sink. The EBC C-sink is currently the most rigorous standard available for carbon sinks based on the carbon-preserving applications of biochar. The EBC provides a platform for verifying and certifying that C-sink credits are real, measurable, unique, and independently verified according to the guidelines defined in the EBC C-sink standard

##### 2. [International Biochar Initiative:Verfies products in Canada.](#)

The IBI Biochar Certification Program is a voluntary scheme administered by the International Biochar Initiative (IBI) to provide certification of biochar products. The purpose of the program is to provide to biochar manufacturers the opportunity to demonstrate that their biochar(s) meet the minimum criteria established in the most recent version of the IBI Standardized Product Definition and Product Testing Guidelines for Biochar That Is Used in Soil (also referred to as the IBI Biochar Standards). These Standards, which include stipulations of maximum concentrations for potentially toxic elements and compounds, serve as the foundation of the IBI Biochar Certification Program. IBI will allow biochar that successfully passes the testing and

other criteria in the IBI Biochar Standards and meets all other certification program requirements, to carry the IBI Certified™ biochar seal.

#### H. Biochar certification bodies.

For Puro. Earth has its own independent verification bodies.

- [Bio Inspecta](#)
- [DNV.GL](#)
- [Energy Link Services](#)

#### I. Carbon Sink Calculation

Example of Carbon capture potential

CO <sub>2</sub> mass to C mass ratio, i.e. amount of CO <sub>2</sub> produced from burning 1 tn of Carbon	3.66
Carbon content of HUSK Biochar	48%
CO <sub>2</sub> eq-content per t of biochar (dry matter) [gross C-sink] (3.66 x 48%)	1.76 t CO <sub>2</sub> eq
Total GHG emissions per t biochar (dry matter)	0.01 t <sub>n</sub>
C-sink potential in tCO <sub>2</sub> eq per t of biochar (dry matter) [net C-sink]	1.75 t CO <sub>2</sub> eq

#### J. Biochar Pricing

The potential income for biochar companies to market their capacity to sequester carbon by selling Carbon Removal Credits has seen a sharp increase since early 2019. When the first Puro platform auction was carried out in late 2019 and the average price was c. 25€. Puro in 2021 is now selling credits at 100€ to 150€ and other platforms are trading around 100€. The assumption is that the price will change over time depending on supply and demand for credits

\*\*CORC: Carbon Removal certificate: Certifying that 1 metric ton of CO<sub>2</sub> has been removed from the atmosphere.

### 10. Research Articles.

1. Review of Large-Scale Biochar Field-Trials for Soil Amendment and the Observed Influences on Crop Yield Variations