



Answers to Many of Your Biochar Questions

1. What is biochar?

Biochar is made of carbon. Biochar has a cellular-like structure that has enormous internal surface area. Biochar is manufactured from selected clean biomass (such as forest industry waste material) utilizing a carefully controlled high temperature, oxygen exclusion process called pyrolysis. The granular product, biochar, has specific properties that optimize composition, screen size and physical structure for use as an amendment to enhance sustainable soil fertility and other applications. It is a remarkably effective soil amendment to help your plants, garden and crops grow!

To learn more about biochar, please visit www.airterra.ca/about-biochar.

2. What is the difference between biochar and common charcoal?

Common charcoal is manufactured from a variety of biomass materials and process conditions. It is primarily used as a fuel. Common charcoal likely contains binders or other substances that could affect beneficial soil microorganisms and be unsuitable for growing plants for human consumption.

3. What are the benefits of using biochar to amend soils?

Among the many benefits, these are the most significant:

- Biochar surfaces are highly porous and retain moisture and nutrients, making it an attractive habitat for beneficial microorganisms to thrive in a close, and often symbiotic relationship with plant roots.
- Biochar porosity yields a large surface area to which nutrients can adhere and become ionized. When ionized, nutrients are more bio-available for uptake by plant roots and microorganisms.
- Biochar particles can be manufactured with consistent sizing for a particular soil application. Biochar amended soils have an increased pliability that enables roots and microorganisms to grow and move through the soil more easily.
- Biochar particles create air channels in the soil which improves oxygen penetration and provides aerobic conditions for beneficial bacteria and healthy plant roots.
- Biochar stores carbon in the soil in a resilient, stable form that remains intact for decades and centuries. As such, it provides a method of removing CO₂ from the atmosphere—one of very few natural methods of accomplishing this.

4. How should I apply biochar?

Biochar has many physical benefits for soils, but it does not contain nutrients when it is freshly produced. Biochar's carbon structure will help retain nutrients already found in soil if added without further treatment. However, "conditioning" the biochar with nutrients before it is amended into the soil makes biochar a great carrier and reservoir of nutrients for plants and microorganisms.



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Combining food waste/garden remnants with biochar when composting is a very effective method for the home gardener. The biochar captures the nutrients in the composting process and will present them for plant use when the co-composted material is added to the soil or spread over the garden surface. Biochar works well with any composted materials. The use and application of biochar is very applicable from small to larger commercial operations.

To learn how best to use biochar, please visit our website at www.airterra.ca/soilmatrix.

5. What is biochar made from?

Biochar can be made from many different types of biomass, such as

- wood residues
- compost waste
- agricultural residues, and
- forest wastes.

AirTerra's biochar is made *exclusively* from selected residual forest industry wood, under strict quality control parameters to comply with the Canadian Food Inspection Agency (CFIA) Fertilizer Division requirements. AirTerra's biochar is processed into a granulated material, about the size and shape of rice grains, to make it easier and more beneficial to blend into soils.

6. How is biochar made?

While similar to common charcoal, biochar is derived from selected materials under specific conditions that result in a carbon-rich material that is beneficial for soils. Biochar is made by heating organic matter (biomass) in an oxygen deprived environment such that combustion does not occur. This process is known as "pyrolysis." During pyrolysis, heat in the absence of oxygen, drives off gases from the biomass, leaving behind a porous material that is rich in carbon and highly resistant to decay.

7. Does making biochar require use of fossil fuels?

A small amount of natural gas or liquid fuel is often used for the initial heating process to begin but after that, the pyrolysis process is self-sufficient as the associated pyrolysis gas production can be used as fuel to sustain the process.

8. How does the biochar process supply alternative energy?

Once the biochar-making process has been initiated, it generates a high-energy content gas (synthetic gas, or wood gas) that can be used as fuel for the process itself, to heat buildings, or to run electrical generators. Therefore, the biochar-making process is a potential source of alternative energy to offset the burning of fossil carbons. The produced gases are also rich in organic compounds that can be condensed and used for other purposes such as fuels and associated wood vinegars that are useful as soil amendments.

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9. How was biochar re-discovered?

Biochar was recently “re-discovered” through studies of ancient civilizations that lived in the Amazon rain forests of Brazil. Soil scientists were amazed by the fertile soils that occur in some regions of South America. In these locations the existence of very dark nutrient-rich soils contrasted with the lighter less rich surrounding soils. It turns out that the people of these ancient civilizations amended the darker fertile soils with biochar generated from their cookstoves.

Although there are no written and oral accounts, we believe that Amazonians discovered and produced biochar through observing plants growing better where wood charcoal was left on the ground . We expect that:

- Amazonians cooked food with very inefficient wood stoves that left charcoal behind after the cooking sessions. They then spread this charcoal onto compost piles before using this material as a fertilizer for their crops, or
- Amazonians realized the benefits of adding large quantities of carbon to their soil and intentionally built earthen kilns in the form of mounds to produce what we now call biochar. They harvested trees from the forest to produce this biochar and increased the productivity of their poorer soils for planting maize. Biochar then formed what we know as Terra Preta soils.

10. What is Terra Preta?

The Amazonian dark soils of South America are locally referred to as “Terra Preta” or dark earth, when translated directly from Portuguese. These soils have been fertile for an exceptionally long time—between 2000 to 8000 years.

More information about Terra Preta soils is available here:

https://en.wikipedia.org/wiki/Terra_preta

11. Are there any concerns about the use of biochar?

Some people think that the widespread use of biochar will result in over consumption of our forest reserves. Biochar is typically made from forest industry residuals in an “environmentally sustainable” manner after the lumber and other related products have been produced. Fully utilizing the “residuals” means that nothing is wasted.

The future for biochar production is bright because of its net carbon sequestration potential. The sustainability of Canada’s forest industry depends on its continued commitment to the environment, and regulations which require reforestation. The full utilization of the forestry residuals enhances the commitment to the environment and ensuring the future of the forest industry for generations to come.



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A misconception is that biochar could carry pathogens into our agricultural soils. Because forestry residuals do not have animal pathogens, and any pathogens that could possibly be in the woody feedstock would be completely destroyed in the high temperature pyrolytic process to produce biochar. However, biochar could become contaminated with a pathogen after its production if it mixed with infected materials. AirTerra sells only pristine, freshly produced biochar and we ensure any subsequently blended materials are strictly controlled to ensure there are no pathogens in the final product.

12. What is the “State of the Art” of biochar today?

A great deal of research is underway to learn more about how biochar benefits soils for plant growth, health, and nutrition. There are many aspects to this research including:

- Social elements
- Economics
- Engineering (production processes)
- Soil science and agronomics
- Land use and land use change management
- Climate change mitigation by storage of carbon in soils

Research is ongoing and soil-related research is focusing on biochar applications as a method of “carrying” beneficial microorganisms (such as nitrogen fixing bacteria) to the soil. Recent understanding of how biochar benefits plants points to using biochar as a co-composting ingredient. Co-composting generates plant-available nutrients that coat the surfaces of the biochar. Given biochar’s adsorptive ability, agronomists are also finding ways to “charge” the biochar to carry nutrients to the soil in a way that slowly releases them for plant use.

13. How does biochar benefit the environment?

Biochar carbon is very long-lived in soils; as such, it is an excellent way to withdraw CO₂ from the atmosphere. AirTerra’s biochar production process captures and sequesters carbon that is stored in plant tissues during photosynthesis and would otherwise return to the environment via natural carbon cycling. Through thermal conversion (pyrolysis), carbon in plant tissue is converted to biochar. This process results in about half of the carbon that the trees capture from the atmosphere being sequestered when applied to soils while the other half of the stored plant carbon is released back to the atmosphere.

To learn more about how biochar helps address sustainability and climate change concerns, please visit the International Biochar Initiative website at <https://biochar-international.org/sustainability-climate-change/>



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14. Does the use of biochar as a “carbon sink” qualify for carbon credits and offsets?

The United Nations Framework for Climate Change Convention (UNFCCC) now recognizes biochar soil amendments as a method of offsetting carbon emissions to the atmosphere. As such, it qualifies for carbon offset protocols when its use is formally monitored and managed.

You can learn more about the United Nations Climate Change initiatives at <https://unfccc.int>.

A growing number of jurisdictions are developing formal “carbon offset protocols” to enable using biochar amendments as a registered, monitored, and monetized carbon offset.

15. Is biochar a “fad”?

No. Biochar is a scientifically proven soil amendment that enhances the soil structure, adds carbon to the soil, promotes healthy microorganisms, and is safe for all soils.

To learn more about biochar applications, please visit our website at www.airterra.ca/the-soilmatrix-library.

16. Can biochar be used as a livestock feed additive?

Biochar is being carefully studied as an alternative for activated carbon used as a feed additive to ruminant animals such as cows and calves and research trials are underway to establish its many health benefits.

Thanks for asking us!!!

Have more questions? Please submit a request form on our website at: www.airterra.ca/contact

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Don Harfield, on behalf of
AirTerra Inc.