

Biochar

- Carbon sequestrant
- Soil additive
- Advanced carbon feedstock

ILLINOIS SUSTAINABLE TECHNOLOGY CENTER
PRAIRIE RESEARCH INSTITUTE



What is Biochar?

Biochar is a charcoal material byproduct produced from the thermochemical conversion of biomass in a limited oxygen environment. This process, called pyrolysis, also creates syngas and bio-oils, which are used to generate energy.



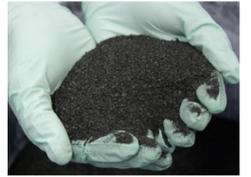
Biomass



Pyrolysis



Bio-oil



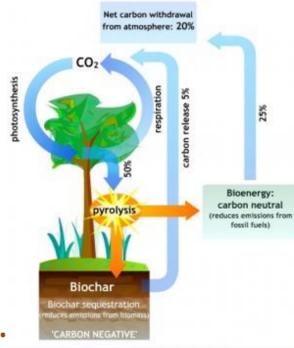
Biochar

Syngas
H₂, CO, CO₂

Why research Biochar?

Does it help reduce greenhouse gas emissions?

Scientists have predicted that biochar can sequester CO₂ for long periods and also reduce N₂O and CH₄ emissions.



What properties make it a good soil additive?

Pros

- Could help retain soil moisture
- Could retain soil nutrients
- May increase soil microbial habitat

Cons

- May concentrate heavy metals from feedstocks
- Pyrolysis process may enrich polycyclic aromatic hydrocarbons (PAHs)
- Could reduce soil microbial diversity
- Could make some soils too alkaline

Can it be used as an advanced carbon feedstock?

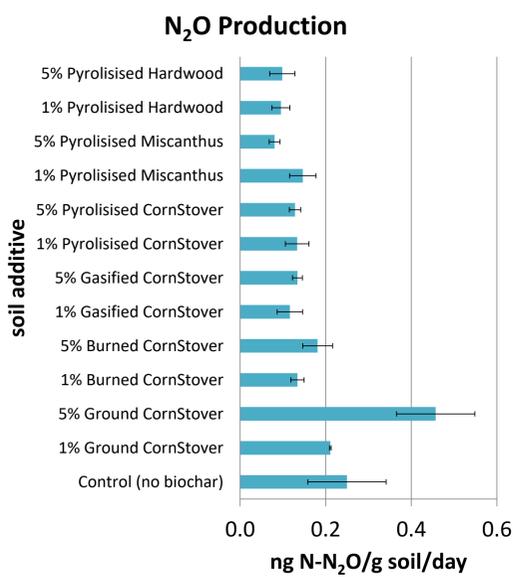
Yes, it has potential use as:

- Supercapacitors
- Water filtration systems

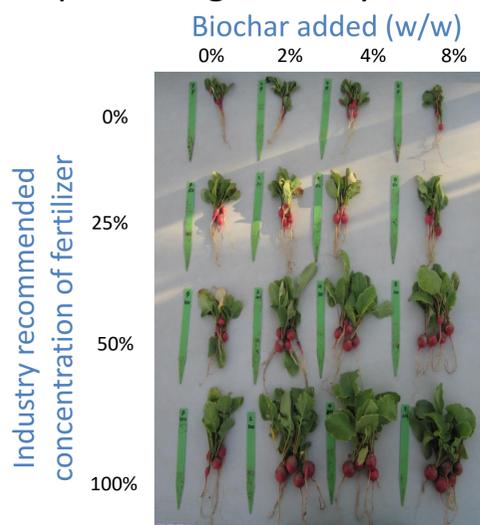


ISTC Biochar Highlights

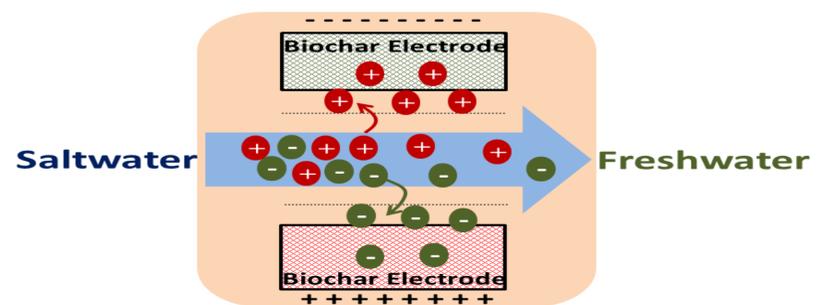
Biochar reduced N₂O emissions in Illinois agricultural soils.



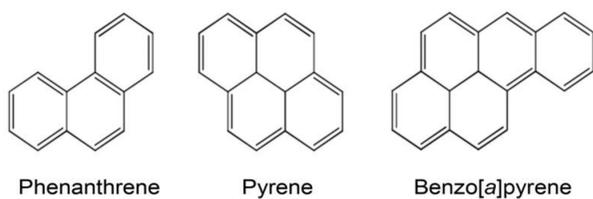
Biochar reduced the need for fertilizer by 50% while producing similar yields.



Biochar can be used to make supercapacitors to store energy. Biochar supercapacitors could also be used in supercapacitor-based capacitive deionization which is a promising treatment technology for seawater desalination and the clean-up of oil- and gas-produced water, industrial water, and brackish water.



The concentration of PAHs decreased with increased pyrolysis temperature. Different feedstocks contribute to different levels of PAHs in biochar. PAHs are known carcinogens.



Chemical structure of three PAHs

PAHs at Different Pyrolysis Temperature

