

Botanic Gardens - Biochar Production Using State of the Art Pyrolysis Technology

The disposal of waste biomass can be a large problem for land owners and botanic gardens across the world. At Earth Systems, we have designed, manufactured and patented a large scale slow pyrolysis unit called the CharMaker Mobile Pyrolysis Plant (MPP). Our technology offers an exciting opportunity to sustainably turn waste biomass into a number of useful horticultural products including biochar.



At Earth Systems we have developed an innovative and patented technology that produces large quantities of biochar from a range of waste biomass feedstocks. Our pyrolysis unit, the CharMaker MPP, converts the waste biomass into a useful soil enhancer called biochar. Biochar is a charcoal-like substance and can be utilised in a number of applications including agriculture, horticulture, ecological restoration and natural resource management.

Biochar is an exciting soil amendment which has recently received a lot of scientific attention due to its ability to enhance plant growth and agricultural productivity whilst sequestering carbon in the soil. Biochar is produced by a process known as slow pyrolysis where the biomass is heated slowly to temperatures of approximately 500 °C in the absence of oxygen. Slow pyrolysis represents a tried and tested way for waste biomass to be converted into a valuable soil amendment.

The CharMaker can be easily loaded with a range of waste biomass feedstocks that do not need to be chipped and can be pyrolysed with very little pre-processing. The process is fully automated and takes on average 5–6 hours (depending on moisture content) to complete a batch. The CharMaker can also be connected to the internet and monitored or controlled remotely if required.

CHARMAKER MPP: ADVANTAGES

- Mobile, easily transportable pyrolysis technology; or can be installed as a fixed installation
- Can produce large amounts of biochar per run
- Smoke minimised technology
- Removes waste biomass and converts it into valuable biochar
- Add ons available, such as bio-liquids recovery and kiln wood drier from waste heat utilisation
- Continuous monitoring and training provided by Earth Systems staff – on site and remotely from our international offices
- Easy to use and can be loaded/unloaded by conventional machinery (e.g. bobcat, tractor)
- Can be used with any woody biomass feedstocks
- No chipping of the biomass is required

A CharMaker has been successfully installed at the botanical gardens in Hong Kong. The unit is being used to process waste biomass from the garden's operations and create biochar, bio-liquids (including 'wood vinegar') and heat. The biochar is being used to enhance plant growth and aid in forest restoration efforts within the botanical garden. Earth Systems also installed a drying unit where the waste heat from the pyrolysis process is harvested to dry out wet biomass to prepare it for the pyrolysis process, and other kiln drying uses. Earth Systems staff travelled to Hong Kong to aid in installation and local staff training. We continue to provide remote assistance to the botanic garden as required.





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A recent fixed installation CharMaker, drier unit and Bio-liquids Recovery System at Kadoorie Farm & Botanic Garden in Hong Kong

We have also optimised our technology through a number of efficient add-ons to the CharMaker that enable further products to be derived by the waste biomass. Our bio-liquids extraction system can harvest sustainable fuels and a product known as 'wood vinegar' from the pyrolysis process. Wood vinegar (also known as pyroligneous acid) is used as an alternative to pesticides in many areas of the world and can also be used as a seed germination enhancer. We are also able to install heat extraction and drying units that utilise waste heat from the pyrolysis process for wood kiln drying.

A CharMaker is a beneficial addition for a botanic gardens, helping with the sustainable management of waste biomass and the production of a soil enhancer product, biochar. Biochar can be used in potting, bedding, composting and habitat restoration work. Through the application of biochar to the soil, carbon is removed from the atmosphere, helping you to reduce your carbon footprint and aiding in the development of a more sustainable economy.

BIOCHAR: ADVANTAGES

Carbon Sequestration

The production of biochar takes carbon that has been assimilated in organic matter by photosynthesis and transforms it into an inorganic stable form. This carbon has been shown to be stable in soils for thousands of years. Sustainable production of biochar provides a simple and effective way of utilising waste biomass, sequestering carbon and mitigating greenhouse gas emissions.

Soil Amendment

As a soil amendment, biochar can increase root growth and promotes beneficial soil microbes and mycorrhizae. The high surface area of biochar means that it can absorb and retain large amounts of water. Charge on the surface of the biochar binds nutrients, inhibiting leaching of nutrients from the soil and reducing input fertiliser requirements. Biochar also increases cation exchange capacity.

Waste biomass to Product

Waste biomass can be a large problem and expensive to dispose of. Pyrolysing the biomass not only results in environmentally friendly disposal methods, but also encourages re-use through the conversion of waste into a valuable product.

- ✓ *Improves soil fertility and soil health*
- ✓ *Encourages beneficial soil microbes*
- ✓ *Increases cation exchange capacity*
- ✓ *Increases soil pH*
- ✓ *Increases soil water and nutrient retention*
- ✓ *Increases inorganic and organic soil carbons*
- ✓ *Improves plant growth*

