

# Biocoal from Spent Mushroom Substrate

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Loritus

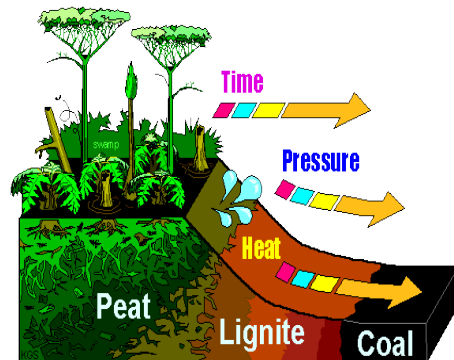
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Hydrothermal Carbonization (HTC) is the Earth's process to recover carbon and convert organic material into new plant life, nutrient rich soil, peat, and coal. HTC material recovery uses the same principles of heat and pressure in a water based environment to turn any organic matter, in any combination, into a carbon neutral biocoal, carbon sequestering biochar, or healthy engineered soil.

Because HTC processing is agnostic to organic composition and its moisture content, while also being an exothermic process, it is a very efficient recovery process for Spent Mushroom Substrate, along with many other unwanted or underutilised agricultural and food production material streams.

Hydrothermal Carbonization (HTC):

- Produces virtually no gases during processing
- Takes less than 12 hours to process 100% of the solid material
- Creates an energy self sufficient process
- Does not require any drying or dewatering (pre-processing)
- Does not require pre-process sorting
- Simple and safe operation
- Flexible output: energy or agriculture

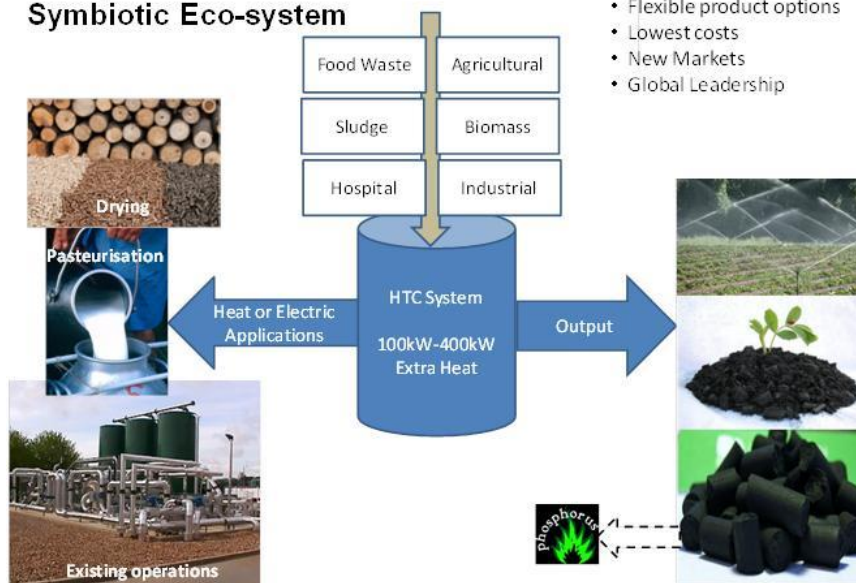


Loritus International Limited was one of the first companies in the world to patent processing designs in HTC. The broad acceptance of material means that robust and practical collection and disposal regimes can be enacted for businesses, while the flexible output offers users a local and best value proposition based on current market conditions. Moreover, because HTC process happens over the course of a couple of hours at more than 180°C all output is sterile, stable, and long term storable.

HTC services improve market and environmental impacts from:

- Energy consumption:
  - o Reduce dependence on wood chips, mined coal, and farmed peat
  - o Emission reductions through the use of a carbon neutral and on site biofuel
- Food processing
  - o Remove costs for organic waste disposal
  - o Minimise or remove thermal energy cost
  - o Offer new products for resale
  - o Stop dependence on land spreading and transportation
- Waste management:
  - o Organic Municipal Solid Waste is increasing globally and heavily subsidized
  - o Treatment benchmarks for emissions and productivity are more strict
  - o Current processes are emissions intensive and costly

## Multiple Offers in Ireland – Symbiotic Eco-system



### The Mushroom Industry:

Within the mushroom industry significant quantities of Spent Mushroom Substrate (SMS) are produced without break throughout the year. With land spreading becoming stricter and the industry becoming more globally competitive, there is pressure to more effectively manage disposal costs and recover better value from residual material. Specifically, historical attempts to make SMS into a biofuel have not been successful because the high moisture content demands heavy drying and pre-processing cost.

Loritus HTC is a difference maker, because the HTC conversion uses the moisture of SMS as the catalyst for the process, and makes a carbon dominant fuel readily obtainable within 6 to 12 hours that is stable, sterile and storable.

After testing Loritus HTC on multiple mushroom composts with the support of the government organised *Technology Centre for BioRefining and BioEnergy* ([www.tcbb.ie](http://www.tcbb.ie)), strong results were achieved. HTC was the first and only technology to effectively convert all mushroom residues into a usable carbon neutral biofuel, and could totally remove the demand for externally purchased thermal energy products. Furthermore, the water separated during the HTC process, has significant fertility benefits to support growing and land conditioning, but also can be polished to a clean liquid readily released back to nature.



### HTC waste recovery and recycling benefits:

- ✓ Completed in 6-12 hours with no residual waste
- ✓ Virtually no emissions from processing
- ✓ No pre-process preparation – no drying or complex sorting required
- ✓ 100% sterile and stable energy or agriculture products are produced
- ✓ Simple and safe operation with a very small footprint

Loritus creates a continuous HTC process that has an operational expense lower than other traditional solutions because the HTC reaction is exothermic and self sustainable with Loritus' patented designs.

Large scale plants are 1/10<sup>th</sup> the size of an equivalent biogas facility, and for example, to process 10,000 tonnes of material per year only an 8 to 16m<sup>3</sup> system is needed. This greatly reduces complexity of implementation and real estate costs on existing sites.

HTC processing time is adjusted to produce a very diverse line of stable 100% sterile end products – biocoal for energy and heating, or various forms of peat and biochar to improve land fertility rates and applications. The HTC reaction is a natural chemical process happening at over 200°C for many hours - all viruses and pathogens are destroyed permanently.

**HTC creates revenue:**

- ✓ Biocoal for heat and energy
- ✓ Peat based products
- ✓ Charcoal for products – ink, filters, etc.
- ✓ Biochar for land spreading
- ✓ An array of liquid fertilisers high in N,P,K

**The new HTC project:**

Loritus targets any mixture of organic waste larger than 8000 tons per year, and there is no upper limit to capacity because reactors are added in parallel to the same location, take up very little space, and offer a clean environmental footprint.

Loritus in cooperation with CMP and Golden Mushrooms has won a Horizon 2020 grant to build an HTC system on Golden Mushrooms farm, and integrate it into the daily operations of mushroom production. Through this project we expect Golden to become carbon neutral with zero residual waste from all mushroom growing, and improve profit margins by deleting SMS disposal combined with a total removal in demand for external thermal energy purchasing.

**The HTC service can be:**

- Purchased by public or private groups
- Built and operated on behalf of a client by Loritus

**Bespoke services for:**

- Food and Beverage - palm oil, citrus, etc.
- Meat, Poultry, and Dairy Industry
- Water treatment Facilities
- Forestry or Mining businesses
- Starch and Sugar industry
- Chemical and Paper Industry
- Pharmaceutical and Cosmetic Industry
- Fish and Fish Oil processing
- Waste recycling and recovery businesses