Instructions for Making and Using the Liberty Biofuel Products LLC Biochar Processor

By Ed Cahoj

Introduction:

Ed Cahoj measures the height of his switchgrass crop.

Growing up on a row crop and cattle farm in Northwest Kansas, I learned about soil at an early age. I remember seeing black carbon in the soil and asking my Dad: "When did a fire come through here?" Later I learned that the natural history of prairie fires had endowed our Midwestern soils with a high carbon content, making them some of the most productive soils in the world.

But increasingly, these amazing soils are losing their fertility. Synthetic nitrogen fertilizers and constant tillage are degrading the soils. Farmers are well aware of this problem but don't know what to do about it. Soil degradation is a global problem that threatens our food security. Farmers need techniques for soil restoration that are simple and affordable. I developed my Biochar Processor to provide myself and my neighbors with biochar so we can become more self-sufficient in our farming and less reliant on costly inputs that degrade our soils over time. I am offering the information here as an open source technology to farmers and gardeners who want to make their own biochar. If you decide to try some of these ideas yourself, please be careful and follow all relevant safety practices that apply to metal fabrication and combustion.

Happy Growing!

Ed Cahoj

If you have questions about this device and how to use it, you may contact Ed Cahoj (ecahoj@windstream.net) and he will do his best to try to help you.

Beans without biochar.

Beans with biochar.

Liberty Biofuel Products LLC Biochar Processor

The complete unit.

Description:

The Biochar Processor is a gasifier that works similarly to a Top-Lit Updraft gasifier, except that the configuration is horizontal. A flaming pyrolysis front moves through the feedstock material, heating it and gasifying it. The gas is combusted above the pyrolysis front, resulting in clean combustion with very little smoke. It is especially designed for processing switchgrass.

Components List:

- Vessel
- Lid
- Primary air inlet
- Primary air distribution plate
- Secondary air inlets
- Lighting/thermocouple port
- Concentrator plate
- Flue ring
- Chimney
- Base stand
- Stove gasket and adhesive for lid
- Clamps for securing lid

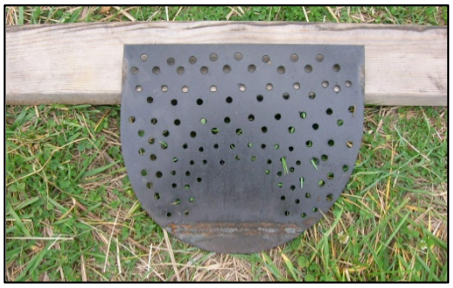
The vessel. The primary air inlet is visible at the far end. The primary air distribution plate has been removed. On the near end you can see the pair of secondary air intakes and the smaller lighting/thermocouple port.

Sheet Metal

The sheet metal used for the vessel and lid was ten gauge and twelve gauge. Ten gauge was used for the main part of the lid and the main part of the vessel. Twelve gauge was used for the ends, the air distribution plate, the ring the flue pipe goes on and the concentrator plate on the underside of the lid.

Vessel

The main part of the vessel, before the ends are welded on is six feet in length. This piece was rolled out of ten gauge mild steel. The interior width of the vessel is 12 ¼" and is 10 5/8" deep in the center. The total width of the vessel including the lip is 15 5/8". The total length of the vessel with the two ends welded on is 6' ¼"

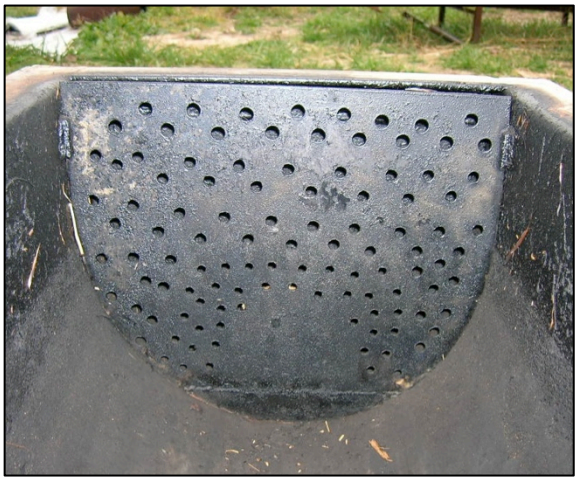


The primary air distribution plate.

Primary Air

The Primary air inlet is made out of a 3" nipple which is 2 ⅜" in length, and the inlet is attached to the vessel ¾" up from the bottom and centered from left to right.

The Primary Air Distribution Plate is perforated with 1/4", 3/8", and 5/16" holes to distribute the air appropriately. The plate is held in place with a total of four 1/4" pieces of key stock. Measuring from the inside front (primary air intake end) of the vessel, mark 2 ¼" and add 1/8". This is where the slot will be. Weld one piece of 1" key stock to each side of the slot marks. Do the same on both sides of the vessel and the plate will be able to be slid in and out as needed. On this unit the pieces of key stock were welded 1" down from the top lip of the vessel.



The Primary Air Distribution Plate in place in the slot created by welded 1/4" pieces of key stock.

Lighting/Thermocouple Port

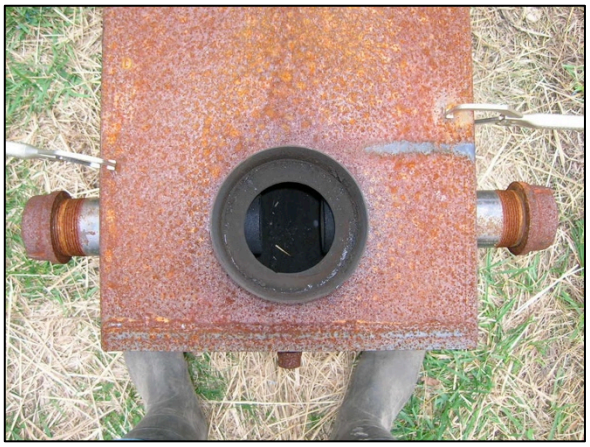
The Lighting/Thermocouple port is made from a ½" nipple cut to 1" in length. It is positioned on center 2 ⅜" down from the top of the vessel.

Secondary air intakes are on the sides and the lighting/thermocouple port is on the end of the vessel.

Secondary Air Intakes

The secondary air intakes are made from two 2½" nipples cut to 10 1/16" in length. These are positioned 2 ¼" down from the top lip and 3 ⅝"from the end. The two secondary intake pipes extend into the vessel 4⅜" on the right side (if you are facing the end with the flue pipe) and 4 11/16" on the left.

There is a three inch gap between the two pipes centered under the concentrator plate with the 3 ⅞" inch opening. The concentrator plate was added to adjust the size of the flue exit. It would not be needed if you cut the hole in the lid to the correct diameter of approximately 3 ¾ to 4".



With the lid in place, you can see the concentrator plate and the placement of the air intakes.

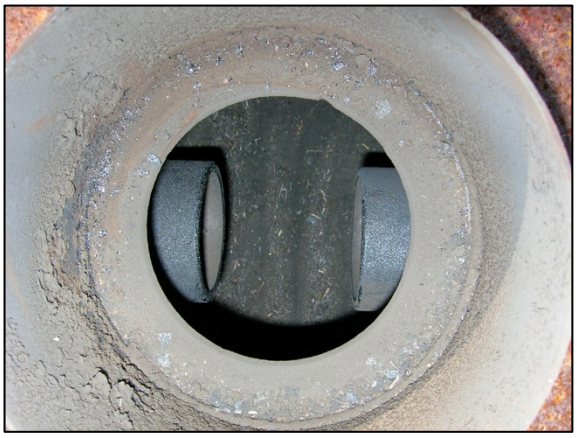
Lid, Base Stand and Flue Ring

Build the vessel first, and then fabricate the lid and base. In the event the vessel dimensions vary somewhat, you can make adjustments to the dimensions of the base and lid to accommodate the changes.

The lid has a ½" lip on all four sides and is made of ten gauge mild steel. Place handles where it is most convenient for yourself. I don't

recommend hinging the lid until you know what feedstock(s) you are going to use. Some feedstocks generate more heat than others and may cause more warping. Experiment first and verify which feedstock works the best for you. To date, switch grass and wheat straw are processing fine with no noticeable warping of the metal.

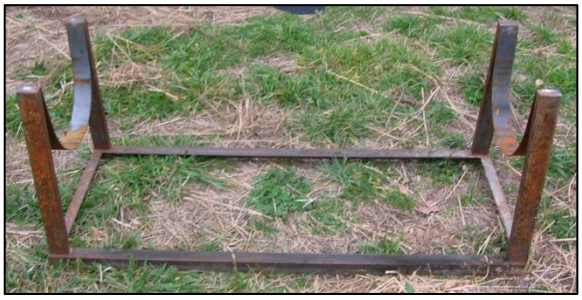
The dimensions for the lid are as follows: outside measurement is 72 15/16" long ; inside measurement is 72 ⅝". The width on the outside is 16 ¼" and on the inside is 16". The flue ring measures (outside) 5 7/8" and is three inches tall fabricated out of twelve gauge mild steel.



A close up view of the concentrator plate and the interior of the flue ring that holds the chimney in place.

Loading and Sealing

The feedstock needs to be packed loosely enough to allow the primary air to flow through it evenly. Using gasket adhesive, attach a length of ¾" flat wood stove gasket material on the sealing area of the lid. Make sure the metal is clean and dry and allow the adhesive to dry over night before using. I use six adjustable Vice-Grip type C-clamps, spaced evenly, with two on each end and two in the middle. Once the clamps are adjusted appropriately, they are very convenient to use.



The base stand. For best results, place on a slight incline, with the flue end up.

Lighting, Processing and Safety

For best results, place the unit on a small incline (an inch or two is all that's needed) – flue end up. To light the processor, I ignite a small handheld propane torch, insert it into the lighting port under the flue, and sweep the tip from side to side. If the moisture content of the feedstock is appropriate, the process progresses rapidly. Individuals will learn a lot with the first few batches they process. A batch of switch grass will be done processing in approximately four minutes.

After the process concludes, I secure the caps and place a gallon can over the flue opening and let the processor and biochar cool for approximately five to six minutes. Once I open the vessel, I scoop the biochar with a metal scoop into a galvanized bucket with a tight fitting lid, which prevents the biochar from re-igniting in the event there is an active ember in biochar.

For safety, I wear a good quality dust mask and welding gloves when I am handling the hot materials. ◆

The finished product: switchgrass biochar.