- Mission
- Projects
- Partners
- Gallery
- Calendar
- Downloads
- Donate

SeaChar.org

It's time to get positive about negative thinking.

2009 SeaChar Stoves Workshop with Dr. Paul Anderson

Posted by: Art Donnelly in: 501(c)(3), BioStove Project

On Saturday, August 1, Seachar hosted Dr. Paul Anderson (Dr. TLUD) for an all-day workshop in the construction of Top-Lit Up Draft (TLUD) cookstoves. The stoves can quickly be constructed from commonly available materials, and produce charcoal while providing heat for cooking (or other uses). Paul's TLUD stoves have been tested and shown to produce very low emissions of CO and particulates. The stoves can provide benefits wherever people rely on biomass for cooking. TLUD stoves use a wide variety of small pieces of biomass for fuel. The clean burn greatly improves indoor air quality compared with open burning and many other types of stoves. In addition, the charcoal can be used as biochar to improve soil fertility, sequester carbon, and potentially provide a source of income through carbon credits.

The key to the clean operation and the production of charcoal is the separation of the production of flammable gases and the combustion of those gases. The gases are produced by the heat of the limited flame within the biomass. The flame is constrained by limiting the amount of primary air. The combustion occurs with the introduction of secondary air above the biomass zone.

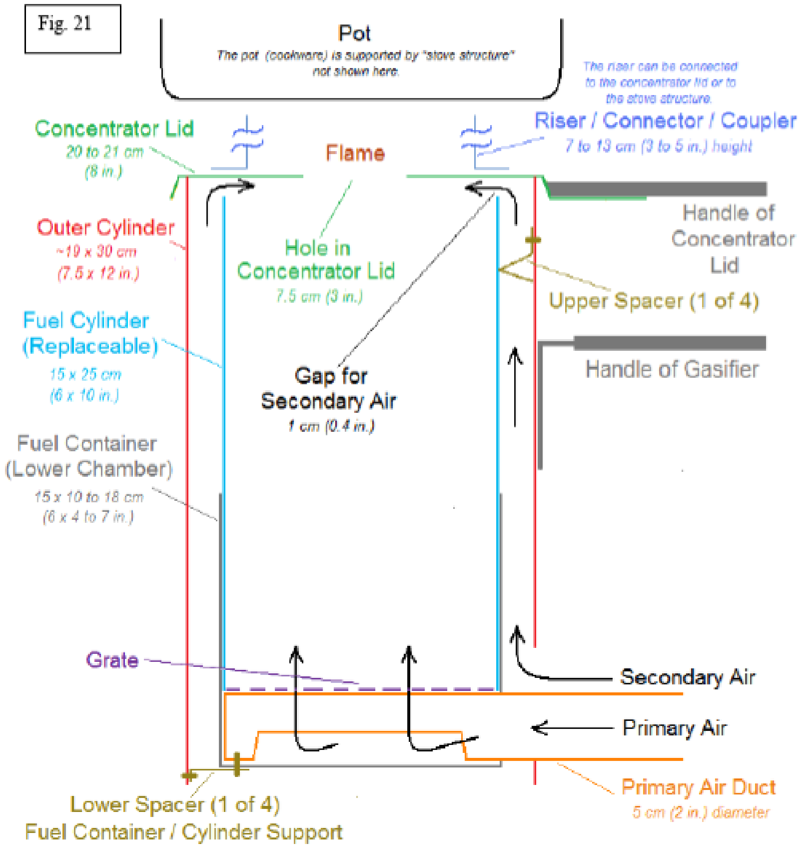
More information about the TLUDs is available at the following sites.
Theory of opertion: http://www.hedon.info/docs/BP53-Anderson-14.pdf
Video and graphic: http://www.thinkingglobalactinglocal.com/the-stovers/a-t-lud-stove-demonstration.html
Construction plans: http://www.bioenergylists.org/files/Construction%20Plans%202009-03-11.pdf
Emissions: http://www.bioenergylists.org/andersontludcopm

To really get a feel for what we did, check out slides from the day's events: http://picasaweb.google.com/art.donnelly/SeaCharSSeattleStoveLab2009AndThe1stAnnualBlackEarthBall?feat=email#slideshow/5370768626846121986

Workshop

We'll use Paul's graphic throughout the description of the workshop:

Fig. 21



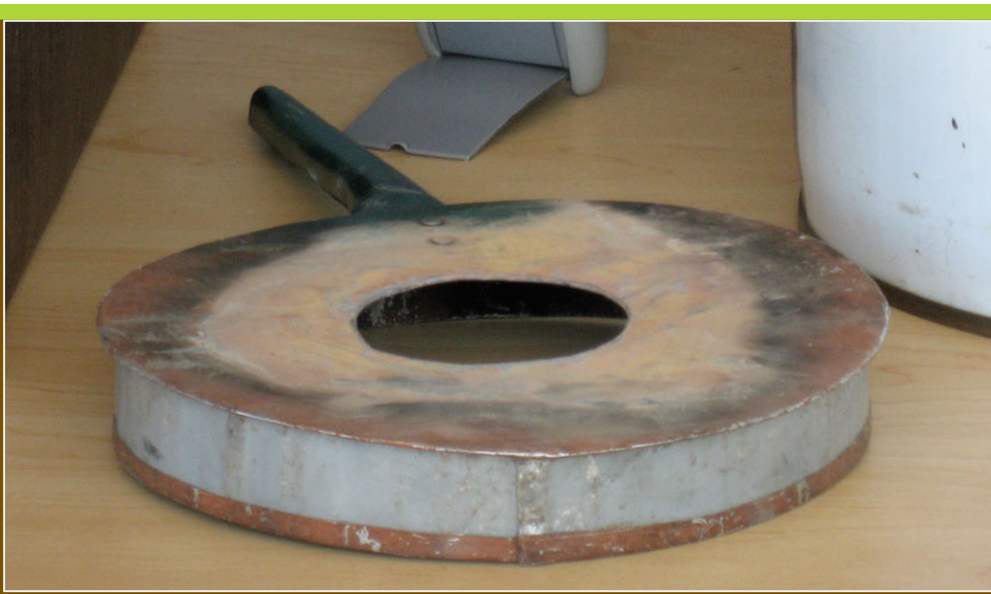
Construction

We all chose to make a 5 gallon size TLUD. This is quite a bit larger than the standard cookstove size, and we will be challenged to effectively use all the heat produced. We started by punching holes in the bottom of the standard metal paint buckets. You could use a drill, but the tool developed by Paul is quite a bit faster. The tool is made from standard conduit. These holes allow the primary air to enter the biomass zone.

The TLUD is an *air-controlled* stove, in contrast to fuel-controlled. The ability to limit primary air can be useful, and one option is to construct a base with a single inlet that can be damped - the cookie tin shown above. We all chose to proceed with a simple base which involves resting the bucket on three short lengths of angle-iron, as shown below.

We built two types of stove - the first includes the outer cylinder as shown in the diagram above; the second skips this piece. We used standard sheet metal to make this outer cylinder, fastening it with screws or pop rivets. The purpose of the outer cylinder is to provide a space for preheating the secondary air before the air encounters the gases produced in the pyrolysis zone. The outer cylinder also allows the ability to control the flow of secondary air.   We built the outer cylinder aiming for an air space of about an inch between the two cylinders, but this dimension has not been optimized. The photo below shows the two cylinders and the simple base.

The next step is the construction of the concentrator lid. The type of lid depends on whether the stove includes the outer cylinder. The stoves with an outer cylinder need a concentrator lid which fits over the cylinder as shown below. The secondary air is channeled between the two cylinders, gaining heat in the process. The hole should be somewhere between 3 - 5 inches in diameter, though again, this dimension has not been optimized. We mostly chose 4 or 4 1/2 inches. The hole needs to be smaller in diameter than the inner cylinder, forcing the gases into the smaller space and producing turbulence in the region above the lid where the combustion occurs. We constructed the lids from sheet metal.



With no outer cylinder, the concentrator lid is just the paint can lid with a couple bars inserted through the holes to lift the lid off the can enough to allow entry of secondary air, as shown below (a couple weeks later the bars have rusted somewhat). The lid tabs can be manipulated to control the flow of secondary air. We first removed the gasket from the inner lip of the paint can lid.

The final piece in the stove itself is the riser/combustion chamber/chimney. This is the area where the gases are mixed with the (preheated) secondary air and burned. This is a natural draft stove, and inflow of both primary and secondary air requires a chimney. A tall chimney will generally draw in air at a faster rate than a smaller one. Paul has much more experience with the smaller cook stoves, and cannot specify an optimum stack height for the larger 5 gallon size. The right height would depend on the primary air flow and the purpose of the stove. We built our chimneys from tin cans and stove pipe. When we tested the stoves, the flames clearly over-topped the shorter risers, indicating that a taller chimney would help, or perhaps that primary air needed to be restricted. The photo below shows a short riser made from a couple tin cans crimped together. The flames shot out the top of a riser of this height.

In addition to the construction of the stove itself, the application of the stove also requires some structure. The photo below shows one such structure built by Dr. TLUD for cooking. The design includes a skirt to surround the pot to increase the heat transfer to the pot.

Fuels

The inner cylinder is filled with twigs, broken to lengths of a couple inches, or wood chips, or similar fuel. The fuel should be dry. Care is needed in the fuel choice for a couple reasons. Sawdust is too compact, and does not allow air flow. Rice husks only work with forced convection. Longer pieces can be arranged vertically and tightly. A danger with the stacking of some fuels is that a piece of burning material might fall down through the fuel. This burning material will then be first to use the oxygen coming up from below, and will burn the material above without producing char and pyrolysis gases as intended.

Lighting the stove

The fuel is lit from the top. In our case we used standard charcoal lighter fluid, but other starters can be used. With some work, standard fire lighting techniques can be used - paper, kindling, etc.

Biochar

To recover char from the stove, the flame needs to be extinguished before the char is consumed. After the flame has worked its way down through the biomass, leaving charcoal in its wake, the fire will proceed to consume the charcoal unless it is put out. The moment of transition is easy to detect as the fire turns from flames in the riser area to a typical charcoal glow in the lower area. To put out the fire, remove the primary air. This may be as simple as removing the pieces that form the base and covering the top. An alternative is to dump the charcoal out into a container which can be sealed.

It was a great day all around

Our heartfelt thanks go to Paul for coming out to Seattle and sharing his knowledge with us. Paul works with Rotary and other organizations to develop construction of these clean stoves in parts of the world where people are dependent on biomass for cooking. Indoor air pollution from this cooking is one of the world's leading health problems. Paul generously donates his time and expertise to alleviate these problems, as well as promote a way of cooking which sequesters carbon and improves soil fertility.

TrackBack URI

- RSS feed for comments on this post

One Response

1. 1. **Ken**
21|Aug|2009

Good write up and photos of the event. We are making biochar now.
Thanks for putting this on.

Ken
Vashon, Wa

Leave a reply

Name (required)

E-mail (required, never displayed)

URI

POST YOUR COMMENT
POST YOUR COMMENT

Search

Categories

- 501 (c) (3)
- BioStove Project
- Central American Biostove Project
- Education and Outreach
- News
- Organizational Development
- Plot Testing
- Pyrolysis
- SSCC Test Plot

Links

- Biochar's Youtube Channel
- International Biochar Initiative
- Terra Preta (Biochar)