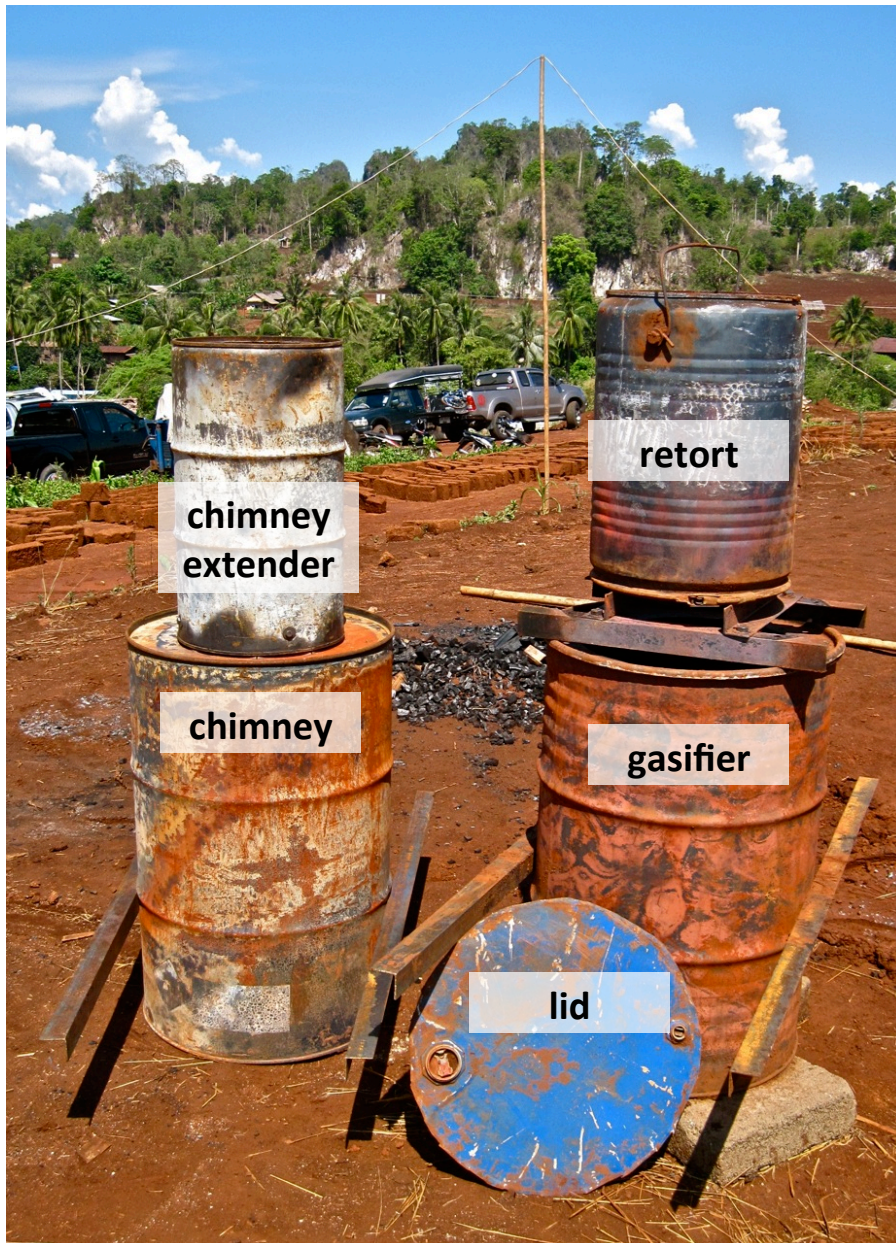


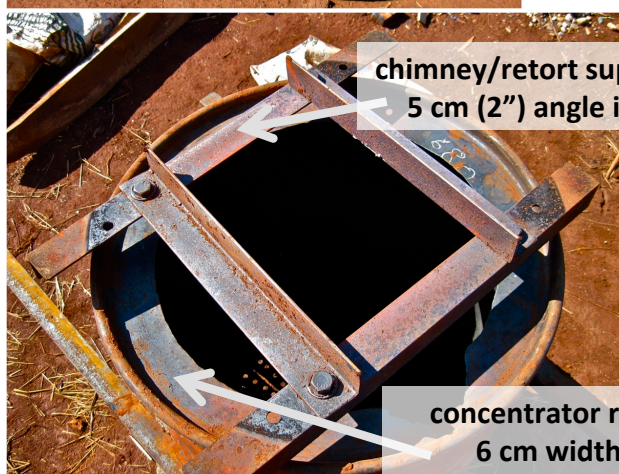
JRO Gasifier and Retort Char System



The purpose of this handbook is to show the construction and operation of a JRO (“Jolly Roger Oven”) char manufacture system. The JRO costs \$50-90 to build, and uses the waste heat given off by a high temperature gasifier char oven (lower unit) to make a smaller batch of low temperature retort (upper unit) char. The high temperature gasifier char is ideally suited for water treatment applications and the low temperature retort char is excellent for use as cooking fuel.



The JRO is made from two 200 L (55 gal) steel drums, two smaller (50-75 L) steel drums, 7 m of scrap angle iron, and a 1 m piece of $\frac{1}{4}$ " scrap rebar. Also required are 18 sets of bolt-washer-washer-nut, $\frac{3}{8}$ " to $\frac{1}{2}$ " thread diameter and $1\frac{1}{4}$ " to $1\frac{1}{2}$ " in length. The small drum used for the retort should have a removable, clamp-able lid. An electric drill or drill press and a handheld angle grinder are useful tools for this project, though all holes and cuts can be made with only a punch and cold chisel if necessary.



Using a drill and/or grinder, make as many holes as possible in the bottom of the gasifier drum without making it too weak. Cut two 60 cm and two 40 cm pieces of angle iron and bolt them together in a square configuration to make the retort/chimney support. Cut a 5-6 cm lip in the top of the gasifier drum to serve as a concentrator ring – this channels combusting gases into the chimney and prevents flames from escaping sideways out of the combustion zone.

Cut the end out of the chimney drum for use as a lid on the retort drum. The lid must be large enough in diameter to overlap the concentrator ring by at least 1 cm all around. Cut the ends out of one small drum for use as the chimney extender – cut a tabbed opening in the top of the chimney drum and bolt the extender onto the tabs as pictured above. Cut four 125 cm pieces of angle iron and bolt these onto the chimney and retort drums to use as handles.

Cut several slits in a uniform pattern into the removable lid of the retort. Bend the 1 m piece of 1/4" rebar into a handle shape and bolt this onto the bottom-sides of the retort drum. The retort drum is placed onto the gasifier upside-down (i.e. with the slits in the lid aiming downwards into the combustion zone), so the rebar handle will be facing upwards when the unit is in operation.

Load the gasifier completely full with small (10-15 cm in length, 2-5 cm in thickness), dry, woody material. Pack the retort tightly with with larger pieces, e.g. scrap cut just to fit the length of the retort interior. Clamp on the lid of retort and place it upside-down (slits facing down) onto the retort/chimney support. Place the chimney over the retort, and light the fire at the top of the gasifier. Once gasification begins (after 5-10 minutes of initial burning), all flames should travel up the chimney, and little if any smoke should be visible emerging from the chimney extender. No flames should exit sideways out of the combustion zone.





When all wood gases have been burned from the gasifier leaving only a faint blue flame, remove the chimney and set it aside (a). Remove the retort and place it lid-down into a mud pit to seal the slits and prevent ingress of oxygen (b). Remove the retort/chimney support and set it aside; place the lid on the gasifier and set the gasifier into the mud pit to seal the bottom (c). Seal the lid of the gasifier with mud (d). Allow retort and gasifier to cool at least 2 hours before removing char.

Note: The JRO char making system described here is an open architecture – feel free to modify as needed to achieve desired performance. We invite your feedback on the construction and use of this and similar units. Please send comments to josh@aq solutions.org.

