

## Cheap Technology to Produce Char Briquets from Biomass

Herman Johannes

Gadjah Mada University Energy Studies Centre, Yogyakarta, Indonesia.

### ABSTRACT

*A simple method to produce char and char briquets from grasses, weeds, leaves, and agricultural wastes for domestic and industrial uses is described. The cheap technology will provide jobs, earnings, saving of fossil fuels and firewood, and safeguarding of afforestation.*

### EXPERIMENTAL METHOD

Charcoal or in short char can be produced from lalang and other grasses, from waterweeds and landweeds, from agricultural wastes and fallen leaves, with a kiln that can be built without cost by every farmer who will need only his knife and a trowel as tools.

The kiln can be built from self-made sun-dried clay bricks measuring  $12\text{ cm} \times 12\text{ cm} \times 5\text{ cm}$ , applying clay mud as mortar. It can be erected on the bare ground or on a floor of sun-dried bricks laid on the ground.

The kiln may be constructed in the form of a truncated cone with a 15 cm thick wall by laying the bricks in concentric circular layers of diminishing diameters, piling them one upon the other (Fig. 1).

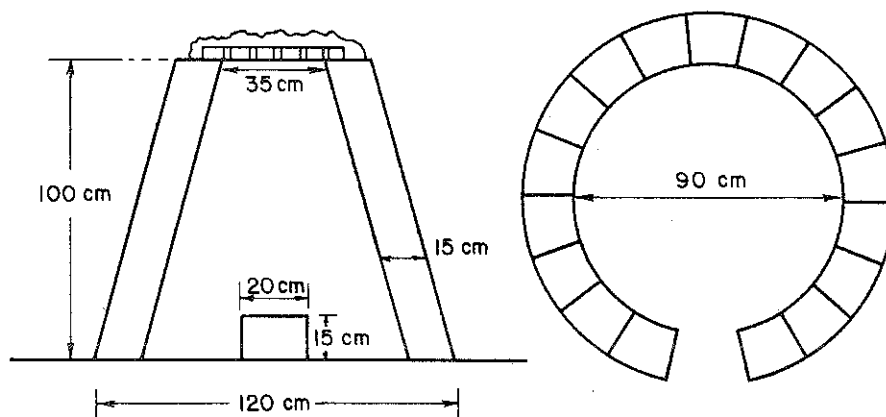


Fig. 1 Char Kiln.

A small kiln may have a height of 100 cm, an inner diameter of 90 cm at the bottom and of 35 cm at the mouth. An opening of  $20\text{ cm} \times 15\text{ cm}$  is retained in the wall just above the bottom.

The kiln is filled densely with dry leaves or other biomass and fired from the opening near the bottom. As soon as a thick smoke emerges from the mouth of the kiln the bottom opening

should be closed with bricks and mud leaving a small slit open for air to enter the kiln. This slit should be closed too with mud within thirty minutes, the approximate time needed by the fire to spread throughout the lower part of the kiln. Additional biomass could be charged to the kiln.

The biomass in the kiln undergoes an exothermic reaction converting itself into carbon or char and smoke. This smoke comprises of water, methanol, acetone, acetic acid, and tar that can be condensed, and of gas containing carbon monoxide and hydrogen that can be burned. The farmer may be interested in producing char only.

When the smoke emerging from the kiln has become less dense the mouth of the kiln should be covered with a grid made of fresh twigs or bamboo laths allowing the smoke to escape through its slits preventing air to enter into the kiln and burning the biomass to ash. A dry grid should be wetted.

After three to five hours depending on the weight of the biomass processed the smoke from the kiln will become thin indicating that the conversion reaction is nearing its end. Then the grid at the top of the kiln should be covered with mud making the whole kiln airtight and allowing it to cool. Having cooled off for half a day the bottom aperture can be pried open again and the char taken out.

## RESULTS

The char is brittle and pulverizes easily. To be used as a substitute for ordinary charcoal from wood it should be briquetted.

The char is pulverized and mixed with glue made from two to three percent in weight of cassava starch. The cassava can be grown by the farmer himself. The dough of char and glue is put in a metal or bamboo cylinder with an inner diameter of 3 cm and a height of 6 cm, and compressed into briquets of 3 cm diameter and 3 cm length. The compression is done with a stick struck with a hammer.

An other method of briquetting is to compress the dough into plates having thickness of 2 cm and to cut the plates, when still a little moist, into blocks of 3.5 cm x 3.5 cm x 2 cm. In full sunlight the briquets should become thoroughly dry within three days.

When carefully processed the yield of char will be one third of the weight of the dry biomass without much ash and half done biomass.

## DISCUSSION

Many kinds of neglected biomass can be converted into char and char briquets, such as lalang grass (*Imperata cylindrica*), water hyacinth (*Eichhornia crassipes*), reed (*Saccharum officinarum*), lantana (*Lantana camara*), rice straw, cassava stalks, maize stalks.

The briquets can be used to replace wood charcoal for cooking, baking, heating, ironing, and forging, diminishing the need for cutting trees for firewood and charcoal production, resulting in safeguarding the efforts of afforestation. Kerosene used for cooking could be saved.

The simple and cheap technology allows for self employment and increased earnings.

Char from biomass may be converted to synthesis gas and methanol and eventually with the Mobil process to gasoline.