



Charcoal Production In Dome Charcoal Kiln

Ethiopia | Madagascar | Tanzania





INTRODUCTION: Bamboo is one of the fastest growing plants on the planet. Using bamboo for charcoal production permits substitution of wood timber charcoal and hence reduces the pressure on natural forests. Bamboo cultivation and utilisation including conversion into charcoal and charcoal based products provides income generating options for farmers and communities.

Bamboo charcoal is produced by pyrolysis process - thermal decomposition of bamboo biomass carried out in high temperature with no air or limited supply of air (oxygen). Bamboo charcoal is similar to wood charcoal and other lingo-cellulosic material, has excellent calorific value, carbon content as well as burning qualities. Bamboo charcoal has excellent pore structure, larger specific surface area and has much higher adsorption capacity than wood charcoal. Because of these qualities, in addition to energy applications, bamboo charcoal is being used for a wide range of different applications such as (a) purification and absorption (drinking water, air pollution, air filters, gas masks), (b) daily health care, (c) deodoriser; (d) building interior decoration, (e) as food; (f) soil improvement, and other applications.

RAW MATERIALS & ITS FORMS

Any species or variety of bamboo is suitable for charcoal production.

Whole bamboo poles, rhizomes, lops, tops and thick branches; bamboo splits, cut pieces and thick solid waste arising out of bamboo processing (with exception of particulate or powdered waste) can be used for charcoal production.

Note:

- For good quality charcoal, mature bamboo (3-5 years) should be used as the starch levels and moisture are lower.
- Moisture content should be as low as 20 – 25 percent. During rains, bamboo should be harvested and left to air dry for some days.
- DO NOT MIX different forms of raw material. Loading uniform/ homogeneous raw material is necessary for easy stacking inside the kiln and for proper charcoalization.

STEP BY STEP PROCESS

Sizing

Cut bamboo culms / cut pieces / processed waste into the required size to fit well into the kiln and to ensure proper loading / stacking.



Loading

Place the bamboo inside the kiln through the front door at the bottom.



Stacking

Vertically stack the bamboo inside the kiln. Loading begins from tail end of the kiln towards the front door. Fill in till the door opening.



Once the bottom portion is complete; start loading the top conical portion of the dome kiln.



Fill all the spaces on the sides of dome as well as top with cut pieces or splits to eliminate any open spaces to ensure smooth burning and charcoalization.

STEP BY STEP PROCESS

Near the lighting hole at the top of the dome, stack biomass which can be easily ignited.



Close the front opening or charging / discharging doorway with single layer of bricks.



Plaster the outer surface of the front door with mortar to provide complete insulation and prevent air leakage.



Keep all the wall openings (single brick) open during the firing to create the required draft.



Igniting: Only use the top opening to fire the kiln. Allow it to catch fire for a few minutes.



When the combustion has completely started, close the firing / lighting hole with steel plate and fill mortar (mud) on the sides to insulate or close the air flow.

STEP BY STEP PROCESS

When the top lighting hole is closed, the smoke will start coming out from the wall openings.



Determine the carbonization stages for closing of wall openings by watching the color and smell of the smoke.



Drying stage: Smoke is thick white in color containing a lot of steam.

Carbonization Phase: Smoke turns grey / dark color / slightly yellow accompanied with tar smell.

Refining: The smoke turns slightly blue / transparent indicating end of carbonization and the start of refining.

When the smoke turns blueish white / transparent; close the wall openings one by one, starting from the top. The wall opening should be sealed with bricks and mortar.

Note: In case of uneven burning or progress on all sides, regulate a few openings (open/close) across the kiln to create air draft and enable uniform burning and/or carbonisation.

Check for air cracks / smoke emissions on the wall and wall openings, seal them with light mortar and let the bamboo charcoal in kilns cool down. If the kiln is not sealed well, bamboo charcoal will be easily oxidised or air will provoke fire in the charcoal.

The entire process of charcoalization may take approximately 8 – 24 hours. The duration of carbonization is closely related to size of raw material and also size of charcoal dome. Thick bamboo pieces carbonize slower than the cut pieces and/or processed waste.

Keep all the openings closed for 1-2 days. This duration depends on the local weather conditions. Cooling happens faster in cold weather conditions than hot weather.



STEP BY STEP PROCESS

The ideal temperature to open the kiln for discharging the charcoal is around 60 Degree C. In practice, the operator estimates the temperature by feeling the heat on the walls of kiln.

Don't open the kiln which is not sufficiently cool. If opened, fire in the charcoal may reignite. Application of water for putting off fire results in low quality control.

Open the front discharge opening, only after ascertaining that the fire is completely put off. As a precaution, before opening the kiln, keep plenty of water (water pipe, drum / bucket of water) ready before opening the front discharge opening.



Open the top lid and wall opening for air circulation.



Charcoal Extraction:

Extract the charcoal from the dome kiln. Sprinkle small amount of water, if the charcoal is too hot. Don't use excess water, as it may lower the quality of charcoal.

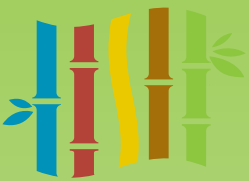


Cleaning: Clean the kiln of residue ash and charcoal pieces. Undertake mortar plastering, if there are cracks or breakage in wall plasters.



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