

BIOCHAR PRODUCTION USING SINGLE DRUM RETORT KILN: A PRACTICAL GUIDE FOR FARMERS

1. Possible Fuel Sources for Biochar Production

Biochar can be produced from a variety of agricultural residues, making it a sustainable solution for managing organic waste while improving soil health. Below are potential fuel sources suitable for the single drum retort kiln:

- **Coffee Pruning Residues:** Branches and twigs from coffee plants are abundant during the pruning season and provide an excellent biomass source.
- **Coffee Husks:** The outer covering of coffee beans, often discarded during processing, can be utilized.
- **Candlenut Shells:** Hard and dense, these shells burn efficiently and produce quality biochar.
- **Cocoa Pod Shells:** Abundant in cocoa-growing regions, they decompose slowly, making them ideal for pyrolysis.
- **Rice Husks:** Lightweight and readily available, these are particularly effective for producing biochar due to their silica content.
- **Corn Cobs:** Commonly available after harvest, they burn steadily and provide high-quality char.
- **Branches and Wood Stems:** These provide long-lasting heat and are useful when mixed with other lighter biomass.

The kiln's design allows for the use of mixed biomass, enhancing flexibility and ensuring efficient use of available resources.

2. Safety Considerations

Using a biochar kiln involves handling high temperatures and combustible materials. Adhering to safety guidelines minimizes risks.

A. Safety Gear

- **Heat-Resistant Gloves:** Protect hands from burns when handling hot surfaces or materials.
- **Face Mask:** Prevent inhalation of smoke or particulate matter during pyrolysis.
- **Fire-Resistant Clothing:** Wear long-sleeved, fire-retardant clothing for additional protection.
- **Safety Goggles:** Shield eyes from sparks and smoke.

B. Location

- Choose a well-ventilated, open area away from flammable structures or materials.
- Ensure the kiln is placed on stable ground to prevent tipping during operation.

C. Heat Management

- Maintain a safe distance from the kiln when it's operational.
- Keep a fire extinguisher or a bucket of sand and water nearby for emergencies.
- Regularly monitor the biomass burning rate to prevent overheating.

3. Producing Biochar Using Coffee-Based Biomass

Biochar production using a single drum retort is an effective and simple method to transform agricultural residues into a valuable soil amendment. Below is a step-by-step process:

A. Preparation of Biomass:

- Collect agricultural residues such as corn cobs, coffee husks, or other biomass materials.
- Ensure the biomass is dry by sun-drying it for several days. This step reduces the moisture content, facilitating efficient combustion during pyrolysis.



B. Setting up the Drum:

- Use a recycled drum with dimensions approximately 90 cm in height and 60 cm in diameter.
- Ensure the drum is clean and equipped with a steel grate inside to separate ash from biomass.

C. Loading the Drum:

- Place the dry biomass into the drum in layers, ensuring even distribution for uniform combustion.
- Do not overload the drum, as it can obstruct airflow and lead to incomplete pyrolysis.

D. Ignition:

- Use small, easily combustible materials like dry twigs, paper, or plastic as a fire starter.
- Light the fire at the bottom of the drum and allow the flame to spread through the biomass.



E. Burning and Mixing:

- Once the biomass begins burning steadily, tilt the drum slightly and add additional biomass gradually.



- Use a wooden stick to stir the contents occasionally, ensuring even combustion.



F. Sealing the Drum:

- After achieving the desired biochar volume, upright the drum and cover its top with a dampened burlap sack or similar material.
- Add a layer of sand on top of the cover to seal the drum, preventing oxygen entry and halting combustion.



G. Cooling:

- Allow the sealed drum to cool naturally for 1–2 days. This prevents the biochar from reigniting when exposed to air.

H. Extracting and Preparing Biochar:

- Once cool, remove the biochar from the drum.
- Sift the biochar to remove unburned materials and grind it into a fine texture if necessary.
- Pack the processed biochar into bags for storage or distribution.

This method ensures efficient carbonization while utilizing locally available resources, making it an ideal technique for small-scale biochar production in rural settings.

4. Maintenance and Troubleshooting

Proper maintenance ensures the kiln's longevity and consistent performance.

A. Maintenance

(1) Regular Cleaning:

- Remove ash and debris from the drum after each use to ensure proper airflow.
- Check and clean the chimney to prevent blockages.

(2) Inspect for Damage:

- Regularly inspect the drum, grate, and chimney for signs of wear or rust.
- Reapply heat-resistant paint or repair insulation as needed.

(3) Grate Care:

- Ensure the grate remains intact and replace it if it shows signs of warping or damage.

B. Troubleshooting

(1) Excessive Smoke:

- Cause: Wet biomass or poor airflow.
- Solution: Use drier biomass and check for blockages in the airflow system.

(2) Uneven Pyrolysis:

- Cause: Overloading or uneven biomass placement.
- Solution: Redistribute the biomass evenly and avoid overloading the drum.

(3) Slow Carbonization:

- Cause: Insufficient heat or airflow.
- Solution: Increase airflow and ensure the kiln reaches the optimal temperature.

The single drum retort kiln offers coffee farmers in Lampung an efficient method to produce biochar from agricultural residues. By following the guidelines outlined in this module, farmers can safely and effectively utilize their resources to enhance soil fertility and support sustainable farming practices. The flexibility in fuel sources, coupled with the kiln's simple operation, makes this technology an excellent choice for smallholder farmers. Proper maintenance and adherence to safety measures ensure the kiln's durability and reliability, fostering long-term benefits for the farming community.