

KILN CONSTRUCTION FOR BIOCHAR PRODUCTION USING SINGLE DRUM RETORT

1. Introduction to the Drum Retort Method

Biochar production is an environmentally sustainable solution to improve soil fertility and sequester carbon. The drum retort kiln method is a simple and cost-effective technique for small-scale biochar production. Using a 200-liter drum as the primary container, this method allows farmers to efficiently convert biomass into biochar by controlling oxygen levels during pyrolysis. The drum retort system is particularly suitable for farmers, including coffee farmers in Lampung, who have access to abundant agricultural residues. The system is relatively easy to construct, requires minimal resources, and ensures consistent quality biochar production, making it an ideal choice for rural communities.

2. Materials and Tools Required

Before starting construction, gather the following materials and tools:

Materials:

- 200-liter steel drum
- Metal pipes for chimneys (1–2 meters in length)
- Steel grates (sized to fit the drum's diameter)
- High-temperature-resistant insulation materials (e.g., refractory cement or clay)
- Bricks or stones (for foundation)
- Heat-resistant paint (optional, to prevent rust)
- Bolts, nuts, and metal hinges

Tools:

- Cutting tools (angle grinder, metal saw)
- Welding machine and safety gear
- Hammer and nails
- Measuring tape
- Drill with metal bits
- Screwdriver
- Shovel (for foundation preparation)

3. Construction Methodology

To construct the drum retort kiln, follow these steps:

A. Foundation Construction

(1) Select the Site:

- Choose a flat, firm ground to ensure stability.
- Ensure adequate ventilation around the site for safety.

(2) Prepare the Base:

- Create a square or circular base using bricks or stones.
- Secure the base with mortar or clay to provide a heat-resistant platform.

(3) Ensure Drainage:

- Incorporate slight inclines or drainage channels to prevent water accumulation around the kiln.

B. Drum Modification

(1) Prepare the Drum:

- Clean the 200-liter drum thoroughly to remove any residues.
- Remove one end of the drum to create an opening for biomass loading.

(2) Drill Airflow Holes:

- Drill small holes (approximately 2 cm in diameter) or triangle near the bottom to control oxygen flow during pyrolysis.



(3) Install Chimney:

- Cut a hole on the top lid of the drum to attach the chimney pipe.
- Weld or bolt the pipe securely to the drum.



C. Assembly of Drum Retort

(1) Position the Drum:

- Place the modified drum on the prepared foundation, ensuring stability.
- The bottom airflow holes should remain unobstructed for efficient oxygen control.

(2) Attach Grate:

- Install a steel grate inside the drum to create a separation between the biomass and ash collection zone.

D. Insulation

(1) Apply Insulation:

- Coat the outer surface of the drum with refractory cement or clay to retain heat and improve energy efficiency.

E. Grate Installation

(1) Fabricate the Grate:

- Use steel mesh or rods to construct a durable grate.
- Ensure the dimensions fit snugly within the drum.

- (2) Install the Grate:
 - Weld or bolt the grate into position inside the drum, approximately 10–15 cm from the bottom.
- (3) Test for Stability:
 - Confirm that the grate can support the intended biomass load without deformation.

4. Labor and Time Requirements

Labor Needs:

- Skilled Workers: One or two individuals with basic welding and metalworking skills.
- Helpers: Two to three individuals to assist with foundation preparation, material handling, and assembly.

Estimated Time:

- Material Preparation: 1–2 days (includes purchasing and cleaning materials).
- Foundation Construction: 1 day.
- Drum Modification and Assembly: 2 days.
- Insulation Application: 1–2 days (including drying time).
- Total Time Required: Approximately 4–7 days, depending on the availability of materials and labor efficiency.

The single drum retort kiln is an efficient and accessible technology for coffee farmers in Lampung to produce high-quality biochar. By following the construction methodology outlined above, farmers can build a reliable system to transform agricultural residues into a valuable soil amendment. With proper maintenance and operation, the drum retort kiln can serve as a sustainable tool for enhancing productivity and promoting environmental stewardship.