A TWO-BURNER CONTINUOUS-TYPE RICE HUSK GAS STOVE DEVELOPED FOR HOUSEHOLD/SMALL COTTAGE INDUSTRY

by

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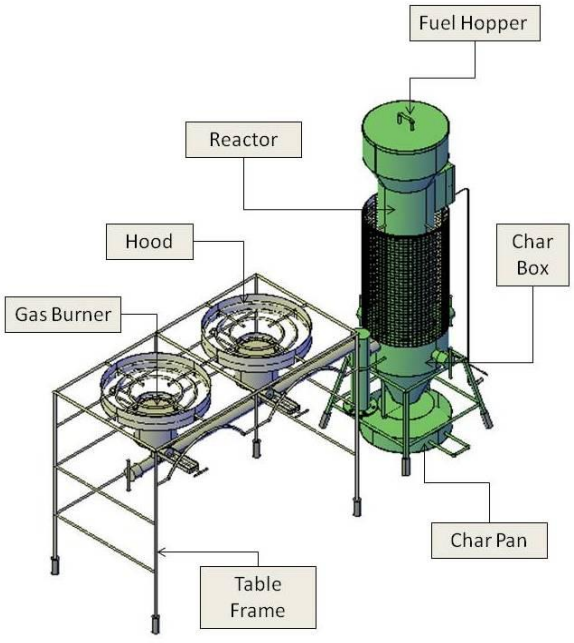
Glory to God!

Continuous cooking using the rice husk gas stove can now be done on the recently developed two-burner stove using raw rice husks as fuel. Rural households can now cook even for more than an hour without entirely discharging and reloading the stove. Small cottage industries needing a low-cost but clean-cooking device can also be benefitted from using the stove in their daily cooking activities, especially if supply of rice husks is accessible to them.

This stove development by CRHET is another phase of study in collaboration with the small fabrication shops aimed to provide options for rural households and small cottage industries a clean technology for cooking using agricultural wastes, like rice husks as fuel. Funds were provided by the Rolex Awards for Enterprise 2008 and by The Tech Awards 2010.



As shown in the schematic diagram at the right side, the stove consists of the following: (1) a 0.5 kg capacity fuel hopper where fresh rice husks are feed to fuel the stove; (2) a 16-cm diameter by 60-cm high reactor where rice husk fuel is gasified producing combustible gases that are rich in carbon monoxide (CO) and hydrogen (H_2) mixture; (3) a char box which temporarily hold burned rice husks; and (4) a char pan which holds the char prior to disposal. The gas produced from the reactor is burned in the drum-type gas burners to produce a luminous blue-to-pink

flame for cooking. The gas valves control the amount of gas to be burned in the burner and the hood keeps the flame in stable condition. The gas burner is supported by a table frame at a height of 70 cm.

The stove operates on a moving-bed down draft mode. Char is used as filler for the char box to seal the spout and to divert the gas into the burners. Rice husks are ignited from the bottom end of the reactor through the ignition ports and the burning front or fire zone moves upward. A 120 mm x 120 mm, 12-volt DC or 220-AC fan is used to supply the air needed for gasifying the fuel. A 1.2-mm thick galvanized iron sheet is used for the construction of feed hopper, reactor, and char box. A 1.5-in. diameter GI pipe schedule 20 is the material used for gas piping. The support structure for the gasifier and for the burner table is made of 8-mm diameter round bar. This stove model can be built by local people using basic fabrication equipment such as arc welding machine, bar cutters, hand drill, etc.

Testing and evaluation of its performance revealed that the stove requires 0.8 kg of char as filler and 2 kg of rice husk as fuel in one full load. The fuel consumption of the stove is at an average rate of 2.6 kg of rice husks per hour. Combustible gas is produced within 5 to 10 minutes from ignition of fuel. One and a half liters of water can be boiled in the stove within 14 to 20 minutes, depending on the size of the opening of the gas valve at the burner. The average gas temperature coming out from the reactor is 185°C. The temperature at the bottom of the pot averaged at 420°C. Based on the overall thermal efficiency, the computed power output of the stove is 2,028 kcal per hour or 1,014 kcal per hour-burner. Moreover, the specific gasification rate of rice husks is around 130 kg per hour-m^2. The fire zone moves from the bottom to the top of the reactor at a rate of 2.2 cm per minute. The computed thermal efficiency of the stove is 26% and the percentage char produced is 32% of rice husks consumed.

There is a need to push the char out of the char box from time to time to replace burned rice husks with new ones. Initially, operation is quite difficult. But, the longer the stove is operated and its operation is mastered, the more it becomes convenient to use and the more its benefits are enjoyed.

Some of the advantage features of the stove are: (1) Uses rice husks as fuel; (2) Produces combustible gases for cooking; (3) Continues operation until all cooking preparations are finished; (4) Fast ignition of fuel and almost no smoke during operation; (5) Operates on AC line or on DC using a battery; (6) Low CO_2 and black carbon emissions; (7) Simple design and fabrication making the technology affordable; (8) Safe to operate; and (9) Burned rice husks can be used as soil conditioner.

Design and Performance Specifications of the Stove.

CFRHGS Model	16D-2B
Reactor Diameter and Height	16 cm ø x 60 cm
Type and Number of Burners	Drum – 2 burners
Fan	120 mm x 120 mm, 16 watts 12 DC or 220 AC
Fuel Consumption Rate	2.6 kg/hr on the average
Start-Up Time	5 to 10 min
Boiling Test	14 to 20 min for 1.5 liters of water
Gas Temperature	185°C
Temperature Beneath the Pot	420°C
Power Output	2,028 kcal/hr or 1,014 kcal per burner
Specific Gasification Rate	130 kg/hr-m^2
Fire Zone Rate	2.2 cm/min
Thermal Efficiency	26%
Percentage Char Produced	32%

The stove is being sold at P7,000.00 retail price. This investment cost can be recovered within 6 months if the rice husk stove is used for at least 3 hours every day over the conventional fossil-based fuel stoves. The use of the rice husk stove can generate savings for the households and can earn greater profit for small cottage industries. Moreover, the stove can be scaled-up in size, if needed, to meet cooking requirements of the business.

For further detail, you may contact: Engr. Alexis Belonio of Center for Rice Husk Energy Technology (CRHET) – atbelonio@yahoo.com. Units of the stove are presently available at BEST-e in Munoz, Nueva Ecija, and at BMC in Pavia, Iloilo, Philippines.

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