SIMPLIFIED DESIGN OF THE BATCH-TYPE RICE HUSK GAS STOVE

by

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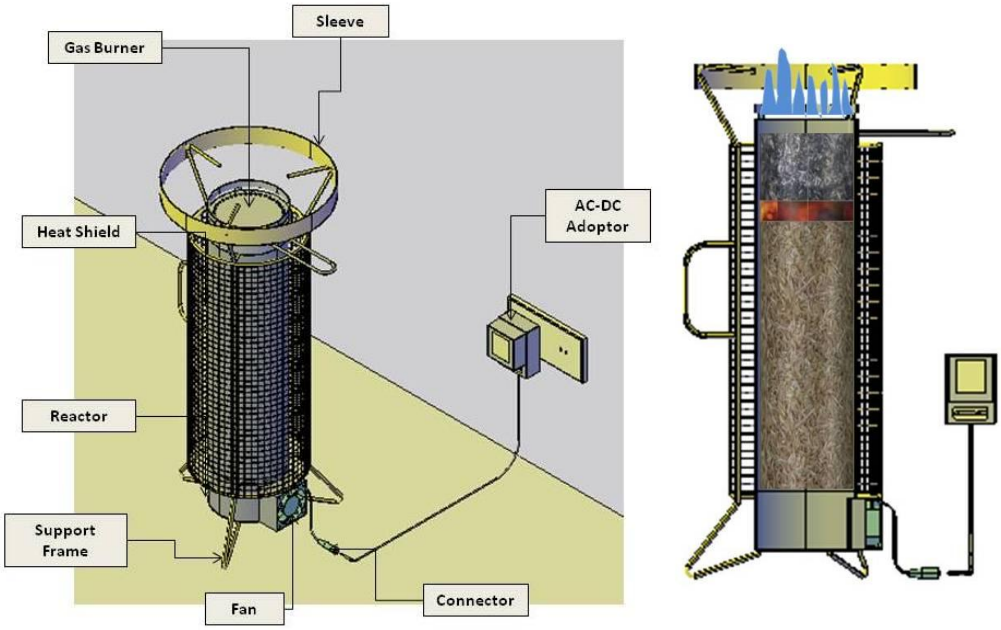
Glory to God!!

For several years of continuous research and improvement on clean energy source using agro-wastes as fuel, the rice husk gas stove was proven to be a good alternative device for cooking. This is basically because of its low CO_2 (i.e., 0.6 kg CO_2 per kg of rice husks) and black carbon (i.e., 50 ug/m^3) emissions. Also, the cost of cooking is much lower as compared with that of conventional cookstoves. With an aim to further simplify the design of rice husk gas stove to suit specific needs of rural households in the Philippines, a collaborative effort was carried out between the Center for Rice Husk Energy Technology (CRHET) and the Biomass Energy System and Technology Enterprise (BEST-e) in the Science City of Munoz, Nueva Ecija, Philippines. Instead of continuous operation that allows it to operate for a longer period, the stove was



Stove Parts and Schematic of Operation

designed to operate just enough to cook one dish or boil water with one load of fuel. In this way, women who do the cooking can easily use the stove not requiring much attendance to reload fuel and to discharge char. In addition, the cost of construction of the stove is cheaper hence making it more affordable to many.

As shown in the figure at the right above, the stove consists of the following: a 12-cm ø x 45-cm high reactor where rice husks are gasified producing combustible gases, which are rich in carbon monoxide and hydrogen; a gas burner where the gas produced are efficiently burned, giving a blue-to-pink flame; a 12-volt, 0.3-amp DC fan that supplies the air needed in gasifying rice husks; a 1000-mA AC-DC adoptor which energizes the fan; a heat shield that protects the user from accidental touching the hot reactor; and a 2-cm high sleeve that helps in keeping the heat intact and directs the flame to the bottom of the pot during cooking.

Design and Performance Specification of the Stove

Model	RHGS-12D
Fuel	Rice Husk
Fuel Consumption Rate	400 grams per load
Flame Color	Blue to pink
Power Output	0.91 kW
Fan	3 watt, 12 volt DC
Start-Up Time	1 min
Time to:	
Rice	3 cups of rice in 15 minutes
Boil Water	12 min for 2 liters of water
Fry	3 pcs of tilapia in 15minutes 3 pcs of table egg in 5 minutes
Operating Time	18-20 min
Overall Dimension	20-cm W x 20-cm L x 50-cm H

Solar and Battery for the Stove

Results of performance evaluation of the stove shown in table above revealed that in one load, it consumes 0.4 kg of rice husks within 18 to 20 minutes, depending on the input voltage of the fan that controls the flow of air through the fuel bed. Start-up time is almost 1 minute using burning pieces of paper. Two liters of water can be boiled in the stove within 12 minutes. A 200-g rice can be cooked within 15 minutes while 3 pieces of tilapia can be fried within 18 minutes. Moreover, the computed specific gasification rate of the stove is 114 kg/hr-m^2 with a power output of 0.91 kWt. The stove has the following advantages: (a) easy to operate; (b) controllable flame intensity by simply adjusting the input voltage of the fan with the use of a switch located at the adoptor; (c) with light-blue colored flame indicating the gas burned is clean; (d) no smoke during operation; (e) safe to operate since it operates in DC power and at almost ambient pressure; (f) very minimal electrical consumption in running the fan; and (g) very affordable. In cases where grid is not available, the stove can still be used with a 12-volt battery or a 5-watt solar panel (see photo right side above) to energize the fan. The by-product in burning rice husks in the stove

has a percentage char content of about 30% which is a good source of material as soil conditioner. Tests conducted on char have shown that it can hold water 5 to 7 times of its weight.

Capacity

The stove can be easily produced using locally available materials such as metals sheet, bar, and wire mesh screens. Basic tools and equipment that can be found even in some remote places in the Philippines, such as arc welding machine, hand drill, tin snip, grinding wheel, and others are used in the production of the stove. Standard parts of the stove like fan and adoptor can also be found in local stores at a cheap price. Producing the stove in volume basically can generate employment and additional income for the local people. Retail price of the stove including the fan and adoptor is P1,500.00 (1 US$ = PHP 45) per unit. Distributors price is P1,300.00 per unit with a minimum order of 20 units. Users of the stove can recover their investment within 2 months against LPG- and kerosene- fueled stoves.

Several Units of the Stove Ready for Use

At present, BEST-e is mass producing the stove in limited numbers for distribution in Central Luzon region and in neighboring provinces. BEST-e also engaged in helping communities by encouraging others to produce the stove for the benefit of others especially in the Visayas and Mindanao Regions.

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