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Evaluation of biomass gas stove

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ABSTRACT

The evaluation of the biomass stove was carried out at All India Coordinated Research Project on Renewable Energy Sources, Dr. PDKV, Akola centre. A survey of dhabas/ hotels/tea shops owners situated on national highway was conducted for introduction of the biomass gas stove. Traditional community stove (bhatti), kerosene pressure stove was used for preparation of meal and LPG stove was used for preparation of breakfast and fast food. The biomass gas stove was installed under operational research demonstration programme at the selected dhabas/hotels/tea shops to evaluate its performance. The rate of fuel consumption of the stove was found to be 3 to 3.2 kg per hour. The thermal efficiency of the biomass stove was found to be 18-19% using babul (*Acacia nilotica*) wood fuel. The ultimate strength of the stove was found to bear up to 170 kg weight. By the introduction of the biomass gas stove, 25% of fuel saving is observed and yearly saving of Rs. 4320/- could be achieved.

Key words : Biomass gas stove, Thermal efficiency, Fuel consumption.

World over, biomass fuels represent the second largest source of energy used after fossil fuels. In developing countries, about two thousand million people rely almost entirely on biomass fuels for their energy needs. Biomass represents about 35 per sent of the energy used. About 40 per cent of the total energy consumed in India, even today, comes from fuel wood, charcoal and various agricultural residues (Anonymous, 2007). About half of all the trees cut in the world, for whatever reasons, end up being used as fuel for cooking and heating. The present methods for utilization of these resources are highly inefficient. On the other hand, utilization of the residues through gasification route becomes economical and promising for thermal and power needs of rural areas and small-scale agro-industries.

This will also reduce the pressure on the worsening fuel wood situation since agro-residues are available abundantly and can be used for gasification. Biomass gasification is basically conversion of solid biomass such as wood, agricultural residues etc., into a combustible gas mixture normally called "Producer gas". The solid biomass is burnt in the presence of limited air or oxygen to produce a low or medium calorific value gas. Partial combustion process occurs when air supply is less than adequate for combustion. Biomass contains carbon, hydrogen, nitrogen and oxygen molecules and incomplete combustion would produce carbon monoxide as well as hydrogen, which are combustible gases.

Renewed emphasis on increased use of bio resources does not imply going back to traditional, inefficient and inconvenient techniques and devices. Number of thermal applications of gasifier systems has shown adequate and immediate promise. These applications may involve follow diverse situations where, biomass might already be in use with traditional technologies, biomass may not be currently in use, but is available as a by-product and biomass may need to be procured for a switch over from fossil fuel. However, even in situations where thermal energy is currently being provided by bio-resources, careful study of the application and effective development of application packages become necessary. The biomass gas stove was developed for small-scale thermal applications in agriculture and allied industries. These stoves widen the market for agro-residues and make possible a higher efficiency and reduce the time and investment, as compared to conventional stoves.

The overall objective of this investigation is to monitor the performance of biomass gas stove under laboratory and field conditions. The scope of work included installation and evaluation of the prototypes of biomass gas stove in the laboratory, selection of beneficiaries, installation of prototypes in the field, monitoring its performance and to obtain opinion of the beneficiaries about the biomass gas stove.

METHODOLOGY

The biomass gas stove is a natural convection type updraft gasifier consisting of a cylindrical body of clay, sand and paddy husk with its' top open and bottom closed. The outer diameter and height of the stove was 350 mm and 700 mm respectively. These can be reduced depending on the application. An iron grate to hold the biomass is fixed at 50 mm from the base of the reactor.