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Evaluation of composition, burn rate and economy beehive charcoal briquettes

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ABSTRACT : Beehive charcoal briquette has been found to be an excellent source of alternative household fuel for the rural people of North-East India. These briquettes are produced from charcoal and mud. Mud is added as binding agent. Experiments were conducted to determine the burning characteristics of this briquette with respect to its density and composition. Five treatments were chosen with different density achieved from five different compositions of charcoal, mud and cowdung. Proximate analysis of each briquette was carried out. Combustion test was conducted on a test platform with ample supply of air and loss of weight was recorded at two minutes interval. The study revealed that Normalised Burn Rate (NBR) varied exponentially with density ($NBR=26.17e^{-0.0059*DEN}$). Higher density briquettes showed lower NBR and *vice versa*. Total burning time increased exponentially with increasing density ($TBT=34.44e^{-0.002*DEN}$). After considering all the input costs, it was calculated that an entrepreneur can earn approximately Rs. 21000 per month with an average production of 6000 briquettes.

KEY WORDS : Charcoal briquettes, Low density briquettes, Normalised burn rate, Alternate energy, Briquetting economy

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The people of North East India are still using traditional cook stoves for cooking and space heating with wood or coal as fuel. Thermal efficiency of these traditional stoves is very low and cause widespread air pollution. Also direct burning of biomass emits substantial amount of pollutants including respirable particles, carbon monoxide, nitrogen and sulphur oxides which may cause health hazards and increased green house gas emission (Bruce *et al.*, 2000). Densified biomass which is also known as briquette has been found to be a solution to these problems (Grover and Mishra, 1996).

Briquetting has been practiced for many years in several countries. Biomass briquettes can provide an alternative household solid fuel, especially in rural areas. These can be burnt clean and, therefore, are eco-friendly and also those advantages that are associated with the use of biomass are present in the briquettes (Grover and Mishra, 1996). Briquettes can be produced with a density of 1.2 Mg/m³ from loose biomass of bulk density 0.1 to 0.2 Mg /m³. Compared with wood, biomass briquettes are unique in that they provide opportunity to control in the manufacturing process. The dried briquettes are easy to store because they come in a uniform shape and size.

Briquettes are of mainly two types –biomass briquette and charcoal briquette. Biomass briquettes are produced by densifying loose biomass in a briquetting machine whereas charcoal briquettes are produced from charcoal and some binding agent. Beehive briquettes (Fig. A) are produced from charcoal and mud. Mud is used as binding agent. In general the ratio of charcoal and mud is 70:30 by volume. These briquettes are made cylindrical with parallel holes which make this looked like beehive. Dried beehive briquettes produce smokeless blue flame with an average burning time of 2 to 2.5 hours.

In agricultural production system, waste biomass are abundant and so as in forestry. In North-East India, 37 million tonnes of biomass are produced annually from agriculture and forestry. There are multiple uses of this biomass in plain areas such as animal feeding, production of farm yard manure, vermicompost, as fuel for bio-gasifiers etc. But in hilly areas of North-East India these practices are not common. Thus, agricultural and forest waste biomass available in the region can be used to produce briquettes to mitigate the demand of household fuel and also to provide small scale business opportunity to entrepreneurs.

The fuel density, moisture content, size and geometry