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Renewable Energy Production from *Lantana Camara* Biomass

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Abstract- With consumption of about 3% of the world's total energy per annum, India is the world's sixth largest energy consumer. Exploring renewable energy sources has a strong worldwide interest in the meeting the energy needs of fast growing population, both for environmental reasons (release of pollutants and fossil reserves depletion) and economical ones. Most of the population in India does not have access to reliable energy. India has millions of tonnes of unwanted available biomass, often burnt inefficiently in open fields, causing air pollution. However this 'waste' can be turned into a completely environment-friendly source of energy.

World economy is dominated by technologies that rely on fossil energy petroleum, coal, natural gas) to produce fuels, power, chemicals and materials. While the use of conventional energy like oil, coal and electricity has increased enormously in the last 25 years in ASEAN economies, India still imports crude oil & petroleum over 111.92 million tonnes peryear. This heavy dependence on imported oil leads to economic and social uncertainties. Currently there is a strong worldwide interest in the development of technologies that allow the exploitation of renewable energy sources, both for environmental (release of pollutants and fossil reserves depletion)and economical reasons.

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Renewable Energy Production from *Lantana Camara* Biomass

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I. Introduction

Biomass, fourth largest energy source in the world, provides about 13% of world's energy consumption. Globally, biomass has an annual primary production of 220 billion oven-dry tonnes (odt) or 4,500 EJ and India produces 350 million tonnes of agricultural wastes per year. Charcoal is a premium fuel widely used in many developing countries to meet household as well as a variety of other needs. Recent improvements in technology for charcoal production have increased its efficiency, resulting in renewed interest in the use of charcoal as a fuel that can be easily stored and transported. High-value carbon products (activated carbon and electrode carbon) can also be produced from charcoal. This study presents charcoal production from *Lantana camara* biomass.

Lantana camara (Native from tropical America) is one of the ten most noxious weeds in the world. It is toxic to animals and exerts allelopathic action on neighbouring vegetation. The pathological and biochemical effects of the lantana plant in cattle, sheep and guinea pigs have been determined. None of the methods for control of lantana viz. mechanical, cultural, chemical and biological have been found effective.

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There are large wasteland & forest areas infested with this plant not only in India but more than 67 countries all across the globe. It has severe impact on net primary productivity and nutrient cycling, as a consequence of degradation of the forests. In order to fulfill the energy requirement of rural population as well as to save our forest and indigenous plant species, the best way would be to utilize the *Lantana camara* biomass as alternate renewable source of energy.

Lantana camara, abundant available forest weed with abundant biomass, across the world & has been found appropriate as alternate renewable source of energy. Its exploitation would also address to many interlinked issues, like - Forest conservation, Increase in useful indigenous species, Relief from harmful weeds, Air pollution control, Economical availability of fuel and availability of local employment.

The total net primary productivity of *Lantana camara* shrubland is 17 t ha^{-1} yr^{-1}, which is similar to the values reported for forests: 16 - 21 t ha^{-1} yr^{-1}. Total nutrient content (N, P) in the soil in the *L. camara* shrubland : 2932 kg ha^{-1} N and 111 kg ha^{-1} P, was lower than that of the forest soils.

Charcoal is the blackish residue consisting of impure carbon obtained by removing water and other volatile constituents from animal and vegetation substances.

Charcoal is usually produced by slow pyrolysis, the heating of wood, bone char, or other agricultural substances in the absence of oxygen environment at 450°-510°C by using either in a kiln or a continuously-fed furnace called a retort. The resulting soft, brittle, lightweight, black, porous material resembles coal and is 85% to 98% carbon with the remainder consisting of volatile chemicals and ash.

Briquetting is the process of converting low bulk density biomass into high density and energy concentrated fuel briquettes.

Materials and methods:

(Charcoal Briquetting of *Lantana camara* Biomass):

Biomass collection

⇩

Drying

⇩

Carbonization

⇩

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⇩

Preparation of Char powder

⇩

Binder preparation & Mixing

⇩

Briquettes production

⇩

Drying & Packing

⇩

Marketing

a) *Materials required*

1. Biomass waste - Agricultural, industrial or forest
2. Charcoal kiln / drum (150 cm x 100 cm)
3. Briquetting machine (15kg / hr)
4. Binding materials (eg. starch or cassava flour)

Lantana camara biomass is converted into charcoal briquettes by igniting the biomass under low oxygen conditions. These briquettes have hi her calorific value an burning capacity than using plant biomass dir ctly. Lantana camara stem was used as biomass source. Carbonization was carried out at different temperatures from 100°C to 600°C for optimizing the char yield and different cost effective binders such as sta ch, rice powder, clay etc. were also tried. Th fuel briquettes produced through briquettin machines (calorific values - max. 6500 kcal/kg nd min. 4500 kcal/kg) are utilized as alternative fuel. T e biomass charcoal briqu tting technology has been dissemi ated to various beneficiaries such as farmers, individuals, un mployed p ople, NGOs etc.

b) *Biomass collection*

Collection of biomass of *Lantana camara* along with from different sources (nearby forest area & fellow lands). Different other types of waste biomass can also be utelised, such as paddy, wheat, millet, sorghum, pulses, oil seed crops; maize stalks and cobs; cotton and mustard stalk; jute sticks; sugarcane trash; leaves or industrial wastes such as rice husk, groundnut shell, cotton waste, coconut shell, coir pith, tamarind shell, mustard husk, coffee husk, Cassava peel, bagasse, tea waste, Casuarina leaf litter, silk cotton shell, cotton waste, oil palm fiber and shells, cashew nut shell, coconut shell, coir pith or commonly available plants like Prosopis twigs, Ipomoea stem, coconut fronds, Eucalyptus leaves and dry under sunlight.

II. Carbonization of Biomass

For carbonization, loosely pack the collected biomass into the kiln. The kiln willaccommodate ~ 100kg dry biomass. After loading the biomass into the kiln, lose the top of the kiln with metal lid attached to a conical chimney. Use little amount of biomass in the firing portion to ignite in the kiln and close the doors tightly to start the pyrolysis process. In the absence of air, theburning process is slow and the fire slowly spreads to thebiomass through the holes in the perforated sheets.

After the biomass gets fully carbonized (~1-2 hrs; depending upon the biomass), remove the lid and sprinkle water over the char. Use theresultant char powder for preparation of briquettes. Though the carbonization process produces @ 30-45% char powder on an average, the char yield varies according to the biomass used.

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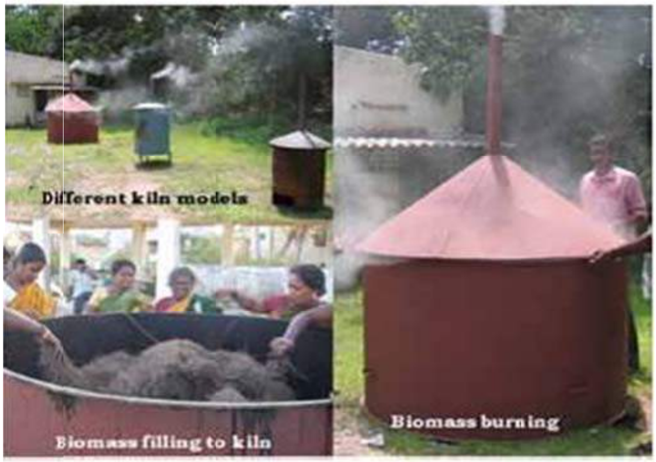
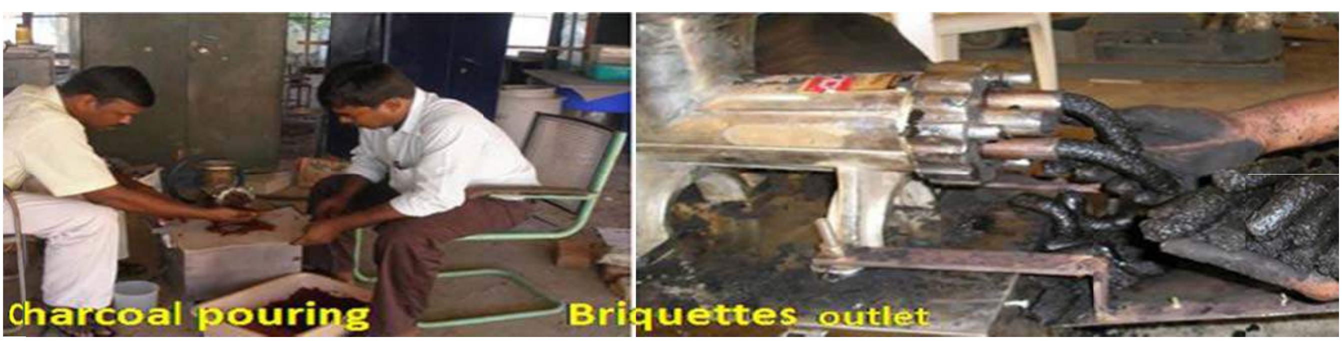


III. Binder Preparations and Mixing

IV. Briquetting

The charcoal mixture with binder can be made into briquettes either manually or using machines. For the mechanical operation, load the form uniform-sized cylindrical briquettes. mixture directly into the briquetting mould / machine to For preparation of binding material add starch to water in the ratio of 10:1 and al-low it to disperse without any clumps. Then heat the solution for 10 minutes and do not allow it to boil (the final stage can be identified by the sticki ess of the solution).After boiling, pour the liquid solution onto the char powder and mix to ensure that every particle of carbonized char is coated with the binder.

This process enhances charcoal adhesion and produce identical briquettes.



V. Drying, Packing and Marketing

Collect the briquettes in a tray, dry them in sunlight for 2-3 days and pack them in sealed plastic bags for sale

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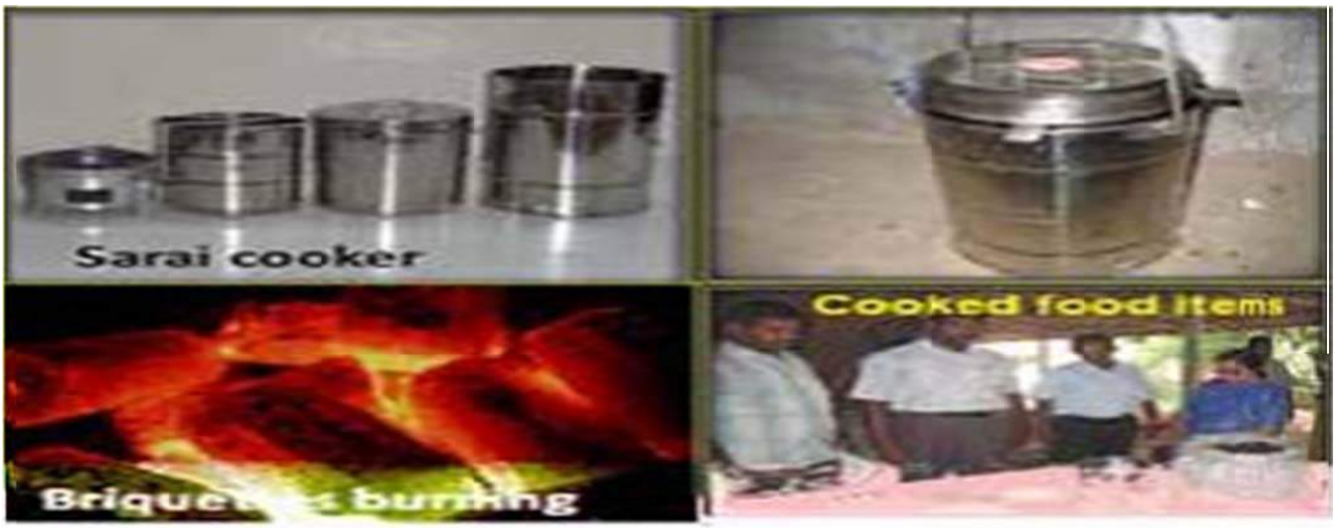
VI. Biomass Briquettes used as Alternative Fue

Charcoal briquettes can be used as fuel in rural houses for cooking, laundering and in boilers in tea shops and Tandoor Chulhas in hotels.

Cooking tests conducted using a non-pressurized cooker (Sarai cooker,ARTI) shows that 200-250 g of briquettes is enough to cook food in about 45-60 minutes. The heat was stable for 2 hours. Feedback survey conducted indicate that the biomass charcoal briquettes shows higher energy, quick heating in less time with less smoke and comparable to the wood charcoal.



Who will get benefited

- Un-employed people in ruralareas
- Self help groups (SHGs)- men & women
- Farmers
- Rural enterprises
- Forest Department

Advantages of the technology:

1. Smokeless: The charcoal briquettes burn without much smoke during ignition and burning.
2. Low Ash content: Minimum residual ash formed is less than 5% of the original weight of the charcoal.
3. Calorific value: ~ 243.58 K cal / Kg (wood charcoal - 6592.52 Kcal / Kg).
4. Odourless: Contains minimum evaporative substances thus eliminating the possibility of odour.
5. Sparkless: No sparks are produced like wood charcoal.
6. Less crack & better strength: Helps burn for a longer time.

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